SUGARCANE RESEARCH

ANNUAL PROGRESS REPORT

2005

This report is from 2005 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 in St. Gabriel, Louisiana. The Iberia Research Station helped to accomplish specific sugarcane research objectives in 2005.

Important parts of the 2005 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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SUGARCANE SUMMARY FOR CROP YEAR 2005

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In 2005, sugarcane was grown on 462,510 acres (an increase of 772 acres or 0.2% when compared to the 2004 crop) by 694 producers (a decrease of 24 producers or 3.3%) in 24 Louisiana parishes (counties). An estimated 425,509 acres (an increase of 710 acres or 0.2%) were available for harvest for sugar (assuming 8% of the total acres were used for seed cane purposes); however, there were approximately 75,000 tons of cane (3,500 acres) left standing in the field in the Lacassine area of western Louisiana as a new syrup factory slated for operation in that area was not ready in time for the 2005 crop. Because of the cane left in the field in the western area of the state, the actual acreage of sugarcane harvested for sugar was approximately 422,009 acres (a decrease of 2,790 acres or 0.7%). It is speculated that the factory will commence operations in early 2006 to test its equipment and will possibly process some of the remaining cane into high-test molasses, barring a killing freeze that would render the cane unmerchantable.

The 13 raw sugar factories (a decrease of 2 factories or 13.3% from the 2004 crop) operating in the state processed 10,786,275 tons of cane (a decrease of 697,836 tons or 6.1%) producing 1,170,299 short tons of sugar (96 pol)(a decrease of 3,729 short tons or 0.3%). Accordingly, the average yield of cane per total acre (to include acres used for seed and the 3,500 acres left standing in the field) was 23.3 tons (a decrease of 1.6 tons or 6.4%). The average yield of cane from each harvested acre amounted to 25.6 tons (a decrease of 1.4 tons or 5.2%). Sugar produced per total acre amounted to 5,061 pounds (a decrease of 24 pounds or 0.5%). And sugar produced per harvested acre was approximately 5,546 pounds (an increase of 19 pounds or 0.3%). The average sugar recovery at the 13 factories was 10.93% or 218 pounds of sugar (96 pol) per ton of cane; this was an increase of 6.9% when compared to the 2004 crop.

The gross farm value of $292,553,746 for sugar and molasses (a decrease of $12,862,525 or 4.2% from the 2004 crop and $63,355,454 or 17.8% from the 1999 crop), as reported in the crop production statistics, is 60% of the value of the sugar and 50% of the value of the molasses produced, with the remaining percentage going to processing and marketing. Gross farm value for sugarcane continues to fall since 2002 when the state experienced two tropical systems, Tropical Storm Isidore and Hurricane Lili. The onset of allotments, the gradual reduction in sugarcane acreage, the residual effect of Isidore and Lili on the subsequent crops, the keeping of older stubble, the reduced yield of the leading variety, LCP 85-384 and the three tropical systems, Tropical Storm Cindy and Hurricanes Katrina and Rita, that struck the state during the summer of 2005 are, undoubtedly, responsible for this downturn in gross farm value of the sugarcane crop to Louisiana. However, even with this downturn, sugarcane still ranks first amongst row crops grown in the state.

The total planted area of 462,510 acres for the 2005 crop was very similar to the area planted in 1999 (463,000 acres) when the industry produced its largest crop. Many producers had to plough out unproductive fields in the spring of 2005 that were previously affected by harvesting equipment during the 2002 crop year because of the persistent wet weather following the two tropical systems. Approximately 89% of the 2005 crop was planted to one variety, LCP 85-384, which has shown a significant decline in yield each year since the 2002 crop. Further, data obtained in both 2004 and 2005 showed that this variety is very susceptible to common brown rust which was shown to reduce the yield of LCP 85-384 by as much as 7 tons of cane per acre in the heavier infected areas. Although the amount of plantcane rebounded somewhat in 2005, there was still approximately 42.9% of the crop in second and older stubble.

The 2005 crop year was one of contrast with regards to turbulent weather conditions. Temperature, as an average for all state reporting stations, was above normal for 6 of the 12 months [January (+5°), February (+2°), June (+1°), August (+2°), September (+5°) and November (+2°)], below normal for only 3 months [March (-1°), May (-1°) and December (-2°)] and at normal for 3 months (April, July and October). Rainfall, as an average for all state reporting stations, was below normal for 9 of the 12 months and above normal for only 3 months (February, July and September). Generally speaking, the crop had a good start in the spring with excellent tillering weather; however, much of the state had drought conditions during the grand growth period resulting in below normal growth of the crop. Then the sugar industry of the state took the impact of two hurricanes, Katrina and Rita, which crossed the coast-line approximately three weeks apart in late August and mid September. This was following the passage of Cindy that caused significant damage to the sugarcane crop in southern Terrebonne and Lafourche Parishes in July. Katrina was an extraordinarily powerful and deadly hurricane that carved a wide swath of catastrophic damage in the eastern parishes of the sugarcane belt. After reaching Category 5 intensity over the central Gulf of Mexico, Katrina weakened to Category 3 before making landfall on the northern Gulf coast east of New Orleans on August 29. Rita was also a Category 5 storm that made landfall as a Category 3 storm west of Lake Charles, LA on September 22.

When hurricanes occur, the impact to agricultural in general and sugarcane in particular, can originate from several different sources. For sugarcane, the impact was forecasted to originate from the following sources: 1) Sugar losses due to delayed maturity. Research has shown that one can expect little increase in yield of recoverable sugar per ton of cane following a catastrophic event such as a hurricane. However, because of the weather conditions following the storms, i.e. low rainfall and plenty of sunlight, maturity was only adversely affected for a short period of time after which sucrose accumulation was at or above normal. 2) Sugar losses due to excessive trash. Research has shown that the average trash in harvested cane that is erect ranges from 8-12%. On the other hand, average trash in lodged cane can range from18-22% or higher with a loss of 3 pounds of sugar per ton for each 1% trash in harvested cane. However, because of the dry field conditions, the level of trash in harvested cane was relatively low considering the lodged conditions. In many instances, producers were able to reduce trash content by burning in standing cane prior to harvesting by cane combine or burning on the "heap row" for cane harvested by the whole-stalk or soldier harvester. 3) Sugar losses due to broken tops. According to a survey completed by county agents following the passage of Cindy, Katrina and Rita, there was an average of approximately 10% broken tops for the industry. However, it appeared that these broken tops had little impact on sugar recovery although it did have some impact on yield of tons of cane per acre at harvest. 4) Cane losses due to harvesting efficiency. Average harvest efficiency of harvesting green, lodged cane by the combine harvest system is approximately 90%; with the whole-stalk system that figure is 75%. However, again because of the relatively dry harvest season and plenty of sunlight, much of the lodged cane was relatively erect at harvest. Further, by burning in standing cane, combine harvester efficiency was considerably improved. Also, harvester efficiency of the whole-stalk system was improved by the lower than anticipated field yields.

Another consideration following the passage of tropical systems is the residual impact on the subsequent stubble crops. Following the passage of the two tropical systems and wet field conditions in 2002, it was documented that the residual impact on the subsequent stubble crop was a loss of approximately 15% in yield of tons of cane per acre for the 2003 crop. It was seen that the residual effect goes beyond just one year following an event of this magnitude. Other special situations of concern during the 2005 crop were the flooded fields that caused a reduction in yield of recoverable sugar per ton of cane, especially in Iberia and St. Mary Parishes. Overall, there were approximately 30,000 acres flooded in these parishes as well as Terrebonne Parish. Also of concern was the fact that much of the flood waters had high concentrations of salt of up to 15,000 ppm that have left high concentrations of salt in the surface soil. It is too early to determine if these high levels of salt will have a residual impact on the yield of cane in the subsequent crops. These flood waters also impacted the germination and growth of newly planted cane. In several instances, these flood waters actually killed the cane which will necessitate the replanting of these fields at considerable monetary expense. For the producers in Vermilion Parish, the debris that occurred from the 8-12 foot tidal surge added to the loss of yield of both tons of cane and sugar per ton of cane on approximately 5,000 acres as well as added to the monetary cost of harvesting those fields.

Because of the low field yields, especially in older stubble, many growers reverted back to harvesting by the whole-stalk system in an effort to reduce cost of harvesting. In many instances, field yields did not improve significantly in the first-stubble or plantcane crops. It appeared that LCP 85-384 did not perform very well across the state; however, it is known that LCP 85-384 does not perform well with a high water table, nor does it yield to its potential under drought conditions. It is assumed that common brown rust also impacted its yield in areas of high infection. However, field yields of three other varieties, HoCP 85-845, HoCP 91-555 and HoCP 96-540, appeared superior to those of LCP 85-384 when grown under similar conditions and crop year. Growers were likewise pleased with the appearance of the two new varieties, L 97-128 and Ho 95-988. There was only limited planting of LCP 85-384 in 2005 with most producers expanding the newer varieties, especially HoCP 96-540 and L 97-128.

Sugar prices remained relatively constant through most of 2005 ($20.45/cwt) being slightly higher to the prices received for 2004 ($20.25/cwt). However, in recent months sugar prices have increased and are holding firm but this increase may be too little and too late to have a significant impact on the overall price paid for sugar for the 2005 crop. On the other hand, molasses prices are averaging $0.35 per gallon and are expected to increase before the end of the pricing period for the 2005 crop. On the spot market, molasses price has exceeded $100 per ton.

PLANT COMMODITIES - 2005

Commodity	Gross Farm Income	Value Added	Total Value
Sugarcane[1]	$292,553,746	$199,800,192	$492,353,938

[1] Includes raw sugar and molasses

ST. GABRIEL 2005 WEATHER OVERVIEW

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From an annual perspective, 2005 was a “warm” and “dry” year for St. Gabriel. The station's annual temperature averaged 68.5°F (1.4° above normal), with annual rainfall totaling 49.00” (83% of normal). 2005 proves to be the “warmest” year since 1999 (which also ended the year with an average temperature of 68.5°F), and among the three “warmest” years since at least 1980. In terms of annual rainfall, complete annual rainfall series extend back to 1985 for LSU-St. Gabriel and 2005 ranks as the second “driest” year in the 21-year series. The only “drier” year in the series is 2000 (44.53”), occurring at the end of a three-year period (1998-2000) which ranks among south Louisiana's most severe droughts of the past century.

A look at monthly rainfall records confirms 2005 as a drought year for St. Gabriel from a climatological perspective. Nine of twelve months displayed below-normal monthly totals. Yet even in drought years, brief runs of unusually-wet weather are not uncommon for Louisiana, and such was the case for St. Gabriel in 2005. While “dry” was the dominant pattern for the year, several brief stormy-weather events served as short respites from the longer-term pattern, highlighted by a very wet two-week period in June. More than 12” of rain was recorded at St. Gabriel between June 6-19, accounting for nearly one-fourth of the year's total! But heavy rains over such a short run of days result in high run-off rates, such that much of that June moisture was lost (unavailable) from an agricultural perspective. Indeed, given the contribution of June's wet spell to the annual total, considerably less than the annual total of 49.00” for 2005 can be considered as “effective” rainfall.

2005 began with “warm and dry” weather, with January rains running just over half the monthly average and January temperatures averaging 5.5°F above the monthly norm. While temperatures did dip below freezing on five dates, there were no “Arctic outbreaks” (extremely cold weather), and temperatures rose well-above freezing each of those five days. In fact, those five events were the only “freeze days” for the start of 2005, as temperatures remained above freezing through the remainder of the winter and through the spring.

February also proved to be “warm”, although rainfall was near the monthly norm. March and April temperatures averaged close to their respective monthly norms, but rainfall totaled less than 2” for each of the two months, resulting in an early-spring rain deficit of nearly 6” for the two-month period. A “warm” May included three dates -- May 23, 24, and 25 -- with afternoon highs reaching the mid-90°s, but fortunately, late May also marked a return of spring rains, closing the month with 3” of rain in three days.

By the first of June, field conditions and soil-moisture levels were deemed “fair to good”, as May rains had eased fears regarding the development of a summer drought. And any lingering moisture deficits were quickly eliminated during the very stormy spell of June 6-19, when 12” of rain left fields flooded and soils saturated. Included within June's run of stormy weather was a tornado ('F1') that briefly touched-down in the St. Gabriel community on the morning of June 9. The twister lifted one wooden-frame house off its foundation and moved the structure several feet, but produced no injuries or fatalities.

The weather pattern shifted dramatically after the June "wet" spell, with less than 6" of rain -- roughly half the norm -- falling between June 20 and August 28. At the same time, temperatures for that period averaged nearly 2°F above normal. Although the mid-summer dry-out following the June deluge was initially welcomed, the persistence of the "hot and dry" weather pattern from late June into late August -- coupled with high insolation and elevated evapotranspiration rates -- brought renewed concerns regarding soil-moisture shortages and the possibility of the development of a late-summer drought. Even a July landfall by Hurricane Cindy on July 5th failed to produce any significant rain in the St. Gabriel area.

Afternoon readings rose above-normal frequently during the middle of the 2005 summer, with daily highs frequently climbing into the mid- to upper-90°s between late July and the end of August, including a run of 16 consecutive dates (Aug 13-28). Fortunately, the developing "summer drought" was eased by just over 2" of rain on August 29-30, delivered by monstrous Hurricane Katrina. Although Katrina produced sustained winds at St. Gabriel on the order of 30-45 mph (with higher gusts) for a period of more than six hours, wind damage was relatively modest in and around the St. Gabriel community, especially when one compares local impacts from Katrina with the devastation experienced by parishes to the south and east.

Following Katrina, St. Gabriel experienced another run of unusually dry weather, as less than 1.5" of rain fell between August 31 and September 23. Highs in the 90°s were again the rule for much of a "hot" September 2005, including eight days when afternoon readings climbed into the mid- and upper-90°s. Once again, however, tropical weather broke the "hot and dry" spell, as Hurricane Rita made landfall over southwestern Louisiana on September 24th.

Interestingly, of the three hurricanes to strike the Bayou State in 2005, Rita's landfall was the farthest from St. Gabriel, yet 'she' proved to be the "wettest" of the three storms for the research station, delivering nearly 5" of rain over a two-day period. Prolonged, sustained winds from Rita were not as high as those experienced during Katrina, but sustained winds of 20 mph or more persisted for the better part of 15 hours.

In the absence of a tropical system, October can often be among the driest months of the year for south Louisiana. But a "rain-free" month -- in October or any time of the year -- is quite rare. But such was the case for October 2005, only the second month in the entire time series for St. Gabriel that the station failed to receive any measurable rain throughout an entire month! And while October started out quite warm, with highs during the first seven days averaging just over 90°F, temperatures moderated through the month, with highs only reaching the 60°s and 70°s during October's final seven days.

The "dry" weather pattern that became established in October continued through the remainder of the year, as November through December rains combined for less than 5" over the two-month period, roughly half the two-month norm. The first freeze of the fall season arrived on the morning of November 18th, with the thermometer just briefly dipping to 32°F near sunrise. Indeed, November 2005 proved to be a “warm” November, with monthly temperatures averaging 2°F above the mean. By contrast, monthly temperatures averaged nearly 2°F below normal for December. December also matched January's total of six freeze dates, but just as was true during January, none of the December freeze events were unusually cold or prolonged in duration.

Table 1. 2005 St. Gabriel Daily Precipitation Calendar (in Inches).

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	0.00	1.08	0.00	0.08	0.70	0.05E	1.10	0.00	0.00	0.00	0.00	0.00	1
2	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.07	1.43	0.00	0.00	0.00	2
3	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00	0.00	3
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.08	0.00	0.00	0.00	0.00	4
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40	5
6	0.11	0.00	0.00	0.00	0.00	4.03	0.00	0.00	0.00	0.00	0.00	0.00	6
7	0.00	0.00	0.00	0.08	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	7
8	0.90	0.00	0.31	0.00	0.00	1.60	0.00	0.00	0.00	0.00	0.00	0.00	8
9	0.00	0.27	0.00	0.00	0.00	0.57	0.00	0.22	0.00	0.00	0.00	0.05	9
10	0.00	0.08	0.00	0.00	0.07	2.05	0.00	0.00	0.00	0.00	0.00	0.00	10
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
12	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13
14	0.00	1.33	0.04	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.10	0.00	14
15	1.04	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.08	1.20	15
16	0.00	0.00	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	16
17	0.00	0.00	0.00	0.00	0.00	0.28	0.60	0.00	0.00	0.00	0.00	0.00	17
18	0.00	0.00	0.00	0.00	0.88	1.70	0.18	0.00	0.00	0.00	0.00	0.40	18
19	0.00	0.00	0.00	0.00	0.14	1.50	0.00	0.00	0.00	0.00	0.00	0.00	19
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20
21	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	21
22	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.43	0.00	0.00	0.00	0.00	22
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.50	0.00	0.00	0.00	24
25	0.00	1.37	0.00	0.00	0.00	0.50	0.00	0.00	0.40	0.00	0.00	0.20	25
26	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26
27	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	27
28	0.00	0.00	0.00	0.00	0.00E	0.00	0.00	0.00	0.00	0.00	0.03	0.00	28
29	1.00	---	0.00	0.00	0.60E	0.00	0.00	1.90E	0.60E	0.00	0.00	0.00	29
30	0.00	---	0.00	0.00	2.10E	0.00	0.00	0.30E	0.00	0.00	0.00	0.00	30
31	0.00	---	0.12	---	0.80E	---	0.60	0.00	---	0.00	---	0.00	31

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SUM	3.05	4.70	1.85	1.63	5.65E	12.68E	3.62	4.00E	6.93E	0.00	1.61	3.28
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	-2.53	-0.47	-3.04	-2.72	+1.09	+6.62	-1.87	-1.08	+2.41	-4.09	-2.82	-1.86

Annual Total: 49.00E Annual DFN: -10.36

T - Trace of rain (less than 0.01")
E - estimated value

Precipitation data are those collected by the LSU-St. Gabriel staff for the official National Weather Service (NWS) Cooperative daily rainfall record (Station No. 16-8139).

Missing daily rainfall observations in the NWS record were estimated (E) using a regional assessment of observations from the LSU AgCenter's LAIS (Louisiana Agriclimatic Information System) station at LSU-St. Gabriel and from NWS Cooperative observations collected at LSU-Ben Hur Farm (Station No. 16-5620) and Gonzales (Station No. 16-3695).

Table 2. 2005 St. Gabriel Daily Max/Min Temperature Calendar (°F).

Day	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Day
1	71	57	51	45	64	38	78	66	70	50	79	70	97	73	94	71	96	75	91	70	80	48	64	38	1
2	74	61	57	45	62	40	72	47	74	48	83	68	95	75	94	74	93	71	92	69	63	37	75	40	2
3	74	63	51	44	57	41	71	46	78	54	90	69	96	70	90	74	93	71	91	73	75	39	70	42	3
4	76	60	48	43	60	39	76	45	77	55	92	70	93	75	89	73	93	69	89	72	80	45	78	63	4
5	75	61	52	36	69	43	75	46	74	50	92	72	94	74	91	71	92	68	90	71	83	65	80	44	5
6	79	55	66	39	70	50	81	58	80	49	91	71	88	73	90	70	91	70	91	69	85	61	50	28	6
7	60	54	65	56	72	48	82	52	84	54	87	69	91	71	91	70	88	70	91	64	87	61	54	30	7
8	78	50	69	59	74	49	75	53	85	60	90	70	92	72	94	72	92	69	77	58	87	59	59	44	8
9	65	44	72	61	62	46	76	51	84	65	91	69	93	73	93	72	91	66	80	55	82	59	53	35	9
10	65	50	69	41	65	37	81	56	83	59	91	70	95	73	94	72	94	67	81	54	84	58	50	33	10
11	69	57	57	33	67	42	81	54	88	60	90	71	88	74	94	72	93	64	84	55	77	54	55	33	11
12	80	63	63	36	72	40	84	53	91	63	87	68	96	74	94	74	91	64	88	61	78	46	60	37	12
13	78	54	67	46	78	46	79	48	92	65	92	73	96	74	96	72	92	64	86	60	82	55	68	34	13
14	56	43	64	52	79	49	77	46	87	64	94	75	93	77	96	71	92	66	87	62	85	62	69	41	14
15	59	35	78	54	68	48	73	48	85	65	95	76	85	75	96	71	95	73	87	61	81	69	75	51	15
16	58	36	76	60	62	48	77	51	86	61	96	73	85	75	95	70	95	74	84	52	84	47	57	32	16
17	56	27	79	52	49	42	82	50	84	63	96	69	92	73	96	72	95	72	88	49	55	35	50	38	17
18	50	29	64	43	58	35	80	52	87	62	91	69	92	74	97	74	95	74	85	48	56	32	45	36	18
19	51	29	62	40	66	44	77	52	89	64	88	66	93	75	96	73	94	71	88	50	60	34	60	38	19
20	56	36	70	49	80	55	81	58	90	66	89	68	91	76	97	74	95	73	88	52	64	43	56	33	20
21	72	49	75	56	71	56	85	60	91	72	90	68	93	73	98	79	97	69	86	59	60	45	55	33	21
22	76	54	81	61	80	57	86	63	94	65	91	69	95	74	98	74	95	71	88	55	61	37	53	28	22
23	73	29	81	62	80	49	87	60	95	75	94	70	94	75	95	73	93	76	78	48	69	37	58	28	23
24	46	26	70	55	71	50	76	43	95	73	93	70	96	76	98	74	82	68	80	45	77	38	65	36	24
25	55	29	61	46	78	53	72	53	95	71	95	70	95	76	97	76	87	71	65	38	80	51	69	45	25
26	70	37	64	43	85	61	67	53	90	71	93	70	96	74	95	76	90	78	68	34	70	52	63	32	26
27	77	46	59	50	74	58	82	48	89	64	92	71	96	76	96	76	94	76	69	36	79	59	70	38	27
28	56	45	68	48	70	46	82	53	90	65	93	71	94	77	95	75	94	69	72	37	80	55	76	53	28
29	59	46	---		72	43	85	58	92	63	95	73	96	76	94	73	93	66	71	39	68	44	74	39	29
30	57	46	---		77	54	84	62	88	65	95	76	91	74	81	71	91	65	75	37	60	34	71	42	30
31	56	48	---		77	65	---		80	69	---		94	73	92	74	---		78	45	---		75	54	31

Monthly Averages:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tmax	65.4	65.7	70.0	78.8	86.0	91.2	93.1	94.1	92.5	82.8	74.4	63.1
DFN	+5.0	+1.6	-1.3	+1.1	+1.3	+1.5	+1.7	+2.6	+4.5	+2.6	+3.6	-0.3
Tmin	45.8	48.4	47.5	52.8	62.3	70.5	74.2	73.0	70.0	54.1	48.7	38.6
DFN	6.1	+5.9	-1.8	-2.5	-1.5	+1.0	+2.2	+1.7	+2.9	-1.5	+0.8	-3.2
Mean	55.6	57.0	58.7	65.8	74.1	80.8	83.6	83.5	81.3	68.5	61.5	50.9
DFN	+5.5	+3.7	-1.6	-0.7	-0.2	+1.2	+1.9	+2.1	+3.7	+0.6	+2.1	-1.7

Annual Average Temperature: Total: 68.5 Annual DFN: +1.4

Daily temperature records were obtained from the NWS Cooperative record collected at nearby LSU-BEN HUR FARM NWS (Station No. 16-5620).

Data provided by: LSU Southern Regional Climate Center
LSU AgCenter / LAIS Network
NOAA / National Weather Service

AN OVERVIEW OF 2005 ACTIVITIES IN THE LSU AGCENTER SUGARCANE VARIETY DEVELOPMENT PROGRAM

K. A. 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 (plantcane, 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 2005.

Team Member	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 96,787 seedlings from 194 crosses from the 2004 crossing series were planted in the field in the spring of 2005. A total of 93,490 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 2006 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 2005 was below average, with 240 crosses being made. The below average performance was likely due to Hurricanes Katrina and Rita and above average August temperatures. Germination tests were conducted in December and January. Seed production for 2005 was more than adequate based on germination test results, with 173,763 true seed produced during 2005.

In the fall of 2005, individual selection was practiced on first stubble seedlings that represented the 2003 crossing series. The cross appraisal was combine harvested prior to selection. Family selection (top 60% in 2005) was utilized based on information from the cross appraisal results. Due to Hurricanes Katrina and Rita, the seedlings were severely lodged and tangled. Selection was done during the third week of September as the combine harvester peeled away each row. From this initial population, 1,548 clones were selected and planted to establish the first-line trials.

Established procedures were used to advance superior clones of the 2002 crossing series from first-line trials to second-line trials (601 clones) and of the 2001 crossing series from second-line trials to increase trials (287 clones). Preliminary ratings for cane yield and plant type in August were done prior to the Hurricanes. Clones with acceptable ratings were further evaluated for lodging, broken tops, borer damage, diseases, pith/tube, and Brix/sugar per ton.

The best 35 experimental varieties from the 2000 crossing series were assigned permanent variety designations in the fall of 2005. Newly assigned varieties were entered in replicated nursery trials at three locations (St. Gabriel Research Station, USDA-ARS Ardoyne Farm, and Iberia Research Station). "L", "HoCP, or Ho" varieties of the 2005 assignment series were exchanged in the fall of 2005 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 2004 series), introduced to the outfield tests (three varieties of the 2003 series), and planted in outfield tests (two experimental varieties of the 1999 assignment series; two experimental varieties of the 2001 assignment 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 2005 meeting was held on August 10, 2005, at the American Sugar Cane League office in Thibodaux, Louisiana.

The distribution of "L" and "LCP" experimental clones through stages of testing in 2005 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 2005.

Series	**Stage of Testing**	**Number of experimental varieties**
L 1999	Outfield – Replanted and harvested as plantcane, first stubble, and second stubble Off-station nurseries – harvested as fourth stubble	2
L 2000	Outfield – Replanted and harvested as plantcane and first stubble Off-station nurseries – harvested as third stubble	0
L 2001	Outfield – Replanted and harvested as plantcane On-station nurseries – harvested as third stubble Off-station nurseries – harvested as second stubble	2
L 2002	Outfield – Planted On-station nurseries – first stubble harvested Off-station nurseries plantcane harvested	0
L 2003	Outfield - Introduced On-station nurseries – harvested as first stubble Off-station nurseries – harvested as plantcane	3
L 2004	On-station nurseries – harvested as plantcane Off-station nurseries - planted	14
L 2005	Assignment – On-station nurseries planted	35

2005 PHOTOPERIOD AND CROSSING IN THE LSU AGCENTER SUGARCANE VARIETY DEVELOPMENT PROGRAM

C. L. LaBorde, K. A. Gravois, and K. P. Bischoff
St. Gabriel Research Station

The LSU AgCenter's Sugarcane Variety Development Program encompasses many stages to develop new commercial sugarcane varieties for the Louisiana sugarcane industry. The duration of the program spans a thirteen year period from crossing to variety release. 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. Photoperiod induction is essential for the transition or phase change from the vegetative to the reproductive stage of the sugarcane life cycle. In addition to photoperiod induction, proper hybridization techniques are the other key for the production of viable seed. Viable "true" seed is seed that has a sufficient germination count. The objective of crossing is to produce viable "true" seed from the most desirable crosses. This seed will then be advanced to the seedling stage of the Sugarcane Variety Development Program.

Cuttings of potential parent varieties used for the 2005 crossing season were planted in the fall of 2004. 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 2005, the cuttings were then transferred to can culture. In early 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 six light-tight chambers 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 12½ 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, 2005, when natural day length was 12½ 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 very poor on the photoperiod carts in 2005 (Tables 1-2). Total flowering percentage for the six bays was 24%, which was comprised from 1,602 stalks. To make matters worse, mechanical failure to Bay 4 of the photoperiod chambers resulted in a lack of darkness required to transition the sugarcane plants into the reproductive stage as can be seen in Table 1. Although the flowering percentage was low in 2005, successful seed production is comprised of a multitude of factors. An adequate germination rate provided the Variety Development Program with sufficient seed production. In 2005 as in previous years, seedlings were produced from hybridization techniques that used sugarcane yield components, borer resistance, and disease resistance as some of the criteria to determine which breeding stocks were most compatible.

The flowering season in 2005 began during the third 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 appears due to temperature during the photoperiod induction phase, varietal characteristics, and the photoperiod treatments. Crossing began on September 13 and ended on November 16, 2005. The end date was a true end date; there were no more flowers to be used for hybridization. This was an unusual year because of the low number of flowers that were produced. A total of 380 tassels of 111 varieties were used to produce 241 crosses producing 174,070 viable seed with 140,545 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 done with the best possible combinations available due to the lack of flowering. High temperatures throughout the summer months can result in poor production of sugarcane flowering as is being speculated in 2005. Along with the hot summer months, high temperatures in September can also result in poor seed set. 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 2005 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		Mean Flowering Date	Total Stalks	Percent Flowered
					Peak 1	Peak 2			
1	A	16-Jun	44	30-Jul	72	87	288±15	100	39
1	B	16-Jun	44	30-Jul	72	87	289±14	90	43
1	C	16-Jun	44	30-Jul	72	87	285±15	85	24
2	A	16-Jun	34	20-Jul	72	87	291±14	101	27
2	B	16-Jun	34	20-Jul	72	87	294±15	94	13
2	C	16-Jun	34	20-Jul	72	87	293±19	85	19
3	A	30-May	37	6-Jul	87	102	275±21	77	29
3	B	30-May	37	6-Jul	87	102	267±10	85	28
3	C	30-May	37	6-Jul	87	102	284±21	76	18
4	A	30-May	37	6-Jul	87	102	281±22	90	18
4	B	30-May	37	6-Jul	87	102	290±12	89	9
4	C	30-May	37	6-Jul	87	102	304	86	1
5	A	4-Jun	36	10-Jul	82	97	274±15	98	38
5	B	4-Jun	36	10-Jul	82	97	284±17	97	13
5	C	4-Jun	36	10-Jul	82	97	275±9	88	15
6	A	30-May	41	10-Jul	82	97	281±18	84	35
6	B	30-May	41	10-Jul	82	97	277±14	95	24
6	C	30-May	41	10-Jul	82	97	285±18	82	33

Table 2. Summary of can, variety, and flower information on bays 1-6 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----------								
111	324	127	1602	380	4.95±1.12	3.02±1.55	4.71±1.72	85.94±17.28

† 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 2005 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	196	140,545	721±1001	680±942	104±118
Polycross	16	12,419	828±962	808±971	144±164
Self	29	21,106	728±1294	728±1293	99±140
Total	241	174,070	728±1034	694±988	106±124

Table 4. Summary of can, variety, and flowering information on bays 7 and 8 under natural photoperiod.

Total Cans	Total Varieties		Variety Flowering Stage		Mean stalks per can	Mean stalks in a reproductive phase per can
	Known flowering response	Unknown flowering response	Number in Reproductive Phase†	Number in Nonreproductive Phase‡		
----------Number----------						
108	5	88	67	38	5.34±1.0	4.73±1.1

† Based upon cans that have been rated as either initiated or in boot stage.
‡ Denotes the number of varieties that had some stalks that did not flower; varieties will overlap in some cases.

Table 5. Varietal flowering summary in 2005 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	39±1	.	.	.	13	.	.
CP73-351	39±1	.	.	.	10	.	.
CP79-348	37	.	.	.	11	.	.
CP83-644	41	287	112±16	6±2	28	2	7
CP89-2143	36±1	.	.	.	8	.	.
HO01-564	41	292	107±6	5	12	2	17
HO02-653	44	307	96	3	12	1	8
HO89-889	39±1	.	.	.	8	.	.
HO91-572	41±4	273	90±4	3	10	2	20
HO95-988	39±1	273	97±4	7	74	7	9
HOCP00-927	36	.	.	.	11	.	.
HOCP00-930	41±2	294	97±6	6±1	10	6	60
HOCP00-950	37	269	82	7	19	1	5
HOCP01-517	37±1	.	.	.	16	.	.
HOCP01-523	36	.	.	.	15	.	.
HOCP01-551	41	290	99	3	9	1	11
HOCP01-561	37	301	114	5	15	1	7
HOCP02-610	38±2	262	93±10	2±1	10	5	50
HOCP02-618	40±2	283	86±4	4±1	13	7	54
HOCP02-620	44±0	280	74±5	6±1	5	2	40
HOCP02-623	36±0	264	82±4	4±1	9	4	44
HOCP02-625	34	320	119	4	11	1	9
HOCP02-632	40±1	.	.	.	11	.	.
HOCP02-640	35	.	.	.	11	.	.
HOCP02-652	43±1	259	71±3	5±1	10	8	80
HOCP03-703	34	.	.	.	5	.	.
HOCP03-708	34	.	.	.	5	.	.
HOCP03-718	34	.	.	.	6	.	.
HOCP03-757	41	276	89±3	3	6	3	50
HOCP85-845	39±1	.	.	.	44	.	.
HOCP88-739	38±1	.	.	.	12	.	.
HOCP89-831	37	.	.	.	3	.	.
HOCP89-846	38±1	256	83±5	5	23	12	52
HOCP91-552	42±1	256	64±2	3	17	14	82
HOCP91-555	39±1	.	.	.	15	.	.
HOCP92-618	37	320	133	3	21	1	5
HOCP92-624	39±1	256	76±2	7	26	20	77
HOCP92-648	44	283	88±8	7	22	3	14
HOCP93-746	43±1	.	.	.	7	.	.
HOCP95-951	37	262	83±8	6±1	6	2	33
HOCP96-509	36	.	.	.	17	.	.
HOCP96-540	37±1	264	90±3	4	65	34	52
HOCP96-561	36	266	97±7	4	10	8	80
HOCP97-606	36	.	.	.	16	.	.
HOCP97-609	34	307	106	3	12	1	8
HOCP98-741	40±1	256	70±4	4	7	.	.
HOCP98-781	39±1	.	.	.	6	4	67

Table 5. Continued.

Variety	Days of Constant Photoperiod	First Flower Date	Mean Days to Flower	Pollen Rating	Total Stalk Number	Total Flowers	Percent Flowering Stalks
HOCP99-815	41	312	121	7	6	1	17
HOCP99-825	36	.	.	.	4	.	.
HOCP99-866	44	.	.	.	5	.	.
L00-266	41	.	.	.	12	.	.
L01-281	35	.	.	.	11	.	.
L01-283	38	.	.	.	21	.	.
L01-299	41	264	91±5	4	34	10	29
L02-316	39±1	271	92±4	5	10	6	60
L02-324	39±1	.	.	.	8	.	.
L02-325	38±1	.	.	.	11	.	.
L02-342	39±1	.	.	.	12	.	.
L03-364	41	294	103	4	4	1	25
L03-365	34	.	.	.	5	.	.
L03-371	34	.	.	.	6	.	.
L03-374	44	312	103±2	4±1	10	3	30
L03-378	39±1	.	.	.	14	.	.
L03-387	41	278	92±3	4±1	9	3	33
L03-392	35	269	83±7	7	12	5	42
L03-396	44	276	73±6	6	6	6	100
L04-405	34	.	.	.	4	.	.
L04-407	37	.	.	.	5	.	.
L04-408	36	.	.	.	5	.	.
L04-410	41	271	86±3	3	6	4	67
L04-418	36	.	.	.	6	.	.
L04-420	44	.	.	.	6	.	.
L04-423	44	.	.	.	3	.	.
L04-425	34	283	94±6	3±1	6	5	83
L04-430	36	.	.	.	6	.	.
L04-434	44	313	102	7	2	1	50
L04-437	34	.	.	.	4	.	.
L89-113	36	.	.	.	11	.	.
L91-255	39	.	.	.	17	.	.
L91-281	44	283	87±7	6	10	5	50
L92-312	41	287	96	6	7	1	14
L92-321	36	.	.	.	5	.	.
L94-424	39	.	.	.	9	.	.
L94-426	35±1	280	97±9	4±1	22	5	23
L94-428	37	.	.	.	17	.	.
L94-432	39	.	.	.	10	.	.
L94-433	41	271	97±7	4±1	13	8	62
L97-128	39±1	256	79±2	7	77	52	68
L97-137	40±1	.	.	.	17	.	.
L98-197	40±2	.	.	.	9	.	.
L98-207	38±1	.	.	.	34	.	.
L98-209	36±1	273	96±9	7	28	3	11
L99-226	39±1	264	85±3	3	67	32	48
L99-233	38±1	256	70±1	3	32	28	88

Table 5. Continued.

Variety	Days of Constant Photoperiod	First Flower Date	Mean Days to Flower	Pollen Rating	Total Stalk Number	Total Flowers	Percent Flowering Stalks
LCP81-010	38±1	262	93±6	5	26	15	58
LCP82-089	41	304	119±6	4±1	16	2	13
LCP85-384	36±1	280	111±5	4	89	7	8
LCP86-454	38	.	.	.	22	.	.
N27	37	.	.	.	7	.	.
TUCCP77-042	36±1	287	104±3	6±1	16	7	44
US01-039	37	.	.	.	6	.	.
US01-040	37	287	102±2	3	5	2	40
US02-095	44	.	.	.	6	.	.
US02-099	41	315	124	7	3	1	33
US79-010	39±2	262	88±6	6±1	12	7	58
US80-004	36	.	.	.	9	.	.
US90-018	36	.	.	.	6	.	.
US93-015	35	.	.	.	11	.	.
US96-002	34	.	.	.	6	.	.
US99-002	44	307	99±2	7	7	4	57
US99-004	44	278	77±4	4±1	5	4	80

Table 6. Crosses and seed made in 2005 sorted by cross number.

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL05-001	HOCP89-846	L99-233	99	XL05-053	LCP81-010	L04-410	2600
XL05-002	HOCP92-624	L99-233	830	XL05-054	L97-128	L04-410	145
XL05-003	L97-128	L99-233	912	XL05-055	L01-299	L04-410	225
XL05-004	HOCP91-552	L99-233	1486	XL05-056	L04-410	L04-410	497
XL05-005	L99-233	L99-233	613	XL05-057	L02-316	HOCP96-540	1059
XL05-006	HOCP92-624	HOCP98-781	121	XL05-058	L94-433	L99-233	446
XL05-007	HOCP92-624	HOCP91-552	2521	XL05-059	L97-128	HOCP02-652	75
XL05-008	L97-128	HOCP91-552	452	XL05-060	HOCP91-552	05P3	1718
XL05-009	HOCP91-552	HOCP91-552	3783	XL05-061	L01-299	05P3	236
XL05-010	HOCP92-624	L99-233	2873	XL05-062	L94-433	05P3	1396
XL05-011	L97-128	L99-233	1306	XL05-063	L99-226	05P3	39
XL05-012	HOCP02-652	L99-233	79	XL05-064	L99-233	05P3	857
XL05-013	HOCP92-624	HOCP02-610	949	XL05-065	LCP81-010	HOCP91-552	2554
XL05-014	L97-128	HOCP02-610	106	XL05-066	HO95-988	L94-433	12
XL05-015	HOCP02-610	HOCP02-610	1856	XL05-067	L97-128	L94-433	20
XL05-016	HOCP92-624	HOCP91-552	998	XL05-068	L94-433	L94-433	44
XL05-017	L97-128	HOCP91-552	88	XL05-069	HO95-988	L04-410	79
XL05-018	HOCP89-846	HOCP91-552	394	XL05-070	LCP81-010	L04-410	17
XL05-019	HOCP95-951	L99-233	817	XL05-071	US79-010	L04-410	195
XL05-020	L97-128	L99-233	115	XL05-072	HOCP02-623	HOCP91-552	182
XL05-021	LCP81-010	L99-233	2035	XL05-073	L01-299	HOCP91-552	284
XL05-022	L97-128	US79-010	20	XL05-074	L98-209	HOCP91-552	984
XL05-023	US79-010	US79-010	18	XL05-075	HOCP02-623	HOCP98-781	545
XL05-024	HOCP92-624	HOCP02-623	226	XL05-076	HOCP96-561	HOCP98-781	589
XL05-025	L97-128	HOCP02-623	122	XL05-077	L02-316	HOCP98-781	448
XL05-026	HOCP02-623	HOCP02-623	35	XL05-078	HOCP98-781	HOCP98-781	19
XL05-027	L01-299	HOCP89-846	56	XL05-079	HOCP02-652	L99-226	0
XL05-028	LCP81-010	HOCP89-846	379	XL05-080	HOCP96-561	L99-226	321
XL05-029	HOCP89-846	HOCP89-846	0	XL05-081	L97-128	L99-226	1527
XL05-030	L97-128	HOCP96-540	232	XL05-082	L03-392	HOCP96-540	0
XL05-031	HOCP96-540	HOCP96-540	5607	XL05-083	L97-128	HOCP96-540	821
XL05-032	L97-128	L99-226	382	XL05-084	HO91-572	HOCP96-540	1260
XL05-033	L99-226	L99-226	197	XL05-085	HOCP89-846	HOCP03-757	334
XL05-034	L97-128	L99-233	677	XL05-086	HOCP92-624	HOCP03-757	269
XL05-035	L97-128	HOCP02-652	46	XL05-087	LCP81-010	HOCP03-757	1043
XL05-036	HOCP96-561	HOCP02-652	479	XL05-088	HOCP03-757	HOCP03-757	1248
XL05-037	HOCP02-652	HOCP02-652	0	XL05-089	HOCP92-624	L99-226	529
XL05-038	L97-128	L99-226	550	XL05-090	HOCP02-652	L99-226	157
XL05-039	HOCP91-552	05P1	1318	XL05-091	HOCP96-540	L99-226	4686
XL05-040	L99-226	05P1	412	XL05-092	L97-128	L99-226	818
XL05-041	L99-233	05P1	867	XL05-093	HOCP92-624	HOCP91-552	494
XL05-042	HOCP00-950	L99-233	185	XL05-094	L03-396	HOCP91-552	49
XL05-043	HOCP92-624	L99-233	4993	XL05-095	L98-209	HOCP91-552	247
XL05-044	L01-299	L99-233	219	XL05-096	HOCP92-624	L99-233	2818
XL05-045	LCP81-010	L99-233	2979	XL05-097	HOCP02-652	L99-233	198
XL05-046	HOCP92-624	HOCP91-552	767	XL05-098	HOCP96-540	L99-233	5412
XL05-047	L97-128	HOCP91-552	540	XL05-099	L03-396	L99-233	420
XL05-048	HOCP92-624	HOCP96-540	3411	XL05-100	L97-128	L99-233	1286
XL05-049	L03-392	HOCP96-540	0	XL05-101	HOCP92-624	HOCP89-846	1603
XL05-050	HOCP91-552	05P2	3756	XL05-102	HOCP96-540	HOCP89-846	2229
XL05-052	L99-226	05P2	582	XL05-103	L97-128	HOCP89-846	367

Table 6. Continued

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL05-104	HOCP95-951	L99-233	978	XL05-154	L97-128	US01-040	687
XL05-105	L97-128	L99-233	1880	XL05-155	L03-387	US01-040	313
XL05-106	HOCP96-561	L99-233	965	XL05-156	US01-040	US01-040	381
XL05-107	L02-316	L04-410	736	XL05-157	HOCP02-620	L94-426	310
XL05-108	L97-128	L04-410	1159	XL05-158	L97-128	L94-426	37
XL05-109	L03-392	L99-226	0	XL05-159	L97-128	L99-233	26
XL05-110	US79-010	L99-226	1254	XL05-160	HOCP02-618	L99-233	697
XL05-111	US99-004	L99-226	6055	XL05-161	L02-316	L99-226	264
XL05-112	L03-387	L99-226	1352	XL05-162	US01-040	L99-226	1156
XL05-113	L03-396	HOCP02-652	24	XL05-163	L97-128	HOCP02-618	348
XL05-114	L97-128	HOCP02-652	377	XL05-164	US79-010	HOCP02-618	32
XL05-115	L97-128	HOCP96-540	2751	XL05-165	HOCP02-618	HOCP02-618	39
XL05-116	HO95-988	HOCP89-846	0	XL05-166	L97-128	LCP81-010	27
XL05-117	L01-299	HOCP89-846	366	XL05-167	HO01-564	LCP81-010	38
XL05-118	LCP81-010	HOCP89-846	2341	XL05-168	LCP81-010	LCP81-010	0
XL05-119	L99-226	HOCP89-846	90	XL05-169	HO95-988	L01-299	24
XL05-120	HO95-988	HOCP03-757	0	XL05-170	HOCP00-930	L01-299	31
XL05-121	HOCP96-561	HOCP03-757	438	XL05-171	TUCCP77-042	L01-299	51
XL05-122	LCP85-384	HOCP03-757	380	XL05-172	L01-299	L01-299	0
XL05-123	HO95-988	HOCP96-540	1385	XL05-173	HOCP00-930	L03-364	21
XL05-124	L99-226	HOCP96-540	1011	XL05-174	L97-128	L03-364	0
XL05-125	HOCP02-620	L94-426	303	XL05-175	L03-364	L03-364	10
XL05-126	HOCP89-846	L94-426	511	XL05-176	HOCP02-652	HOCP02-610	681
XL05-127	L99-226	L94-426	1104	XL05-177	US99-004	HOCP02-610	600
XL05-128	L94-426	L94-426	22	XL05-178	HOCP92-624	L02-316	405
XL05-129	HO95-988	HOCP02-623	390	XL05-179	L97-128	L02-316	302
XL05-130	HOCP92-624	HOCP02-623	1405	XL05-180	HOCP92-648	HOCP89-846	53
XL05-131	HOCP92-648	HOCP02-623	385	XL05-181	LCP81-010	HOCP89-846	33
XL05-132	L91-281	L04-425	60	XL05-182	L91-281	HOCP89-846	0
XL05-133	L94-426	L04-425	382	XL05-183	L03-392	L01-299	39
XL05-134	HOCP02-618	L04-425	655	XL05-184	TUCCP77-042	L01-299	86
XL05-135	L04-425	L04-425	652	XL05-185	TUCCP77-042	L99-226	58
XL05-136	L91-281	HOCP96-540	1019	XL05-186	LCP81-010	HOCP96-561	65
XL05-137	L01-299	HOCP96-540	492	XL05-187	HO01-564	HOCP96-561	28
XL05-138	L03-396	HOCP96-540	379	XL05-188	L94-433	HOCP96-561	18
XL05-139	L94-433	HOCP96-540	693	XL05-189	L97-128	HOCP96-561	9
XL05-140	L97-128	HOCP96-540	519	XL05-190	HOCP96-561	HOCP96-561	5
XL05-141	HOCP03-757	L04-425	1618	XL05-191	LCP85-384	LCP82-089	1811
XL05-142	US99-004	L04-425	4662	XL05-192	L97-128	LCP82-089	293
XL05-143	HOCP02-618	L99-226	1352	XL05-193	LCP82-089	LCP82-089	1508
XL05-144	L03-387	L99-226	1317	XL05-194	HOCP00-930	L99-226	692
XL05-145	CP83-644	L02-316	2399	XL05-195	L99-226	L99-226	263
XL05-146	HOCP89-846	L02-316	516	XL05-196	HO91-572	HOCP96-540	975
XL05-147	TUCCP77-042	L02-316	84	XL05-197	HO95-988	HOCP02-618	0
XL05-148	L02-316	L02-316	261	XL05-198	TUCCP77-042	HOCP02-618	56
XL05-149	TUCCP77-042	L99-226	129	XL05-199	US99-002	HOCP02-618	18
XL05-150	L97-128	L99-226	745	XL05-200	LCP85-384	L99-226	796
XL05-151	L92-312	L99-226	698	XL05-201	TUCCP77-042	L99-226	108
XL05-152	L97-128	HOCP96-540	173	XL05-202	L94-433	L99-226	1665
XL05-153	US79-010	HOCP96-540	774	XL05-203	L99-226	L99-226	565

Table 6. Continued

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL05-204	HO02-653	05P4	45	XL05-224	L04-425	HOCP02-610	1006
XL05-205	HOCP00-930	05P4	525	XL05-225	L04-434	HOCP02-610	264
XL05-206	L04-425	05P4	275	XL05-226	HOCP00-930	HOCP02-610	1475
XL05-207	US99-002	05P4	88	XL05-227	HOCP02-610	HOCP02-610	880
XL05-208	LCP85-384	HOCP02-610	909	XL05-228	HOCP00-930	LCP82-089	851
XL05-209	HOCP92-648	LCP85-384	759	XL05-229	US99-002	LCP82-089	0
XL05-210	LCP85-384	LCP85-384	9	XL05-230	L98-209	LCP82-089	896
XL05-211	L91-281	L01-299	439	XL05-231	US02-099	HOCP96-561	207
XL05-212	L03-396	L01-299	0	XL05-232	HOCP89-846	L99-226	46
XL05-213	L97-128	L01-299	0	XL05-233	CP83-644	L99-226	30
XL05-214	LCP81-010	L03-374	0	XL05-234	HOCP92-624	LCP85-384	265
XL05-215	HOCP99-815	L03-374	3	XL05-235	L03-374	LCP85-384	55
XL05-216	L97-128	L03-374	737	XL05-236	L94-426	LCP85-384	0
XL05-217	L03-374	L03-374	0	XL05-237	LCP81-010	LCP85-384	220
XL05-218	US79-010	HOCP96-540	702	XL05-238	US79-010	LCP85-384	42
XL05-219	US99-002	HOCP96-540	235	XL05-239	HOCP02-625	HOCP92-618	575
XL05-220	HOCP96-540	HOCP96-540	2594	XL05-240	L94-433	HOCP92-618	1312
XL05-221	HO95-988	L03-374	0	XL05-241	TUCCP77-042	05P5	305
XL05-222	L91-281	L03-374	226				
XL05-223	LCP81-010	L03-374	498				

SELECTIONS, ADVANCEMENTS, AND ASSIGNMENTS OF THE LSU AGCENTER'S SUGARCANE VARIETY DEVELOPMENT PROGRAM FOR 2005

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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 96,787 seedlings from 194 crosses were planted in the field in the spring of 2005. The majority of these seedlings are progeny of crosses among commercial and elite experimental varieties. Due to Hurricanes Katrina and Rita in the fall of 2005, single stool selection was delayed until late September. Family selection was practiced on fewer stubble seedlings than in previous years because of the extremely lodged conditions and to expedite planting of first-line trials. This selection resulted in the planting of only 1,548 first-line trial plots. At the same time, superior clones were also selected and advanced through subsequent stages (601 to second-line trials, 287 to the increase stage). Assignments of permanent "L05" numbers were given to the 35 best clones of the 2000 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 96,787 seedlings from 194 crosses of the 2004 crossing series were planted to the field in the spring of 2005 (Table 1). Many of these seedlings were progeny of crosses among commercial and superior experimental varieties. In the fall of 2005, individual selection was practiced on a portion of the 70,910 stubble single-stools of the 2003 crossing series that survived the winter. The 1,548 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 2,800 first-line trial plots of the 2002 crossing series were rated for cane yield and pest resistance in August of 2005 (Table 3). Due to the hurricanes, Brix and other factors were further evaluated at planting. This second stage of advancement was concluded with the planting of 601 clones in single row 16-foot second line trials plots.

Stalk counts were made on the 773 plantcane second line trial plots of the 2001 crossing series in August 2005. Based on these counts and 2004 sucrose lab data collected, 287 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 2006. Of the 313 candidates from the first-stubble crop of the second line trial plots, the best 35 clones from the 2000 crossing series were assigned permanent “L05” numbers (Table 5). These newly assigned “L05” 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 2000 through 2004 is shown in Table 6. Crosses are sorted by female parent in ascending order, with the percentile (Pcnt’l) ranking given for each cross in each stage of the program. The results of the 2003 crossing series cross appraisal in 2005 are presented in Table 7.

Table 1. Summary of selections, advancements and assignments made during 2005 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 (L05 Assignments)
			------------------------------	number of clones	----------------------------			
X00	76	211	98371	75973	4158	699	313	35
X01	218	247	93019	46325	2902	773	287	
X02	200	192	72061	50951	2742	601		
X03	134	211	92598	70910	1548			
X04	67	194	93490					

Table 2. Dates of seedling and line trials planted or harvested in 2005.

Crossing Series	Test	Crop	Date Planted	Date Harvested
X2004	Seedlings	Planted	4/8 – 4/18/05	
X2004	Progeny Test	Planted	4/18/05	
X2003	Seedlings	First Stubble	4/14 -4/19/04	
X2003	Progeny Test	First Stubble	4/20/04	9/28/05
X2003	First Line Trials	Planted	9/30/05	
X2002	First Line Trials	Plantcane	9/10/04	
X2001	First Line Trials	First Stubble	9/11 - 9/17/03	11/14–11/15/05
X2002	Second Line Trials	Planted	10/10/05	
X2001	Second Line Trials	Plantcane	9/22/04	10/18/05
X2000	Second Line Trials	First Stubble	10/1/03	10/12/05
X2001	Light Soil Increase	Planted	10/19/05	
X2000	Light Soil Increase	Plantcane	9/28/04	12/5/05
X1999	Light Soil Increase	First Stubble	10/2/03	11/15/05
X1998	Light Soil Increase	Second Stubble	10/17/02	10/12/05
X2001	Heavy Soil Increase	Planted	10/19/05	
X2000	Heavy Soil Increase	Plantcane	9/28/04	11/7/05
X1999	Heavy Soil Increase	First Stubble	10/2/03	11/7/05

Table 3. Numbers of experimental clones dropped for identified faults in the 2002 crossing series first-line trials.

Trait	Fault	
	Frequency	Percent
	--------- 2742 clones enter first round of evaluation ----------	
Initial Selection (Rating)	1257	45.8
	-------- 1485 clones enter second round of evaluation --------	
Brix / All Others	884	32.2
Clones advanced to second line trial stage	601	21.9

Table 4. Number of experimental clones dropped for identified faults in the 2001 crossing series of the plantcane second line trial prior to advancement to the increase stage.

Trait	Fault	
	Frequency	Percent
	------- 773 clones enter first round of evaluation --------	
Stalk Counts / All Others	486	62.9
Clones advanced to Increase stage	287	37.1

Table 5. Mean yield data of the 2005 “L” assignments made in first-stubble second line trial 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
LCP85-384	CP77-310	CP77-407	8438	37.4	227	1.40	53089
HOCP91-555	CP83-644	LCP82-094	9256	36.4	255	1.47	49761
HOCP96-540	LCP86-454	LCP85-384	10375	44.2	235	1.87	50215
L2005-439	LCP81-010	LCP85-384	9019	38.7	233	1.41	54904
L2005-440	L97-128	L91-281	9584	38.3	250	1.42	53996
L2005-441	HOCP92-624	LCP85-384	9806	40.4	243	1.47	54904
L2005-442	LCP87-492	HOCP97-609	10716	39.1	274	1.69	46283
L2005-443	LCP87-492	L99-233	9733	38.0	256	1.47	51728
L2005-444	HOCP96-561	L99-229	10195	37.8	270	1.46	51728
L2005-445	L98-198	HOCP97-621	10310	40.0	258	1.71	46736
L2005-446	L99-229	LCP85-384	9524	39.4	242	1.77	44468
L2005-447	HOCP96-561	L99-233	14212	56.2	253	1.89	59441
L2005-448	LCP87-492	L99-233	9668	42.0	230	1.93	43560
L2005-449	LCP86-454	LCP85-384	9943	40.4	246	1.31	61710
L2005-450	US79-010	LCP85-384	11020	50.1	220	1.66	60349
L2005-451	LCP81-010	LCP85-384	10262	38.7	265	1.69	45829
L2005-452	L99-226	L99-233	8535	37.9	225	1.76	43106
L2005-453	LCP85-384	HOCP96-540	10481	46.2	227	1.59	58080
L2005-455	HOCP92-624	L98-197	8678	34.7	250	1.50	46283
L2005-456	L99-233	LCP85-384	8470	36.4	233	1.47	49459
L2005-457	L97-128	LCP87-492	10388	42.9	242	1.59	53996
L2005-458	HOCP92-624	HOCP97-609	9398	41.0	229	1.36	60349
L2005-459	L89-113	LCP85-384	9384	37.1	253	1.34	55358
L2005-460	HOCP92-624	L91-255	13660	49.3	277	1.52	64886
L2005-461	L99-233	LCP85-384	10029	43.6	230	1.55	56265
L2005-462	HOCP96-540	HOCP91-552	10595	40.0	265	1.78	44921
L2005-463	LCP81-010	L92-312	8621	31.3	275	1.47	42653
L2005-464	CP79-318	L99-233	9954	38.7	257	1.76	44014
L2005-465	HO95-988	L98-207	9813	42.5	231	1.24	68516
L2005-466	CP83-644	HOCP97-609	9372	35.9	261	1.33	53996
L2005-467	HO95-988	L94-433	8466	32.9	257	1.32	49913
L2005-468	L93-399	HOCP91-552	9112	33.6	271	1.30	51728
L2005-469	HO95-988	L98-209	10404	41.5	251	1.45	57173
L2005-470	L94-428	L91-281	10835	43.5	249	1.40	62164
L2005-471	L94-428	L91-281	9627	34.8	277	1.38	50366
L2005-472	HOCP92-624	HOCP96-522	8790	35.2	250	1.26	55811
L2005-473	HOCP95-951	LCP85-384	12711	55.3	230	2.10	52635

Table 6. Advancement summary of crosses in the 2000 through 2003 crossing series.

			1st Line		2nd Line		Increase		Assignment	
Female	Male	Survive	No.	Rank Pcnt'l	No.	Rank Pcnt'l	No.	Rank Pcnt'l	No.	Rank Pcnt'l
2000 Crossing Series										
CP65-357	L91-255	429	30	79	2	54	0	21	0	42
CP65-357	LCP85-384	984	40	53	6	58	4	65	0	42
CP77-405	L96-040	249	8	42	1	38	0	21	0	42
CP77-405	L98-197	242	16	77	3	79	2	87	0	42
CP77-405	L98-209	483	7	18	1	31	1	49	0	42
CP77-405	LCP85-384	940	20	29	3	35	3	60	0	42
CP78-317	L98-209	496	14	37	2	38	0	21	0	42
CP78-317	L99-229	245	22	90	3	77	1	66	0	42
CP78-317	LCP85-384	493	21	55	1	29	0	21	0	42
CP79-318	HOCP92-618	251	8	42	0	13	0	21	0	42
CP79-318	L96-040	243	16	77	0	13	0	21	0	42
CP79-318	L98-207	254	10	49	1	37	0	21	0	42
CP79-318	L98-209	249	5	27	3	75	1	63	0	42
CP79-318	L99-233	962	18	25	5	55	2	50	1	87
CP79-318	LCP85-384	727	9	17	0	13	0	21	0	42
CP83-644	HOCP97-609	251	10	51	4	88	1	61	1	94
CP89-846	LCP85-384	249	12	60	4	89	2	85	0	42
HO91-572	L94-428	250	2	16	0	13	0	21	0	42
HO91-572	LCP85-384	688	41	72	4	56	0	21	0	42
HO91-572	LCP87-492	244	0	6	0	13	0	21	0	42
HO95-988	HOCP85-845	241	11	59	1	41	0	21	0	42
HO95-988	HOCP96-561	249	5	27	0	13	0	21	0	42
HO95-988	L90-191	227	14	73	1	51	1	75	0	42
HO95-988	L94-433	426	27	75	9	93	7	97	1	93
HO95-988	L96-040	480	0	6	0	13	0	21	0	42
HO95-988	L98-207	733	31	54	4	56	4	79	1	88
HO95-988	L98-209	247	6	31	1	38	1	64	1	95
HO95-988	LCP85-384	1047	77	82	9	70	3	58	0	42
HOCP85-845	HOCP92-624	241	15	73	5	91	2	88	0	42
HOCP85-845	HOCP96-540	507	21	53	1	29	0	21	0	42
HOCP85-845	L89-113	254	1	14	0	13	0	21	0	42
HOCP85-845	L91-255	220	5	30	0	13	0	21	0	42
HOCP85-845	L98-209	470	0	6	0	13	0	21	0	42
HOCP85-845	LCP85-384	2348	129	68	11	54	5	54	0	42
HOCP91-522	US80-004	194	14	80	2	73	0	21	0	42
HOCP91-552	L90-191	182	3	21	0	13	0	21	0	42
HOCP91-552	L91-255	476	34	79	5	74	3	83	0	42
HOCP91-552	L94-432	211	9	55	1	54	1	77	0	42
HOCP91-552	L99-233	912	26	39	3	36	1	44	0	42
HOCP91-552	LCP85-384	.	0	.	6	.	1	.	0	.
HOCP92-618	HOCP96-540	697	63	90	9	82	0	21	0	42
HOCP92-618	L99-233	245	3	17	0	13	0	21	0	42
HOCP92-624	HOCP85-845	477	16	44	2	45	1	51	0	42
HOCP92-624	HOCP92-618	251	17	78	2	63	2	84	0	42
HOCP92-624	HOCP96-522	241	9	47	3	79	1	68	1	96
HOCP92-624	HOCP96-540	977	82	88	10	72	6	81	0	42

Table 6. Continued

			1st Line		2nd Line		Increase		Assignment	
Female	Male	Survive	No.	Rank Pcnt'l	No.	Rank Pcnt'l	No.	Rank Pcnt'l	No.	Rank Pcnt'l
HOCP92-624	HOCP96-561	473	2	14	0	13	0	21	0	42
HOCP92-624	HOCP97-601	249	11	56	2	63	1	63	0	42
HOCP92-624	HOCP97-609	498	46	91	16	96	6	94	1	90
HOCP92-624	HOCP97-621	486	14	39	3	58	1	48	0	42
HOCP92-624	L89-113	735	44	72	5	61	0	21	0	42
HOCP92-624	L91-255	1185	106	89	26	94	15	95	1	86
HOCP92-624	L91-281	239	29	97	2	67	1	69	0	42
HOCP92-624	L98-197	483	40	87	7	85	4	87	1	91
HOCP92-624	L98-209	236	8	44	2	69	2	90	0	42
HOCP92-624	L99-226	239	8	43	2	67	2	89	0	42
HOCP92-624	LCP85-384	2371	110	59	20	67	8	60	1	85
HOCP92-624	LCP85-384	715	32	57	3	45	1	45	0	42
HOCP92-624	LCP86-454	665	26	49	4	57	2	58	0	42
HOCP92-624	US80-004	252	7	37	1	38	1	61	0	42
HOCP92-648	HOCP85-845	243	6	33	4	90	2	86	0	42
HOCP92-648	HOCP92-624	228	8	46	3	84	3	96	0	42
HOCP92-648	L91-281	246	23	92	3	77	0	21	0	42
HOCP92-648	L93-363	238	7	39	2	67	2	89	0	42
HOCP92-648	L96-040	230	15	76	2	71	1	74	0	42
HOCP92-648	L98-209	238	2	16	0	13	0	21	0	42
HOCP92-648	LCP85-384	700	34	61	5	62	4	79	0	42
HOCP94-867	L99-226	227	36	99	3	84	1	75	0	42
HOCP95-950	LCP85-384	482	10	29	2	41	1	49	0	42
HOCP95-951	HOCP96-540	247	0	6	0	13	0	21	0	42
HOCP95-951	LCP85-384	732	24	43	5	61	3	66	1	88
HOCP96-522	CP78-317	501	20	51	1	29	0	21	0	42
HOCP96-522	HOCP96-561	453	38	88	6	84	1	55	0	42
HOCP96-522	L91-255	498	28	70	3	57	3	80	0	42
HOCP96-522	L94-432	223	9	51	2	72	2	92	0	42
HOCP96-522	LCP85-384	973	78	86	8	64	3	59	0	42
HOCP96-522	LCP85-384	615	0	6	0	13	0	21	0	42
HOCP96-540	HOCP85-845	222	10	57	0	13	0	21	0	42
HOCP96-540	HOCP91-552	232	26	95	6	94	3	96	1	98
HOCP96-540	HOCP92-624	245	0	6	0	13	0	21	0	42
HOCP96-540	L91-281	398	0	6	0	13	0	21	0	42
HOCP96-540	L92-312	248	0	6	0	13	0	21	0	42
HOCP96-540	L94-433	243	0	6	0	13	0	21	0	42
HOCP96-540	L99-229	219	0	6	0	13	0	21	0	42
HOCP96-540	US96-001	216	0	6	0	13	0	21	0	42
HOCP96-561	HOCP92-624	244	21	89	9	97	3	94	0	42
HOCP96-561	L99-229	251	19	83	4	88	2	84	1	94
HOCP96-561	L99-233	776	26	44	6	63	1	44	1	88
HOCP97-601	HOCP92-618	245	11	57	3	77	1	66	0	42
HOCP97-606	LCP85-384	486	9	25	2	41	1	48	0	42
HOCP97-609	HOCP85-845	229	6	34	3	83	2	91	0	42
HOCP97-609	HOCP92-624	469	0	6	0	13	0	21	0	42
HOCP97-609	HOCP97-621	215	13	72	1	54	1	77	0	42

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
HOCP97-609	L91-255	483	19	49	4	65	3	82	0	42
HOCP97-609	LCP81-010	235	1	14	0	13	0	21	0	42
HOCP97-609	LCP85-384	227	9	51	1	51	0	21	0	42
HOCP97-621	HOCP96-540	249	0	6	0	13	0	21	0	42
HOCP97-621	LCP85-384	946	26	35	7	62	3	59	0	42
HOCP97-645	L98-197	234	12	65	5	93	2	91	0	42
HOCP97-645	L99-226	469	37	85	1	31	0	21	0	42
HOCP98-743	L98-209	675	0	6	0	13	0	21	0	42
HOCP98-743	L99-226	236	0	6	0	13	0	21	0	42
HOCP98-776	HOCP97-621	240	16	78	1	45	1	68	0	42
HOCP98-776	L91-281	250	4	21	0	13	0	21	0	42
HOCP98-776	LCP81-010	711	15	29	2	34	0	21	0	42
L89-113	L96-040	230	32	98	13	99	6	98	0	42
L89-113	LCP85-384	482	32	77	10	91	6	95	1	91
L90-191	LCP85-384	239	18	83	2	67	1	69	0	42
L90-191	US96-001	236	0	6	0	13	0	21	0	42
L91-255	HOCP85-845	481	12	33	1	31	0	21	0	42
L91-255	L96-040	447	0	6	0	13	0	21	0	42
L91-255	LCP85-384	710	36	65	2	34	2	57	0	42
L91-281	L91-255	242	18	82	1	41	0	21	0	42
L91-281	L96-040	247	4	21	0	13	0	21	0	42
L91-281	L98-197	476	17	46	3	59	1	51	0	42
L91-281	L98-209	461	35	83	5	74	3	83	0	42
L91-281	L99-237	238	23	92	5	92	0	21	0	42
L91-281	LCP85-384	1205	60	63	5	41	3	56	0	42
L93-363	HOCP92-618	239	0	6	0	13	0	21	0	42
L93-363	L96-040	477	24	63	4	67	3	82	0	42
L93-363	LCP85-384	243	7	39	3	78	1	67	0	42
L93-399	HOCP85-845	489	24	61	6	78	0	21	0	42
L93-399	HOCP91-552	237	12	65	3	81	2	90	1	97
L93-399	L99-226	233	6	34	1	49	0	21	0	42
L94-426	L96-040	248	7	37	3	76	1	64	0	42
L94-426	L98-209	249	11	56	0	13	0	21	0	42
L94-426	L99-224	234	13	70	1	49	0	21	0	42
L94-426	L99-233	234	9	48	0	13	0	21	0	42
L94-426	LCP85-384	947	25	34	3	35	1	43	0	42
L94-426	LCP86-454	237	19	86	5	93	1	71	0	42
L94-428	HOCP97-601	472	16	44	2	45	1	53	0	42
L94-428	L91-281	241	32	98	10	98	7	99	2	99
L94-428	L94-433	234	18	84	1	49	0	21	0	42
L94-428	L99-226	226	12	66	1	51	0	21	0	42
L94-428	LCP81-010	675	16	31	0	13	0	21	0	42
L94-428	LCP85-384	712	39	68	1	28	1	45	0	42
L94-432	HOCP85-845	244	5	27	1	41	0	21	0	42
L96-040	HOCP98-776	471	0	6	0	13	0	21	0	42
L96-040	LCP81-010	242	15	73	3	79	1	67	0	42
L96-040	LCP85-384	1193	36	41	4	36	2	47	0	42

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
L97-128	HOCP85-845	237	2	16	0	13	0	21	0	42
L97-128	HOCP92-618	237	15	75	0	13	0	21	0	42
L97-128	L91-281	993	119	96	13	83	6	80	1	86
L97-128	L93-363	479	52	94	18	97	4	88	0	42
L97-128	L99-229	471	53	95	6	81	2	73	0	42
L97-128	L99-233	199	22	94	3	87	2	93	0	42
L97-128	LCP81-010	699	33	60	3	49	1	47	0	42
L97-128	LCP87-492	468	40	88	4	69	1	54	1	92
L97-128	US80-004	236	12	65	0	13	0	21	0	42
L97-128	US96-001	476	32	78	3	59	1	51	0	42
L98-158	L99-233	225	11	61	1	51	0	21	0	42
L98-197	HOCP96-522	204	0	6	0	13	0	21	0	42
L98-197	US99-002	225	0	6	0	13	0	21	0	42
L98-198	HOCP97-621	445	26	71	5	75	1	55	1	93
L98-198	US79-010	474	35	82	2	45	1	53	0	42
L98-207	CP79-318	702	11	21	2	34	2	57	0	42
L98-207	L92-312	250	25	93	4	89	1	62	0	42
L98-207	POLY	1	1	99	1	99	1	99	1	99
L98-209	L94-428	238	0	6	0	13	0	21	0	42
L98-209	L99-233	476	9	25	3	59	1	51	0	42
L98-209	LCP85-384	461	0	6	0	13	0	21	0	42
L99-224	L99-226	240	14	71	2	65	0	21	0	42
L99-224	L99-233	234	8	44	2	69	1	73	0	42
L99-226	HOCP96-522	231	23	93	2	71	1	74	0	42
L99-226	L99-233	711	14	27	3	45	1	45	1	89
L99-226	LCP85-384	688	0	6	0	13	0	21	0	42
L99-229	LCP81-010	240	11	59	1	45	0	21	0	42
L99-229	LCP85-384	474	19	51	7	86	2	71	1	92
L99-233	LCP85-384	838	52	73	25	95	16	98	2	94
LCP81-010	CP78-317	458	1	13	0	13	0	21	0	42
LCP81-010	HOCP85-845	439	8	24	1	33	0	21	0	42
LCP81-010	HOCP96-561	186	7	48	0	13	0	21	0	42
LCP81-010	HOCP97-609	475	11	30	7	86	2	70	0	42
LCP81-010	HOCP97-621	229	4	23	1	51	1	75	0	42
LCP81-010	L92-312	243	13	66	3	78	2	86	1	96
LCP81-010	L94-428	239	13	67	1	45	1	69	0	42
LCP81-010	L96-040	239	6	33	0	13	0	21	0	42
LCP81-010	L98-207	705	12	23	1	28	1	46	0	42
LCP81-010	L99-233	817	13	21	1	27	0	21	0	42
LCP81-010	LCP85-384	1687	122	80	26	88	9	78	2	87
LCP81-010	US96-001	236	7	41	0	13	0	21	0	42
LCP81-010	US99-002	221	11	63	0	13	0	21	0	42
LCP81-030	HOCP85-845	249	7	37	1	38	1	63	0	42
LCP85-384	CP79-318	243	0	6	0	13	0	21	0	42
LCP85-384	HOCP92-624	236	0	6	0	13	0	21	0	42
LCP85-384	HOCP96-540	720	53	82	22	95	13	97	1	89
LCP85-384	L93-363	224	18	86	2	71	1	76	0	42

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	L94-433	712	21	39	3	45	2	56	0	42
LCP85-384	L99-226	757	0	6	0	13	0	21	0	42
LCP85-384	LCP86-454	943	18	25	1	27	1	43	0	42
LCP86-454	L99-226	710	26	47	5	61	0	21	0	42
LCP86-454	L99-234	252	6	31	0	13	0	21	0	42
LCP86-454	LCP85-384	1861	157	88	27	85	14	84	1	85
LCP87-492	HOCP97-609	241	29	96	12	98	2	88	1	96
LCP87-492	L89-113	219	6	35	0	13	0	21	0	42
LCP87-492	L91-281	487	25	65	5	73	3	81	0	42
LCP87-492	L94-432	224	0	6	0	13	0	21	0	42
LCP87-492	L98-209	481	8	23	1	31	1	50	0	42
LCP87-492	L99-233	446	41	91	16	96	5	93	2	98
TUCCP77-042	LCP85-384	716	82	96	12	90	7	92	0	42
US79-010	HOCP96-540	237	13	68	3	81	1	71	0	42
US79-010	L98-209	236	13	68	1	45	1	72	0	42
US79-010	LCP85-384	700	19	35	3	49	1	47	1	90
US79-010	LCP87-492	246	4	21	1	41	1	65	0	42
US80-004	LCP85-384	664	7	17	3	53	3	77	0	42
US92-010	L91-281	201	9	57	3	87	1	78	0	42
US96-001	LCP85-384	948	15	21	2	31	0	21	0	42
US96-002	L94-432	221	3	18	1	53	0	21	0	42
US96-002	LCP85-384	468	19	53	1	31	1	54	0	42
2001 Crossing Series										
CP65-357	L92-312	240	10	61	3	72	2	84	.	.
CP77-405	L98-207	187	0	21	0	22	0	29	.	.
CP77-405	LCP85-384	394	0	21	0	22	0	29	.	.
CP78-317	HOCP91-552	191	0	21	0	22	0	29	.	.
CP79-318	L98-209	229	0	21	0	22	0	29	.	.
CP79-318	L98-209	225	0	21	0	22	0	29	.	.
CP83-644	HOCP96-540	430	15	57	9	86	3	80	.	.
CP83-644	HOCP96-561	210	7	54	1	51	0	29	.	.
CP83-644	HOCP97-621	218	0	21	0	22	0	29	.	.
CP83-644	HOCP98-778	212	0	21	0	22	0	29	.	.
CP83-644	L98-209	402	24	77	8	85	1	64	.	.
CP83-644	L99-226	398	0	21	0	22	0	29	.	.
CP83-644	L99-238	175	0	21	0	22	0	29	.	.
CP89-846	HOCP97-621	229	0	21	0	22	0	29	.	.
CP89-846	L98-209	385	0	21	0	22	0	29	.	.
HO89-889	HOCP85-845	219	11	68	1	50	0	29	.	.
HO89-889	HOCP96-561	69	0	21	0	22	0	29	.	.
HO89-889	L99-233	235	0	21	0	22	0	29	.	.
HO95-988	HOCP96-540	930	45	64	11	70	5	76	.	.
HO95-988	HOCP96-561	237	12	69	3	73	1	68	.	.
HO95-988	HOCP97-609	419	17	60	7	79	2	72	.	.
HO95-988	L89-113	452	19	61	7	77	2	69	.	.

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	L98-207	625	65	95	28	98	10	96	.	.
HO95-988	L99-226	464	0	21	0	22	0	29	.	.
HO95-988	L99-238	197	11	74	3	76	1	74	.	.
HO95-988	LCP85-384	432	49	96	20	98	8	98	.	.
HO95-988	TUCCP77-042	424	9	47	4	64	2	71	.	.
HOCP85-845	HO95-988	197	10	69	4	85	0	29	.	.
HOCP85-845	HOCP96-540	955	31	53	6	55	1	58	.	.
HOCP85-845	HOCP97-609	228	12	71	4	81	0	29	.	.
HOCP85-845	L96-092	215	0	21	0	22	0	29	.	.
HOCP85-845	L98-207	1325	41	51	16	70	8	78	.	.
HOCP85-845	L99-233	208	11	71	2	65	2	89	.	.
HOCP85-845	LCP85-384	656	39	76	6	63	4	78	.	.
HOCP88-739	LCP85-384	208	15	85	8	95	2	89	.	.
HOCP89-846	HOCP98-741	167	17	95	1	55	1	77	.	.
HOCP89-846	LCP85-384	203	2	44	1	52	0	29	.	.
HOCP89-846	LCP85-384	178	4	48	0	22	0	29	.	.
HOCP89-846	LCP85-384	198	7	57	3	76	1	73	.	.
HOCP89-846	TUCCP77-042	201	15	86	4	85	2	91	.	.
HOCP90-941	L97-137	226	7	51	4	81	1	69	.	.
HOCP90-941	LCP85-384	223	0	21	0	22	0	29	.	.
HOCP91-552	01P1	456	15	54	1	46	0	29	.	.
HOCP91-552	HOCP96-540	543	12	48	4	58	0	29	.	.
HOCP91-552	HOCP97-609	90	0	21	0	22	0	29	.	.
HOCP91-555	HOCP00-955	200	0	21	0	22	0	29	.	.
HOCP91-555	HOCP96-509	210	10	64	0	22	0	29	.	.
HOCP91-555	HOCP96-540	198	0	21	0	22	0	29	.	.
HOCP91-555	HOCP96-540	723	22	50	4	54	2	65	.	.
HOCP91-555	HOCP98-776	149	9	77	1	56	0	29	.	.
HOCP91-555	L99-226	429	38	91	6	74	1	63	.	.
HOCP91-555	LCP85-384	203	0	21	0	22	0	29	.	.
HOCP91-555	LCP86-454	195	0	21	0	22	0	29	.	.
HOCP92-618	HOCP96-540	709	32	63	13	82	6	84	.	.
HOCP92-618	LCP85-384	429	0	21	0	22	0	29	.	.
HOCP92-618	TUCCP77-042	430	0	21	0	22	0	29	.	.
HOCP92-624	HOCP00-961	232	19	88	2	61	0	29	.	.
HOCP92-624	HOCP91-552	219	0	21	2	63	0	29	.	.
HOCP92-624	HOCP96-540	242	12	68	2	60	1	67	.	.
HOCP92-624	HOCP96-561	373	24	80	3	58	2	75	.	.
HOCP92-624	L00-257	442	21	64	7	78	4	86	.	.
HOCP92-624	L89-113	231	14	78	5	87	3	94	.	.
HOCP92-624	L94-426	181	0	21	0	22	0	29	.	.
HOCP92-624	L94-428	218	4	46	2	64	1	71	.	.
HOCP92-624	L98-207	560	18	53	9	78	3	75	.	.
HOCP92-624	L98-209	468	35	86	1	45	1	61	.	.
HOCP92-624	L99-226	232	0	21	0	22	0	29	.	.
HOCP92-624	L99-233	401	37	92	13	95	9	99	.	.
HOCP92-624	LCP85-384	144	12	88	3	86	2	94	.	.

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
HOCP92-648	HOCP96-540	369	18	66	7	83	3	83	.	.
HOCP92-648	HOCP96-561	210	12	75	1	51	0	29	.	.
HOCP92-648	HOCP97-609	222	0	21	0	22	0	29	.	.
HOCP92-648	HOCP97-621	196	0	21	0	22	0	29	.	.
HOCP92-648	L99-226	345	0	21	0	22	0	29	.	.
HOCP92-648	L99-226	175	6	56	0	22	0	29	.	.
HOCP92-648	L99-234	238	0	21	0	22	0	29	.	.
HOCP92-648	LCP85-384	455	60	98	13	92	7	96	.	.
HOCP92-648	LCP85-384	198	20	94	8	97	3	95	.	.
HOCP94-806	HOCP97-621	72	0	21	0	22	0	29	.	.
HOCP94-806	L99-226	245	0	21	0	22	0	29	.	.
HOCP94-806	L99-233	236	14	76	4	80	1	68	.	.
HOCP95-951	CP79-348	420	54	98	18	97	4	87	.	.
HOCP95-951	HOCP96-540	422	22	70	10	88	3	81	.	.
HOCP95-951	HOCP96-540	232	10	62	6	91	4	97	.	.
HOCP95-951	L97-137	465	33	84	8	80	1	61	.	.
HOCP95-951	LCP82-089	450	28	79	7	77	5	92	.	.
HOCP96-509	HOCP96-561	368	25	82	3	59	0	29	.	.
HOCP96-509	L92-312	243	0	21	0	22	0	29	.	.
HOCP96-509	L99-226	226	0	21	0	22	0	29	.	.
HOCP96-509	LCP85-384	184	17	92	6	95	3	97	.	.
HOCP96-522	HOCP89-846	225	12	71	3	73	2	85	.	.
HOCP96-522	HOCP96-561	184	6	54	2	67	0	29	.	.
HOCP96-522	L91-255	207	11	71	1	51	0	29	.	.
HOCP96-522	L98-209	410	20	66	3	57	1	63	.	.
HOCP96-522	LCP85-384	203	7	56	1	52	0	29	.	.
HOCP96-540	HOCP89-846	623	0	21	0	22	0	29	.	.
HOCP96-540	HOCP96-561	237	0	21	0	22	0	29	.	.
HOCP96-540	L89-113	190	0	21	0	22	0	29	.	.
HOCP96-540	L91-255	371	0	21	0	22	0	29	.	.
HOCP96-540	L99-226	449	0	21	0	22	0	29	.	.
HOCP96-540	LCP85-384	392	0	21	0	22	0	29	.	.
HOCP96-561	HOCP85-845	452	14	51	5	68	0	29	.	.
HOCP97-606	L96-092	237	7	50	3	73	0	29	.	.
HOCP97-609	HO91-572	207	0	21	0	22	0	29	.	.
HOCP97-609	HOCP97-621	167	0	21	0	22	0	29	.	.
HOCP97-609	HOCP98-741	231	0	21	0	22	0	29	.	.
HOCP97-609	L89-113	250	0	21	0	22	0	29	.	.
HOCP97-609	L99-226	417	0	21	0	22	0	29	.	.
HOCP97-609	L99-233	142	4	49	2	75	0	29	.	.
HOCP97-609	LCP82-089	448	31	82	8	82	1	63	.	.
HOCP97-621	L98-207	452	0	21	0	22	0	29	.	.
HOCP98-741	HOCP92-618	236	0	21	0	22	0	29	.	.
HOCP98-741	L94-432	239	0	21	0	22	0	29	.	.
HOCP98-741	LCP85-384	413	43	95	8	84	3	82	.	.
HOCP98-776	CP79-348	210	2	44	0	22	0	29	.	.
HOCP98-776	HOCP96-540	177	0	21	0	22	0	29	.	.

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
HOCP98-776	L91-255	203	9	62	6	93	2	90	.	.
HOCP98-776	L99-226	236	0	21	0	22	0	29	.	.
HOCP98-776	L99-233	218	6	49	1	50	0	29	.	.
HOCP98-778	CP79-318	219	0	21	0	22	0	29	.	.
HOCP98-778	HOCP97-621	93	0	21	0	22	0	29	.	.
HOCP98-781	HOCP96-540	442	38	90	5	69	0	29	.	.
HOCP99-825	L91-281	217	0	21	0	22	0	29	.	.
HOCP99-833	L98-209	180	13	85	2	68	0	29	.	.
L00-249	L94-432	236	0	21	0	22	0	29	.	.
L00-254	HOCP97-609	430	0	21	0	22	0	29	.	.
L00-254	L98-209	244	0	21	0	22	0	29	.	.
L00-254	LCP85-384	416	0	21	0	22	0	29	.	.
L00-260	HOCP97-621	232	0	21	0	22	0	29	.	.
L00-260	L99-233	400	0	21	0	22	0	29	.	.
L00-264	L94-432	145	0	21	0	22	0	29	.	.
L00-264	LCP85-384	226	7	51	2	62	0	29	.	.
L00-264	LCP85-384	202	7	57	0	22	0	29	.	.
L00-268	HOCP96-540	971	63	81	25	91	11	92	.	.
L00-271	HOCP96-540	194	11	75	1	53	1	75	.	.
L00-273	LCP82-089	198	0	21	0	22	0	29	.	.
L91-255	HOCP96-509	141	0	21	0	22	0	29	.	.
L91-255	L98-207	427	0	21	0	22	0	29	.	.
L91-255	LCP85-384	386	18	63	1	46	0	29	.	.
L91-281	HOCP96-540	240	21	90	3	72	2	84	.	.
L91-281	HOCP96-561	442	53	97	12	92	4	86	.	.
L91-281	L97-137	246	12	66	4	79	3	93	.	.
L91-281	L99-234	218	12	73	5	88	1	71	.	.
L91-281	LCP85-384	226	0	21	0	22	0	29	.	.
L93-386	HOCP96-540	363	0	21	0	22	0	29	.	.
L93-391	L98-209	215	0	21	0	22	0	29	.	.
L93-391	L99-226	206	0	21	0	22	0	29	.	.
L93-391	LCP85-384	97	0	21	0	22	0	29	.	.
L93-399	HOCP85-845	176	0	21	0	22	0	29	.	.
L93-399	HOCP85-845	326	12	58	0	22	0	29	.	.
L93-399	LCP85-384	171	0	21	0	22	0	29	.	.
L94-426	HOCP97-621	174	0	21	0	22	0	29	.	.
L94-426	L99-233	185	7	58	1	53	0	29	.	.
L94-426	LCP85-384	224	11	66	1	49	1	70	.	.
L94-426	LCP85-384	184	22	97	9	99	2	91	.	.
L94-426	LHO92-314	234	0	21	0	22	0	29	.	.
L94-428	HOCP96-540	354	32	91	11	94	6	97	.	.
L94-428	MISC	178	8	63	2	69	0	29	.	.
L94-432	HOCP96-540	209	36	99	4	83	2	88	.	.
L94-432	L89-113	208	0	21	0	22	0	29	.	.
L94-432	L91-281	195	0	21	0	22	0	29	.	.
L94-432	L98-207	337	0	21	0	22	0	29	.	.
L94-432	LCP85-384	194	0	21	0	22	0	29	.	.

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	TUCCP77-042	383	13	56	3	58	0	29	.	.
L96-040	HOCP92-618	228	22	93	9	96	0	29	.	.
L96-040	HOCP96-540	227	13	75	1	49	0	29	.	.
L96-040	L99-233	211	0	21	0	22	0	29	.	.
L96-040	L99-233	393	26	81	6	76	1	64	.	.
L97-128	HOCP85-845	224	14	80	2	63	0	29	.	.
L97-128	L91-281	174	15	90	1	54	1	77	.	.
L97-128	L99-233	228	25	96	12	99	5	99	.	.
L97-128	LCP82-089	416	29	83	10	89	6	95	.	.
L97-128	LHO92-314	205	0	21	0	22	0	29	.	.
L97-128	TUCCP77-042	191	32	99	8	97	4	98	.	.
L97-137	HOCP94-806	219	13	76	4	82	2	87	.	.
L97-137	L94-428	406	20	66	7	80	5	93	.	.
L98-197	HOCP00-961	227	0	21	0	22	0	29	.	.
L98-207	01P5	473	2	43	0	22	0	29	.	.
L98-207	CP79-318	388	0	21	0	22	0	29	.	.
L98-207	HOCP85-845	736	45	78	18	90	5	80	.	.
L98-209	01P4	416	38	92	4	65	3	82	.	.
L98-209	HOCP97-621	474	17	58	3	55	1	60	.	.
L98-209	HOCP98-741	205	0	21	0	22	0	29	.	.
L98-209	L92-312	182	0	21	0	22	0	29	.	.
L98-209	LHO92-314	457	18	59	3	56	0	29	.	.
L98-209	TUCCP77-042	427	24	74	9	87	3	80	.	.
L99-214	HOCP97-621	235	0	21	0	22	0	29	.	.
L99-214	L99-233	207	17	88	4	84	2	89	.	.
L99-221	HOCP96-540	433	0	21	0	22	0	29	.	.
L99-226	01P4	676	12	46	2	47	1	59	.	.
L99-226	HOCP92-618	436	0	21	0	22	0	29	.	.
L99-226	HOCP96-540	757	0	21	0	22	0	29	.	.
L99-226	L89-113	204	0	21	0	22	0	29	.	.
L99-226	L99-233	754	5	43	3	48	2	65	.	.
L99-226	LCP82-089	464	19	60	4	61	1	62	.	.
L99-226	LCP85-384	843	42	68	10	70	6	81	.	.
L99-226	TUCCP77-042	621	11	46	2	47	1	60	.	.
L99-231	HOCP85-845	195	3	45	1	53	1	74	.	.
L99-231	HOCP97-621	194	0	21	0	22	0	29	.	.
L99-231	L92-312	147	0	21	0	22	0	29	.	.
L99-233	HOCP97-621	173	0	21	0	22	0	29	.	.
L99-233	L94-428	205	16	86	5	90	2	90	.	.
L99-234	HOCP96-540	216	0	21	0	22	0	29	.	.
L99-234	L98-207	365	0	21	0	22	0	29	.	.
L99-238	L94-432	220	0	21	0	22	0	29	.	.
LCP81-010	L89-113	208	0	21	0	22	0	29	.	.
LCP81-010	L91-281	209	11	71	5	89	3	95	.	.
LCP81-010	L92-312	143	0	21	0	22	0	29	.	.
LCP81-010	L92-312	124	0	21	0	22	0	29	.	.
LCP81-010	L94-428	460	6	44	2	48	1	62	.	.

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	L98-207	617	39	80	15	90	5	82	.	.
LCP81-010	L98-207	1095	35	53	12	68	6	76	.	.
LCP81-010	L98-209	605	24	59	5	60	3	73	.	.
LCP81-010	L99-233	898	28	51	12	74	3	66	.	.
LCP81-010	LCP82-089	384	0	21	0	22	0	29	.	.
LCP81-010	LCP85-384	844	85	94	25	93	8	87	.	.
LCP81-010	LCP85-384	937	17	46	4	48	1	59	.	.
LCP82-089	LCP85-384	381	20	70	1	46	1	65	.	.
LCP83-137	HOCP96-561	404	34	89	9	87	4	90	.	.
LCP85-313	HOCP96-509	342	24	83	10	92	3	85	.	.
LCP85-313	HOCP97-609	415	29	83	3	57	2	72	.	.
LCP85-384	01P4	597	0	21	0	22	0	29	.	.
LCP85-384	HOCP89-846	240	19	87	3	72	1	67	.	.
LCP85-384	HOCP92-618	230	0	21	0	22	0	29	.	.
LCP85-384	HOCP97-621	471	53	96	5	67	3	79	.	.
LCP85-384	L91-281	378	0	21	0	22	0	29	.	.
LCP85-384	L99-233	609	13	47	6	66	2	66	.	.
LCP86-454	L99-233	591	32	73	6	66	3	74	.	.
LCP86-454	LCP85-384	636	45	84	10	78	4	78	.	.
LCP86-454	LCP85-384	1475	64	62	18	71	3	60	.	.
LCP86-454	TUCCP77-042	335	0	21	0	22	0	29	.	.
LHO83-153	L99-233	180	14	86	7	96	2	92	.	.
LHO83-153	LCP85-384	213	5	48	2	64	0	29	.	.
LHO92-314	L99-226	207	0	21	0	22	0	29	.	.
LHO92-314	LCP85-384	229	0	21	0	22	0	29	.	.
MISC	MISC	240	15	80	2	60	1	67	.	.
TUCCP77-042	L98-209	162	14	90	5	94	0	29	.	.
TUCCP77-042	L99-238	232	12	70	2	61	2	85	.	.
TUCCP77-042	LCP85-384	476	25	71	7	75	3	79	.	.
US96-002	LCP85-384	229	22	93	2	62	1	69	.	.
2002 Crossing Series										
CP70-321	LCP85-384	185	2	28	0	21	.	.	.	.
CP77-405	HOCP96-540	454	0	12	0	21	.	.	.	.
CP77-405	L99-233	172	3	31	0	21	.	.	.	.
CP77-405	LCP85-384	234	8	48	0	21	.	.	.	.
CP78-317	L92-312	80	9	95	2	91	.	.	.	.
CP79-318	L91-255	243	10	55	0	21	.	.	.	.
CP79-318	L92-312	222	7	45	0	21	.	.	.	.
CP79-348	HOCP92-618	239	16	77	3	74	.	.	.	.
CP79-348	L98-207	703	89	96	15	87	.	.	.	.
CP83-644	02P9	196	4	33	1	52	.	.	.	.
CP83-644	L99-233	465	19	55	6	77	.	.	.	.
CP89-831	HOCP89-846	485	22	62	3	54	.	.	.	.
HO01-566	02P9	481	17	49	3	54	.	.	.	.
HO89-889	HOCP89-846	714	18	37	2	44	.	.	.	.

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	02P13	239	0	12	0	21	.	.	.	.
HO95-988	HOCP93-767	443	10	35	0	21	.	.	.	.
HO95-988	HOCP96-540	236	0	12	0	21	.	.	.	.
HO95-988	L00-266	249	23	88	2	60	.	.	.	.
HO95-988	L94-432	58	4	80	0	21	.	.	.	.
HO95-988	L98-207	664	41	74	10	81	.	.	.	.
HO95-988	LCP82-089	404	40	93	2	51	.	.	.	.
HO95-988	LCP85-384	464	45	90	8	83	.	.	.	.
HO95-988	LCP85-384	1203	118	91	46	97	.	.	.	.
HOCP00-905	02P3	245	26	94	13	99	.	.	.	.
HOCP00-905	02P4	477	42	87	17	97	.	.	.	.
HOCP00-920	HOCP92-618	138	3	34	0	21	.	.	.	.
HOCP00-920	L99-226	411	0	12	0	21	.	.	.	.
HOCP01-517	02P10	164	5	42	2	72	.	.	.	.
HOCP85-845	02P11	1831	6	24	1	42	.	.	.	.
HOCP85-845	02P15	226	10	61	1	48	.	.	.	.
HOCP85-845	02P3	336	14	58	0	21	.	.	.	.
HOCP85-845	HOCP89-846	234	4	31	1	47	.	.	.	.
HOCP85-845	L98-207	1343	51	52	14	70	.	.	.	.
HOCP91-552	HOCP97-609	466	0	12	0	21	.	.	.	.
HOCP91-552	L98-209	851	26	43	4	50	.	.	.	.
HOCP92-624	02P10	233	2	27	0	21	.	.	.	.
HOCP92-624	02P16	216	17	83	4	84	.	.	.	.
HOCP92-624	HOCP98-741	202	15	81	5	91	.	.	.	.
HOCP92-624	L00-259	1435	140	91	32	88	.	.	.	.
HOCP92-624	L00-266	711	35	65	9	75	.	.	.	.
HOCP92-624	L91-255	868	76	87	11	75	.	.	.	.
HOCP92-624	L98-209	1149	59	67	9	58	.	.	.	.
HOCP92-624	L99-226	1171	46	53	9	58	.	.	.	.
HOCP92-624	LCP85-384	1396	81	73	21	80	.	.	.	.
HOCP92-624	US01-040	230	41	98	9	98	.	.	.	.
HOCP93-746	L91-255	217	5	35	0	21	.	.	.	.
HOCP93-746	L99-233	463	20	59	3	55	.	.	.	.
HOCP93-749	L00-247	131	2	29	0	21	.	.	.	.
HOCP93-749	L00-266	481	0	12	0	21	.	.	.	.
HOCP93-749	LCP85-384	68	0	12	0	21	.	.	.	.
HOCP93-749	LCP85-384	239	9	52	3	74	.	.	.	.
HOCP93-767	HOCP97-609	213	0	12	0	21	.	.	.	.
HOCP93-767	L99-226	234	33	97	6	92	.	.	.	.
HOCP94-806	HOCP91-552	212	11	68	2	67	.	.	.	.
HOCP94-806	HOCP93-767	240	11	63	3	73	.	.	.	.
HOCP94-806	HOCP96-540	209	12	72	4	85	.	.	.	.
HOCP95-951	02P2	670	56	86	20	95	.	.	.	.
HOCP96-509	L98-207	1205	76	75	16	79	.	.	.	.
HOCP96-561	HOCP00-905	118	0	12	0	21	.	.	.	.
HOCP96-561	L99-226	466	16	48	6	77	.	.	.	.
HOCP98-741	HOCP85-845	249	7	40	2	60	.	.	.	.

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	L00-249	236	16	78	1	46	.	.	.	.
HOCP98-741	L00-268	214	22	94	2	67	.	.	.	.
HOCP98-741	L91-255	236	10	58	2	62	.	.	.	.
HOCP98-741	L94-432	225	7	43	2	65	.	.	.	.
HOCP98-741	L98-207	178	0	12	0	21	.	.	.	.
HOCP98-741	L98-209	151	0	12	0	21	.	.	.	.
HOCP98-741	L99-226	244	23	89	1	45	.	.	.	.
HOCP98-781	HOCP85-845	423	3	25	0	21	.	.	.	.
HOCP98-781	LCP85-384	684	38	70	4	52	.	.	.	.
HOCP99-866	L01-291	473	0	12	0	21	.	.	.	.
L00-247	02P4	230	13	72	3	79	.	.	.	.
L00-247	HOCP97-609	35	0	12	0	21	.	.	.	.
L00-247	L98-209	80	0	12	0	21	.	.	.	.
L00-247	L99-226	204	4	33	2	68	.	.	.	.
L00-264	L94-432	232	21	88	2	63	.	.	.	.
L00-266	LCP86-454	413	0	12	0	21	.	.	.	.
L00-268	HOCP92-618	435	21	63	3	56	.	.	.	.
L00-268	HOCP96-540	1070	0	12	0	21	.	.	.	.
L00-268	L92-321	217	0	12	0	21	.	.	.	.
L00-270	02P2	426	19	62	3	57	.	.	.	.
L00-270	HOCP96-540	521	3	25	1	43	.	.	.	.
L00-270	HOCP97-609	793	0	12	0	21	.	.	.	.
L00-270	L00-247	228	10	61	2	64	.	.	.	.
L00-270	L99-226	1089	0	12	0	21	.	.	.	.
L01-315	HOCP96-540	465	23	65	5	71	.	.	.	.
L01-315	HOCP96-561	232	4	31	0	21	.	.	.	.
L01-315	HOCP98-741	487	20	55	5	69	.	.	.	.
L01-315	HOCP99-825	78	2	38	0	21	.	.	.	.
L01-315	L94-428	188	0	12	0	21	.	.	.	.
L01-315	LCP86-454	240	8	46	1	46	.	.	.	.
L01-315	US01-040	244	0	12	0	21	.	.	.	.
L89-113	LCP85-384	250	20	84	6	89	.	.	.	.
L91-255	HOCP00-905	82	2	36	0	21	.	.	.	.
L91-281	L99-226	761	45	73	6	59	.	.	.	.
L92-312	02P2	442	0	12	0	21	.	.	.	.
L92-312	US80-004	101	0	12	0	21	.	.	.	.
L93-363	L00-259	579	15	38	4	56	.	.	.	.
L93-363	L91-255	208	31	98	4	86	.	.	.	.
L93-363	L99-226	144	12	85	3	86	.	.	.	.
L93-365	L99-233	242	7	41	0	21	.	.	.	.
L93-365	LCP85-384	236	8	48	0	21	.	.	.	.
L93-399	L98-209	229	8	49	2	63	.	.	.	.
L93-399	L98-209	394	17	59	0	21	.	.	.	.
L94-426	HOCP96-540	122	0	12	0	21	.	.	.	.
L94-426	HOCP97-609	225	15	77	1	48	.	.	.	.
L94-426	L98-207	117	2	31	1	62	.	.	.	.
L94-428	02P12	214	2	27	1	50	.	.	.	.

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
L94-428	HOCP96-540	482	31	76	11	88	.	.	.	.
L94-428	HOCP97-609	41	0	12	0	21	.	.	.	.
L94-428	L00-259	442	21	63	4	66	.	.	.	.
L94-428	L98-207	943	48	67	18	85	.	.	.	.
L94-433	HOCP92-618	174	11	75	0	21	.	.	.	.
L94-433	L94-428	189	0	12	0	21	.	.	.	.
L94-433	L99-226	1280	41	45	6	50	.	.	.	.
L96-040	HOCP97-609	490	0	12	0	21	.	.	.	.
L96-040	L00-268	240	8	46	0	21	.	.	.	.
L96-040	L99-226	664	0	12	0	21	.	.	.	.
L96-092	LCP85-384	463	13	40	5	71	.	.	.	.
L97-128	HOCP91-951	186	5	39	0	21	.	.	.	.
L97-128	HOCP96-540	246	18	80	8	96	.	.	.	.
L97-128	L94-428	146	6	55	0	21	.	.	.	.
L97-128	L98-207	133	7	69	0	21	.	.	.	.
L97-128	L99-233	87	6	80	1	72	.	.	.	.
L97-128	LCP85-384	69	0	12	0	21	.	.	.	.
L98-197	HOCP99-866	226	0	12	0	21	.	.	.	.
L98-207	02P10	1009	96	89	24	89	.	.	.	.
L98-207	02P7	244	0	12	0	21	.	.	.	.
L98-207	02P9	920	0	12	0	21	.	.	.	.
L98-207	L92-321	225	17	82	2	65	.	.	.	.
L98-207	L99-226	461	17	51	8	83	.	.	.	.
L98-209	HOCP97-609	213	0	12	0	21	.	.	.	.
L98-209	L01-299	326	0	12	0	21	.	.	.	.
L99-233	02P18	232	10	59	6	92	.	.	.	.
L99-233	HOCP98-741	216	0	12	0	21	.	.	.	.
L99-233	L99-226	248	9	50	2	61	.	.	.	.
LCP81-010	HOCP96-540	673	54	84	11	82	.	.	.	.
LCP81-010	L92-312	462	14	42	1	44	.	.	.	.
LCP81-010	L99-233	162	11	78	4	90	.	.	.	.
LCP81-010	LCP85-384	226	12	69	1	48	.	.	.	.
LCP81-10	02P19	223	9	54	0	21	.	.	.	.
LCP82-089	02P3	445	0	12	0	21	.	.	.	.
LCP82-089	02P4	410	0	12	0	21	.	.	.	.
LCP85-313	HOCP92-618	137	2	29	0	21	.	.	.	.
LCP85-313	HOCP97-609	159	9	72	0	21	.	.	.	.
LCP85-313	L98-209	623	31	66	8	76	.	.	.	.
LCP85-313	LCP82-089	109	4	51	1	66	.	.	.	.
LCP85-384	02P11	1105	22	33	7	55	.	.	.	.
LCP85-384	02P17	145	14	90	0	21	.	.	.	.
LCP85-384	02P3	200	0	12	0	21	.	.	.	.
LCP85-384	02P4	244	18	81	7	94	.	.	.	.
LCP85-384	HOCP01-517	444	49	95	20	98	.	.	.	.
LCP86-454	02P11	1033	0	12	0	21	.	.	.	.
LCP86-454	02P14	233	12	68	3	77	.	.	.	.
LCP86-454	L98-207	374	3	26	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
LCP86-454	LCP85-384	1366	34	37	7	52	.	.	.	.
LH083-153	HOCP92-618	92	0	12	0	21	.	.	.	.
N-27	HOCP96-540	383	38	93	11	94	.	.	.	.
N-27	L94-428	185	6	45	3	82	.	.	.	.
N-27	L98-209	657	18	39	4	53	.	.	.	.
N-27	LCP85-384	252	16	75	7	93	.	.	.	.
TUCCP77-042	LCP85-384	476	24	66	6	74	.	.	.	.
US79-010	HOCP96-540	131	17	97	4	95	.	.	.	.
US79-010	L01-299	216	17	83	3	80	.	.	.	.
US79-010	L98-207	245	10	55	0	21	.	.	.	.
US79-010	LCP85-384	102	19	99	1	68	.	.	.	.
US96-002	L01-299	185	2	28	0	21	.	.	.	.
2003 Crossing Series										
CP65-357	HO95-988	238	0	39	.	.	.	.	.	.
CP65-357	LCP85-384	1235	0	39	.	.	.	.	.	.
CP65-357	LCP85-384	964	0	39	.	.	.	.	.	.
CP73-351	HOCP96-540	457	0	39	.	.	.	.	.	.
CP77-310	HOCP91-552	231	0	39	.	.	.	.	.	.
CP83-644	HOCP97-606	244	0	39	.	.	.	.	.	.
HO01-564	L99-226	425	29	84	.	.	.	.	.	.
HO01-564	LCP85-384	238	0	39	.	.	.	.	.	.
HO89-889	L98-209	209	0	39	.	.	.	.	.	.
HO95-988	L99-226	182	0	39	.	.	.	.	.	.
HO95-988	L99-233	274	0	39	.	.	.	.	.	.
HO95-988	LCP85-384	243	27	91	.	.	.	.	.	.
HOCP00-905	HOCP00-930	154	28	99	.	.	.	.	.	.
HOCP00-905	HOCP92-618	175	0	39	.	.	.	.	.	.
HOCP00-905	HOCP96-540	222	0	39	.	.	.	.	.	.
HOCP00-905	HOCP97-609	248	0	39	.	.	.	.	.	.
HOCP00-905	L91-281	500	0	39	.	.	.	.	.	.
HOCP00-905	L94-432	377	56	97	.	.	.	.	.	.
HOCP00-905	LCP85-384	251	0	39	.	.	.	.	.	.
HOCP00-905	LCP85-384	452	0	39	.	.	.	.	.	.
HOCP00-930	HOCP91-552	478	36	86	.	.	.	.	.	.
HOCP00-930	HOCP96-540	490	0	39	.	.	.	.	.	.
HOCP00-942	L00-266	242	0	39	.	.	.	.	.	.
HOCP00-946	LCP85-384	236	0	39	.	.	.	.	.	.
HOCP00-950	HOCP01-506	212	24	92	.	.	.	.	.	.
HOCP00-950	HOCP01-506	228	0	39	.	.	.	.	.	.
HOCP00-950	HOCP91-552	668	6	79	.	.	.	.	.	.
HOCP00-950	HOCP91-552	446	0	39	.	.	.	.	.	.
HOCP00-950	HOCP96-540	934	71	87	.	.	.	.	.	.
HOCP00-950	L00-266	249	0	39	.	.	.	.	.	.
HOCP00-950	L99-226	240	23	89	.	.	.	.	.	.
HOCP01-523	HO91-572	240	0	39	.	.	.	.	.	.

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
HOCP01-523	LCP85-384	234	0	39	.	.	.	.	.	.
HOCP01-523	LCP85-384	243	16	84	.	.	.	.	.	.
HOCP01-525	03P12	235	0	39	.	.	.	.	.	.
HOCP01-525	HOCP01-506	244	26	90	.	.	.	.	.	.
HOCP01-525	LCP85-384	213	31	96	.	.	.	.	.	.
HOCP01-528	03P15	175	0	39	.	.	.	.	.	.
HOCP01-541	HOCP96-540	153	0	39	.	.	.	.	.	.
HOCP01-544	L98-197	244	0	39	.	.	.	.	.	.
HOCP01-558	HOCP00-905	241	0	39	.	.	.	.	.	.
HOCP01-561	03P12	490	64	94	.	.	.	.	.	.
HOCP01-561	03P13	256	0	39	.	.	.	.	.	.
HOCP01-561	LCP85-384	172	0	39	.	.	.	.	.	.
HOCP85-845	03P22	232	32	95	.	.	.	.	.	.
HOCP85-845	HOCP01-506	483	0	39	.	.	.	.	.	.
HOCP85-845	L02-328	247	25	89	.	.	.	.	.	.
HOCP85-845	L98-207	727	68	88	.	.	.	.	.	.
HOCP85-845	L98-209	741	0	39	.	.	.	.	.	.
HOCP85-845	LCP85-384	467	0	39	.	.	.	.	.	.
HOCP88-739	LCP85-384	683	0	39	.	.	.	.	.	.
HOCP89-831	03P12	489	0	39	.	.	.	.	.	.
HOCP89-831	LCP85-384	491	0	39	.	.	.	.	.	.
HOCP89-846	HOCP96-540	796	0	39	.	.	.	.	.	.
HOCP89-846	HOCP96-540	245	0	39	.	.	.	.	.	.
HOCP89-846	L02-328	241	0	39	.	.	.	.	.	.
HOCP89-846	L98-209	442	0	39	.	.	.	.	.	.
HOCP89-846	LCP85-384	244	0	39	.	.	.	.	.	.
HOCP91-552	03P16	183	0	39	.	.	.	.	.	.
HOCP91-552	L99-226	393	44	92	.	.	.	.	.	.
HOCP92-618	L02-333	231	0	39	.	.	.	.	.	.
HOCP92-624	03P1	641	0	39	.	.	.	.	.	.
HOCP92-624	03P2	247	0	39	.	.	.	.	.	.
HOCP92-624	HOCP00-905	235	0	39	.	.	.	.	.	.
HOCP92-624	HOCP85-845	239	0	39	.	.	.	.	.	.
HOCP92-624	HOCP91-552	355	0	39	.	.	.	.	.	.
HOCP92-624	HOCP91-552	228	33	96	.	.	.	.	.	.
HOCP92-624	HOCP96-540	497	0	39	.	.	.	.	.	.
HOCP92-624	L02-320	234	0	39	.	.	.	.	.	.
HOCP92-624	L02-323	208	31	97	.	.	.	.	.	.
HOCP92-624	L91-281	502	0	39	.	.	.	.	.	.
HOCP92-624	L96-092	494	0	39	.	.	.	.	.	.
HOCP92-624	L98-209	1114	0	39	.	.	.	.	.	.
HOCP92-624	L98-209	501	0	39	.	.	.	.	.	.
HOCP92-624	L99-226	250	0	39	.	.	.	.	.	.
HOCP92-624	LCP85-384	222	0	39	.	.	.	.	.	.
HOCP92-624	LCP85-384	473	0	39	.	.	.	.	.	.
HOCP92-624	LCP85-384	498	26	82	.	.	.	.	.	.
HOCP92-624	LCP85-384	315	0	39	.	.	.	.	.	.

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
HOCP92-648	HOCP96-540	215	0	39	.	.	.	.	.	.
HOCP92-648	L98-209	482	0	39	.	.	.	.	.	.
HOCP92-648	L98-209	487	0	39	.	.	.	.	.	.
HOCP92-648	L99-233	437	49	92	.	.	.	.	.	.
HOCP92-648	LCP85-384	1199	0	39	.	.	.	.	.	.
HOCP92-648	LCP85-384	256	0	39	.	.	.	.	.	.
HOCP92-648	LCP85-384	247	0	39	.	.	.	.	.	.
HOCP93-746	HOCP85-845	438	0	39	.	.	.	.	.	.
HOCP93-746	LCP85-384	437	0	39	.	.	.	.	.	.
HOCP93-749	L99-226	246	0	39	.	.	.	.	.	.
HOCP95-951	03P1	254	21	87	.	.	.	.	.	.
HOCP96-540	03P11	1587	0	39	.	.	.	.	.	.
HOCP96-540	03P12	474	0	39	.	.	.	.	.	.
HOCP96-540	03P18	195	0	39	.	.	.	.	.	.
HOCP96-540	03P19	200	0	39	.	.	.	.	.	.
HOCP96-540	03P6	251	0	39	.	.	.	.	.	.
HOCP96-540	03P8	249	0	39	.	.	.	.	.	.
HOCP96-540	03P9	1376	0	39	.	.	.	.	.	.
HOCP96-540	HOCP01-506	674	0	39	.	.	.	.	.	.
HOCP96-540	L02-316	1218	0	39	.	.	.	.	.	.
HOCP96-540	L98-209	435	0	39	.	.	.	.	.	.
HOCP96-540	L99-226	1435	0	39	.	.	.	.	.	.
HOCP96-561	03P19	247	43	98	.	.	.	.	.	.
HOCP96-561	L02-341	306	0	39	.	.	.	.	.	.
HOCP97-606	HOCP96-540	592	0	39	.	.	.	.	.	.
HOCP97-606	L98-209	239	0	39	.	.	.	.	.	.
HOCP97-609	03P13	365	0	39	.	.	.	.	.	.
HOCP97-609	03P15	247	0	39	.	.	.	.	.	.
HOCP97-609	HOCP96-540	805	0	39	.	.	.	.	.	.
HOCP98-741	L02-320	383	0	39	.	.	.	.	.	.
HOCP98-781	03P9	438	0	39	.	.	.	.	.	.
HOCP98-781	L98-207	481	0	39	.	.	.	.	.	.
HOCP98-781	LCP85-384	208	0	39	.	.	.	.	.	.
L01-281	03P9	428	0	39	.	.	.	.	.	.
L01-283	HOCP91-552	476	15	79	.	.	.	.	.	.
L01-283	LCP85-384	160	0	39	.	.	.	.	.	.
L01-299	LCP85-384	646	0	39	.	.	.	.	.	.
L01-299	LCP85-384	677	0	39	.	.	.	.	.	.
L02-233	L96-092	241	23	88	.	.	.	.	.	.
L02-319	HOCP96-540	407	0	39	.	.	.	.	.	.
L02-320	HOCP85-845	229	0	39	.	.	.	.	.	.
L02-320	HOCP96-540	487	0	39	.	.	.	.	.	.
L02-320	L99-226	243	12	81	.	.	.	.	.	.
L02-322	HOCP85-845	240	0	39	.	.	.	.	.	.
L02-322	HOCP96-540	132	0	39	.	.	.	.	.	.
L02-322	L99-226	211	0	39	.	.	.	.	.	.
L02-328	HO91-572	223	0	39	.	.	.	.	.	.

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
L02-328	HOCP91-552	224	0	39	.	.	.	.	.	.
L02-328	HOCP91-552	204	0	39	.	.	.	.	.	.
L02-328	L99-226	896	53	83	.	.	.	.	.	.
L02-328	L99-233	711	0	39	.	.	.	.	.	.
L02-333	HOCP96-540	748	0	39	.	.	.	.	.	.
L02-336	POLY	227	0	39	.	.	.	.	.	.
L02-341	HOCP91-552	381	42	90	.	.	.	.	.	.
L02-341	HOCP91-552	208	10	80	.	.	.	.	.	.
L02-341	HOCP96-540	428	0	39	.	.	.	.	.	.
L02-351	LCP85-384	242	0	39	.	.	.	.	.	.
L91-255	HOCP96-540	471	0	39	.	.	.	.	.	.
L91-255	L00-266	437	0	39	.	.	.	.	.	.
L91-255	LCP85-384	245	0	39	.	.	.	.	.	.
L94-426	HOCP91-552	356	0	39	.	.	.	.	.	.
L94-428	HOCP96-540	246	0	39	.	.	.	.	.	.
L94-432	03P24	458	0	39	.	.	.	.	.	.
L94-432	LCP85-384	419	0	39	.	.	.	.	.	.
L94-433	HO91-572	460	0	39	.	.	.	.	.	.
L94-433	LCP85-384	1087	54	81	.	.	.	.	.	.
L96-040	HOCP00-905	241	0	39	.	.	.	.	.	.
L96-040	L94-432	477	0	39	.	.	.	.	.	.
L96-040	L99-226	1105	0	39	.	.	.	.	.	.
L96-040	LCP85-384	212	0	39	.	.	.	.	.	.
L97-128	HO91-572	186	0	39	.	.	.	.	.	.
L97-128	HOCP91-552	207	0	39	.	.	.	.	.	.
L97-128	HOCP91-552	166	0	39	.	.	.	.	.	.
L97-128	L98-197	166	0	39	.	.	.	.	.	.
L97-128	L98-207	435	31	85	.	.	.	.	.	.
L97-128	L98-209	153	23	98	.	.	.	.	.	.
L97-128	L99-226	74	0	39	.	.	.	.	.	.
L97-128	LCP85-384	188	0	39	.	.	.	.	.	.
L97-128	POLY	371	0	39	.	.	.	.	.	.
L97-137	L94-432	440	0	39	.	.	.	.	.	.
L97-137	L96-092	486	0	39	.	.	.	.	.	.
L98-207	HOCP01-553	721	0	39	.	.	.	.	.	.
L98-209	HOCP91-552	362	0	39	.	.	.	.	.	.
L98-209	HOCP96-540	229	0	39	.	.	.	.	.	.
L98-209	L98-207	1190	0	39	.	.	.	.	.	.
L99-226	03P10	233	0	39	.	.	.	.	.	.
L99-226	03P13	238	0	39	.	.	.	.	.	.
L99-226	HOCP92-618	850	44	82	.	.	.	.	.	.
L99-226	HOCP96-540	764	64	87	.	.	.	.	.	.
L99-226	L98-197	1172	0	39	.	.	.	.	.	.
L99-226	L99-233	920	0	39	.	.	.	.	.	.
L99-233	L96-092	396	0	39	.	.	.	.	.	.
LCP02-337	03P14	243	0	39	.	.	.	.	.	.
LCP02-337	03P18	342	0	39	.	.	.	.	.	.

Table 6. Continued

			1st Line		2nd Line		Increase		Assignment	
Female	Male	Survive	No.	Rank Pcnt'l	No.	Rank Pcnt'l	No.	Rank Pcnt'l	No.	Rank Pcnt'l
LCP02-337	HOCP96-540	440	0	39	.	.	.	.	.	.
LCP02-337	L99-226	1160	0	39	.	.	.	.	.	.
LCP02-344	HOCP96-540	395	0	39	.	.	.	.	.	.
LCP02-345	HOCP96-540	450	0	39	.	.	.	.	.	.
LCP02-345	L99-226	190	0	39	.	.	.	.	.	.
LCP81-010	03P15	1323	0	39	.	.	.	.	.	.
LCP81-010	HO91-572	487	0	39	.	.	.	.	.	.
LCP81-010	HOCP91-552	242	13	83	.	.	.	.	.	.
LCP81-010	L02-320	226	0	39	.	.	.	.	.	.
LCP81-010	L98-197	786	0	39	.	.	.	.	.	.
LCP81-010	L98-207	238	0	39	.	.	.	.	.	.
LCP81-010	L98-207	694	0	39	.	.	.	.	.	.
LCP81-010	L98-207	1152	83	85	.	.	.	.	.	.
LCP81-010	LCP85-384	908	0	39	.	.	.	.	.	.
LCP81-010	LCP85-384	956	0	39	.	.	.	.	.	.
LCP82-089	LCP85-384	708	0	39	.	.	.	.	.	.
LCP85-384	03P10	866	37	80	.	.	.	.	.	.
LCP85-384	03P22	95	0	39	.	.	.	.	.	.
LCP85-384	03P24	248	0	39	.	.	.	.	.	.
LCP85-384	03P8	666	0	39	.	.	.	.	.	.
LCP86-454	03P8	246	0	39	.	.	.	.	.	.
MISC	MISC	489	0	39	.	.	.	.	.	.
N-27	HO95-988	233	30	94	.	.	.	.	.	.
N-27	03P22	466	66	95	.	.	.	.	.	.
TUCCP77-042	POLY	245	0	39	.	.	.	.	.	.
US01-039	HO91-572	481	0	39	.	.	.	.	.	.
US01-039	HOCP96-540	444	0	39	.	.	.	.	.	.
US01-039	LCP85-384	489	58	93	.	.	.	.	.	.
US01-039	LCP85-384	150	11	86	.	.	.	.	.	.
US01-040	HO91-572	172	0	39	.	.	.	.	.	.
US02-096	HOCP01-553	230	42	99	.	.	.	.	.	.
US02-096	LCP85-384	210	0	39	.	.	.	.	.	.
US99-002	LCP85-384	242	28	93	.	.	.	.	.	.
US99-004	LCP85-384	222	0	39	.	.	.	.	.	.

Table 7. Plant weight and rank summary statistics from the 2003 crossing series first stubble cross appraisal test at the St. Gabriel Research Station in 2005.

Cross	Female	Male	Plant Weight	
			Kg/Plant	Pcnt'l
XL03-250	LCP81-010	HOCP91-552	6.43	98
XL03-238	LCP81-010	L02-320	6.08	97
XL03-251	L02-341	HOCP91-552	6.02	95
XL03-278	US01-039	LCP85-384	5.99	94
XL03-361	HOCP00-950	L99-226	5.87	92
XL03-276	HOCP01-523	LCP85-384	5.81	91
LCP85-384			5.80	89
XL03-193	HOCP01-525	LCP85-384	5.76	88
XL03-246	US01-039	LCP85-384	5.71	86
XL03-369	L02-233	L96-092	5.65	85
XL03-239	HOCP98-741	L02-320	5.63	83
XL03-123	HOCP01-561	03P12	5.56	82
XL03-121	HOCP00-933	03P12	5.55	80
XL03-379	N-27	03P22	5.55	79
HOCP91-555			5.46	77
XL03-003	HOCP95-951	03P1	5.36	76
XL03-332	HOCP85-845	L02-328	5.28	75
XL03-207	HOCP00-905	L94-432	5.22	73
XL03-200	HOCP00-930	HOCP91-552	5.21	72
XL03-295	HO01-564	L99-226	5.21	70
XL03-131	HOCP92-648	L99-233	5.19	69
XL03-299	L01-283	HOCP91-552	5.18	67
XL03-203	L02-341	HOCP91-552	5.10	66
XL03-151	HOCP00-950	HOCP01-506	5.01	64
XL03-163	HOCP01-525	HOCP01-506	5.00	63
XL03-226	US01-039	HO91-572	4.94	61
L97-128			4.88	60
XL03-343	HOCP92-624	L02-323	4.87	58
XL03-383	HOCP00-905	HOCP00-930	4.86	57
XL03-218	L02-328	L99-226	4.82	55
XL03-247	US99-002	LCP85-384	4.80	54
XL03-217	L02-320	L99-226	4.79	52
XL03-305	US02-096	HOCP01-553	4.78	51
XL03-352	CP77-407	L99-226	4.74	50
XL03-231	L97-128	03P15	4.71	48
XL03-195	L02-351	LCP85-384	4.54	47
XL03-199	L94-426	HOCP91-552	4.40	45
XL03-184	HOCP85-845	L98-209	4.39	44
XL03-237	HOCP92-624	L02-320	4.36	42
XL03-109	L94-428	L98-207	4.30	41
XL03-073	L94-426	LCP85-384	4.30	39
XL03-283	HOCP00-905	L91-281	4.25	38

Table 7. Continued

Cross	Female	Male	Plant Weight	
			Kg/Plant	Pcnt'l
XL03-091	HOCP00-905	HOCP97-609	4.18	36
XL03-192	HOCP01-523	LCP85-384	4.15	35
XL03-120	HOCP96-540	L99-226	4.06	33
XL03-360	L02-322	L99-226	4.03	32
XL03-260	L01-283	LCP85-384	3.97	30
XL03-089	US01-039	HOCP96-540	3.93	29
XL03-220	LCP02-337	L99-226	3.90	27
XL03-215	LCP02-337	HOCP96-540	3.81	26
XL03-201	HOCP00-950	HOCP91-552	3.77	25
XL03-407	HOCP00-942	L00-266	3.75	23
XL03-165	HOCP85-845	HOCP01-506	3.43	22
XL03-152	HOCP96-540	HOCP01-506	3.32	20
XL03-191	HO01-564	LCP85-384	3.28	19
XL03-374	HOCP01-523	HOCP97-606	3.28	17
XL03-291	LCP02-345	HOCP96-540	3.20	16
XL03-212	L02-319	HOCP96-540	3.07	14
XL03-213	L02-320	HOCP96-540	2.96	13
XL03-304	L98-207	HOCP01-553	2.91	11
XL03-253	L97-128	HOCP91-552	2.88	10
XL03-161	LCP02-337	03P14	2.86	8
XL03-082	HOCP92-618	HOCP96-561	2.83	7
XL03-382	L02-328	HO91-572	2.79	5
XL03-388	L99-233	L96-092	2.57	4
XL03-111	HOCP01-528	L98-207	1.76	2
XL03-202	L02-328	HOCP91-552	1.60	1

2005 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. There are 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). Both the LSU and USDA varieties were planted at each location with the exception of D & N Farm which only contains LSU 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 4-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. Four commercial check varieties, LCP85-384, Ho95-988, HoCP96-540, and L97-128, were planted in all nursery and infield tests for comparison.

Millable stalk counts for both nursery and infield tests were made in late July and August. A combine harvester and weigh wagon system was used to cut and weigh plots, respectively, for the infield tests. During the harvest season, 10-stalk samples were harvested by hand and stripped of leaves for the nursery tests. For the two infield tests, a 10-stalk sample was taken to the USDA Ardoyne Farm and analyzed for fiber content using the pre-breaker press method. Samples were weighed and milled at the sucrose laboratory 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 2005 sugarcane crop experienced less-than-ideal growing conditions. Late winter and spring were excessively wet, making early-season cultivation and herbicide application difficult. After a wet beginning, the industry as a whole experience a dry growing season. The planting season was fairly normal until the land fall of two major hurricanes interrupted planting. After receiving the heavy rains associated with the two hurricanes, the harvest was dry which contributed to excellent maturity. The crop was lodged, and cane tonnage was lower than due to the combined effects of sugarcane rust disease and lodging. All experimental locations were harvested before any freezing temperatures occurred. Recommended cultural practices were followed at all test locations.

LCP85-384 has been the leading variety in Louisiana since 1998. Approximately 89% of Louisiana's harvested sugarcane acreage was in LCP85-384 for 2005. 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. 2005 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	10/21/05	39	2
1999	Newton Cane, Inc.	Nursery	Moreland silt loam	08/24/00	09/21/05	39	2
2000	Blackberry Farms	Infield	Commerce silt loam	08/21/01	10/21/05	48	1
2000	Newton Cane, Inc.	Nursery	Moreland silt loam	08/24/01	09/21/05	48	1
2001	Ardoyne Farm-U.S.D.A	Nursery	Commerce silt loam	10/18/01	10/13/05	37	2
2001	Iberia Research Station	Nursery	Baldwin silty clay	10/22/01	10/13/05	37	2
2001	Blackberry Farms	Infield	Commerce silt loam	08/27/02	10/21/05	38	4
2001	Newton Cane, Inc.	Nursery	Moreland silt loam	08/21/02	09/21/05	38	4
2001	D & N Farm	Nursery	Baldwin silty clay	08/22/02	10/13/05	12	2
2001	Sugarland Acres, Inc.	Infield	Coteau silt loam	08/09/02	12/15/05	38	4
2001	Landry Farms	Nursery	Commerce silt loam	08/29/02	10/24/05	38	4
2002	Blackberry Farms	Infield	Commerce silt loam	08/20/03	12/02/05	41	4
2002	Newton Cane, Inc.	Nursery	Moreland silt loam	08/15/03	11/04/05	41	4
2002	Sugarland Acres, Inc.	Infield	Coteau silt loam	08/19/03	12/05/05	41	4
2002	Landry Farms	Nursery	Commerce silt loam	08/21/03	10/24/05	41	4
2003	Ardoyne Farm-U.S.D.A	Nursery	Commerce silt loam	10/16/03	12/09/05	35	3
2003	Iberia Research Station	Nursery	Baldwin silty clay	10/21/03	12/01/05	35	3
2003	St. Gabriel Research Station	Nursery	Sharkey clay	10/09/03	11/08/05	35	3
2003	Blackberry Farms	Infield	Commerce silt loam	08/17/04	12/02/05	40	8
2003	Newton Cane, Inc.	Nursery	Moreland silt loam	08/31/04	11/04/05	40	8
2003	D & N Farm	Nursery	Baldwin silty clay	08/26/04	11/10/05	14	3
2003	Sugarland Acres, Inc.	Infield	Coteau silt loam	08/19/04	12/05/05	40	8
2003	Landry Farms	Nursery	Commerce silt loam	08/18/04	12/01/05	40	8
2004	Ardoyne Farm-U.S.D.A	Nursery	Commerce silt loam	10/19/04	12/08/05	37	14
2004	Iberia Research Station	Nursery	Baldwin silty clay	10/27/04	12/01/05	37	14
2004	St. Gabriel Research Station	Nursery	Sharkey clay	10/18/04	12/08/05	37	14
2004	Blackberry Farms	Infield	Commerce silt loam	08/12/05		50	
2004	Landry Farms	Nursery	Commerce silt loam	08/18/05		50	
2004	Sugarland Acres, Inc.	Infield	Coteau silt loam	08/19/05		50	
2004	Newton Cane, Inc.	Nursery	Moreland silt loam	08/25/05		50	
2005	St. Gabriel Research Station	Nursery	Sharkey clay	10/25/05		35	
2005	Ardoyne Farm-U.S.D.A	Nursery	Commerce silt loam	10/26/05		35	
2005	Iberia Research Station	Nursery	Baldwin silty clay	10/28/05		35	

† 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. Infield fourth-stubble means of the 1999 "HoCP" and "L" assignment series on a Commerce silt loam soil at Blackberry Farms in Vacherie, Louisiana in 2005.

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	1732 -	7.1 -	247	1.32	10708	12.4
LCP85-384	5357	20.3	264	1.23	34012	12.6
HoCP85-845	5009	19.7	254	1.32	30043	13.5
L99-226	6514	22.8	287 +	1.75	26080	12.5
L99-233	8040 +	31.8 +	253	1.21	55699	14.9 +

Table 3. Nursery fourth-stubble means of the 1999 "HoCP" and "L" assignment series on a Moreland silt loam soil at Newton Cane, Inc. in Bunkie, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
CP70-321	6320 -	36.7	171	1.48	49550 -
LCP85-384	10358	59.9	173	1.46	82038
HoCP85-845	5955 -	29.8 -	199 +	1.43	41564 -
L99-226	10700	56.4	190	2.28 +	49550 -
L99-233	9220	57.1	162	1.42	80768

Table 4. Nursery third-stubble means of the 2000 "HoCP" and "L" assignment series on a Moreland silt loam soil at Newton Cane, Inc. in Bunkie, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	5892	36.6	162	1.35	54269
HoCP85-845	5427	27.8 -	195	1.36	41019 -
HoCP91-555	5217	31.1	168	1.11 -	56447
HoCP00-950	7552 +	37.6	201	1.30	58080

Table 5. Infield third-stubble means of the 2000 "HoCP" and "L" assignment series on a Commerce silt loam soil at Blackberry Farms in Vacherie, Louisiana in 2005.

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	5271	19.8	264	1.22	32035	11.6
HoCP85-845	6200	24.7	250	1.52	32444	12.2
HoCP91-555	6060	23.2	261	1.40	33261	13.2
HoCP00-950	7534	27.3	275	1.48	36873	11.2

Table 6. Nursery second-stubble means of the 2001 "HoCP" and "L" assignment series on a Moreland silt loam soil at Newton Cane, Inc. in Bunkie, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	6393	37.0	172	1.39	53543
HoCP85-845	8019	38.8	207	1.62	48098
HoCP91-555	5779	32.1	180	1.39	46827
L01-283	10628 +	51.1 +	207	1.67	61347
L01-299	11205 +	54.3 +	207	1.62	67155 +
HoCP01-523	11115 +	51.6 +	216	1.60	64433
HoCP01-564	6891	33.8	204	1.56	43560

Table 7. Nursery second-stubble means of the 2001 "L" assignment series on a Baldwin silty clay soil at D& N Farm in Cecilia, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7334	33.3	221	1.30	51546
HoCP85-845	5519	26.6	209	1.39	38297 -
HoCP91-555	5592	27.2	205	1.27	42834 -
L01-283	9452	42.2 +	225	1.84 +	45920 -
L01-299	8412	39.5	213	1.59 +	49913

Table 8. Infield second-stubble means of the 2001 "HoCP" and "L" assignment series on a Commerce silt loam soil at Blackberry Farms in Vacherie, Louisiana in 2005.

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	5271	24.8	211	1.23	40397	12.2
HoCP85-845	7424 +	31.8 +	234	1.90 +	33571	14.3
HoCP91-555	8319 +	34.7 +	241	1.51 +	46084	11.9
L01-283	9674 +	41.6 +	233	1.79 +	46588	11.5
L01-299	9422 +	44.4 +	212	1.49 +	59831	11.8
HoCP01-523	8966 +	39.0 +	230	1.74 +	45361	12.6
HoCP01-564	8982 +	36.9 +	243	1.58 +	46913	11.9

Table 9. Nursery second-stubble means of the 2001 "HoCP" and "L" assignment series on a Commerce silt loam soil at Landry Farms in Paincourtville, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	12092	51.1	236	1.59	64070
HoCP85-845	10287	44.8	230	2.27	39930 -
HoCP91-555	17346	63.7	273	1.99	63888
L01-283	14494	56.9	255	1.67	68244
L01-299	14747	59.5	248	1.86	64433
HoCP01-523	10955	42.5	257	1.87	47009 -
HoCP01-564	12258	43.8	280	1.64	53543

Table 10. Infield second-stubble means of the 2001 "HoCP" and "L" assignment series on a Coteau silt loam soil at Sugarland Acres, Inc. in Youngsville, Louisiana in 2005.

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	6934	25.1	277	1.31	42462	11.3
HoCP85-845	7457	29.4	254 -	1.65	35637	13.1 +
HoCP91-555	6796	25.0	273	1.43	35751	11.5
L01-283	8248	30.4	271	1.52	40452	10.9
L01-299	11050 +	41.1 +	269	1.77	47645	11.2
HoCP01-523	8801 +	33.2 +	265	1.60	42214	11.6
HoCP01-564	9138 +	31.4 +	291	1.84	35305	10.6

Table 11. Nursery third-stubble means of the 2001 "L" assignment series on a Commerce silt loam soil at U.S.D.A-Ardoyne Farm in Chacahoula, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	9056	40.8	222	1.34	61256
HoCP85-845	8069	34.1	238	1.69	41518 -
HoCP91-555	10747	43.2	249	1.49	58307
L01-283	15136	61.5	246	1.71	72146
L01-299	12316	52.2	235	1.64	63979

Table 12. Nursery third-stubble means of the 2001 "L" assignment series on a Baldwin silty clay soil at Iberia Research Station in Jeanerette, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	5490	26.1	210	1.18	44014
HoCP85-845	1513	8.7	191	1.19	34031
HoCP91-555	5540	26.2	211	1.10	48098
L01-283	6599	31.6	209	1.31	46056
L01-299	4216	22.5	190	1.02	49913

Table 13. Nursery first-stubble means of the 2002 "HoCP" and "L" assignment series on a Moreland silt loam soil at Newton Cane, Inc. in Bunkie, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7468	31.3	238	1.42	44286
HoCP91-555	10802	43.6	249	1.60	54269 +
HoCP96-540	12489 +	47.6 +	264 +	2.03 +	46646
HoCP02-610	14071 +	58.4 +	241	1.97 +	59532 +
HoCP02-618	11464 +	42.7	269 +	1.50	56991 +
HoCP02-620	9638	39.2	246	1.58	49731
HoCP02-623	8375	30.3	277 +	1.37	44468

Table 14. Infield first-stubble means of the 2002 "HoCP" and "L" assignment series on a Commerce silt loam soil at Blackberry Farms in Vacherie, Louisiana in 2005.

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	8010	29.1	276	1.47	39775	11.8
HoCP91-555	8577	31.0	278	1.64	37730	12.9
HoCP96-540	9969	36.7	272	1.90 +	38679	11.4
HoCP02-610	9141	36.6	250	2.17 +	33752	13.6
HoCP02-618	8205	31.0	265	1.38	45139	12.1
HoCP02-620	7967	31.1	257	1.36	46820	12.8
HoCP02-623	9232	36.1	256	1.47	49121	13.9

Table 15. Nursery first-stubble means of the 2002 "HoCP" and "L" assignment series on a Commerce silt loam soil at Landry Farms in Paincourtville, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	9008	37.2	244	1.27	59169
HoCP91-555	11800	48.8	243	1.61	60803
HoCP96-540	13023	50.0	260	1.77 +	56991
HoCP02-610	12982	55.9	233	1.89 +	58988
HoCP02-618	11565	44.1	263	1.45	60984
HoCP02-620	11402	44.3	257	1.35	65522
HoCP02-623	13601	52.4	260	1.60	65703

Table 16. Infield first-stubble means of the 2002 "HoCP" and "L" assignment series on a Coteau silt loam soil at Sugarland Acres, Inc. in Youngsville, Louisiana in 2005.

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	7078	26.0	273	1.49	36733	11.3
HoCP91-555	8574	30.1	285	1.82	34218	11.9
HoCP96-540	9002	32.8	275	2.13	30755	11.5
HoCP02-610	8811	35.2	251 -	2.07	34281	13.3
HoCP02-618	7391	27.1	273	1.47	37251	11.7
HoCP02-620	7135	27.6	259 -	1.42	39334	12.3
HoCP02-623	7020	26.6	264	1.62	33289	13.0

Table 17. Nursery plantcane means of the 2003 "HoCP" and "L" assignment series on a Moreland silt loam soil at Newton Cane, Inc. in Bunkie, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7411	30.8	241	1.93	32126
HoCP91-555	9981	41.5	241	1.93	43016 +
HoCP95-988	8686	34.7	251	1.77	38841
HoCP96-540	12205 +	49.2 +	248	2.28 +	43016 +
L97-128	9734	41.5	236	2.20	37389
L03-371	11197 +	43.0 +	261	2.39 +	36119
L03-378	6874	27.9	247	1.75	31944
L03-396	7658	31.2	244	1.84	33941
HoCP03-704	8285	36.3	229	1.50 -	48279 +
HoCP03-708	9490	36.4	261	1.78	41201
HoCP03-716	11443 +	49.6 +	231	2.08	47735 +
HoCP03-743	6158	23.3	266	1.77	26318
HoCP03-757	7935	31.5	252	1.82	34666

Table 18. Nursery plantcane means of the 2003 "L" assignment series on a Baldwin silty clay soil at D & N Farm in Cecilia, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	8119	31.8	256	1.46	43016
HoCP91-555	8596	29.3	294 +	1.38	42471
HoCP95-988	7768	28.0	277 +	1.46	38297
HoCP96-540	10266	35.8	287 +	1.95	37208
L97-128	9865	36.8	270	1.85	39567
L03-371	8353	29.3	289 +	1.51	38841
L03-378	7390	26.2	282 +	1.46	36119
L03-396	7778	27.0	289 +	1.59	34122

Table 19. Infield plantcane means of the 2003 "HoCP" and "L" assignment series on a Commerce silt loam soil at Blackberry Farms in Vacherie, Louisiana in 2005.

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	6980	24.8	281	1.48	33567	12.3
HoCP91-555	9108 +	33.8 +	270	1.70	39745	13.0
HoCP95-988	9895 +	35.8 +	277	2.33	31036	12.7
HoCP96-540	10819 +	38.6 +	281	2.14	37519	12.1
L97-128	8663	32.1 +	270	2.34	28609	13.0
L03-371	9856 +	34.6 +	284	1.98	35645	10.6 -
L03-378	7528	28.4	265	1.97	29279	13.3
L03-396	6539	24.1	272	1.76	27457	13.2
HoCP03-704	7506	30.1	250 -	1.99	30301	13.6 +
HoCP03-708	9256 +	35.0 +	264	1.84	38192	14.2 +
HoCP03-716	9350 +	36.8 +	254 -	1.83	40143	12.7
HoCP03-743	7716	27.2	283	2.26	24014	11.8
HoCP03-757	7445	26.8	278	1.74	31514	11.4

Table 20. Nursery plantcane means of the 2003 "HoCP" and "L" assignment series on a Commerce silt loam soil at Landry Farms in Paincourtville, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	11610	43.3	268	1.64	52998
HoCP91-555	14867	53.2	279	2.04 +	51183
HoCP95-988	14756	54.7	271	1.99	54995
HoCP96-540	19399	69.1	281	2.42 +	57354
L97-128	15876	58.6	271	2.50 +	46827
L03-371	12391	44.6	280	2.17 +	40837
L03-378	14155	53.0	267	2.27 +	46645
L03-396	12876	47.8	270	1.89	50639
HoCP03-704	12191	44.3	275	1.93	46101
HoCP03-708	13786	50.5	273	1.77	56991
HoCP03-716	16430	56.5	291	2.53 +	44649
HoCP03-743	14975	53.2	282	2.17 +	49005
HoCP03-757	13188	47.4	278	1.92	49912

Table 21. Infield plantcane means of the 2003 "HoCP" and "L" assignment series on a Coteau silt loam soil at Sugarland Acres, Inc. in Youngsville, Louisiana in 2005.

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	5733	20.4	282	1.60	25574	11.4
HoCP91-555	9409	34.1	274	1.70	40401	11.7
HoCP95-988	8852	32.4	274	1.73	37393	11.4
HoCP96-540	8407	29.4	286	2.14 +	27465	11.5
L97-128	6495	26.0	250	2.16 +	23703	13.0
L03-371	9154	31.2	292	2.20 +	28551	11.0
L03-378	5871	22.7	262	1.84	24304	11.3
L03-396	6606	23.7	280	1.91 +	25115	12.0
HoCP03-704	8484	33.9	254	2.16 +	31339	11.6
HoCP03-708	7574	28.5	267	1.80	31700	14.0 +
HoCP03-716	9665	38.9	249	2.28 +	34167	12.7
HoCP03-743	6716	24.3	277	2.01 +	24196	11.5
HoCP03-757	5565	19.8	281	2.01 +	19703	9.2 -

Table 22. Nursery first-stubble means of the 2003 "L" assignment series on a Commerce silt loam soil at U.S.D.A-Ardoyne Farm in Chacahoula, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	14851	51.0	291	1.87	54677
HoCP91-555	12334	41.2	300	1.72	48324
HoCP96-540	14334	49.0	293	2.39 +	41064
L03-371	14780	51.6	286	2.38 +	43560
L03-378	15108	53.0	285	2.06	51501
L03-396	10768	38.1	284	1.75	43333

Table 23. Nursery first-stubble means of the 2003 "L" assignment series on a Baldwin silty clay soil at Iberia Research Station in Jeanerette, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	14550	56.3	261	1.79	62391
HoCP91-555	10000 -	38.4 -	260	1.51	51047
HoCP96-540	17172	62.1	276	2.22 +	56265
L03-371	12562	44.6	282	1.78	50139
L03-378	12221	44.5	275	1.62	55131
L03-396	9395 -	33.0 -	284	1.50	44921

Table 24. Nursery first-stubble means of the 2003 "L" assignment series on a Sharkey clay soil at St. Gabriel Research Station in St. Gabriel, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	11582	45.5	256	1.78	51274
HoCP91-555	13533	48.6	279	1.90	51274
HoCP96-540	11687	41.4	282	1.99	41745
L03-371	14546	51.4	283	2.09	49232
L03-378	7880	28.9	274	1.62	34712
L03-396	8741	33.5	261	1.68	39930

Table 25. Nursery plantcane means of the 2004 "L" assignment series on a Commerce silt loam soil at U.S.D.A-Ardoyne Farm in Chacahoula, Louisiana in 2005.

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	11767	38.6	305	1.50	51501	11.8
HoCP95-988	12630	41.7	305	2.11 +	39930 -	11.3
HoCP96-540	15591 +	53.5 +	293	2.69 +	39703 -	11.8
L97-128	14659	53.0 +	277 -	2.64 +	40157 -	12.9
L04-400	11718	42.6	276 -	2.25 +	37888 -	12.3
L04-403	12363	50.7	244 -	1.90	53543	11.7
L04-404	13619	49.1	278 -	2.75 +	35619 -	13.2 +
L04-407	13467	49.6	272 -	2.46 +	40384 -	13.8 +
L04-408	11085	36.6	305	1.93	37661 -	10.7
L04-409	9209	31.6	292	1.37	46056	12.9
L04-410	13636	44.1	310	2.12 +	41518 -	12.5
L04-417	9820	35.8	274 -	1.88	38115 -	17.8 +
L04-423	10462	36.5	287	1.83	39930 -	12.6
L04-425	14034	48.2	290	2.25 +	43333 -	9.6 -
L04-429	11153	40.7	275 -	1.97	41291 -	11.8
L04-430	10749	36.8	294	1.62	45375	13.0
L04-431	11571	40.6	285	2.02	40157 -	11.5
L04-434	11403	39.7	288	2.28 +	34939 -	11.2

Table 26. Nursery plantcane means of the 2004 "L" assignment series on a Baldwin silty clay soil at Iberia Research Station in Jeanerette, Louisiana in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	10327	38.8	266	1.90	40838
HoCP95-988	10029	36.5	276	2.14	34031
HoCP96-540	11178	41.2	271	2.15	38115
L97-128	13273	55.7	240 -	2.24	49686
L04-400	7873	34.8	226 -	2.00	34712
L04-403	10564	48.0	221 -	1.98	48551
L04-404	8523	32.0	266	2.03	31763
L04-407	6665	27.3	244 -	1.62	34712
L04-408	7974	28.4	281	1.70	34031
L04-409	8041	30.0	266	1.23	48324
L04-410	12502	46.0	271	1.96	46963
L04-417	10280	38.4	268	1.97	39023
L04-423	12216	47.4	258	2.11	44468
L04-425	12693	50.6	251	2.70	38569
L04-429	9916	37.9	263	1.91	39249
L04-430	9133	34.6	263	1.62	43106
L04-431	12832	50.8	253	2.03	51047
L04-434	7937	31.7	251	2.30	27679

Table 27. Nursery plantcane means of the 2004 "L" assignment series on a Sharkey clay soil at St. Gabriel Research Station in St. Gabriel, Louisiana in 2005.

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	10803	36.5	294	1.70	42879	11.3
HoCP95-988	9284	33.7	275	2.14	31536	11.6
HoCP96-540	12344	42.5	291	2.39 +	35619	11.7
L97-128	11887	43.0	277	1.95	44014	12.6
L04-400	9207	35.6	264 -	1.70	40611	11.5
L04-403	14455	55.7 +	260 -	2.40 +	46509	13.5 +
L04-404	10806	37.5	288	2.00	37661	11.6
L04-407	10145	36.4	279	1.80	40838	13.2 +
L04-408	9993	32.3	310	1.55	41518	10.4
L04-409	7151	24.1	297	1.19	40611	12.4
L04-410	10665	36.2	296	1.73	41745	11.8
L04-417	8316	28.5	292	1.47	39023	14.6 +
L04-423	9544	34.0	283	2.22	30401	12.3
L04-425	13017	43.7	297	2.10	41972	10.1
L04-429	8921	29.0	310	1.79	32443	11.5
L04-430	10378	35.6	292	1.71	41518	12.8
L04-431	9430	32.3	292	1.80	36754	11.7
L04-434	10633	35.5	300	2.16	32897	10.9

Table 28. Infield and nursery fourth-stubble means of the 1999 "HoCP" and "L" assignment series across locations in 2005.

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	4026	21.9	209	1.40	30129	12.4
LCP85-384	7858	40.1	218	1.35	58025	12.6
HoCP85-845	5482	24.8	226	1.37	35803	13.5
L99-226	8607	39.6	238	2.01 +	37815	12.5
L99-233	8630	44.5	207	1.31	68233	14.9

Table 29. Infield and nursery third-stubble means of the 2000 "HoCP" and "L" assignment series across locations in 2005.

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	5581	28.2	213	1.29	43152	11.6
HoCP85-845	5813	26.3	222	1.44	36731	12.2
HoCP91-555	5639	27.2	214	1.25	44854	13.2
HoCP00-950	7543	32.4	238	1.39	47477	11.2

Table 30. Nursery third-stubble means of the 2001 "L" assignment series across locations in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7273	33.5	216	1.26	52635
HoCP85-845	5214	23.3	219	1.49	37775
HoCP91-555	8143	34.7	230	1.29	53202
L01-283	10964	46.9	226	1.49	59101
L01-299	8918	40.0	216	1.39	56946

Table 31. Infield and nursery second-stubble means of the 2001 "HoCP" and "L" assignment series across locations in 2005.

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	7605	34.3	223	1.36	50403	11.7
HoCP85-845	7741	34.3	226	1.76 +	39106 -	13.7 +
HoCP91-555	8766	36.6	234	1.52	47077	11.7
L01-283	10499 +	44.5 +	238	1.70 +	52510	11.2
L01-299	10967 +	47.8 +	230	1.66 +	57795	11.5
HoCP01-523	9542	40.3	238	1.68 +	48949	12.1
HoCP01-564	8900	35.2	251	1.63 +	44025	11.3

Table 32. Infield and nursery first-stubble means of the 2002 "HoCP" and "L" assignment series across locations in 2005.

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	7891	30.9	258	1.41	44991	11.5
HoCP91-555	9938 +	38.4 +	263	1.67 +	46755	12.4
HoCP96-540	11121 +	41.8 +	267	1.96 +	43268	11.4
HoCP02-610	11251 +	46.5 +	244	2.02 +	46638	13.4 +
HoCP02-618	9656 +	36.2	267	1.45	50091	11.9
HoCP02-620	9036	35.5	255	1.43	50352	12.5
HoCP02-623	9557 +	36.3	264	1.51	48145	13.4 +

Table 33. Nursery first-stubble means of the 2003 “L” assignment series across locations in 2005.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	13661	50.9	269	1.81	56114
HoCP91-555	11956	42.7	279	1.71	50215
HoCP96-540	14398	50.9	284	2.20 +	46358
L03-371	13963	49.2	284	2.08	47644
L03-378	11737	42.1	278	1.76	47114
L03-396	9635	34.9	276	1.64	42728

Table 34. Infield and nursery plantcane means of the 2003 “HoCP” and “L” assignment series across locations in 2005.

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	7970	30.2	265	1.62	37456	11.9
HoCP91-555	10392 +	38.4 +	271	1.75	43363 +	12.3
HoCP95-988	9992 +	37.1 +	270	1.86 +	40112	12.0
HoCP96-540	12219 +	44.4 +	276	2.19 +	40512	11.8
L97-128	10127 +	39.0 +	259	2.21 +	35219	13.0
L03-371	10190 +	36.5 +	281 +	2.05 +	35999	10.8
L03-378	8363	31.6	264	1.86 +	33658	12.3
L03-396	8292	30.8	271	1.79	34255	12.6
HoCP03-704	8828	34.8	254	1.82	39278	12.6
HoCP03-708	9738 +	36.3 +	268	1.72	42294	14.1 +
HoCP03-716	11434 +	44.1 +	258	2.11 +	41947	12.7
HoCP03-743	8603	30.7	279 +	1.98 +	31156 -	11.6
HoCP03-757	8245	30.1	274	1.79	34222	10.3 -

Table 35. Nursery plantcane means of the 2004 "L" assignment series across locations in 2005.

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	10966	38.0	288	1.70	45073	11.5
HoCP95-988	10648	37.3	285	2.13 +	35166 -	11.5
HoCP96-540	13037	45.7	285	2.41 +	37813 -	11.8
L97-128	13273 +	50.5 +	264 -	2.28 +	44619	12.8
L04-400	9600	37.7	255 -	1.98	37737 -	11.9
L04-403	12460	51.5 +	242 -	2.09 +	49534	12.6
L04-404	10983	39.6	277	2.26 +	35014 -	12.4
L04-407	10092	37.8	265 -	1.96	38644	13.5 +
L04-408	9684	32.4	299	1.73	37737 -	10.5
L04-409	8134 -	28.6 -	285	1.26 -	44997	12.6
L04-410	12268	42.1	292	1.94	43409	12.1
L04-417	9472	34.3	278	1.77	38720	16.2 +
L04-423	10741	39.3	276	2.05	38266 -	12.5
L04-425	13248 +	47.5 +	279	2.35 +	41291	9.8 -
L04-429	9997	35.9	282	1.89	37661 -	11.7
L04-430	10087	35.7	283	1.65	43333	12.9
L04-431	11278	41.2	277	1.95	42653	11.6
L04-434	9991	35.6	279	2.25 +	31838 -	11.1

2005 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 various regions of the sugarcane belt. Two years after assignment, active varieties are also planted in an infield test on heavy soil at Ardoyne Farm.

USDA nursery test plots that are planted during the year of assignment consist of two replications with sixteen-foot, single row plots. There is a four-foot alleyway between plots. A minimum of three commercial varieties (LCP 85-384, HoCP 85-845, HoCP 91-555, CP 96-540, Ho 95-988, or L 97-128) are planted in each test for comparison purposes. Beginning in 2003, varieties from the USDA Recurrent Selection for Borers (RSB) program were included in nursery trials. Including RSB selections will give breeders more agronomic data on these varieties and aid in deciding what crosses should be made with these borer-resistant clones.

Nursery test 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, combined 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 weather-related circumstances out of our control, these infield tests were not planted in 2002 and 2003. Fortunately, tests were planted in 2004 (2002 HoCP & L series) and 2005 (2003 HoCP & L series). Infield tests are planted in a randomized complete block design with two replications, and include a minimum of four commercial varieties (LCP 85-384, Ho 95-988, HoCP 96-540, L 97-128, and/or HoCP 91-555) for use as checks. Plot size in infield tests are two rows wide (twelve feet) by twenty-four feet long. A 10-stalk sample is hand-cut from each plot just prior to harvesting and sent to the sucrose lab at Ardoyne Farm for processing for sucrose and fiber analysis. Plots are weighed with a tractor-pulled weigh wagon equipped with electronic load cells mounted in the axles and hitch. 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 plantcane of the 2002 HoCP series infield test can be found in Table 4. Results from individual nursery tests as well as analyses combined by series over locations can be found in Tables 2 and 3 and Tables 5 to 12. 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. 2005 Planting and harvest dates of "HoCP" nursery & infield tests.

					Harvest Dates		
Series	Location[2/]	Soil Texture [3/]	Test type	Planting Date	2003	2004	2005
2001	IRS	Bsc	Nursery	10/23/01	11/12	10/27	10/28
2002	AFL	Csl	Nursery	11/8/02	11/24	11/05	10/17
2002	AFH	Sc	Infield	8/24/04			11/16
2003	AFL	Csl	Nursery	10/20/03		12/06	11/10
2003	IRS	Bsc	Nursery	10/21/03		11/19	11/18
2003	STG	Sc	Nursery	10/17/03		12/13	11/17
2003	AFH	Sc	Infield	9/14/05			
2004	AFL	Csl	Nursery	10/20/04			11/22
2004	IRS	Bsc	Nursery	10/27/04			11/28
2004	STG	Sc	Nursery	10/21/04			12/01
2005	AFL	Csl	Nursery	10/26/05			
2005	IRS	Bsc	Nursery	10/28/05			
2005	STG	Sc	Nursery	10/27/05			

[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. Nursery third-stubble means of the 2001 "HoCP" assignment series on a Baldwin silty clay soil at Iberia Research Station in Jeanerette, Louisiana in 2005

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ Acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	9707	41.1	228	1.57	51501
HoCP 85-845	4825	19.9	243	1.14	35393
HoCP 91-555	11094	42.3	263	1.29	65794
HoCP 01-523	11137	39.7	279	1.31	60349
HoCP 01-564	11057	42.2	262	1.32	64206

Table 3. Nursery second-stubble means of the 2002 "HoCP" assignment series on a Commerce silt loam soil at Ardoyne Farm in Chacahoula, Louisiana in 2005.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ Acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	9536	37.3	256	1.28	58307
HoCP 85-845	8881	33.6	265	1.65	41745 -
HoCP 91-555	13853	50.3	276	1.60	62844
HoCP 02-610	11754	47.8	247	1.65	57626
HoCP 02-618	9989	38.3	261	1.18	64659
HoCP 02-620	12247	51.3	241	1.61	64433
HoCP 02-623	12038	43.7	274	1.45	60122

Table 4. Infield plantcane means of the 2002 "HoCP" assignment series on a Sharkey clay soil at Ardoyne Farm in Chacahoula, Louisiana in 2005.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre	Fiber
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)	(%)
LCP 85-384	7694	28.3	271	1.67	34307	11.6
LCP 91-555	8157	28.5	287	1.78	32200	12.0
Ho 95-988	9624 +	34.4 +	280	1.98	35455	11.8
HoCP 96-540	9246	34.3 +	270	2.09	32905	11.3
L 97-128	7066	27.0	262	1.73	31382	12.1
HoCP 02-610	9608 +	36.6 +	263	2.06	35627	13.0
HoCP 02-618	6589	25.3	261	1.35	37669	12.2
HoCP 02-620	6184	24.9	248 -	1.39	35916	11.9
HoCP 02-623	8475	31.0	274	1.49	41732	13.2

Table 5. Nursery first-stubble means of the 2003 "HoCP" assignment series on a Commerce silt loam soil at Ardoyne Farm in Chacahoula, Louisiana in 2005.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ Acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	10914	39.4	277	1.57	50139
HoCP 91-555	16895 +	57.7 +	293	1.94 +	59441 +
HoCP 96-540	11449	43.9	261	2.19 +	40157 -
HoCP 03-704	11344	42.2	269	1.57	54450
HoCP 03-708	13375	46.8	287	1.66	56265
HoCP 03-716	12872	49.4 +	261	1.99 +	49686
HoCP 03-743	10217	34.5	296	1.75	39476 -
HoCP 03-757	9229	35.3	262	1.52	46509
US 90-18	7366-	26.1 -	283	1.61	32443 -
US 01-40	9302	46.1	202 -	2.20 +	41972 -
US 02-98	7292 -	31.0 -	234 -	1.73	35846 -

Table 6. Nursery first-stubble means of the 2003 "HoCP" assignment series on a Baldwin silty clay soil at Iberia Research Station in Jeanerette, Louisiana in 2005.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ Acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	13520	47.9	284	1.75	54677
HoCP 91-555	13818	49.9	277	1.58	63071
HoCP 96-540	14494	55.3	263	2.13	51954
HoCP 03-704	11851	47.0	253 -	1.66	57853
HoCP 03-708	13502	45.7	297	1.74	52408
HoCP 03-716	12366	47.1	263	1.86	51954
HoCP 03-743	13603	47.1	292	1.84	51047
HoCP 03-757	8815 -	33.6 -	263	1.25 -	54450
US 90-18	7944 -	28.6 -	279	1.44	39476
US 01-40	12285	56.1	221 -	2.09	53543
US 02-98	6714 -	26.5 -	253 -	1.49	35619

Table 7. Nursery first-stubble means of the 2003 "HoCP" assignment series on a Sharkey clay soil at St. Gabriel Research Station in St. Gabriel, Louisiana in 2005.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ Acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	15568	55.3	281	1.77	63298
HoCP 91-555	14420	48.3	299	1.83	52862
HoCP 96-540	15735	56.1	282	2.27 +	49232
HoCP 03-704	15244	57.5	265	1.93	59668
HoCP 03-708	13952	46.6	300	1.72	54223
HoCP 03-716	12176	47.4	257 -	2.00	47417
HoCP 03-743	17188	56.3	306 +	2.18 +	51728
HoCP 03-757	10756 -	38.4	283	1.41 -	53316
US 90-18	11396 -	42	272	1.61	52181
US 01-40	11719	50.5	232 -	2.20 +	46056
US 02-98	9266 -	35.8	259 -	1.98	36300

Table 8. Nursery first-stubble means of the 2003 "HoCP" assignment series across locations in 2005.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ Acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	13334	47.5	281	1.70	56038
HoCP 91-555	15044	51.9	290	1.78	58458
HoCP 96-540	13893	51.8	269	2.19 +	47114 -
HoCP 03-704	12813	48.9	262 -	1.72	57324
HoCP 03-708	13610	46.4	294	1.71	54299
HoCP 03-716	12472	48.0	260 -	1.95 +	49686
HoCP 03-743	13669	46.0	298 +	1.92 +	47417 -
HoCP 03-757	9600 -	35.8 -	269	1.39 -	51425
US 90-18	8902 -	32.2 -	278	1.55	41367 -
US 01-40	11102	50.9	218 -	2.16 +	47190 -
US 02-98	7757 -	31.1 -	249 -	1.73	35922 -

Table 9. Nursery plantcane means of the 2004 "HoCP" assignment series on a Commerce silt loam soil at Ardoyne Farm in Chacahoula, Louisiana in 2005.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ Acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	10186	37.4	272	1.90	39249
HoCP 91-555	13643 +	47.9	285	2.19	43787
Ho 95-988	14770 +	54.7 +	272	2.46 +	44241
HoCP 96-540	11164	41.8	267	2.47 +	34031
L 97-128	12697	49.1 +	259	2.69 +	36527
HoCP 04-801	14954 +	60.2 +	250 -	2.68 +	45148
HoCP 04-802	13780 +	49.5 +	278	2.44 +	40838
HoCP 04-803	12310	47.4	260	2.49 +	38115
HoCP 04-805	12131	44.7	271	2.05	43560
HoCP 04-807	14631 +	56.4 +	260	2.90 +	39023
HoCP 04-809	12884	44.3	289	1.97	45148
HoCP 04-810	12274	46.3	265	2.09	44468
HoCP 04-812	12476	49.8 +	250 -	2.34 +	42653
HoCP 04-813	11430	42.9	266	1.93	44694
HoCP 04-814	17486 +	67.1 +	261	3.16 +	42653
HoCP 04-816	13314	54.5 +	243 -	2.32 +	47417 +
HoCP 04-819	13346	54.4 +	244 -	2.65 +	41064
HoCP 04-820	14996 +	58.6 +	256	2.87 +	40838
HoCP 04-821	13492 +	47.4	284	2.19	43333
HoCP 04-823	12198	45.1	270	2.29	39476
HoCP 04-824	12561	44.7	282	2.01	44241
HoCP 04-825	10924	44.4	246 -	2.00	44468
HoCP 04-827	14227 +	49.3 +	289	2.43 +	40611
HoCP 04-828	11927	51.7 +	230 -	2.25	45602
HoCP 04-829	11662	44.4	263	2.38 +	37661
HoCP 04-832	14496 +	53.7 +	270	2.19	49005 +
HoCP 04-833	11111	42.4	262	1.95	43787
HoCP 04-836	13046	48.5	269	2.10	46283
HoCP 04-837	12157	41.0	296 +	2.12	38796
HoCP 04-838	15308 +	53.2 +	287	2.23	47871 +
HoCP 04-839	11751	45.2	260	1.96	45829
HoCP 04-843	9252	36.4	255	2.06	35393
HoCP 04-844	9203	38.7	239 -	2.08	37208
HoCP 04-847	15852 +	58.0 +	273	2.86 +	40611
HoCP 04-848	13016	50.5 +	258	2.15	47871 +
HoCP 04-849	11114	39.4	282	2.01	39249
HoCP 04-852	12399	60.3 +	206 -	3.28 +	36754
HoCP 04-853	15544 +	55.9 +	278	2.11	53089 +
HoCP 04-854	15482 +	57.4 +	268	2.70 +	42426
HoCP 04-855	13671 +	51.0 +	268	2.46 +	41518
HoCP 04-856	11180	40.2	278	1.72	46736

Table 10. Nursery plantcane means of the 2004 "HoCP" assignment series on a Baldwin silty clay soil at Iberia Research Station in Jeanerette, Louisiana in 2005.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ Acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	10997	37.5	294	1.79	41972
HoCP 91-555	13230	47.4	278	1.82	52181
Ho 95-988	12902	45.3	286	2.02 +	44694
HoCP 96-540	8497	30.6	278	2.09 +	29948
L 97-128	9363	35.2	263 -	1.87 +	37661
HoCP 04-801	12544	49.1	253 -	2.38 +	40611
HoCP 04-802	9946	39.6	251 -	2.17 +	36527
HoCP 04-803	11948	44.3	270	2.29 +	38796
HoCP 04-805	13161	53.3	247 -	2.34 +	45602
HoCP 04-807	18129 +	68.2 +	266 -	3.02 +	44468
HoCP 04-809	9529	32.6	292	1.70	38342
HoCP 04-810	13677	47.7	286	2.31+	41291
HoCP 04-812	9782	39.0	249 -	1.99 +	39023
HoCP 04-813	10750	38.8	276	1.93 +	40157
HoCP 04-814	17007 +	61.6 +	276	2.89 +	42653
HoCP 04-816	10656	41.3	257 -	2.21 +	37661
HoCP 04-819	10573	40.3	263 -	2.24 +	35846
HoCP 04-820	15067	58.9 +	253 -	2.49 +	47190
HoCP 04-821	9778	33.5	293	1.93 +	34939
HoCP 04-823	14918	51.7	288	2.26 +	45829
HoCP 04-824	12942	49.0	263 -	2.17 +	44694
HoCP 04-825	8735	34.9	251 -	1.84	37888
HoCP 04-827	14691	52.0	282	2.41 +	43333
HoCP 04-828	8427	33.5	252 -	2.20 +	30401
HoCP 04-829	13856	51.5	269 -	2.34 +	44014
HoCP 04-832	11002	43.8	251 -	1.97 +	44694
HoCP 04-833	12103	45.9	264 -	1.92 +	47871
HoCP 04-836	14533	52.0	280	1.94 +	53769
HoCP 04-837	13838	49.4	281	2.22 +	44468
HoCP 04-838	11019	39.1	282	1.72	45602
HoCP 04-839	8399	33.2	253 -	1.79	37208
HoCP 04-843	16048	57.6 +	278	2.59 +	44694
HoCP 04-844	9482	38.7	248 -	1.85 +	41745
HoCP 04-847	15272	57.4 +	264 -	2.73 +	41972
HoCP 04-848	10941	47.3	229 -	2.20 +	43106
HoCP 04-849	9521	33.6	283	1.66	40611
HoCP 04-852	14151	69.2 +	204 -	3.40 +	40611
HoCP 04-853	12769	45.9	278	1.70	53996
HoCP 04-854	10828	43.7	248 -	2.02 +	43333
HoCP 04-855	12648	43.6	291	2.16 +	40384
HoCP 04-856	11245	38.9	288	1.70	45602
US 04-9601	7118	39.5	180 -	1.84	43106
US 04-9602	8872	36.2	246 -	1.79	40611
US 04-9603	10323	40.0	258 -	1.73	45829

Table 11. Nursery plantcane means of the 2004 "HoCP" assignment series on a Sharkey clay soil at St. Gabriel Research Station in St. Gabriel, Louisiana in 2005.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ Acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	14233	50.8	280	2.40	42426
HoCP 91-555	14959	52.8	283	2.35	45148
Ho 95-988	13264	46.6	285	2.18	42653
HoCP 96-540	13566	51.3	265	2.90	35393
L 97-128	14352	52.7	273	2.62	40157
HoCP 04-801	13576	53.0	256	2.80	37888
HoCP 04-802	11848	42.6	280	2.21	38342
HoCP 04-803	11932	44.5	270	2.59	34258
HoCP 04-805	13994	59.3	237 -	2.84	41745
HoCP 04-807	12315	47.6	259	2.98	31989 -
HoCP 04-809	14106	49.2	287	2.20	44921
HoCP 04-810	11921	46.5	256	1.94	48098
HoCP 04-812	11552	45.5	254 -	2.48	36527
HoCP 04-813	13476	49.7	271	2.20	45148
HoCP 04-814	15650	60.2	260	3.41 +	35619
HoCP 04-816	13084	50.4	257	2.40	41972
HoCP 04-819	11001	43.6	253 -	2.73	32216 -
HoCP 04-820	14739	59.1	249 -	2.93	40384
HoCP 04-821	10090	35.7 -	285	2.25	31536 -
HoCP 04-823	11752	41.2	286	2.43	33578
HoCP 04-824	12267	47.4	259	2.29	41291
HoCP 04-825	10627	43.5	247 -	2.29	37888
HoCP 04-827	14949	51.9	287	2.29	45375
HoCP 04-828	14079	59.3	237 -	2.71	44241
HoCP 04-829	13274	51.4	258	2.47	42199
HoCP 04-832	12605	55.0	230 -	2.46	44694
HoCP 04-833	9814	40.6	242 -	2.10	38796
HoCP 04-836	13076	47.7	276	2.44	39023
HoCP 04-837	11235	37.3	301	1.97	38115
HoCP 04-838	12715	42.1	302	2.26	39023
HoCP 04-839	9432	37.3	252 -	1.85	40384
HoCP 04-843	11668	44.9	258	2.31	38342
HoCP 04-844	10003	41.1	243 -	1.92	42879
HoCP 04-847	14094	53.0	266	2.89	36754
HoCP 04-848	10593	43.4	245 -	2.16	40384
HoCP 04-849	11573	44.3	264	1.99	44468
HoCP 04-852	10272	59.3	173 -	4.15 +	28586 -
HoCP 04-853	14859	61.2	243 -	2.40	50820
HoCP 04-854	15583	57.0	274	2.88	39703
HoCP 04-855	12253	46.5	265	2.52	37208
HoCP 04-856	12111	42.5	285	1.81	46963
US 04-9601	10802	60.7	179 -	2.21	54904 +
US 04-9602	11483	46.9	245 -	2.10	44694
US 04-9603	11051	45.8	241 -	1.88	49005

Table 12. Nursery plantcane means of the 2004 "HoCP" assignment series across locations in 2005.

Variety	Sugar/ Acre (lbs.)	Tons/ acre (tons)	Sugar/ ton (lbs.)	Weight/ stalk (lbs.)	Stalks/ Acre (no.)
LCP 85-384	11805	41.9	282	2.03	41216
HoCP 91-555	13944	49.4	282	2.12	47039
Ho 95-988	13645	48.9	281	2.22	43863
HoCP 96-540	11076	41.2	270	2.48 +	33124 -
L 97-128	12137	45.7	265 -	2.39 +	38115
HoCP 04-801	13691	54.1 +	253 -	2.62 +	41216
HoCP 04-802	11858	43.9	270	2.27	38569
HoCP 04-803	12063	45.4	267	2.46 +	37056
HoCP 04-805	13095	52.4 +	252 -	2.41 +	43636
HoCP 04-807	15025 +	57.4 +	261 -	2.97 +	38493
HoCP 04-809	12173	42.0	290	1.95	42804
HoCP 04-810	12624	46.8	269	2.11	44619
HoCP 04-812	11270	44.7	251 -	2.27	39401
HoCP 04-813	11885	43.8	271	2.02	43333
HoCP 04-814	16714 +	63.0 +	266	3.15 +	40308
HoCP 04-816	12351	48.8	252 -	2.31	42350
HoCP 04-819	11640	46.1	253 -	2.54 +	36376
HoCP 04-820	14934 +	58.9 +	253 -	2.76 +	42804
HoCP 04-821	11120	38.9	287	2.12	36603
HoCP 04-823	12956	46.0	281	2.32	39628
HoCP 04-824	12590	47.0	268	2.15	43409
HoCP 04-825	10096	41.0	248 -	2.04	40081
HoCP 04-827	14622 +	51.1	286	2.37 +	43106
HoCP 04-828	11478	48.1	240 -	2.39 +	40081
HoCP 04-829	12931	49.1	263 -	2.39 +	41291
HoCP 04-832	12701	50.8 -	250 -	2.21	46131
HoCP 04-833	11009	43.0	256 -	1.99	43484
HoCP 04-836	13551	49.4	275	2.16	46358
HoCP 04-837	12410	42.6	293	2.10	40459
HoCP 04-838	13014	44.8	290	2.07	44165
HoCP 04-839	9861	38.6	255 -	1.87	41140
HoCP 04-843	12323	46.3	263 -	2.32	39476
HoCP 04-844	9563	39.5	243 -	1.95	40611
HoCP 04-847	15073 +	56.1 +	268	2.83 +	39779
HoCP 04-848	11517	47.1	244 -	2.17	43787
HoCP 04-849	10736	39.1	276	1.88	41443
HoCP 04-852	12274	62.9 +	194 -	3.61 +	35317
HoCP 04-853	14391	54.3 +	266	2.07	52635 +
HoCP 04-854	13964	52.7 +	263 -	2.53 +	41821
HoCP 04-855	12858	47.0	274	2.38 +	39703
HoCP 04-856	11512	40.5	284	1.74	46434

2005 LOUISIANA SUGARCANE VARIETY DEVELOPMENT PROGRAM OUTFIELD VARIETY TRIALS

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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 havestability 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 2005 outfield tests. Included are multi-year yield analyses for appropriate test varieties (tables 3-33).

The experimental design used at each outfield location was a randomized complete block design with three replications per location. Test plots were two rows wide and 50 feet long with a 5-foot alley between plots. To reflect industry practices, all locations were harvested with a combine harvester. Each plot was weighed with a weigh wagon fitted 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 laboratory. 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.

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

1Data 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.

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 89% of the sugarcane acreage in 2005 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.

Eight experimental varieties were introduced to the outfield locations for seed increase in 2005 (Table 1). Twelve experimental and five commercial varieties were planted at 10 outfield locations. Twenty-seven tests were harvested in 2005 including nine plantcane, nine first-stubble, seven second-stubble, and two 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 27-33 provide combined analysis of plantcane, first-stubble, second-stubble, and third-stubble crops averaged over several years that is used to evaluate commercial and experimental varieties.

Weather adversely affected all outfield test sites to varying degrees. Hurricanes Cindy, Katrina, and Rita produced high winds that severely lodged the varieties in each test. Useful information was noted regarding degree of lodging and broken tops. The dry weather following the hurricanes made for good field conditions at the time of harvest.

L99-226 and L99-233 continued to perform well in outfield testing in 2005 based on plantcane, first stubble, and second stubble data. L99-226 and L99-233 will be eligible for release in 2006.

HoCP00-950 was included in plantcane and first stubble tests in 2005 and produced high levels of sugar per acre in each crop. HoCP00-950 was sent from the primary seed increase stations to secondary increase stations in 2005. This variety will be eligible for release in 2007.

Four experimental varieties of the 2001 assignment series were tested in the plantcane trials: L01-283, L01-299, HoCP01-523, and Ho01-564. All of these experimental varieties produced significantly higher sugar per acre than LCP85-384. L01-283 had the highest sugar per acre of the group, where as L01-299 had the lowest sugar per acre. These varieties will be eligible for release in 2008.

Table 1. Commercial and experimental varieties planted in the outfield in 2005.

Commercial Varieties	Experimental Varieties		Experimental Varieties Introduced to the Outfield	
LCP85-384	L99-226	HO01-564	L03-371	HoCP03-708
HoCP91-555	L99-233	HOCP 02-610	L03-378	HoCP03-716
HoCP95-988	HoCP00-950	HOCP02-618	L03-396	HoCP03-743
HoCP96-540	L01-283	HOCP02-620	HoCP03-704	HoCP03-757
L97-128	L01-299	HOCP02-623		
	HOCP01-523	CP89-2143		

Table 2. Harvest and planting dates for all outfield locations harvested in 2005.

Location	Parish		Plantcane		First-stubble		Second-stubble		Third-stubble	
		2005 Planting Date	2005 Harvest Date	2004 Planting Date	2005 Harvest Date	2003 Planting Date	2005 Harvest Date	2002 Planting Date	2005 Harvest Date	2001 Planting Date
A. Landry	Iberville	09/15	12/13	09/09	10/20	09/17	**	***	**	***
Allain	St. Mary	09/21	11/22	09/01	**	09/12*	**	***	**	09/19
Alma	Pointe-Coupee	09/16	**	09/20	10/05	09/11	10/05	09/04	**	09/14
Bon Secour	St. James	09/08	12/01	09/08	10/25	09/05	10/24	09/03	10/24	09/08
Georgia	Lafourche	10/03*	12/06	09/07	12/06	09/18	12/06	09/21	**	09/15
Glenwood	Assumption	09/13	11/29	09/10	11/28	08/27	11/28	08/29	**	09/25
K. Self	Pointe-Coupee	09/15*	**	09/22*	**	***	**	***	**	***
Lanaux	St. John	09/14	12/12	08/25	12/12	09/03	11/01	09/11	11/01	09/05
Levert-St. John	St. Martin	09/09	11/03	08/26	11/03	08/26	**	09/11	**	09/19
Magnolia	Terrebonne	10/06	12/08	09/10	12/07	10/09	10/19	08/16	**	10/04
R. Hebert	Iberia	09/12	11/17	09/13	11/02	09/12	11/04	09/18	**	09/27

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

Table 3. Plantcane sugar per acre for five commercial and seven experimental varieties at nine outfield locations in 2005.

	Heavy			Light						
Variety	Landry	Magnolia	Allains	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs/A)					
LCP85-384	7595	6268	7031	8233	6051	7286	7853	8143	4799	7029
HoCP91-555	8663	8940 +	8085	8730	6287	9167 +	9664 +	9332	5004	8208+
HoCP95-988	9414 +	7582	6916	10035+	6716	10402+	10502+	7795	6046	8379+
HoCP96-540	10827+	10241+	7500	9136	8432+	9930 +	9323	10090	6005	9054+
L97-128	8473	7361	6797	8724	5231	9371 +	8723	8101	6679	7718
L99-226	11539+	10898+	8900+	10887+	8684+	11313+	9905 +	9719	5910	9750+
L99-233	9256 +	8774 +	8344+	9213	7808+	10078+	10306+	9488	5116	8709+
HoCP00-950	9453 +	9408 +	7639	10943+	7550+	7882	10138+	9179	5756	8694+
L01-283	9344 +	9506 +	6823	10491+	8622+	11010+	10471+	9129	6351	9083+
L01-299	9481 +	6290	7289	8360	7798+	9800 +	8478	8283	5243	7891+
HoCP01-523	9850 +	9292 +	7636	9503 +	8582+	9031 +	9665 +	9585	5754	8766+
HoCP01-564	10382+	8424 +	6937	11313+	8230+	9212 +	9229	8170	5761	8629+

Table 4. Plantcane cane yield for five commercial and seven experimental varieties at nine outfield locations in 2005.

	Heavy			Light						
Variety	Landry	Magnolia	Allains	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(tons/A)					
LCP85-384	26.4	22.2	26.5	29.1	22.5	28.5	27.5	30.7	19.3	25.8
HoCP91-555	30.4	30.6+	27.4	33.5	23.7	35.1+	34.7+	31.5	21.4	29.8+
HoCP95-988	32.9+	28.1+	26.7	35.2+	25.3	40.9+	36.6+	28.7	24.4	31.0+
HoCP96-540	37.4+	33.8+	26.9	30.5	29.2+	35.2+	32.8+	35.0	23.9	31.6+
L97-128	30.0	28.8+	25.0	29.6	23.4	35.2+	31.6	28.1	26.4	28.7+
L99-226	37.3+	34.4+	31.6+	35.4+	28.9+	37.0+	32.3	31.0	23.8	32.4+
L99-233	33.8+	30.1+	31.0+	35.0+	28.9+	39.9+	38.4+	32.7	21.7	32.4+
HoCP00-950	31.3+	31.7+	25.2	37.0+	26.4+	28.5	32.8+	30.6	20.6	29.4+
L01-283	32.3+	32.9+	23.4	35.1+	31.0+	38.0+	36.5+	30.1	26.5	31.7+
L01-299	34.7+	25.8	26.7	30.5	30.1+	37.2+	30.4	28.3	25.2	29.9+
HoCP01-523	35.3+	30.3+	28.2	33.3	30.6+	33.6+	34.0+	32.3	22.5	31.1+
HoCP01-564	34.1+	29.5+	23.4	37.2+	28.2+	32.9+	30.7	25.6	22.1	29.3+

Table 5. Plantcane sugar per ton for five commercial and seven experimental varieties at nine outfield locations in 2005.

	Heavy			Light						
Variety	Landry	Magnolia	Allains	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs/ton)					
LCP85-384	288	283	266	283	268	256	286	265	249	271
HoCP91-555	283	292	295 +	264	264	261	279	297 +	234	274
HoCP95-988	287	272	258	285	265	254	287	272	249	270
HoCP96-540	289	305	279	300	289	282	285	288 +	252	286 +
L97-128	281	257	272	295	223 -	266	276	288 +	252	268
L99-226	309 +	317	282	308 +	300 +	305 +	307 +	314 +	248	299 +
L99-233	274	291	269	264	269	253	268 -	290 +	234	268
HoCP00-950	302	297	303 +	296	286	277	310 +	300 +	278 +	295 +
L01-283	289	289	291 +	300	279	290 +	287	303 +	240	285 +
L01-299	274	244	273	273	259	263	279	293 +	209 -	263
HoCP01-523	279	307	270	286	280	269	284	297 +	256	281
HoCP01-564	305	286	296 +	304	291	279	301 +	320 +	260	294 +

Table 6. Plantcane stalk weight for five commercial and seven experimental varieties at nine outfield locations in 2005.

	Heavy			Light						
Variety	Landry	Magnolia	Allains	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs)					
LCP85-384	1.88	1.55	1.83	1.70	1.58	1.57	1.75	1.64	1.38	1.65
HoCP91-555	2.07	1.76	1.95	2.21+	1.54	1.68	1.97	1.52	1.48	1.80
HoCP95-988	2.40+	1.82+	1.94	2.59+	2.18+	2.25+	2.40+	2.15+	1.76+	2.17+
HoCP96-540	2.60+	2.09+	1.96	2.11	1.95+	1.93	2.31+	2.04+	1.75+	2.08+
L97-128	2.35+	1.78	2.26+	2.26+	2.00+	2.55+	2.60+	2.07+	2.02+	2.21+
L99-226	2.82+	2.63+	2.51+	2.83+	2.27+	2.29+	2.80+	2.42+	1.98+	2.50+
L99-233	2.20	1.81	1.59	1.84	1.88+	1.71	1.70	1.64	1.40	1.75
HoCP00-950	2.03	1.82+	1.89	2.33+	1.90+	1.76	2.06	1.82	1.58	1.91+
L01-283	2.28	1.96+	1.68	1.84	1.90+	1.98+	2.14+	1.89	1.79+	1.94+
L01-299	1.96	1.97+	1.98	2.32+	2.18+	1.89	1.78	1.70	1.65+	1.94+
HoCP01-523	2.47+	2.24+	1.99	2.33+	1.77	1.89	2.14+	1.97+	1.67+	2.05+
HoCP01-564	2.00	1.53	1.65	2.32+	1.73	1.51	1.88	1.66	1.33	1.73

Table 7. Plantcane stalk number for five commercial and seven experimental varieties at nine outfield locations in 2005.

	Heavy			Light						
Variety	Landry	Magnolia	Allains	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(stalks/A)					
LCP85-384	28293	28744	28984	34525	28491	36238	31700	37666	28731	31486
HoCP91-555	29593	34849	28072	31233	30775	41918	35669	41799	28880	33643
HoCP95-988	27466	30891	27662	27140	23245	36801	30832	26918-	27668	28736
HoCP96-540	28861	32301	27562	28831	29939	37578	28594	34688	27523	30653
L97-128	25518	32839	22195-	26333-	23356	27849 -	24345-	27234-	26360	26225-
L99-226	26472	26246	25255	25512-	25671	32274	23328-	25785-	24051	26066-
L99-233	30816	33526	39002+	38285	30878	47393 +	45609+	40203	31163	37431+
HoCP00-950	31016	35561	26692	31815	27847	32436	32405	33962	26010	30957
L01-283	28952	33565	28093	38329	32739	39104	34228	32332	29597	32993
L01-299	35493	26661	26961	26369-	27727	39604	34119	33518	30697	31239
HoCP01-523	29280	27101	28828	28745	34885+	35812	31716	32951	27390	30745
HoCP01-564	35002	38556 +	28381	32550	32819	43789	32920	30960	33678	34295+

Table 8. First-stubble sugar per acre for four commercial and three experimental varieties at nine outfield locations in 2005.

	Heavy		Light							
Variety	Landry	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs/A)					
LCP85-384	7096	7665	4654	7066	6357	8261	6319	7517	6897	6874
HoCP91-555	8454	8520	5564+	8022	7625+	10832	6995	8403	7713	8018+
HoCP96-540	8013	9993	4867	8120	7483+	11820	7068	8565	8665	8292+
L97-128	7439	8880	6400+	6906	6764	9709	7499	8034	7469	7681+
L99-226	10120	8981	5991+	7871	9053+	11553	8262	9752	8743	8929+
L99-233	7197	8173	6053+	7494	7869+	10516	7816	8056	7060	7807+
HoCP00-950	8771	9108	6386+	9292+	7503+	9464	8859	8226	8735	8474+

Table 9. First-stubble cane yield for four commercial and three experimental varieties at nine outfield locations in 2005.

	Heavy		Light							
Variety	Landry	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(tons/A)					
LCP85-384	29.2	26.3	19.2	30.3	23.6	28.1	21.6	24.5	27.4	25.6
HoCP91-555	29.2	28.3	23.3+	30.5	26.0	36.0	24.7	26.2	29.9	28.2+
HoCP96-540	31.8	32.6	19.8	30.2	25.0	38.3	23.9	26.6	31.6	28.9+
L97-128	29.3	31.4	26.1+	26.6	25.1	33.7	26.6	27.2	26.1	28.0+
L99-226	38.9+	28.5	23.1+	29.3	29.6+	36.0	27.5	29.1	31.0	30.3+
L99-233	30.3	28.1	25.5+	30.3	29.2+	36.1	27.0	26.4	26.5	28.8+
HoCP00-950	31.1	30.3	23.0+	31.8	23.9	30.5	28.9	24.9	28.8	28.1+

Table 10. First-stubble sugar per ton for four commercial and three experimental varieties at nine outfield locations in 2005.

	Heavy		Light							
Variety	Landry	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs/ton)					
LCP85-384	245	295	243	233	270	293	292	307	251	270
HoCP91-555	290	301	239	263	293+	300	284	321	258	283+
HoCP96-540	253	307	246	269+	300+	309	295	323	274	286+
L97-128	252	282	246	260	270	288	282	294	284+	273
L99-226	259	316	260	269+	305+	320	300	335+	281	294+
L99-233	237	291	239	247	270	290	289	306	266	271
HoCP00-950	281	301	277	292+	314+	309	306	331+	303+	301+

Table 11. First-stubble stalk weight for four commercial and three experimental varieties at nine outfield locations in 2005.

	Heavy		Light							
Variety	Landry	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs)					
LCP85-384	1.44	1.36	1.15	1.52	1.55	1.51	1.50	1.26	1.75	1.45
HoCP91-555	1.71	1.61	1.42	1.66	1.72	1.74	1.73	1.42	2.15+	1.69+
HoCP96-540	2.12+	1.73	1.65+	1.89+	1.42	1.93+	1.94	1.65+	2.55+	1.87+
L97-128	1.76+	1.84+	1.70+	2.05+	1.73	2.12+	2.15	1.81+	2.26+	1.94+
L99-226	2.32+	2.23+	1.82+	2.17+	2.31+	2.42+	2.22	1.92+	2.94+	2.26+
L99-233	1.47	1.47	1.14	1.59	1.61	1.66	1.75	1.24	2.01	1.55
HoCP00-950	1.82+	1.77	1.34	1.88+	1.54	1.67	1.87	1.42	2.09	1.71+

Table 12. First-stubble stalk number for four commercial and three experimental varieties at nine outfield locations in 2005.

	Heavy		Light							
Variety	Landry	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(stalks/A)					
LCP85-384	42327	38182	33995	39986	30769	37310	29020	39436	31797	35869
HoCP91-555	34040	35528	33096	36969	30416	41603	28322	37003	28560	33949
HoCP96-540	30176	38559	24129-	32290-	36100	40498	24964	33145	24981-	31649-
L97-128	33303	34587	30752	25924-	28779	32333	24663	30383	23121-	29316-
L99-226	33520	26134	25466-	27001-	25678	29858	26952	30461	21363-	27381-
L99-233	42389	38246	45039+	38105	36447	43650	31591	42308	26993	38308
HoCP00-950	34262	34242	35792	34197	31170	36618	30797	36322	27946	33483

Table 13. Second-stubble sugar per acre for five commercial and two experimental varieties at seven outfield locations in 2005.

	Heavy	Light						
Variety	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	Mean
				(lbs/A)				
LCP85-384	4146	3992	6280	6306	8465	6767	6515	6067
HoCP85-845	3650	2186 -	6435	6589	10057	6956	7552	6203
HoCP91-555	2476 -	3568	7874 +	7255	8529	6521	5567	5970
HoCP96-540	3781	3764	6751	7286	9391	7055	8273	6614
L97-128	5088	3829	7310	6710	11430 +	7594	6289	6893 +
L99-226	6174 +	4297	8266 +	8411 +	12319 +	8738	7628	7976 +
L99-233	4797	3229	8700 +	7533 +	11278 +	8555	7995	7441 +

Table 14. Second-stubble cane yield for five commercial and two experimental varieties at seven outfield locations in 2005.

	Heavy	Light						
Variety	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	Mean
				(tons/A)				
LCP85-384	14.3	17.3	24.5	21.3	27.9	26.8	23.8	22.3
HoCP85-845	12.2	10.2-	25.1	23.2	32.8	28.2	30.0	23.1
HoCP91-555	8.5 -	16.6	29.2+	24.9	28.7	25.3	19.4	21.8
HoCP96-540	12.3	17.0	27.5+	24.3	30.9	28.2	30.8	24.4
L97-128	17.6	15.5	27.9+	23.5	37.5+	30.1	25.0	25.3+
L99-226	18.3+	17.7	29.2+	26.6	36.1+	29.5	25.8	26.2+
L99-233	17.0	14.7	32.2+	26.9	37.9+	36.2	30.1	27.8+

Table 15. Second-stubble sugar per ton for five commercial and two experimental varieties at seven outfield locations in 2005.

Variety	Heavy	Light						
	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	Mean
				(lbs/ton)				
LCP85-384	290	230	257	295	303	252	274	272
HoCP85-845	298	212	257	284	306	249	252-	265
HoCP91-555	296	215	270	290	297	259	286	273
HoCP96-540	308	221	245	300	304	250	268	271
L97-128	291	248	261	286	306	254	253-	271
L99-226	336+	242	283	316+	341	295+	295+	301+
L99-233	283	220	270	281	297	236	266	265

Table 16. Second-stubble stalk weight for five commercial and two experimental varieties at seven outfield locations in 2005.

Variety	Heavy	Light						
	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	Mean
				(lbs)				
LCP85-384	0.98	1.20	1.45	1.47	1.53	1.58	1.45	1.38
HoCP85-845	1.15	1.05	1.90+	1.50	1.95+	1.48	1.68+	1.53
HoCP91-555	0.99	1.24	1.58	1.39	1.45	1.66	1.35	1.38
HoCP96-540	0.97	1.36	1.75+	1.74+	1.97+	2.14+	1.89+	1.69+
L97-128	1.46+	1.20	2.02+	1.64	1.83	1.89	1.74+	1.68+
L99-226	1.66+	1.54	2.14+	2.11+	2.05+	2.40+	1.93+	1.98+
L99-233	0.93	1.13	1.79+	1.48	1.61	1.48	1.28-	1.39

Table 17. Second-stubble stalk number for five commercial and two experimental varieties at seven outfield locations in 2005.

	Heavy	Light						
Variety	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	Mean
				(stalks/A)				
LCP85-384	29284	28821	33944	29665	36904	35563	33273	32493
HoCP85-845	20463 -	19214	26847 -	30883	33758	37908	36033	29301
HoCP91-555	16946 -	26752	37263	36193	39965	30580	29116	30974
HoCP96-540	25053	25474	31336	27903	31854	26456	32788	28695
L97-128	24253	26708	27645 -	28565	41079	31664	28767	29811
L99-226	22195	23883	27450 -	25391	35344	25551 -	26711	26646 -
L99-233	36460	25955	36474	36505	47102 +	48970 +	46952 +	39774 +

Table 18. Third-stubble sugar per acre for five commercial varieties at two outfield locations in 2005.

	Light		
Variety	Bon Secour	Lanaux	Mean
	(lbs/A)		
LCP85-384	5315	5414	5365
HoCP85-845	6667+	5542	6105
HoCP91-555	6383+	5778	6080
HoCP96-540	7169+	5709	6439
L97-128	6857+	5677	6267

Table 19. Third-stubble cane yield for five commercial varieties at two outfield locations in 2005.

Variety	Light		Mean
	Bon Secour	Lanaux	
		(tons/A)	
LCP85-384	22.9	19.2	21.0
HoCP85-845	25.5	19.8	22.6
HoCP91-555	24.7	19.9	22.3
HoCP96-540	27.2	19.5	23.4
L97-128	25.9	20.3	23.1

Table 20. Third-stubble sugar per ton for five commercial varieties at two outfield locations in 2005.

Variety	Light		Mean
	Bon Secour	Lanaux	
		(lbs/tons)	
LCP85-384	232	283	257
HoCP85-845	262+	280	271
HoCP91-555	259+	292	276
HoCP96-540	264+	292	278
L97-128	265+	281	273

Table 21. Third-stubble stalk weight for five commercial varieties at two outfield locations in 2005.

Variety	Light		Mean
	Bon Secour	Lanaux	
		(lbs)	
LCP85-384	1.27	1.36	1.32
HoCP85-845	1.57+	1.63	1.60+
HoCP91-555	1.36	1.36	1.36
HoCP96-540	1.79+	1.90	1.84+
L97-128	1.78+	1.70	1.74+

Table 22. Third-stubble stalk number for five commercial varieties at two outfield locations in 2005.

Variety	Light		Mean
	Bon Secour	Lanaux	
		(stalks/A)	
LCP85-384	35957	28712	32334
HoCP85-845	32342	25016	28679
HoCP91-555	36403	29122	32763
HoCP96-540	31030	21580	26305
L97-128	29132	24093	26612

Table 23. Plantcane means from nine outfield locations in 2005: Allains, BonSecour, 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	7029	25.8	271	1.65	31486
HoCP91-555	8208+	29.8+	274	1.80	33643
HoCP95-988	8379+	31.0+	270	2.17+	28736
HoCP96-540	9054+	31.6+	286+	2.08+	30653
L97-128	7718	28.7+	268	2.21+	26225-
L99-226	9750+	32.4+	299+	2.50+	26066-
L99-233	8709+	32.4+	268	1.75	37431+
HoCP00-950	8694+	29.4+	295+	1.91+	30957
L01-283	9083+	31.7+	285+	1.94+	32993
L01-299	7891+	29.9+	263	1.94+	31239
HoCP01-523	8766+	31.1+	281	2.05+	30745
HoCP01-564	8629+	29.3+	294+	1.73	34295+

Table 24. First-stubble means from nine outfield locations in 2005: 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	6874	25.6	270	1.45	35869
HoCP91-555	8018+	28.2+	283+	1.69+	33949
HoCP96-540	8292+	28.9+	286+	1.87+	31649-
L97-128	7681+	28.0+	273	1.94+	29316-
L99-226	8929+	30.3+	294+	2.26+	27381-
L99-233	7807+	28.8+	271	1.55	38308
HoCP00-950	8474+	28.1+	301+	1.71+	33483

Table 25. Second-stubble means from seven outfield locations in 2005: Alma, Bon Secour, Georgia, Glenwood, Lanaux, Magnolia, and R. Hebert 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	6067	22.3	272	1.38	32493
HoCP85-845	6203	23.1	265	1.53	29301
HoCP91-555	5970	21.8	273	1.38	30974
HoCP96-540	6614	24.4	271	1.69+	28695
L97-128	6893+	25.3+	271	1.68+	29811
L99-226	7976+	26.2+	301+	1.98+	26646-
L99-233	7441+	27.8+	265	1.39	39774+

Table 26. Third-stubble means from two outfield locations in 2005: Bon Secour, and Lanaux 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	5365	21.0	257	1.32	32334
HoCP85-845	6105	22.6	271	1.60+	28679
HoCP91-555	6080	22.3	276	1.36	32763
HoCP96-540	6439+	23.4	278	1.84+	26305
L97-128	6267	23.1	273	1.74+	26612-

Table 27. Combined plantcane means across outfield locations from 2001 to 2005.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7463	28.1	266	1.99	28825
HoCP91-555	7961+	29.3+	271	2.07	29038
HoCP96-540	8854+	32.5+	273+	2.52+	26455-
L97-128	8425+	30.8+	273+	2.52+	24681-

Table 28. Combined plantcane means across outfield locations from 2003 to 2005.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7320	26.9	272	1.88	29385
HoCP91-555	8171+	29.1+	280+	1.99+	30067
HoCP96-540	8855+	31.7+	279+	2.41+	27281-
L97-128	8209+	29.4+	280+	2.35+	25138-
L99-226	9493+	32.1+	295+	2.76+	24004-
L99-233	8652+	31.7+	273	1.89	34569+

Table 29. Combined plantcane means across outfield locations from 2004 to 2005.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7114	26.2	272	1.75	30328
HoCP91-555	8398+	29.8+	281+	1.94+	31433
HoCP96-540	9027+	31.8+	283+	2.27+	28546
L97-128	8123+	28.7+	283+	2.30+	25057-
L99-226	9644+	32.4+	297+	2.68+	24520-
L99-233	8762+	31.7+	276	1.83	35193+
HoCP00-950	9096+	30.2+	301+	2.03+	30045

Table 30. Combined first-stubble means across outfield locations from 2002 to 2005.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7175	26.4	273	1.66	32442
HoCP91-555	7467	26.6	281+	1.78+	30422-
HoCP96-540	7853+	28.6+	275	2.07+	28158-
L97-128	7656+	27.4	281+	2.09+	26381-

Table 31. Combined first-stubble means across outfield locations from 2004 to 2005.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	6736	24.8	273	1.52	33100
HoCP91-555	7823+	27.3+	285+	1.72+	32034
HoCP96-540	7951+	28.3+	281+	1.93+	29739-
L97-128	7588+	27.0+	282+	1.97+	27585-
L99-226	8676+	29.1+	299+	2.27+	25882-
L99-233	7833+	28.3+	278	1.59	36268+

Table 32. Combined second-stubble means across outfield locations from 2003 to 2005.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	6197	22.7	275	1.47	31193
HoCP85-845	6109	23.5	261-	1.71+	27634
HoCP91-555	6187	22.4	278	1.53	29443
HoCP96-540	6399	23.9	270	1.78+	26979
L97-128	6920+	24.6+	283+	1.83+	27104

Table 33. Combined third-stubble means across outfield locations from 2004 to 2005.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	5212	19.3	272	1.32	29401
HoCP85-845	5655	20.8	272	1.54+	27198
HoCP91-555	5984	21.4+	284	1.43	30040
HoCP96-540	6260	22.3+	283	1.68+	27092
L97-128	6022	20.7	292+	1.63+	25646

SUCROSE LABORATORY AT ST. GABRIEL

G. L. Hawkins and K. A. Gravois
St. Gabriel Research Station

More than 2,800 samples were processed at the St. Gabriel Sucrose Laboratory during the 2005 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 2,860 samples. 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 2005 to December 2005.

Table 1. Number of sugarcane samples processed at the St. Gabriel Sucrose Laboratory during the 2005 harvest season.

Project Area	Leader	Number of Samples
Agronomy	James Griffin	172
	Chuck Kennedy	469
	Collins Kimbeng	354
	Magdi Selim	24
Iberia Research Station	Howard Viator	162
Plant Pathology and Crop Physiology	Jeff Hoy	289
LCES	Ben Legendre	168
USDA	Ed Richard	36
Variety Development	Line Trials	686
	Increase	133
	Nursery	241
Other		126
TOTAL		2860

THE 2005 LOUISIANA SUGARCANE VARIETY SURVEY

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INTRODUCTION

A sugarcane variety survey was conducted during the summer of 2005 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 plantcane, first-stubble, second-stubble and third-stubble and older crops. Additional information regarding parish acreage was collected as needed from the local Farm Service Agency (FSA) offices.

Total State and Regional Acreage.

Actual area planted to sugarcane included in this survey for each parish, region and the statewide total are shown in Table 1. Statewide, the area planted to sugarcane in 2005 was 457,456 acres. This is approximately 99% of the total acres (462,510) as reported by the Farm Service Agency of the United States Department of Agriculture and used in "Louisiana Summary: Agriculture and Natural Resources 2005" (Anonymous 2005.) 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 198,862 acres reported (43.5% of the total acreage), followed by the River-Bayou Lafourche region with 161,034 acres (35.2%) and the Northern area with 97,500 acres (21.3%). The total area planted to sugarcane in the state actually increased by 772 acres or 0.2% in 2005 when compared to 2004. Acreages had declined in each of the three previous years because of the threat of acreage reductions brought about by allotments and proportionate shares as written in the current Farm Bill. However, these fears went unfounded because of lower production due to hurricanes, drought and the precipitous drop in production of the leading variety, LCP 85-384.

Sugarcane Distribution by Variety and Crop.

The estimated statewide sugarcane acreage in percent by variety and crop is shown in Table 2. The leading variety for 2005 continued to be LCP 85-384, with 89% of the total acreage followed by HoCP 91-555, HoCP 96-540 and HoCP 85-845, with 4, 3 and 2% of the total acreage, respectively. HoCP 91-555 and HoCP 85-845 are two of the older varieties still recommended for commercial planting (Legendre 2001). The new variety, HoCP 96-540, although occupying only 3% of the total acreage, was the second leading variety in the plantcane crop behind LCP 85-384 with 9% of the acreage. Producers, concerned with the decline in yield of LCP 85-384, are switching to the newer varieties, especially HoCP 96-540 until other varieties are developed and released to the industry. The two remaining new varieties, Ho 95-988 and L 97-128, occupied only limited acreage in 2005; however, it is anticipated that their acreage will increase in future years along with that of HoCP 96-540. Of the older varieties, other than LCP 85-384, only HoCP 91-555 occupied 3% or more of the acreage in plantcane through third- and older stubble crops. HoCP 85-845 continued to decline across crop years with 4% in third-and older stubble crops to only 1% in plantcane crop. CP 70-321, the leading variety prior to the release of LCP 85-384 in 1993, occupied only 1% of the total acreage and less than 1% in the plantcane crop in 2005.

The majority of the Louisiana sugarcane crop has been harvested by cane combine since 2000 when over 70% of the crop was planted to LCP 85-384 (Legendre & Gravois 2005), presumably to take advantage of the superior yield potential of the variety. However, with the lower yields experienced since 2003, especially in the older stubble crops, many producers have switched back to the whole-stalk "soldier" system for harvesting their crops because of lower costs of operating the equipment. LCP 85-384 did not perform well across the state regardless of the crop year during 2004. On the other hand, the three new varieties, Ho 95-988, HoCP 96-540 and L 97-128, along with HoCP 85-845 and HoCP 91-555, all performed well with the new varieties generally better suited to mechanical harvesting when compared to LCP 85-384.

Sugarcane Distribution by Region and Crop.

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, because of the poor performance of LCP 85-384, especially in the older stubble crops, that trend changed in 2004 when more acres were replanted in all regions than had been seen in previous years (Table 3). This trend continued into 2005. In 2005, there was an increase in plantcane acreage of 10,266 acres or 2.3 percentage points when compared to 2004 while the acreage in third- and older stubble crops decreased by 12,691 acres or 2.7 percentage points during the same time frame.

For the current survey, the Northern area had only 23.0% in third and older stubble compared to 25.8% in 2004 and 34.3% in 2003 (Table 3). On the other hand, the percentage in plantcane increased from 26.0% in 2004 to 29.5% in 2005. The River-Bayou Lafourche region tends to plant more cane each year, with less of its area devoted to stubble crops. In this region, there was 20.8% of the acreage in third- and older stubble crops in 2004 and only 17.4% in 2005. However, because of the wet planting season in 2002, the River-Bayou Lafourche region had only 23.3% of its area in plantcane for the 2003 crop. This necessitated that its producers plant more cane in 2003 and subsequent years. The current survey shows that this region had 30.2% in plantcane in 2005 compared to 28.9% in 2004. The trend for less stubble and more plantcane was also evident for the Bayou Teche region. This region was also impacted by the wet planting season in 2002. With increased planting, the amount of older stubble decreased from 22.8% in 2004 to 20.6% while plantcane increased from 26.5% to 29.2%.

Sugarcane Distribution by Variety and Crop for the Three Regions.

With regards to crop from plantcane through third- and older stubble crops, LCP 85-384 was still the leading variety in all regions in 2005 (Tables 4, 5 and 6). Although still the dominant variety, its preference in plantcane diminished significantly with the new variety, HoCP 96-540, making up 11, 8 and 4% of the plantcane area in the Bayou Teche, River/Bayou Lafourche and Northern regions, respectively. However, the percentage planted to LCP 85-384 for all stubble crops remained relatively stable from preceding years. The popularity of the older varieties, CP 70-321 and HoCP 85-845, continued to lose favor by producers in all regions. CP 70-321, the predominant variety prior to LCP 85-384, comprised less than 1% of the planted area in all regions in 2005. HoCP 85-845 was grown on only 2-3% of the planted area, regardless of regions. The acreage planted to HoCP 91-555 remained virtually unchanged across crop year and regions. The area planted to the two new varieties, Ho 95-988 and L 97-128, along with HoCP 96-540, was still limited in 2005 but it is anticipated that acreage will increase significantly in ensuing years as producers look for a replacement for LCP 85-384.

Variety Trends.

For the first time since its year of commercial release in1993 has the acreage planted to LCP 85-384 decreased from the previous year, although by only two percentage points from its historical high of 91% in 2004 (Table 7). With the exception of HoCP 91-555, the acreage planted to the older varieties decreased in 2005 from the previous year. CP 70-321 which occupied 49% of the planted acreage as late as 1995 is now planted on only1% of the state's sugarcane. Only one other variety, CP 65-357, released in 1973, reached more than 70% of the total acreage in the state with a high of 71% in 1980. HoCP 96-540, released for commercial planting in 2003, and Ho 95-988 and L 97-128, released for commercial planting in 2004, are expected to gain in popularity as the area planted to LCP 85-384 is reduced. According to Waguespack et al. (2005) the three new varieties, Ho 95-988, HoCP 96-540 and L 97-128, are generally superior to LCP 85-384 in yield of sugar per acre throughout the crop cycle. Ho 95-988 has good stubbling ability; HoCP 96-540 has excellent yield of cane per acre; and, L 97-128 has early, high sucrose content to go along with its early maturity classification. Ho 95-988 is classified as resistant to mosaic and leaf scald and moderately susceptible to smut and rust and susceptible to the sugarcane borer. HoCP 96-540 is classified as resistant to smut and mosaic, moderately resistant to rust and leaf scald and moderately susceptible to the sugarcane borer. L 97-128 is classified as resistant to mosaic, moderately resistant to leaf scald and rust, moderately susceptible to smut and susceptible to the sugarcane borer. All three varieties are more erect than LCP 85-384; hence, losses associated with mechanical harvesting should be less when compared to LCP 85-384. It is anticipated that LCP 85-384 will be the predominant variety for at least the next two years; after which, it is believed that the Louisiana sugarcane industry should have a more balanced mix of varieties.

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Concern over the Dependence of a Single Variety (Monoculture).

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 outweigh potential risk considerations (Tew 1987). Hoy (2005) reported that LCP 85-384 has become susceptible to brown rust, and this disease can have a significant negative impact on both cane and sugar yield in areas of severe rust infection. He reported where rust was controlled by fungicides during the entire epidemic period at one location in 2004 in the Teche region, tonnage and sugar per acre were increased 17 and 21%, respectively. However, none of the fungicides used in these studies are labeled for use. Additional studies were conducted during 2005 with similar results (Hoy, personal communication). Accordingly, the best control option at this point is to plant the new varieties which have shown a greater degree of resistance and it appears that producers are following this recommendation.

Another disease was found in LCP 85-384 in recent years, *sugarcane yellow leaf* disease (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 has developed three new high yielding varieties in recent years, namely, Ho 95-988, HoCP 96-540 and L 97-128. Further, there is a good probability that one or two additional high yielding varieties could be made available to the industry during 2006, i.e. L 99-226 and L 99-233 (Kenneth Gravois, personal communication) that could further reduce the future prospect of a monoculture again.

Millhollon and Legendre (1996) found that the annual use of glyphosate as a ripener will usually increase the yield of sugar per ton of cane and per acre; however, the magnitude of the increase depended on the tolerance of the variety to the treatment. They found that LCP 85-384 is very sensitive to glyphosate, especially at rates higher than generally recommended and the treatment was shown to cause a significant reduction in cane yield in the subsequent stubble crops. Glyphosate is now used on approximately 75% of the total area planted to sugarcane for enhancing maturity of the crop and increasing yield of sugar per ton of cane and per acre. With LCP 85-384 as the major variety, there is the possibility that part of the yield decline experienced in the older stubble was caused, in part, by the sensitivity of LCP 85-384 to glyphosate. This is another reason why the industry might want to consider diversifying into other varieties. The older varieties, namely HoCP 85-845 and HoCP 91-555, are not as sensitive to annual applications of glyphosate as LCP 85-384. Research is ongoing to determine the sensitivity of the new varieties to the application of glyphosate as a chemical ripener.

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Table 1. Total area planted to sugarcane in Louisiana by region and parish (county), 2005[1].

Bayou Teche region		River-Bayou Lafourche region		Northern region	
Parish	Acres	Parish	Acres	Parish	Acres
Acadia	2,026	Ascension	14,663	Avoyelles	19,226
Calcasieu	3,612	Assumption	40,063	East Baton Rouge	513
Cameron	508	Iberville	34,931	Evangeline	965
Iberia	63,506	Lafourche	30,149	Pointe Coupee	32,509
Jeff Davis	4,516	St. Charles	1,674	Rapides	12,112
Lafayette	13,715	St. James	25,850	St. Landry	16,810
St. Martin	33,172	St. John	3,950	West Baton Rouge	15,425
St. Mary	46,000	Terrebonne	9,754		
Vermilion	31,807				
Total	198,862	Total	161,034	Total	97,560
Total all regions: 457,456					

[1] Acreage based on information obtained in variety surveys from 24 parishes by the county agents in 2005.

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

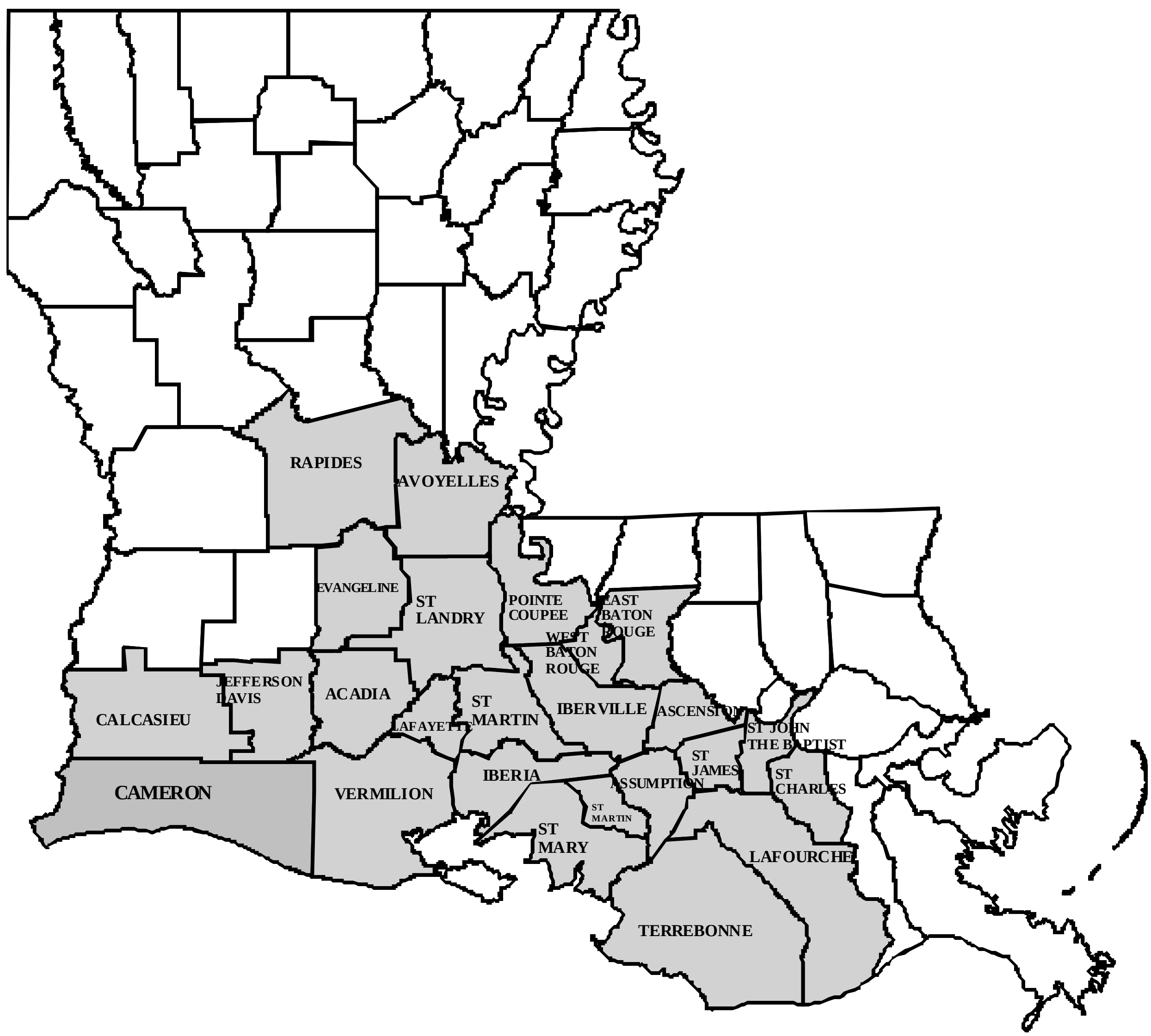

Table 2. Estimated statewide sugarcane acreage percentage by variety and crop, all regions, 2005[1].

Variety	Plant-cane	First-stubble	Second-stubble	Third-stubble and older	Total
	--------------------	--------------------	%	--------------------	--------------------
CP 70-321	<1	1	1	2	1
LCP 85-384	84	91	92	91	89
HoCP 85-845	1	2	2	4	2
HoCP 91-555	3	5	5	3	4
Ho 95-988	1	<1	0	0	<1
HoCP 96-540	9	2	<1	<1	3
L 97-128	1	<1	<1	0	1
Other	<1	<1	<1	<1	<1
Total acres Percent of total crop	135,480 29.6	125,704 27.5	104,847 22.9	91,425 20.0	457,456

[1] Based on information obtained in variety surveys from 24 parishes by county agents in 2005.

Table 3. Estimated sugarcane distribution by region and crop, 2005[1].

Crop	Bayou Teche	River-Bayou Lafourche	Northern	State Total
Plantcane Area (acres) Percent (%)	58,068 29.2	48,632 30.2	28,780 29.5	135,480 29.6
First-stubble Area (acres) Percent (%)	52,897 26.6	47,344 29.4	25,463 26.1	125,704 27.5
Second-stubble Area (acres) Percent (%)	46,931 23.6	37,038 23.0	20,878 21.4	104,847 22.9
Third-stubble and older Area (acres) Percent (%)	40,966 20.6	28,020 17.4	22,439 23.0	91,425 20.0
Total acres	198,862	161,034	97,560	457,456

[1] Based on information obtained in variety surveys from 24 parishes by county agents in 2005.

Table 4. Estimated area planted to sugarcane in percent by variety and crop for the Bayou Teche region, 2005[1].

Variety	Plantcane crop (%)	First-stubble crop (%)	Second-stubble crop (%)	Third-stubble crop & older (%)	Total (%)
CP 70-321	<1	1	1	3	1
LCP 85-384	79	88	91	89	86
HoCP 85-845	1	1	2	4	2
HoCP 91-555	5	7	5	3	5
Ho 95-988	1	<1	0	0	<1
HoCP 96-540	11	2	<1	<1	4
L 97-128	2	<1	<1	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 2005.

Table 5. Estimated area planted to sugarcane in percent by variety and crop for the River/Bayou Lafourche region, 2005[1].

Variety	Plantcane crop (%)	First-stubble crop (%)	Second-stubble crop (%)	Third-stubble crop & older (%)	Total (%)
CP 70-321	<1	<1	<1	2	<1
LCP 85-384	85	92	94	90	90
HoCP 85-845	2	3	2	5	3
HoCP 91-555	2	3	4	3	3
Ho 95-988	1	<1	<1	0	<1
HoCP 96-540	8	2	<1	<1	3
L 97-128	2	<1	<1	<1	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 2005.

Table 6. Estimated area planted to sugarcane in percent by variety and crop for the Northern region, 2005[1].

Variety	Plantcane crop (%)	First-stubble crop (%)	Second-stubble crop (%)	Third-stubble crop & older (%)	Total (%)
CP 70-321	0	<1	<1	1	<1
LCP 85-384	91	94	91	94	93
HoCP 85-845	1	1	1	1	1
HoCP 91-555	2	4	8	3	4
Ho 95-988	1	<1	0	0	<1
HoCP 96-540	4	1	<1	<1	2
L 97-128	1	<1	<1	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 2005.

Table 7. Louisiana sugarcane variety trends, by variety and years, all regions, 2001-2005[1].

	Area planted to sugarcane by variety and years (%)					
Variety	2001	2002	2003	2004	2005	1 yr. Change
CP 70-321	8	5	3	2	1	-1
LCP 85-384	78	85	88	91	89	-2
HoCP 85-845	7	6	4	3	2	-1
HoCP 91-555	1	3	4	3	4	+1
Ho 95-988	0	0	0	<1	<1	0
HoCP 96-540	0	0	<1	1	3	+2
L 97- 128	0	0	0	<1	1	+1
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, 2001-2005.

TRAP, A NEW TOOL FOR SUGARCANE BREEDING: ITS COMPARISON WITH AFLP AND COEFFICIENT OF PARENTAGE

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Abbreviations: TRAP, Target Region Amplification Polymorphism; AFLP, Amplified Fragment Length Polymorphisms; RFLP, Restriction Fragment Length Polymorphism; RAPD, Randomly Amplified Polymorphic DNA; gSSR, genome-derived Simple Sequence Repeats.

Introduction

Traditional breeding has contributed immensely to the sugar industry. In central Queensland, Australia, for example, the cultivar Q50 was nicked named 'mortgage buster' soon after its release because of the wealth it brought to that sugar industry. In Louisiana, the popular cultivar, LCP85-384, increased cane yield by 20-25% and contributed to unprecedented boosts in sugar production. LCP85-384 like most dominant cultivars has enjoyed widespread adoption in the Louisiana sugar industry albeit to the exclusion of other cultivars. It is well known that the over reliance on a single cultivar can result in severe consequences especially in a clonally propagated crop such as sugarcane. Therefore, tremendous effort is being made to release new cultivars that equal or surpass the performance of LCP85-384 to Louisiana growers.

The long duration of a sugarcane selection cycle is one factor limiting the rapid development of competent sugarcane cultivars. It takes about 12-15 years after crossing to complete a selection cycle. Because sugarcane is clonally propagated, during this 12- to 15-year period, no new opportunities exist for sexual recombination or the creation of new genetic variation that the breeder can exploit. The breeder has to rely on the initial variation created during hybridization, and no amount of selection can salvage a good cultivar out of a poor cross. The choice of parents to use in crossing is, therefore, one of the most crucial decisions the breeder has to make.

The complicated genome of cultivated sugarcane (high ploidy levels, aneuploid and multiple alleles at a locus) is another factor limiting progress in sugarcane breeding programs. Cultivated sugarcane was derived by crossing between two species namely, *S. officinarum* (2n = 80) and *S. spontaneum* (2n = 64 to 120) followed by backcrosses to *S. officinarum. Saccharum officinarum* was reported to transmit the somatic chromosome number to its progeny (Bhat and Gill, 1985; Bremer, 1961). Consequently, cultivated sugarcane harbors two genomes with about 80% *S. officinarum* and 20% *S. spontaneum* composition (D'Hont et al., 1996). Furthermore, chromosome numbers within cultivated sugarcane can vary (generally from about 100-130) even among full sib progenies.

Molecular markers are a valuable new tool that can be used to help understand and manipulate a genome as complicated as that of sugarcane. Molecular markers could be used to tag genes for traits of economic importance such that selection for these traits (via Marker Assisted Selection) could occur early in the breeding program. Molecular markers could also be used to facilitate decisions made during crossing by using them (markers) to gain a better understanding of the genetic diversity in the crossing gene pool. That information could then play a vital role in the utilization and management of the genotypes and indeed genes in the breeding gene pool. For example, crosses could be planned between parents from divergent backgrounds to maximize heterosis while increasing genetic diversity in the cultivated gene pool.

In the absence of molecular markers, sugarcane breeders relied upon pedigree records to plan crosses with the aim of increasing genetic diversity among the parent and progeny populations. However, the complicated genealogy of sugarcane and perhaps the inadvertent mislabeling of clones may have aligned with the other factors highlighted above to impede progress. Skinner (1959), for example, found that the weave of the cloth used during crossing by most sugarcane breeding programs at the time was not fine enough to exclude foreign pollen. Recently, molecular markers have been used to question the parentage of certain hybrid progenies (Hack et al., 2002; Pan et al., 2003).

In sugarcane breeding programs, experimental clones are often nominated as parents based upon how they have performed in advanced stage selection trials. Ultimately, most crosses are made between parents with phenotypic superiority in one or more key attributes with the hope of combining all key attributes in the hybrid. It is believed that the probability of recovering superior progeny is higher when both parents are themselves superior. Therefore, one would like to detect genetic diversity among phenotypically superior parents. This can be a very difficult task when relying solely on pedigree records because superior phenotypic characteristics might have been obtained at the expense of genetic diversity at specific loci that have undergone selection. In other words, pedigree-based estimates of genetic diversity may not account for allele frequency changes resulting from selection and genetic drift. By relying on pedigree records to estimate genetic diversity one assumes that all genotypes are unrelated which, may be misleading in cultivated sugarcane where only a handful of clones were used in the original synthesis. Molecular markers on the other hand offer a direct comparison of genetic diversity at the DNA level without the simplifying assumptions inherent with the pedigree-based method.

When used for genetic diversity studies, molecular marker techniques such as RFLP, RAPD, AFLP, gSSR, customarily amplify random (neutral) portions of the genome leading to competent estimates of genetic diversity. However, breeders may be more interested in results from genetic diversity studies when markers that co-segregate with traits of interest are used. However, even after QTLs for traits of interest have been identified, it has been argued that the underlying QTL-trait association is based on relatively large linkage blocks and could easily be lost with recombination. In addition, transferability of QTLs between populations remains a looming question in the minds of many plant breeders. 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 breeder. This may be more important in sugarcane with its large genome size (estimated to be about 6pg, six times larger than that of rice) most of which may be duplicate and redundant (Ma et al., 2004).

Access to increasing numbers of sugarcane gene and EST sequences obtained from diverse cDNA libraries coupled with freely available bioinformatics tools offer new opportunities for achieving a candidate gene approach to molecular markers in sugarcane. Target Region Amplification Polymorphism (TRAP) is a relatively new marker technique which uses the gene/EST sequence information to generate polymorphic bands around targeted/putative candidate gene regions. We previously sequenced TRAP amplicons from sugarcane and showed using Blastx analysis that, the TRAP primers successfully amplified the anticipated candidate gene regions (Alwala et al., 2006). Here, we report on comparisons between TRAP, AFLP and the pedigree-based coefficient of parentage (COP) for estimating genetic diversity and relationships among nine sugarcane genotypes frequently used as parents. The AFLP was chosen for comparison because it has been widely used for genetic diversity studies in sugarcane (Besse et al., 1998; Lima et al., 2002) and other crops such as beans (Bhat et al., 2005), wheat (Tian et al., 2005) and squash (Ferriol et al., 2004). A subsequent study will report on the relative ability of the three genetic diversity measures or combinations of them to predict hybrid performance (mean and viariances).

Materials and Methods

Plant material and DNA extraction

The nine sugarcane parents used in the study are described in Table 1. These genotypes are experimental clones and cultivars adapted to Louisiana's unique temperate climate. TucCP77-42 is a major cultivar in northern Argentina but it too was bred using Louisiana adapted clones as the recurrent parents. This group of genotypes serves as an important parental pool for sugarcane crossing in Louisiana.

Young leaves were collected from each genotype, placed immediately in ice and stored at -80 C. Later, the leaves were ground to powder in liquid nitrogen. Genomic DNA was extracted using the Plant DNeasy Mini Kit (Qiagen, Valencia, Ca.). DNA concentrations were estimated by known concentration of lambda DNA in 1% agarose gel.

TRAP markers

The TRAP is a simple, 2-primer PCR technique. The forward (fixed) primer is designed from genes or EST sequences and accompanied by an arbitrary (reverse) primer designed to target introns or exons. Both primers are usually about 18 bp long.

In this study the fixed primers were designed from four genes believed to be implicated in sucrose metabolism namely, Sucrose Synthase (SuSy), Sucrose Phosphate Synthase (SuPS), Pyruvate Orthophosphate DiKinase (PODK), and Soluble Acid Invertase (SAI). 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 a 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°C, 55°C and 50°C respectively. The GenBank accession number and designed primer sequence for each gene is given in Table 2.

Arbitrary reverse primer sequences were obtained from Li and Quiros (2001). The basic structure of this primer included three selective nucleotides at the 3' end, 4 nucleotides of AT- or GC-rich content in the core region and 11 nucleotides as filler sequences at the 5' end. The AT and GC sequences are believed to target introns and exons, respectively. In addition, the basic rules of primer design such as self-complementarity and maintenance of 40-60% GC content were upheld in designing both primers (Table 2). The TRAP protocol was performed on an *i-cycler* (BioRad Labs, Hercules, CA) as described in Alwala et al (2006). After PCR, the amplified products were run on 7% polyacrylamide denaturing gel for 1.5 hrs at 110 W. The gel was developed and visualized using the silver staining technique.

AFLP markers

AFLP analysis was performed based on the protocol described by Vos et al (1995). Two hundred nanograms of DNA were double digested with *EcoR*I and *Mse*I and linked to specific adaptors. Primers carrying one selective nucleotide were designed based on adaptor sequence, for pre- selective amplification. *EcoR*I and *Mse*I primers with three selective nucleotides were used for selective amplifications. All the PCR amplifications were carried out on an *i-cycler* (BioRad Labs, Hercules, CA). The amplified products were mixed with equal amount of dye (composition) and 5 ul of each sample was separated by electrophoresis on 6% polyacrylamide denaturing gel for 2 hrs at 110 W. The gels were documented using the silver staining technique. A total of 28 *EcoR*I /*Mse*I AFLP primer combinations were used to screen the nine parents.

Estimation of TRAP- and AFLP-derived genetic diversity and polymorphic information content

The bands from AFLP- and TRAP-derived gels were scored as '1' for presence and '0' for absence. Jaccard-similarity coefficient (1908) was used to estimate genetic diversity (GS) between pairs of genotypes as follows: $GSij = a/(a+b+c)$ where $GSij$ 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 bands absent in pairs of individuals were excluded from the calculation.

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:

$$\text{PIC} = 1- \Sigma f_i^2$$

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).

Coefficient of parentage

The coefficient of parentage (COP), which corresponds to the probability that alleles at a locus in two individuals are identical by descent, was calculated to represent the pedigree-based measure of genetic diversity. The COP was calculated based on Kempthorne (1957) using the "proc inbreeding" procedure in SAS (SAS Inc., 2002). The COP value between remotely related parents was assumed to be 0 and each genotype was assumed to receive half of their genome from each of its parent. All the ancestors were assumed to be heterozygous, since sugarcane is a highly heterozygous crop and in addition, the COP of a genotype with itself was assumed to be 0.5 rather 1.0 as for homozygous inbreds like rice (Kempthorne, 1957; Chiang and Lo, 1993; Deren, 1995).

Cluster and Principal Coordinate Analyses

For ease of interpretation, the GS values for TRAP, AFLP and COP between pairs of genotypes were subjected to both Cluster (CA) and Principal Coordinate (PCoA) Analyses to obtain a graphical representation of the relationships between the nine genotypes. The goodness of fit of the dendrograms formed from the GS matrix was evaluated by means of the cophenetic coefficient of correlation. A minimum-length spanning tree (MST) was superimposed on the PCoA plot to help detect local distortion because pairs of points which look close together in a plot may actually be far apart if other dimensions are taken into account. These analyses were performed using the NTSYS (CA; Rohlf, 2000) and PAST (PCoA; Hammer et al 2001) softwares. Bootstrap analysis with 1000 replications and 50 % consensus rule was performed using the PAUP software (Sinauer Associates, Inc., MA) and the boostrap values superimposed on the CA dendrogram as a measure of the robustness of branches on the dendrogram.

Correlation between COP, TRAP- and AFLP-derived GS

The correlation among pairs of the three genetic diversity measures was compared using two methods. The first method employed the MAXCOMP routine of NTSYSPC software in which two GS matrices are compared by estimating the normalized Mantel statistic Z (Mantel, 1967). The second method estimated the simple or Pearson's correlation coefficient (r) between the measures.

Bootstrap analysis

Bootstrap analysis (Efron, 1981) was carried out to investigate if the number of markers used to generate GS were sufficient to provide precise estimates among the genotypes. Sub samples consisting of different number of polymorphic bands were generated by re-sampling 1000 times, with replacement, to estimate GS between every two pairs of genotypes for each sub-sample. The average coefficient of variation was estimated across sub samples for a given number of polymorphic bands. The analysis was performed using the Dboot software kindly provided by Dr. Cohello (Personal communication).

Results

TRAP Markers

Percent polymorphism and PIC Values

All 12 TRAP primer combinations produced multiple PCR fragments (bands) in each of the nine cultivars which ranged in size from 300 to 700 bp (Fig 1). A total of 444 unambiguous bands were scored of which 242 (55%) were polymorphic (Table 3). The total number of bands amplified by individual primer combinations ranged from 19 (SuPS + Arbi 3) to 69 (SuSy + Arbi 1) with an average of 37 bands per primer combination. These two primer combinations were also responsible for the least (10) and most (41) number of polymorphic bands produced with an average of 20 polymorphic bands per primer combination. The PIC value averaged over all polymorphic loci for individual primer combinations varied from 0.32 to 0.40 with an overall mean of 0.36 ± 0.12. From the polymorphism produced it was possible to distinguish each one of the nine genotypes sometimes with just one of the primer combinations. Bands were found to be uniquely present or absent in some genotypes. TRAP fragments were found to be highly reproducible (Fig 1).

Genetic diversity and relationship among genotypes

The TRAP-GS averaged across all pair-wise combinations of genotypes was generally high, 0.75 ± 0.04, as expected from the shared ancestry among these genotypes (Table 1, Fig 2). The GS ranged from 0.67 (between HoCP91-552 and HoCP92-624) to 0.87 (between LCP85-384 and HoCP96-540) (Table 4, Fig 3). Data from the GS matrix were visualized using two methods, CA and PCoA.

The CA yielded a dendrogram (Fig 3) with a cophenetic coefficient of correlation value of 0.81 which is above the 0.80 generally regarded as a good fit (Rohlf and Sokal, 1981. No distinct clusters were found, however, a subgroup was apparent between LCP85-384, HoCP96-540 and LCP86-454 (Fig 3) which is in agreement with the close relationship known among these genotypes (Table 4). Missing from this subgroup, however, was L99-238 a progeny of LCP85-384. The average GS between members of the group containing LCP85-384, HoCP96-540 and LCP86-454 vs. Ho95-988 is 0.78 while for L99-238 it is 0.77; this might explain why using the clustering technique, Ho95-988 was placed closer to the group compared with L99-238.

The bi-plot from PCoA superimposed with the MST portrayed a slightly different sub-grouping which was composed of LCP85-384 and its two progeny, L99-238 and HoCP96-540 (Fig 4, Table 4). Considering the first principal coordinate, LCP86-454 a half-sibling of LCP85-384 was placed outside of the subgroup (Fig 3) although the MST clearly illustrates the relationship between the two genotypes. Both the CA and PCoA portrayed HoCP91-552 as the genotype most distant from the rest of the group (Figs 3 and 4). In the dendrogram (Fig 3) the split of HoCP91-552 from the rest of the genotypes was only one of two branches supported by a bootstrap value greater than 50 %.

Bootstrap analysis

As expected, the accuracy of distinguishing between the nine genotypes, as measured using the mean coefficient of variation (CV %), increased with increasing numbers of polymorphic TRAP bands. Using all 444 polymorphic bands, the nine genotypes were distinguished with an accuracy level of 2.95% which is very reliable considering most authors have recommended a CV of 10% to be reliable (Fig 5). Only 40 polymorphic TRAP bands would be required to distinguish the nine genotypes with an accuracy level of 10 %.

AFLP Markers

Percent polymorphism and PIC Values

A total of 40 AFLP primer combinations were tested of which 28 were polymorphic enough for use in studying genetic relationships. The 28 primer combinations produced a total of 1375 bands of which 689 (50%) were polymorphic (Table 5). The unambiguous bands ranged in size from 250 to 600bp. The total number of bands per primer combination ranged from 23 (E-AAC+M-CTC) to 81 (E-ACA+M-CTC) with an average of 49 bands per primer combination. These two primer combinations were also responsible for the least (8; E-AAC+M-CTC) and the most (44; E-ACA+M-CTC) number of polymorphic bands produced with an average of 25 polymorphic bands per primer combination. The PIC value averaged over all polymorphic loci for individual primer combinations varied from 0.27 (E-ACA+M-CAC) to 0.45 (E-ACA+M-CAG) with an overall mean 0.35 ± 0.12. As with TRAP markers, it was possible to distinguish each one of the nine genotypes sometimes with just one AFLP primer combination. Also, bands were found to be uniquely present or absent in some genotypes.

Genetic diversity and relationship among genotypes

The AFLP-GS estimates between pairs of genotypes ranged from 0.72 (between HoCP92-624 and Ho95-988) to 0.84 (between HoCP92-624 and LCP85-384) with a mean value of 0.76 ± 0.03 (Table 4, Fig 2). Cluster analysis produced a dendrogram with a cophenetic coefficient of correlation value of 75 (Fig 6). The dendrogram had two distinct clusters although the bifurcation had only marginal (45 %) bootstrap support. The cultivar LCP85-384 was placed in a cluster with both of its progenies, L99-238 and HoCP96-540 but not its half sibling LCP86-454 (Fig 6; Table 1). Surprisingly, the closest and most robust (100 % bootstrap support) relationship was found between LCP85-384 and HoCP92-624 a genotype with which it seemingly does not share a recent lineage (Table 6). Similar results were depicted by the PCoA with the same two groups of genotypes apparent in the first principal coordinate (Fig 7).

Bootstrap analysis

A total of 1375 polymorphic bands were revealed by AFLP markers. However, for comparison with the 444 polymorphic bands revealed by TRAP markers, each of 10 sub samples (with replacement) of 450 AFLP polymorphic bands was subjected to bootstrap analysis. The coefficient of variation was then averaged for each number of bands in the query. Based on the 450 bands, the nine genotypes could be distinguished with an accuracy level of 2.7% (Fig 8). In distinguishing among the nine genotypes, only about 30 polymorphic AFLP bands would be necessary to achieve an accuracy level of 10 %.

COP

Genetic diversity and relationship among genotypes

The COP-GS estimates among the nine genotypes varied from 0.03 (between TUCCP77-042 and Ho95-988 and Ho95-988 and LCP86-454) to 0.36 (between HoCP96-540 and LCP85-384) with a mean of 0.12 ± 0.09 (Table 4; Fig 2). Cluster analysis of the pair-wise COP matrix resulted in a dendrogram with a cophenetic coefficient of correlation value of 0.92 (Fig 9). The COP-derived dendrogram revealed no distinct pattern of diversity. For example, although one could still trace the relationship among genotypes such as LCP85-384, HCP96-540, L99-238 and LCP86-454 which are known to share a common lineage (Table 1), CA (Fig 9) displayed no dichotomy between this group (related) and the non-related genotypes in the study. This dichotomy was clearly revealed by the PCoA-derived bi-plot (Fig10)

Associations between Pedigree-, TRAP-, and AFLP-derived GS estimates

Similar levels of association were estimated by both methods (normalized Mantel Z statistic and Pearson's correlation coefficient) used (Table 6). Similar levels of association were found between COP-GS with TRAP-GS and COP-GS with AFLP-GS. Although the correlation values were significant ($P < 0.05$; N = 36) they were in the moderate to low range (0.40). Both methods (Mantel and Pearson) also calculated a similar level of correlation between the two (TRAP and AFLP) molecular marker-derived GS estimates. The correlation between these two molecular DNA-derived GS estimates was much smaller (0.14) compared with each of their correlations to the COP-GS (0.40).

Discussion

Comparing characteristics of TRAP and AFLP markers

The values for percent polymorphism and PIC reported in this study are typical for sugarcane. Using 21 AFLP primer combinations, Lima et al. (2002) detected an average of 50 % polymorphism among 79 Brazilian cultivars while Selvi et al (2005) reported an average of 52 % among 28 cultivars from India using 12 primer combinations. Selvi et al (2005) reported PIC values for AFLP that ranged from 0.31 to 0.41. TRAP analysis based upon 24 primer combinations among 61 sugarcane cultivars from Canal Point, Florida detected 58% polymorphism and a PIC value of 0.32 (Edme et al., Manuscript in Preparation). The complex polymorphism profile displayed by sugarcane for AFLP (Besse et al., 1998; Lima et al., 2002; Selvi et al., 2005; this study) and TRAP (Arro, 2004; Edme et al., In Press; this study) markers can be attributed to its large genome size and high levels of heterozygosity which is perpetuated via vegetative propagation. The complex polymorphism profile displayed by each of the AFLP and TRAP primer combinations meant that no two of the nine genotypes presented an identical profile. Thus, TRAP markers could also be useful for sugarcane fingerprinting.

The utility of a DNA marker technique can be defined by its multiplex ratio (number of markers that can be generated in one single reaction) and the Polymorphism Information Content (effective number of alleles that can be detected per marker in a set of individuals) (Powell et al., 1996). The ability of the AFLP technique to simultaneously amplify a large number of marker loci throughout the genome has been cited as a major advantage of AFLPs over other marker systems (Vuylsteke et al., 2000). In this study, however, the AFLP was only marginally superior to TRAP with regards to the total number of bands amplified per primer combination and the number of bands necessary to attain an accuracy level of 10 % when differentiating among the nine genotypes. The overall percent polymorphism was actually higher for TRAP (242/444) than AFLP (689/1375). In addition, similar PIC values were found between the two marker systems. Thus, on the basis of these data, a similar level of polymorphism detection efficiency is to be expected from these two dominant markers.

Experience in our lab has shown, however, that the relative polymorphism detection efficiency between AFLP and TRAP is highly dependent upon the type of population being genotyped. For example, dramatically different results were obtained when the same set of TRAP and AFLP markers were used to genotype 88 individuals from an interspecific (*Saccharum officinarum x S. spontaneum*) mapping population. The total number of bands amplified and percent polymorphism revealed by AFLP surpassed that of TRAP by about 3-4 fold (Unpublished Data). Because TRAP primers are designed to target only a small portion of the genome (Hu and Vick, 2003; Alwala et al., 2006), AFLP markers may be more robust for detecting polymorphism among closely related genotypes as they are more likely to sample throughout the genome. In soybeans, Powell et al. (1996) found good correlations between AFLP and other markers (RFLP, RAPD and SSR) at the interspecies level which disappeared at the intraspecies level with the AFLP giving the best resolution among genotypes. It is best to allow research objectives to guide the decision of choosing the appropriate DNA marker technique(s).

Comparing GS estimates

The mean, range and distribution values for TRAP-GS and AFLP-GS were similar, but both were distinct from COP-GS (Table 4; Fig 2). The mean values from TRAP-GS and AFLP-GS highlight the narrow genetic base reported for cultivated sugarcane (Berding and Roach, 1987; Mangelsdorf, 1983; Deren, 1995; Lima et al., 2002; Arro, 2004) whereas, judging from the COP-GS it would appear substantial amounts of genetic diversity exist in sugarcane. Figure 2 shows that up to 55% (20/36) of the COP-GS were less than 0.1 suggesting that only about 45% of the genetic material segregating in the ancestral population was identical by descent between any two genotypes in this study. In calculating TRAP-GS and AFLP-GS only polymorphic bands were taken into consideration yet, lower levels of genetic diversity (high GS) were detected by these methods compared with the COP method. Moreover, of the total bands amplified by TRAP and AFLP markers, 45 % and 49 %, respectively, were monomorphic and therefore identical in state. This tendency for the COP method to overestimate genetic diversity compared to DNA-based methods has been reported by other authors (Cox et al., 1985; Barbosa-Neto et al., 1996; Kim and Ward, 1997).

As with several previous studies (Cox et al., 1985; Graner, 1994; Barbosa-Neto et al., 1996; Kim and Ward, 1997; Sun et al. 2003) this study found low to moderate levels of association between the DNA- and COP-based estimates of GS. In wheat, a low *r* value of 0.27 was observed by Cox et al (1985) between isozyme-based GS and COP. RFLP-based GS with COP in barley generated a low correlation value of 0.27 for winter type and a moderate value of 0.42 for spring type (Graner et al. 1994). Evaluating the correlation between RAPD-based GS with COP resulted in a low *r* value of 0.104 in potatoes (Sun et al. 2003). This disparity stems from the fact that the assumptions inherent in calculating COP are unrealistic for most cultivated species and sugarcane is no exception (Deren, 1995). For example, the COP assumes that both parents contribute equally (half of their alleles) to the offspring essentially ignoring the effect of selection and genetic drift during cultivar development. As evident from Table 4, the relationship between LCP85-384 and its two progenies HOCP96540 and L99238 was not equal for TRAP-GS and AFLP-GS. Furthermore, it is well known that chromosome numbers within cultivated sugarcane can vary (generally from about 100-130) even among full sib progenies. This can substantially affect DNA-based measurements of GS but is yet unaccounted for by currently available models for estimating COP.

Considering that only a handful of clones were used in the original nobilization event to derive modern sugarcane, the assumption that two clones in this study are unrelated (COP = 0) relative to the original ancestors would be unrealistic. Thus, contrary to the DNA-based methods, the COP method ignores alleles that are alike in state but not identical by descent resulting in a disproportionate downward bias of GS estimates. Incomplete pedigree records or errors in annotating parents would help to over emphasize the downward bias of COP estimates. To minimize this bias we recalculated the correlation coefficients after eliminating the values for COP < 0.1. The correlation between COP-GS and TRAP-GS increased (r = 0.69; N = 16), that for COP-GS with AFLP-GS decreased (r = 0.31; N = 16), while that between TRAP-GS and AFLP-GS remained unchanged (r = 0.16; N =16). However, when values for the 3 closest known relatives were removed (i.e., COP = 0.35) the correlations decreased to 0.06 (COP with TRAP), 0.22 (COP with AFLP, and 0.11 (TRAP with AFLP). The lack of congruence and consistency among TRAP-GS, AFLP-GS and COP-GS throughout the range of diversity detected among the genotypes in this study suggests that the three measures detect different aspects of relatedness.

Several authors (Graner, 1994; Barbosa-Neto et al., 1996; Kim and Ward, 1997; Sun et al. 2003) have recommended using molecular marker based estimates of GS over COP. This is largely because molecular markers such as TRAP and AFLP provide a more accurate estimate of GS as they directly measure DNA sequence variation. However, a drawback of markers such as TRAP and AFLP is that the utility of bands produced by these markers can be confounded by lack of locus specificity. Without sequencing it is difficult to discount the fact that bands or alleles that are identical in state may not actually represent co-migrating nonhomologous bands. The lack of adequate genome coverage is another factor that can limit the utility of DNA-based estimates of GS. This can be resolved by using markers for which the genome location is known.

Comparing genetic diversity patterns among genotypes

Following CA the least distinct pattern was obtained from the COP dendrogram while AFLP gave the most distinct pattern although it was easier to explain the TRAP dendrogram based on pedigree records. The genetic resolution and interpretation of the data was enhanced by including the PCoA bi-plots. In general, when the dendrogram and bi-plot were considered together the three measures seemed to depict a somewhat similar pattern of relationship among the genotypes, the major exception being the tight relationship (100% bootstrap support) between LCP85-384 and HoCP92-624. A closer examining of the pedigree tree revealed that the maternal grand parents of LCP85-384 (CP52-068 x L65-69) were indeed the great grand parents of HoCP92-624 (CP52-068 x CP62-258) (CP65-357 x L65-69). One could speculate that AFLP markers may be detecting favorable alleles or blocks of genes from these ancestral parents that were preserved through independent selection for the same trait(s) in the two cultivars. Only sucrose related TRAP markers were exemplified in this study and those may not be the subject of selection being detected by AFLP markers.

Conclusion

The results show that TRAP markers have utility for sugarcane genetic diversity studies. TRAP markers produced percent polymorphism and PIC values similar to that of AFLP markers. A similar low to moderate level of association was found between TRAP-GS and COP-GS as with AFLP-GS and COP-GS. Very low level of association was found between TRAP-GS and AFLP-GS. Violations of the assumptions used in calculating COP was partly responsible for the low level of association between COP and the two DNA-based estimates, as the COP method tends to underestimate GS. However, exclusion of subsets of data along the range of COP-GS estimates led to different levels of association between COP and TRAP, COP and AFLP and TRAP and AFLP suggesting that the three measures were detecting different aspects of GS. Notwithstanding, with a few exceptions, the dendrograms and bi-plots produced using the three measures depicted a somewhat similar pattern of diversity among the genotypes. Therefore, some combination of TRAP, AFLP and COP would likely be more useful in estimating GS as this would compensate for the inaccuracies inherent within each of the methods.

Estimates of GS could be incorporated as a tool to assist sugarcane breeders with selecting the most divergent parents to maximize heterosis and transgressive segregation in the progeny population. The inexpensive COP could be used as a first step to assemble a large diverse group of potential parents. Molecular markers such as TRAP and AFLP which provide a more direct and accurate estimate of allele frequency differences among the parents could be used to decide the best crosses based on pair-wise GS values between the parents. Only loci for which the parents carry different alleles will contribute to genetic variance in the progeny population. If such loci co-locate with genes governing the traits being measured then it may be possible to predict hybrid performance based on GS among parents.

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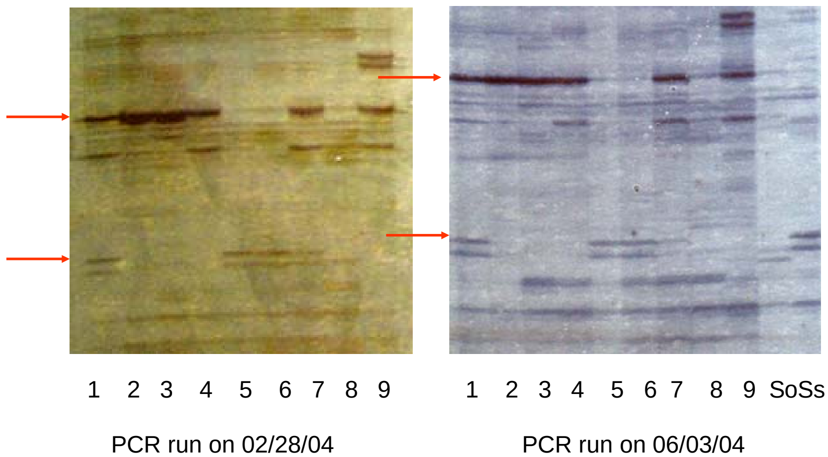

Figure 1. Reproducibility of TRAP markers depicted here by segments from two silver-stained polyacrylamide gels with polymorphic TRAP fragments generated using SuSy + Arbi 3 (see Table 1). Entries 1 to 9 are similar on the two gels but the reactions and gels were run on different dates. Entries: 1= L99-238; 2 = HoCP91-552; 3 = LCP86-454; 4 = HO95988; 5 = LCP85-384; 6 = HoCP96540; 7 = HoCP95951; 8 = TucCP77042; 9 = HoCP92624; So = La Stripe; Ss = SES 147 B. Arrows show identical banding patterns between the two gels

Table 1. Description of cultivars used in the study.

Genotype	Female parent	Male parent	Agronomic characteristics
L99-238	CP79-318	LCP85-384	High sucrose parent
HoCP91-552	LCP81-10	CP72-356	High tonnage; high fiber
LCP86-454	CP77-310	CP69-380	Commercial; early high sucrose content
Ho95-988	CP86-941	US89-12	Commercial; high sugar yields and good ratooning ability
LCP85-384	CP77-310	CP77-407	Commercial; leading commercial cultivar in Louisiana from 1998 to present; high sugar yield, good ratooning ability and recently showing susceptibility to rust disease
HoCP96-540	LCP86-454	LCP85-384	Commercial; released in 2003; high sugar and cane yields; good disease resistance
HoCP95-951	CP85-866	CP85-830	BC_5 of US60-8-3; high cane yield and fiber content
TucCP77-042	CP71-321	US72-19	Commercial cultivar in Argentina; high cane yield and average sucrose content
HoCP92-624	CP81-325	CP71-1038	High sugar and cane yield; dropped due to excessive lodging; used extensively in crossing programs.

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

Fixed	Gene	Sequence (5’→ 3’)	Tm (C)
Primers	Sucrose Synthase (SuSy)	GGAGGAGCTGAGTGTTTC	53
	Sucrose Phosphate Synthase (SuPS)	CGACAACTGGATCAACAG	53
	Pyruvate Orthophosphate DiKinase (PODK)	CGTAAAGATTGCTGTGGA	53
	Soluble Acid Invertase (SAI)	AGGACGAGACCACACTCT	53
Arbitrary primers	Arbi 1	GACTGCGTACGAATTAAT	53
	Arbi 2	GACTGCGTACGAATTGAC	53
	Arbi 3	GACTGCGTACGAATTTGA	53

Table 3. Percent polymorphism and PIC values of TRAP markers used in genotyping nine sugarcane parents.

	Primer combination	Bands observed	Polymorphic bands	Percent Polymorphism	PIC
1	SuSy + Arbi 1	69	41	59.42	0.327
2	SuSy + Arbi 2	60	19	31.66	0.376
3	SuSy + Arbi 3	54	38	70.37	0.345
4	SuPS + Arbi 1	25	15	60.00	0.386
5	SuPS + Arbi 2	45	24	53.33	0.377
6	SuPS + Arbi 3	19	10	52.63	0.401
7	PODK + Arbi 1	31	14	45.16	0.320
8	PODK + Arbi 2	28	18	64.28	0.403
9	PODK + Arbi 3	34	15	44.11	0.353
10	SAI + Arbi 1	35	21	60.00	0.363
11	SAI + Arbi 2	20	13	65.00	0.323
12	SAI + Arbi 3	24	14	58.33	0.338
	Total	444	242		
	Average	37	20	55	0.359

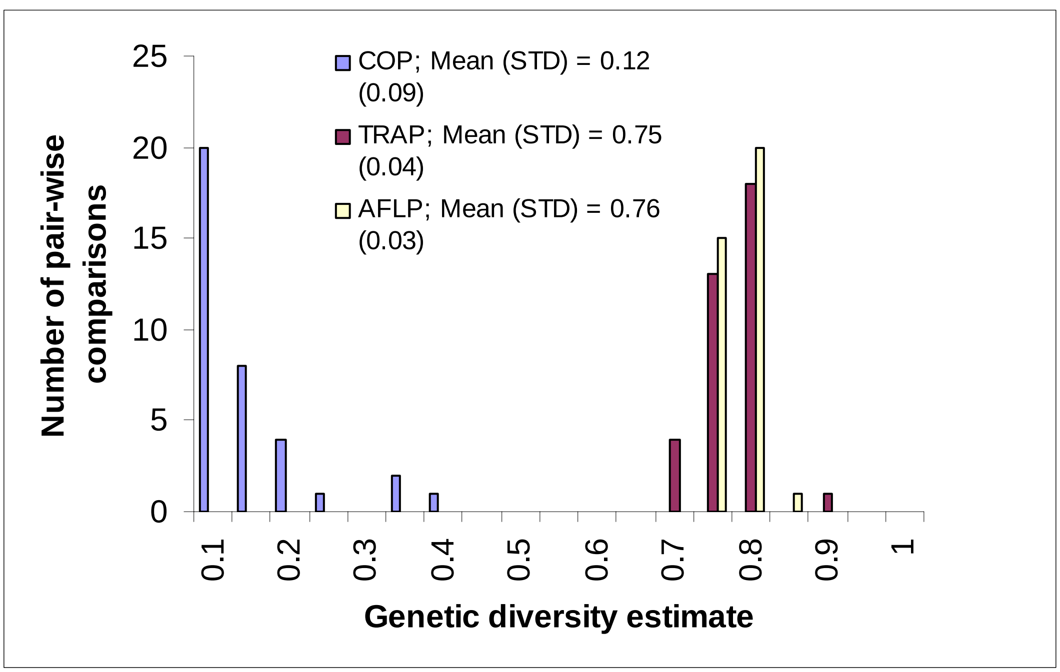

Fig 2. Frequency distribution of genetic similarity estimates based on pedigree (COP), TRAP and AFLP data.

Table 4. Pair-wise genetic similarity estimates for TRAP, AFLP and COP.

	L99238	HOCP91552	LCP86454	HO95988	LCP85384	HOCP96540	HOCP95951	TUCCP77042	HOCP92624
TRAP									
L99238	1								
HOCP91552	0.68	1							
LCP86454	0.76	0.78	1						
HO95988	0.72	0.71	0.78	1					
LCP85384	0.79	0.73	0.79	0.78	1				
HOCP96540	0.78	0.71	0.79	0.79	0.87	1			
HOCP95951	0.69	0.71	0.77	0.75	0.75	0.76	1		
TUCCP77042	0.72	0.72	0.79	0.74	0.78	0.77	0.76	1	
HOCP92624	0.7	0.67	0.76	0.77	0.75	0.75	0.76	0.75	1
AFLP									
L99238	1								
HOCP91552	0.78	1							
LCP86454	0.79	0.8	1						
HO95988	0.73	0.78	0.76	1					
LCP85384	0.8	0.77	0.75	0.76	1				
HOCP96540	0.77	0.75	0.79	0.73	0.77	1			
HOCP95951	0.76	0.75	0.75	0.76	0.74	0.77	1		
TUCCP77042	0.75	0.74	0.76	0.72	0.75	0.74	0.75	1	
HOCP92624	0.77	0.74	0.73	0.72	0.84	0.79	0.72	0.74	1
COP									
L99238	0.50								
HOCP91552	0.10	0.50							
LCP86454	0.15	0.08	0.50						
HO95988	0.05	0.04	0.03	0.50					
LCP85384	0.35	0.08	0.18	0.04	0.50				
HOCP96540	0.25	0.08	0.35	0.04	0.35	0.50			
HOCP95951	0.20	0.11	0.11	0.06	0.20	0.15	0.50		
TUCCP77042	0.07	0.08	0.06	0.03	0.07	0.07	0.08	0.50	
HOCP92624	0.15	0.10	0.11	0.04	0.14	0.13	0.16	0.09	0.50

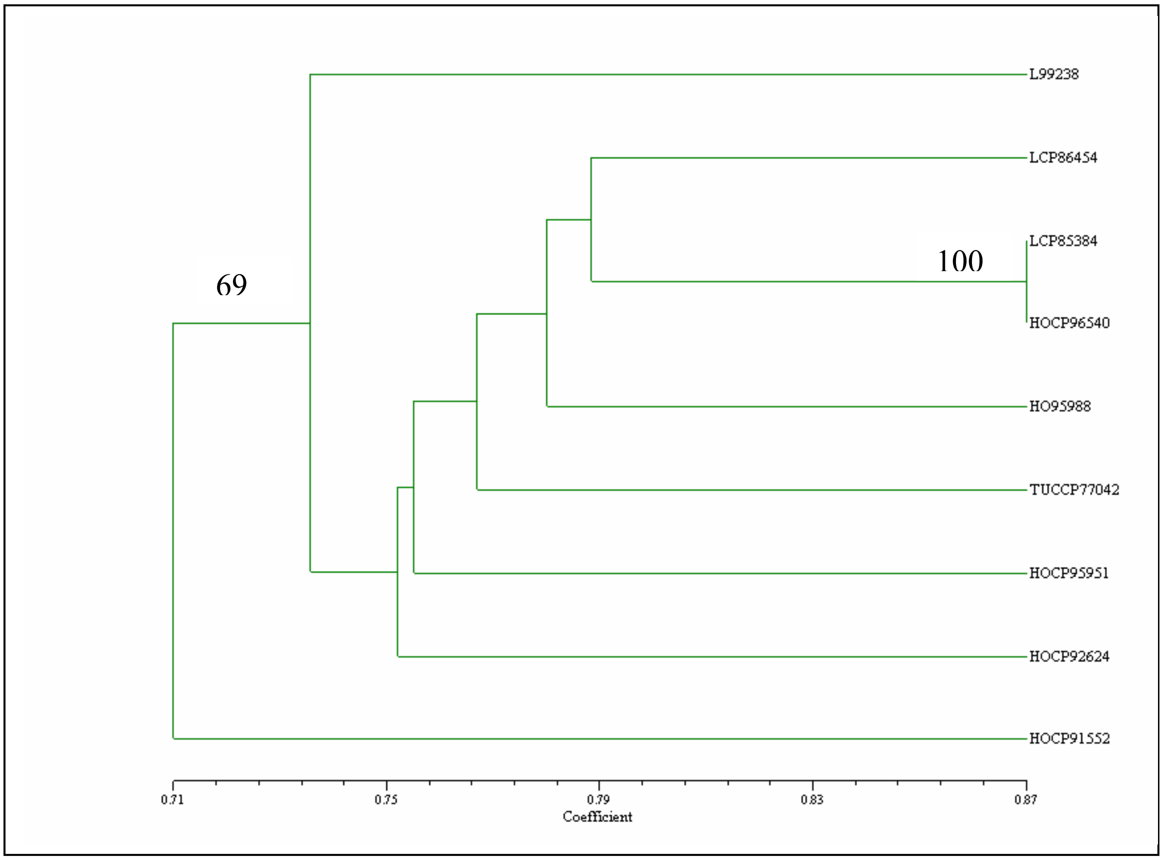

Fig 3. UPGMA dendrogram depicting genetic diversity pattern among nine sugarcane genotypes based on TRAP markers. $r_{Coph.}$ = 0.81. Numbers on dendrogram represent 50% majority rule bootstrap values.

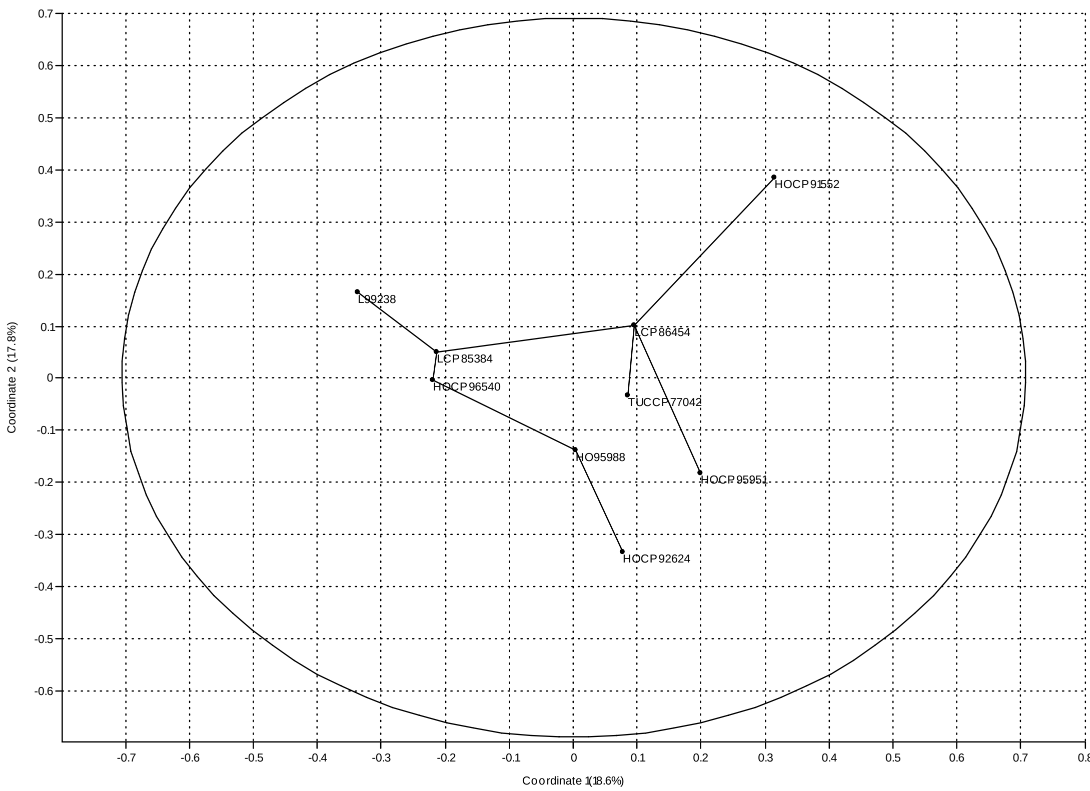

Fig 4. Principal coordinate analysis bi-plot depicting genetic diversity pattern among nine sugarcane genotypes based on TRAP markers.

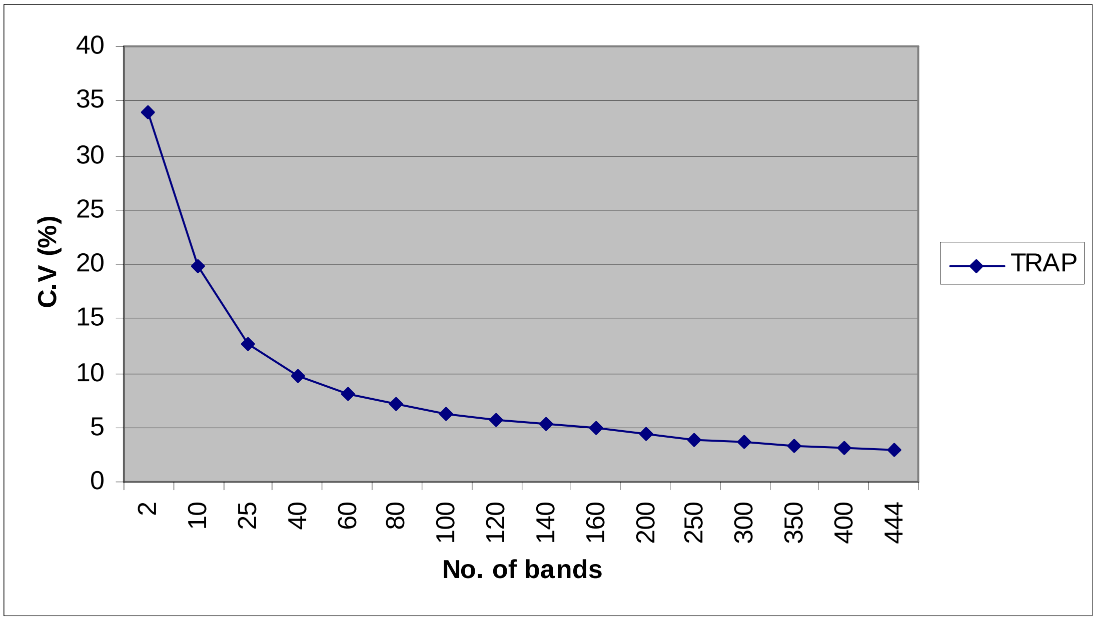

Fig 5. Accuracy (CV, %), estimated using bootstrap analysis, with which nine genotypes can be distinguished using different number of TRAP bands.

Table 5. AFLP primer combinations and the number of total and polymorphic bands observed.

	Primer combination	Bands observed	Polymorphic bands	Percent Polymorphism	PIC
1	E-ACT+M-CAT	64	28	43.75	0.329
2	E-ACT+M-CAA	37	15	40.54	0.332
3	E-ACT+M-CTC	36	35	97.22	0.383
4	E-ACT+M-CTG	53	29	54.71	0.381
5	E-AAC+M-CAA	64	21	32.81	0.345
6	E-AAC+M-CTA	44	26	59.09	0.372
7	E-AAC+M-CTC	23	08	34.78	0.364
8	E-AAC+M-CTG	66	30	45.45	0.393
9	E-ACC+M-CAA	53	17	32.07	0.368
10	E-ACC+M-CTA	55	23	41.81	0.322
11	E-ACC+M-CTC	50	19	38.00	0.332
12	E-ACC+M-CTG	53	22	41.51	0.334
13	E-ACA+M-CAA	39	22	56.41	0.371
14	E-ACA+M-CTA	40	31	77.50	0.288
15	E-ACA+M-CTC	81	44	54.32	0.347
16	E-ACA+M-CTG	68	23	33.82	0.345
17	E-AGC+M-CAT	25	20	80.00	0.345
18	E-AGC+M-CAA	53	18	33.96	0.345
19	E-AGC+M-CTG	46	22	47.82	0.318
20	E-ACG+M-CAT	40	24	60.00	0.390
21	E-ACG+M-CAA	44	27	61.36	0.345
22	E-AAC+M-CAC	45	25	55.55	0.353
23	E-ACC+M-CAC	49	26	53.06	0.387
24	E-ACA+M-CAC	37	26	70.27	0.273
25	E-AGC+M-CAC	40	23	57.50	0.369
26	E-ACC+M-CAG	44	29	65.90	0.357
27	E-ACA+M-CAG	35	21	60.00	0.451
28	E-AGC+M-CAG	41	32	78.04	0.373
	Total	1375	689		
	Average	47	24	50	0.354

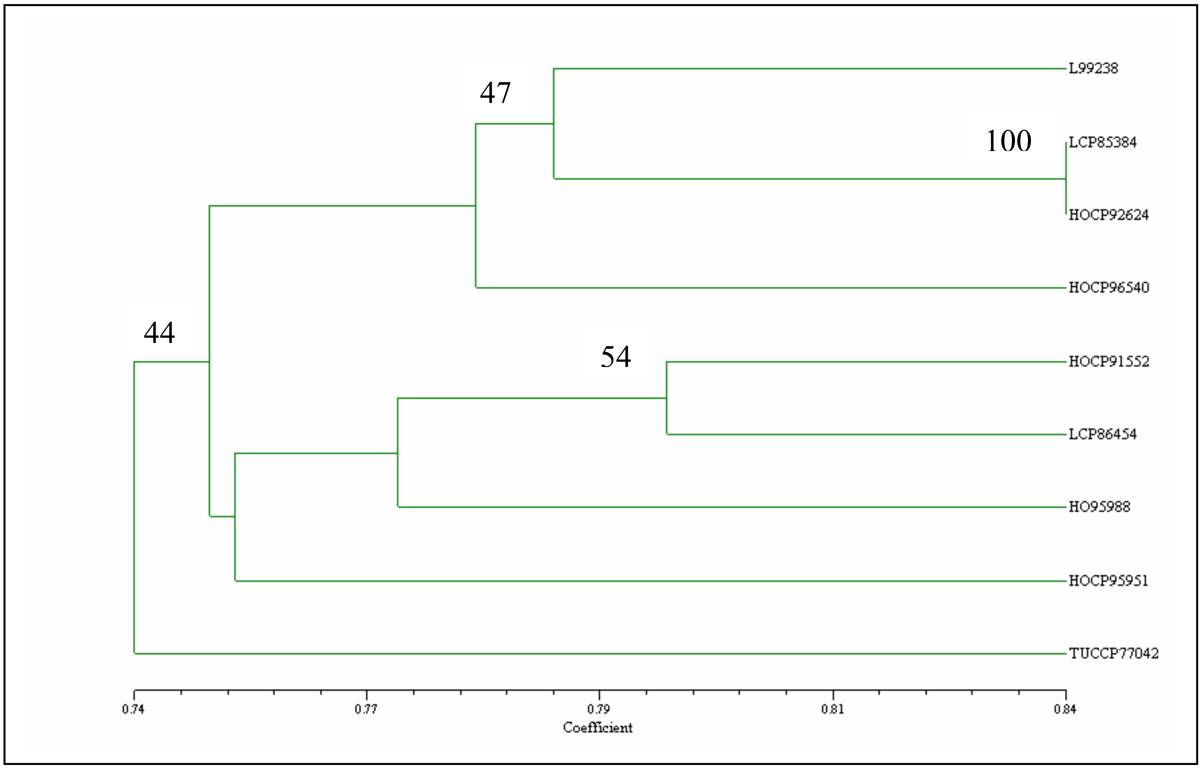

Fig 6. UPGMA dendrogram depicting genetic diversity pattern among nine sugarcane genotypes based on AFLP markers. $r_{Coph.}$ = 0.75. Numbers on dendrogram represent 50% majority rule bootstrap values.

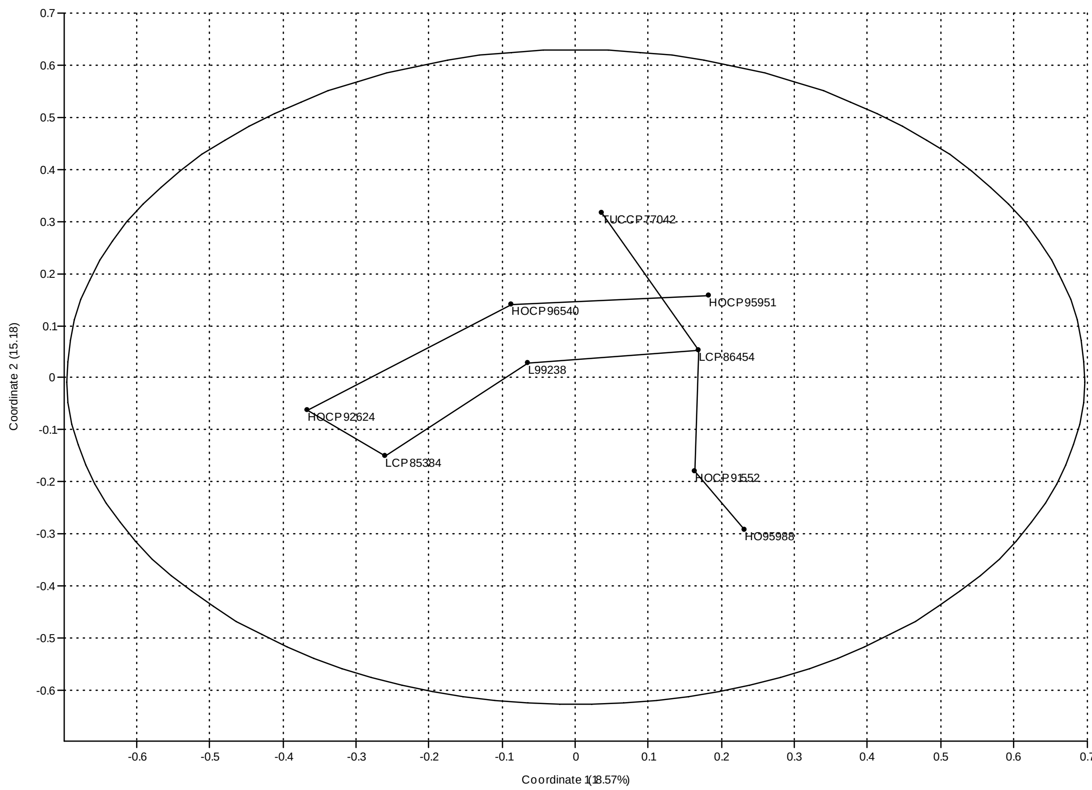

Fig 7. Principal coordinate analysis bi-plot depicting genetic diversity pattern among nine sugarcane genotypes based on AFLP markers.

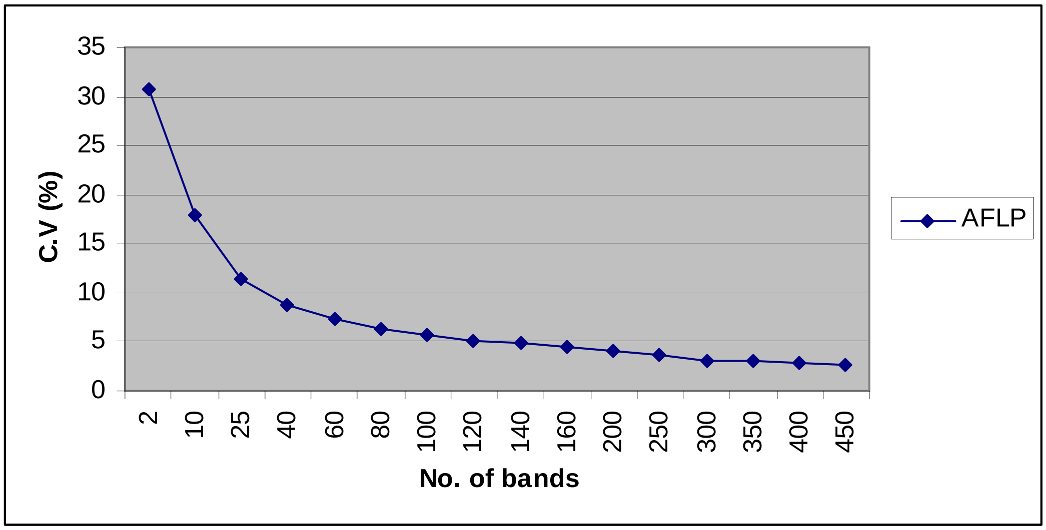

Fig 8. Accuracy (CV, %), estimated using bootstrap analysis, with which nine genotypes can be distinguished using different number of AFLP bands.

Table 6. The Mantel's Z statistic and correlation coefficient for pair-wise comparisons between the COP-, TRAP- and AFLP-derived estimates of genetic similarity.

	Normalized Mantel Z statistic *R*	Correlation Coefficient (*r*)
AFLP vs CoP	0.41	0.42
TRAP vs CoP	0.40	0.41
AFLP vs TRAP	0.14	0.14

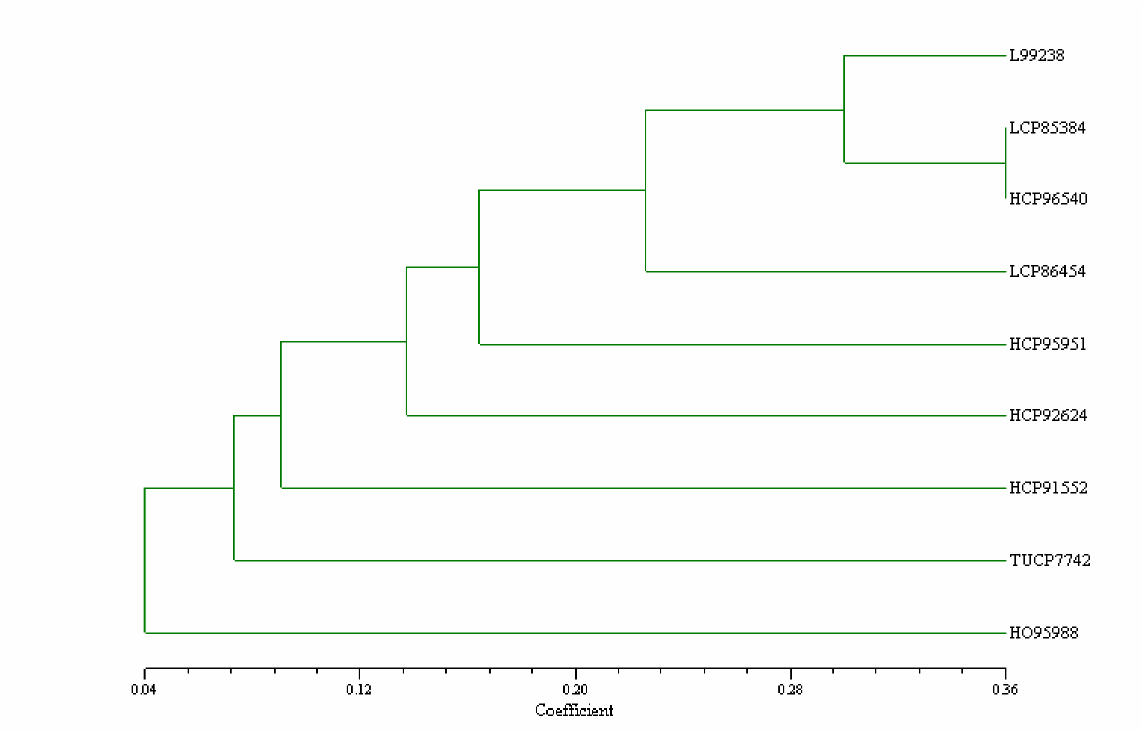

Fig 9. UPGMA dendrogram depicting genetic diversity pattern among nine sugarcane genotypes based on COP. $r_{Coph.}$ = 0.92.

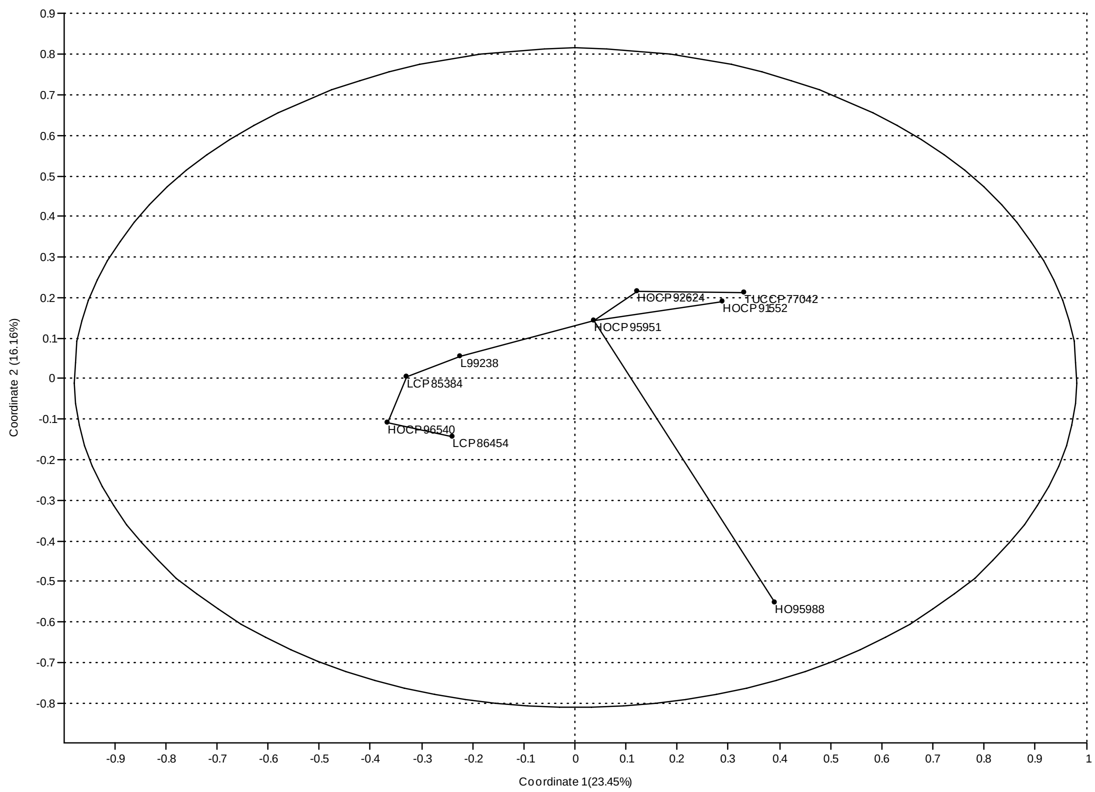

Fig 10. Principal coordinate analysis bi-plot depicting genetic diversity pattern among nine sugarcane genotypes based on COP.

SMALL PLOT ASSESSMENT OF INSECTICIDES AGAINST THE SUGARCANE BORER

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A study was conducted at the LSU AgCenter St. Gabriel Research Station, St. Gabriel, LA to evaluate insecticides for control of the sugarcane borer (SCB) *Diatraea saccharalis* (F.) (Lepidoptera: Crambidae). Nine different insecticide treatments, in addition to an untreated check, were assessed for season-long control of SCB in a randomized complete block design with five replications in a field of ratoon HoCP91-555 cane planted in August 2003. Insecticide treatments were applied to 3-row plots (6 ft x 30 ft) on 26 July when infestation counts reached a threshold of 5% of the plants infested with live first or second instar SCB larvae in the leaf sheaths. The treatments were applied 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. Prior to test initiation, Lorsban 15G (15 lb/acre) and Karate Z (1 oz/acre) were applied directly to the soil in the last week of June 2005 and on July 22nd, respectively, to suppress fire ant predation on SCB larvae. SCB damage to sugarcane was assessed by counting the number of bored internodes and the total number of internodes in each of nine treatments and the untreated control (15 stalks per plot) from each plot at the time of harvest (4 November). Data were analyzed using a one-way analysis of variance (Proc Mixed) with means separated with Tukey's HSD ($P < 0.05$).

Maximum damage in insecticide treated plots was 12% SCB bored internodes with all treatments significantly less than the untreated check (34.4% bored internodes). Novaluron at the 8 oz/acre rate showed maximum borer control (84.3% of check), while V-10170 provided the least level of control (65.1% of check) (Table 1). The other treatments provided intermediate levels of suppression.

Table 1. Insecticidal control of sugarcane borer in a small plot test at the St. Gabriel Research Station, 2005.

Treatment/Formulation	Rate(oz/A)	% Bored Internodes[b]
Diamond 0.83EC	**8.00**	**5.4d**
Diamond 0.83EC	12.00	5.8cd
Karate Z	1.92	6.0cd
Mustang Max 0.8EC	4.00	7.4bcd
Confirm 2F	**8.00**	**11.2bcd**
Prolex 1.25EC	2.00	10.4bcd
Baythroid 2E	2.10	11.8bc
S-1812 4EC	6.4	11.2b
V-10170 50%WDG	20gm/A	12.0b
Check	**--**	**34.4a**
F-value		28.18

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

SMALL PLOT ASSESSMENT OF INSECTICIDES AGAINST THE MEXICAN RICE BORER

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Insecticidal control of the Mexican rice borer (MRB) was evaluated at Santa Rosa, Texas. A randomized block experimental design was conducted with 5 replications of the variety CP 70-1210 plantcane crop during the summer of 2005. Each plot consisted of three 24-ft rows. Insecticide treatments were applied on 16 May, 8 June, 27 June, and 29 July with the surfactant CS-7 at a rate of 0.25% vol/vol with a Knapsack Solo sprayer with a pressure of 25-35 psi at 20 gpa using an 8002 hollow cone nozzle. Data on the percent MRB bored internodes was collected on 19 August from 5-7 stalks on the center row of each plot. The proportion of bored internodes was analyzed using a generalized linear model (Proc Glimmix, SAS Institute 2004) with a binomial distribution.

Confirm (8oz/ac), Novaluron (12oz/ac), and a mix of Novaluron (9oz/ac) and Prolex (2.0oz/ac) reduced injury significantly; 2-fold, 3.4-fold and 5.7-fold, respectively.

Table 1. Insecticidal control of Mexican rice borer at small plot level, Santa Rosa, Texas, 2005.

Treatment/ formulation[a]	Rate oz/ac	% MRB bored internodes[b]
Novaluron + Prolex	**9.0+ 2.0**	**4.3c**
Novaluron	12.0	7.2bc
Confirm	8.0	12.2bc
Novaluron	9.0	14.3abc
Baythroid	2.8	10.7ab
Untreated	**--**	**24.4a**

[a]All treatments were applied with Latron CS-7 at 0.25%v/v.
[b]Means within the same column followed by the same letter are not significantly different (*P* > 0.05; Tukey's [1953] HSD) (df = 5, 24).

EARLY SEASON EVALUATION OF SUGARCANE VARIETAL RESISTANCE TO THE SUGARCANE BORER

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Department of Entomology

Eleven sugarcane varieties were evaluated for their susceptibility to the sugarcane borer (SCB) at the early growth stage at Burns Point in St. Mary Parish. A randomized complete block design was used with four replications. Plots for each variety were 15-ft and the number of deadhearts caused by SCB was counted on April 27 and May 24, 2005. Data on number of deadhearts (per 15-ft plot) were analyzed using Proc Glimmix (SAS Institute 2004).

Significant differences among varieties were detected showing HoCP 01-561 the most significant with the highest number of deadhearts (50,820/acre). This variety also had the highest number of bored internodes (49%) in our 2004 variety screening test. Among the three standards, LCP 85-384 had the highest number of deadhearts (32,234/acre), while HoCP 85-845 showed significantly less susceptibility to SCB in its early growth stages (Table 1). The projected number of deadhearts on a per acre basis shows that susceptible varieties such as HoCP 01-561 have the potential to produce substantial SCB early season populations, while resistant varieties like HoCP 01-523 will be expected to have only 15-20% of those early season populations. These numbers also indicate the importance of development and commercialization of insect resistant varieties.

Table 1. Deadhearts by sugarcane borer in different sugarcane varieties at Burns Point in St. Mary Parish, 2005.

Variety	Deadhearts/15-ft	Deadhearts/acre
HoCP 01-561	17.5a	50820
L 02-324	12.8ab	37171
LCP 85-384	**11.1bc**	**32234**
L 02-342	10.6bc	30782
L 02-316	9.4bcd	27297
HoCP 91-555	**9.3bcd**	**27007**
US 02-99	7.9bcd	22941
HoCP 01-551	6.8cde	19747
L 02-325	6.4cde	18585
HoCP 85-845	**5.3de**	**15391**
HoCP 01-523	3.0e	8712
$P > F^a$	0.04	

Means within the same column followed by the same letter are not significantly different ($P > 0.05$; Tukey's HSD).

MONITORING OF SUGARCANE BORER RESISTANCE TO TEBUFENOZIDE (CONFIRM)

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Continuous use of similar insecticide chemistries exerts selection pressure on insect physiology which may cause insecticide resistance. The sugarcane borer (SCB), *Diatraea saccharalis* (F.) has a long history of resistance development against a wide range of insecticide classes. Our previous studies have shown indication of resistance development in some areas due to continuous use of Confirm® over several years in Louisiana sugarcane industry. In 2005, we continued monitoring for the potential development of resistance in SCB against Confirm®. Borers were collected from four different field locations and tested in the laboratory over a range of Confirm® doses incorporated into artificial diet. After seven days, the borers were transferred from treated to regular diet and data on pupation was recorded for each strain. The Alexandria strain was collected from corn fields where no Confirm® has ever been applied thus serving as a standard to compare strains. The Duson strain was collected from locations where Confirm® has been consistently used for the last several years and control failures have been observed by the consultant.

Our results indicate that areas such as St. Gabriel and St. Mary where rotation of chemistries has been practiced showed little signs of resistance buildup (Table 1). However, Duson strain showed 3.78 and 7.0 times increase in resistance ratios at LC_{50} and LC_{90} levels, respectively. This strain also had the highest pupation and was able to pupate even at concentrations where no other strain survived (Fig. 1). These studies indicate that Confirm® can only be preserved for longer period of time and phenomenon of resistance buildup delayed only if rotation of chemistries is practiced.

Table 1: Changes in susceptibility of sugarcane borer to Confirm.

Strain	LC_{50}	LC_{90}	RR_{50}	RR_{90}
Alexandria	0.14	0.31	1	1
St. Mary	0.20	1.23	1.42	3.96
St. Gabriel	0.22	0.72	1.57	2.32
Duson	0.53	2.17	**3.78**	**7.00**

LC= Lethal concentration necessary to kill 50 and 90% of respective cultures
RR= Resistance ratio in comparison to Alexandria standard

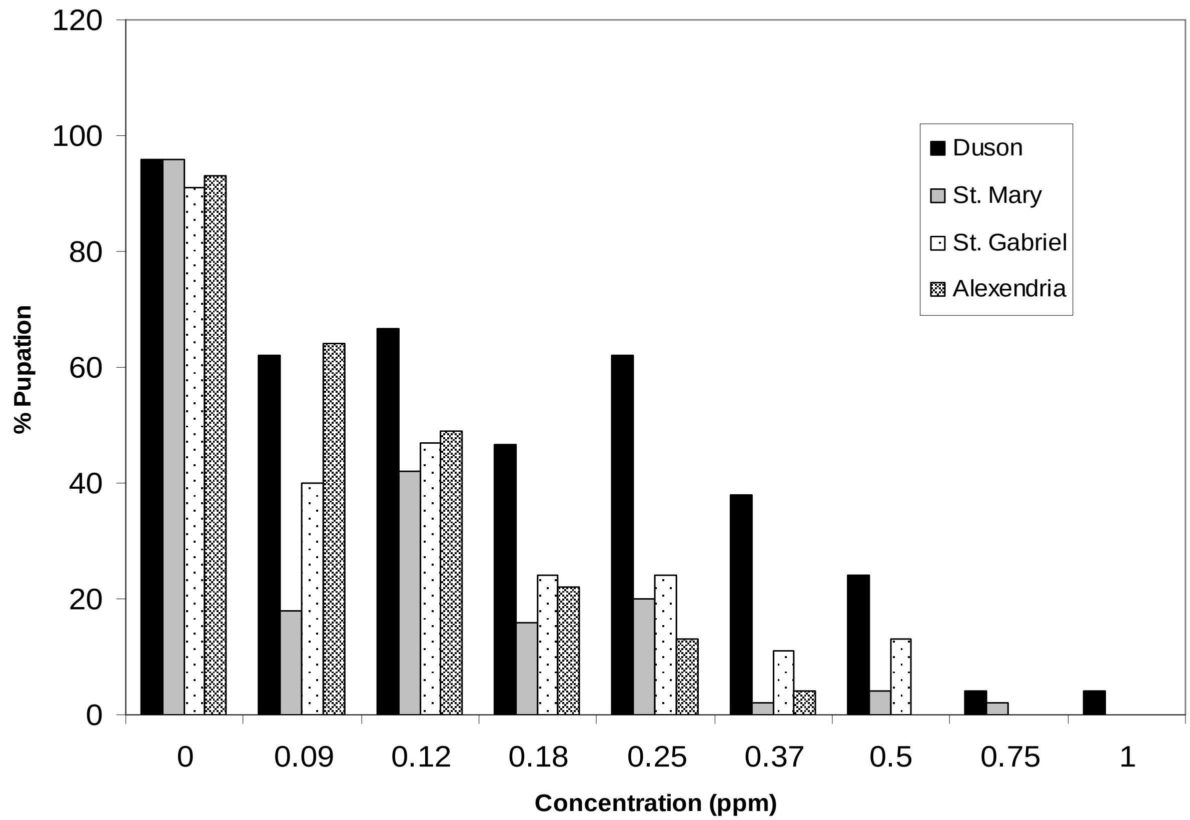

Fig.1. Tebufenozide effects on pupation of field collected strains of the sugarcane borer.

RESISTANCE TO THE SUGARCANE APHID AMONG COMMERCIAL SUGARCANE CULTIVARS IN LOUISIANA

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The sugarcane aphid, *Melanaphis sacchari* is the main vector of sugarcane yellow leaf virus which causes sugarcane yellow leaf disease. Tests for antixenosis (preference or non preference), antibiosis (negative effects of plant on insect biology), and tolerance (plant's ability to withstand injury) were conducted in the greenhouse to assess potential sources of host plant resistance in current Louisiana sugarcane germplasm. The varieties tested include LCP 85-384, HoCP 91-555, Ho 95-988, HoCP 96-540, and L 97-128. For antixenosis tests, 50 apterous nymphs were released at the center of a wooden platform that had one leaf from each variety stuck at the margins. The aphids were recovered after 24 hours. There were four replications of each variety in one experiment and the experiments were repeated three times. For antibiosis tests, two aphids were confined in a clip-on cage on one leaf of each variety with data collected daily to maturity assessing days in reproduction and number of nymphs produced per aphid. Based on this data, intrinsic rate of increase of aphids (r_m) on each variety was calculated. Tolerance was assessed by recording chlorophyll content readings from aphid infested and noninfested leaves of each variety.

Antixenosis tests did not show difference in aphid preference, but antibiosis tests indicate pronounced variation among varieties. The days in reproduction and number of nymphs produced were highest in L 97-128 and least on HoCP 91-555. Calculations based on r_m indicated that L 97-128 was the most susceptible variety and HoCP 91-555 depicted the strongest antibiosis (Fig. 1). Other varieties showed intermediate levels of antibiotic resistance. Similar results were recorded in tolerance tests, as L 97-128 suffered maximum chlorophyll loss and HoCP 91-555 was able to produce more chlorophyll in the infested than in the noninfested leaf tissues (Fig. 2).

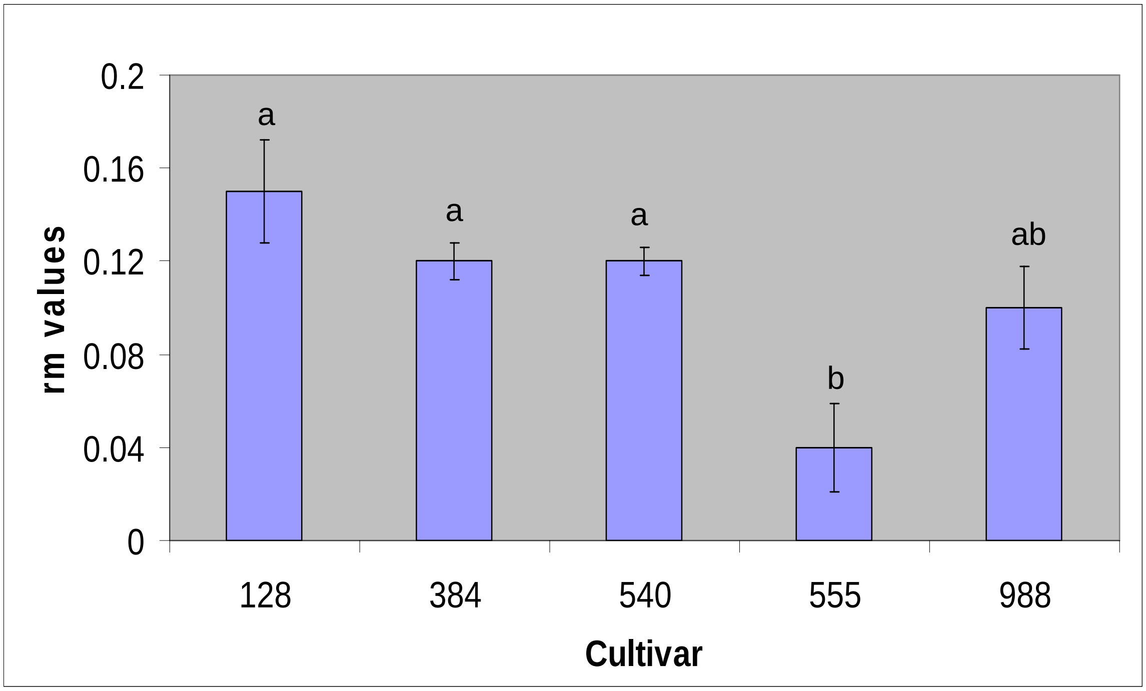

Fig. 1. Effect of sugarcane cultivars on population growth rate (r_m) of sugarcane aphid.

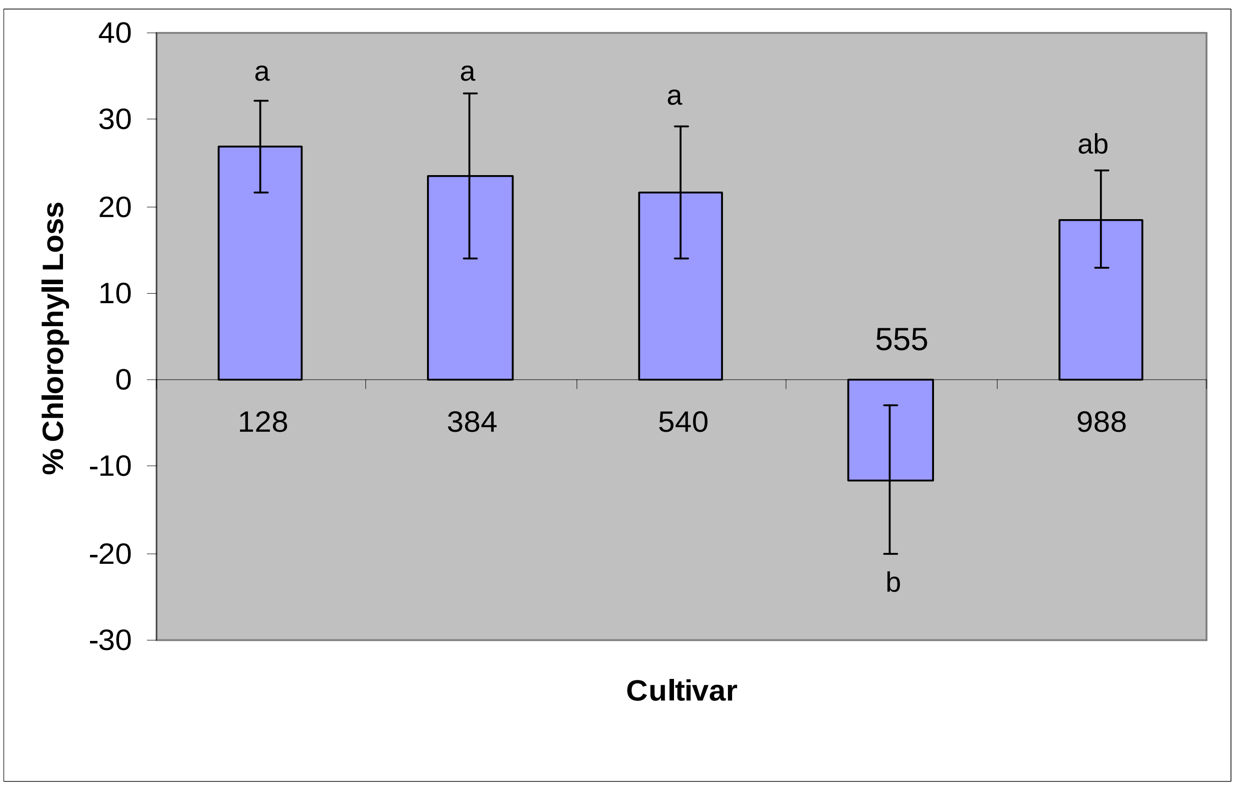

Fig. 1. Effect of sugarcane cultivars on chlorophyll loss due to sugarcane aphid feeding.

MONITORING MEXICAN RICE BORER MOVEMENT

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Cooperative studies on the Mexican rice borer (MRB), *Eoreuma loftini* (Dyar), between the LSU AgCenter, the Texas A&M University research stations at Beaumont and Weslaco, the Texas Department of Agriculture and the Louisiana Department of Agriculture and Forestry were conducted to monitor the movement of this insect towards Louisiana and to study the population dynamics of this devastating pest of sugarcane that can not be controlled with simple insecticide applications. The MRB has been the major economic pest in Texas sugarcane since it established in 1980, quickly surpassing the pest severity of the sugarcane borer, *Diatraea saccharalis* (F.).

A major monitoring effort has been on-going since 2000 with the various cooperating agencies as well as with the assistance from farmers, county agents, and consultants. After the discovery in Brazoria, Colorado, Fort Bend, Waller and Wharton Counties in 2000, Harris and Austin Counties in 2001, Galveston in 2002, Chambers and Liberty in 2004, a new county was documented with MRB invasion (Jefferson) in 2005 (Fig. 1 and Table 1). The MRB is now found within seven miles of Beaumont, ~30 miles from the Louisiana border and has been moving at a rate of 14.4 miles/year since it was discovered in Texas in 1980. Each year, infestations in newly invaded counties were initially low, but consistently increased the following year. Regulatory activities involving both Departments of Agriculture will continue to be important to Louisiana sugarcane farmers in order to delay the invasion of this very serious pest.

Extensive attempts involving several millions of dollars in research to introduce MRB parasites have not resulted in effective control in the Lower Rio Grande Valley of Texas. In our program, alternative control methods involving varietal resistance and cultural practices were investigated. In a field experiment in 2004, the newly released varieties Ho 95-988 (57 % MRB bored internodes) and L 97-128 (47.4 %) were as susceptible as LCP 85-384 (54.4 %). Moderate levels of resistance have been identified among several other varieties, including CP 70-321 and HoCP 85-845. A 2-year field study assessed the role that irrigation could play on the effective management of MRB when used in combination with variety selection and insecticide applications. Seven applications at the 8oz/acre rate of Confirm® (tebufenozide) were sprayed every 2 weeks (June to mid August). 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 2-fold in HoCP 85-845 and LCP 85-384. Using irrigation water without applying insecticides, injury in both resistant and susceptible varieties still exceeded an average across both years of 23 and 35 % bored internodes, respectively. Greenhouse oviposition experiments on sugarcane showed that 100% of the eggs were laid on dry leaf material, which increased under stress, thus explaining the breakdown of resistance under non-irrigated conditions. Our work has emphasized the importance of using multiple tactics in combination to manage this pest, which will be necessary when MRB becomes established in the Louisiana sugarcane industry. Appreciation is expressed to the

American Sugar Cane League for grants to the LSU Sugarcane Entomology program in partial support of this work, also supported by national USDA competitive grants and collaboration with county agents and agricultural consultants.

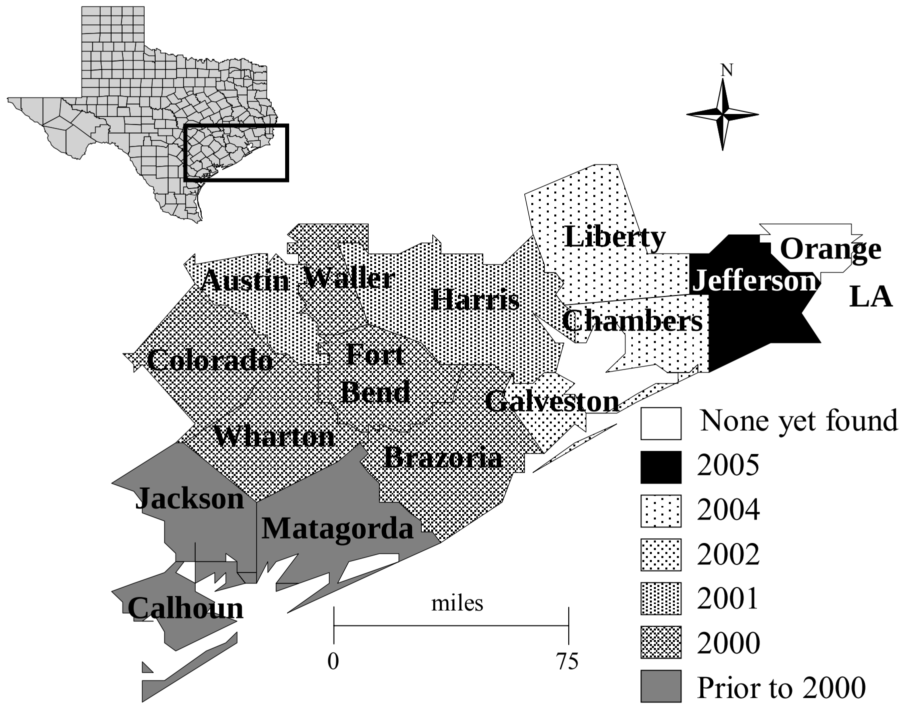

Fig. 1. Movement of the Mexican rice borer through the East Texas rice and sugarcane area, 2000-2005.

Table 1. Pheromone trap collections of Mexican rice borer (*Eoreuma loftini*) moths in Southeast Texas during 2005[1].

Texas Counties									
New Discovery	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Total**
Jefferson	0	0	0	1	2	2	0	-	**5**
Previously Known Counties									
Brazoria	455	718	420	554	1322	3757	846	-	**8072**
Chambers	-			397	287	1583	1576	-	**3843**
Colorado	174	236	236	82	330	1145	367	21	**2591**
Galveston	-	426	463	595	161	941	786	-	**3372**
Jackson	150	110	67	16	-	-	-	6	**349**
Liberty	-	22	44	222	177	603	499	19	**1586**
Matagorda	260	601	151	1219	1436	1008			**4675**
Waller	-	30	426	657	895	3107	974	26	**6115**
No MRB Collected									
Orange	-	-	0	0	0	0	0	0	**0**

[1]Number of moths per two traps per month.

Table 2. Pheromone trap collections of Mexican rice borer (*Eoreuma loftini*) moths in Southeast Texas from 2003 to 2005.

Texas counties	2003	2004	2005
Liberty	0	413	1586
Chambers	0	6	3843
Jefferson	0	0	5

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 a cost-effective manner. Projects receiving emphasis during 2005 included: ratoon stunting disease (RSD) management, evaluating the effect of brown rust on yield and possible control measures, assessing the treat posed by yellow leaf and control measures, improving our understanding of root disease, and billet planting. Research results on billet planting are reported separately.

RATOON STUNTING DISEASE

RSD testing was conducted by the Sugarcane Disease Detection Lab for the 9th year during 2005. RSD was monitored on farms, in the LSU AgCenter Variety Selection Program, in the American Sugar Cane League Variety Release Program, and in the Kleentek® seedcane production system (Table 1). No RSD was detected at any level of Kleentek production or in ASCL Variety Release Program samples. On-farm RSD testing was low due to the hurricanes. Forty-nine fields were sampled on ten farms. RSD was detected in 10% of the farms, 2% of the fields, and 0.3% of the stalks tested. RSD was detected in second stubble (Table 2) of field-run cane (Table 3). In addition to RSD testing, seven varieties were processed through the Local Quarantine to provide healthy material to establish Foundation Stock plants that will serve as the source for tissue culture seedcane production.

Table 1. RSD testing summary for 2005.

Source	Location	No. of fields	No. of varieties	No. of samples
Louisiana growers	State-wide	49	8	937
LSUAC	St. Gabriel & Iberia	-	15	189
Variety Release Program	1° & 2° stations	-	7	468
Helena	Foundation stock	-	8	28
Kleentek®	Foundation stock	-	6	25
Kleentek®	1° increase farms	23	5	374
Kleentek®	2° increase farms	33	4	656
Local Quarantine	LSUAC	-	16	135
Research	LSUAC	-	-	1060
Totals		105		3872

Table 2. RSD field and stalk infection frequencies in different crop cycle years for all varieties combined during 2005.

Crop Year	Total number of fields	Average field infection (%)	Total number of stalks	Average stalk infection (%)
Plantcane	26	0.0	490	0.0
First stubble	8	0.0	160	0.0
Second stubble	11	9.1	207	1.4
Older stubble	4	0.0	80	0.0
Totals/Averages	49	2.0	937	0.3

Table 3. RSD field and stalk infection frequencies as affected by seedcane programs for all varieties combined during 2005.

Seedcane program	Total number of fields	Average field infection (%)	Total number of stalks	Average stalk infection (%)
Heat-treated	-	-	-	-
Kleentek®	10	0.0	197	0.0
ASCL	23	0.0	419	0.0
Field-run	16	6.3	321	0.9
Totals/Averages	49	2.0	937	0.3

BROWN RUST

Field experiments were conducted on commercial farms to evaluate the effect of brown rust on yield of LCP 85-384 and the efficacy of fungicides for rust control. Similar experiments have been established for 2006.

Yield loss experiment:

The experiment was conducted in a LCP 85-384 plantcane field on a commercial farm in St. Mary Parish. The methods used were the same as for two experiments conducted during 2004. A combination of three fungicides, Folicur (tebuconazole), Quadris (azoxystrobin), and Tilt (propiconazole) were applied with a CO_2 backpack sprayer every two weeks once the rust epidemic began. Fungicide treatments were started and stopped at different times to determine when rust was having the greatest impact on yield. Experimental plots consisted of four rows 70 ft. in length with four replications. Rust intensity was assessed at different dates by image analysis using leaves collected from each plot. The rust started later in 2005 than in 2004, so treatments did not begin until May. Cane tonnage was determined using a weigh wagon to record the total weight of harvested cane for each plot, and sugar/acre was calculated with these tonnage figures.

Fungicides applied only in May did not reduce rust intensity or significantly increase yield (Table 4). However, spraying in May and June increased cane tonnage by 6.6 tons/acre (18%) and sugar/acre by 931 lbs. (11%). Spraying only in June resulted in a significant decrease in rust intensity and an increase in tonnage yield. Tonnage was increased by 4.8 tons (13%) and sugar by 1,043 lbs. (12%). The millable stalk population and stalk weight were slightly higher in the May-June and June fungicide treated plots, and these nonsignificant increases together resulted in the tonnage increases.

Table 4. Effect of brown rust on yield of LCP 85-384, St. Mary Parish, 2005.

Fungicide treatment dates				Percent rust (July)	Stalk no./acre (x1000)	Stalk weight (lbs.)	Sugar/ton (lbs.)	Tons/acre	Sugar/acre (lbs.)
None				38.1 B	47.5	1.74	235.9	35.7 B	8417
5/3	5/17			45.1 B	51.0	1.95	231.1	37.2 B	8611
5/3	5/17	6/2	6/15	4.1 A	48.3	1.81	221.7	42.3 A	9348
		6/2	6/15	4.0 A	49.6	1.80	233.7	40.5 AB	9460

Values within columns followed by different letters were significantly different (P=0.05).

Rust reduced cane tonnage in an experiment conducted in Iberia Parish during 2004 by 7 tons (21%). This reduction was similar to that obtained from the 2005 experiment, but the sugar/acre loss caused by rust was less in 2005 (11%) compared to 2004 (28%). Sugar/ton was higher for the rust infected cane during 2005. It should be noted, however, that fungicides applied from April through June did not increase yield in an experiment conducted in St. James Parish during 2004. The rust epidemic began but never became severe in this field.

The results from 2004 and 2005 demonstrate that rust can significantly reduce yield of LCP 85-384. The magnitude of the yield increases obtained with the combination fungicide treatments suggests that the use of fungicides as a rust control measure for farmers should be explored. Therefore, experiments were conducted during 2005 to determine the efficacy of single or combined fungicides for rust control at different times of application.

Fungicide efficacy experiments:

Two field experiments were conducted during 2005 to evaluate the effects of treatment with different fungicides on rust severity and yield. One experiment was initiated in May in a plantcane field of LCP 85-384 in Lafourche Parish. A second experiment was initiated in June in a plantcane field of LCP 85-384 in Iberia Parish.

Seven fungicide treatments were compared to no fungicide treatment. They were: Domark (tetraconazole), Folicur (tebuconazole), Headline (pyraclostrobin) + Folicur, Quadris (azoxystrobin), Quilt (Quadris + Tilt), Tilt (propiconazole), and the combination used in the yield loss experiments (Folicur + Quadris + Tilt). Domark, Folicur, and Tilt have similar modes of action, and Headline and Quadris have similar modes of action. Headline + Folicur was available packaged together, and Quilt is a single product containing Quadris + Tilt together. Rates of application were recommended by the companies making the different products. The rates of application for the seven treatments were 6 oz/acre of formulated product (FP) for Domark, 6 oz/acre FP for Folicur, 6 oz/acre FP Headline + 4 oz/acre FP Folicur, 9 oz/acre FP for Quadris, 14 oz/acre FP for Quilt, 4 oz/acre FP for Tilt, and 6 oz/acre FP Folicur + 10 oz/acre FP Quadris + 6 oz/acre FP Tilt.

In the Lafourche experiment, fungicides were applied on 13 May (1st rust) only, on 3 June only, or on both dates. Rust was just beginning to appear in mid-May in the test field, and the second fungicide application was timed to coincide with the probable loss of effect from the 13 May application. All but one fungicide treatment significantly reduced rust severity (Table 5). The most effective treatments tended to be the combination fungicides applied in May and June. However, the only fungicide treatment that significantly increased cane tonnage compared to the no fungicide treatment was Quadris applied on 3 June only. The next best treatments were Folicur applied on 3 June only and the three fungicide combination applied on both dates. The rust epidemic and plant growth in the test field appeared to be erratic possibly due to recent land-leveling. Sugar/acre yields were particularly erratic. However, the fact is that reductions in rust resulting from fungicide applications did not lead to significant yield increases in this experiment.

Following several hard freezes during the 2004/2005 winter and a cold spring, the occurrence of rust was erratic during the 2005 growing season. Crop growth also was erratic and delayed by weather conditions. Rust usually begins to decrease in intensity during June as temperatures increase, so with the late start for the epidemic, it was anticipated that rust would not be severe in the Louisiana industry during 2005. However, rust continued to spread north into new fields during June and July of 2005. When it became apparent that rust was continuing to spread, it was decided to conduct a second fungicide experiment. The objective would be to determine if the fungicides being evaluated could halt an epidemic that was already in progress.

The same fungicide treatments as in the Lafourche experiment were applied to a plantcane field of LCP 85-384 in Iberia Parish in which rust was already strongly evident. A single application only was made on 10 June. Rust severity was determined and compared in July, and millable stalk counts were made during August. Due to difficulties encountered by the farmer following Hurricane Rita, no tonnage or sugar yields were determined.

Fungicides applied to a field with a severe rust epidemic in progress failed to reduce subsequent rust intensity (Table 6). This included the three fungicide combination that was effective in controlling rust in the yield loss experiments. In addition, no fungicide treatment improved millable stalk population (Table 6).

Table 5. Effects of fungicide treatments on rust severity and yield of LCP 85-384 plantcane, Lafourche Parish, 2005.

Fungicide	Treatment	Percent rust (July)	Stalks/acre (x1,000)	Stalk wt. (lbs.)	Sugar/ton (lbs.)	Tons/acre	Sugar/acre (lbs.)
No fungicide	None	41.8 A	49.9	1.26	220	32.9 BCD	7239 BC
Domark	13 May	24.5 AB	51.8	1.36	199	35.0 ABCD	6943 BC
Domark	3 June	14.4 BC	50.9	1.18	211	32.9 BCD	6996 BC
Domark	Both	12.3 BC	52.1	1.37	204	33.4 BCD	6798 BC
Folicur	13 May	17.4 BC	49.1	1.42	206	32.0 CD	6592 C
Folicur	3 June	10.6 BC	48.6	1.26	205	37.4 AB	7645 ABC
Folicur	Both	9.6 BC	48.3	1.36	217	33.1 BCD	7163 BC
Headline + F	13 May	12.1 BC	47.7	1.32	221	33.0 BCD	7281 ABC
Headline + F	3 June	5.3 C	50.5	1.35	220	30.5 D	6706 C
Headline + F	Both	7.5 BC	44.7	1.30	191	35.1 ABC	6648 C
Quadris	13 May	14.5 BC	51.1	1.24	214	33.9 ABCD	7268 ABC
Quadris	3 June	12.2 BC	51.3	1.19	217	38.4 A	8334 A
Quadris	Both	5.1 C	48.3	1.50	209	31.8 CD	6628 C
Quilt	13 May	10.2 BC	44.4	1.36	208	31.7 CD	6584 C
Quilt	3 June	12.6 BC	50.5	1.36	216	35.4 ABC	7613 ABC
Quilt	Both	4.9 C	47.0	1.30	215	34.8 ABCD	7491 ABC
Tilt	13 May	11.6 BC	43.9	1.33	212	31.2 CD	6599 C
Tilt	3 June	10.7 BC	49.3	1.43	205	33.9 BCD	6905 BC
Tilt	Both	14.2 BC	47.5	1.19	206	33.3 BCD	6864 BC
Q + F + T	Both	6.6 C	48.9	1.21	219	35.7 ABC	7823 AB

Values within a column followed by the same letter were not significantly different (P=0.1).

Table 6. Effect of fungicides on established brown rust in LCP 85-384, Iberia Parish, 2005.

Fungicide treatment	Percent rust in July	Stalks/acre (x 1,000)
None	36.9	53.2
Domark	43.8	52.1
Folicur	36.5	55.8
Headline + Folicur	31.3	52.9
Quadris	45.6	53.9
Quilt	43.2	54.7
Tilt	40.1	51.8
Folicur + Quadris + Tilt	34.2	54.9

Conclusions:

A significant yield loss due to rust was again demonstrated in LCP 85-384. Rust is clearly a factor limiting LCP 85-384 yield, particularly in the southern areas of the industry. The magnitude of the potential yield loss suggests that a fungicide control program might be feasible. It is uncertain which components of the three fungicide combination treatment employed in the yield loss studies were effective in controlling rust or how many times they would need to be applied to be effective. However, Folicur and Tilt have the same mode of action, and fungicides of this type are now commercially available in combination with fungicides, such as Quadris, with a different mode of action. An encouraging outcome from the yield loss studies is that significant yield increases were obtained in 2004 and 2005 without applications to control the earliest stage of the spring epidemic. This could suggest that a high number of fungicide applications might not be necessary. However, a discouraging outcome was the failure to obtain a yield increase at one location during 2004. A large amount of money was spent on fungicides at this site without any benefit.

The 2005 experiments in which the different fungicides were evaluated separately and in combination and at different times of application did not provide conclusive evidence concerning the feasibility of an on-farm fungicide control program for rust. It appears that these fungicides possess the ability to reduce rust severity, either singly or in combination. However, they did not significantly increase yield, and they were not capable of stopping a rust epidemic that had already become severe.

YELLOW LEAF

The Sugarcane Disease Detection Lab also monitored for *Sugarcane yellow leaf virus* (SCYLV) in the LSU AgCenter Variety Selection Program, the ASCL Variety Release Program, and Sugartek® (Helena Chemical Co.) and Kleentek® seedcane sources (Table 7). A total of 12,448 samples were tested. Commercial tissue culture seedcane sources were tested for the second season as part of the Louisiana Department of Agriculture Seedcane Certification Program. No field failed to certify due to virus infection.

Table 7. Sugarcane yellow leaf virus testing summary for 2005.

Source	Location	No. of fields	No. of varieties	No. of samples
LSUAC	St. Gabriel & Iberia	-	14	337
Variety Release Program	1° & 2° stations	-	12	380
Helena	Foundation stock	-	8	28
Helena	Increase farms	34	2	1088
Kleentek®	Foundation stock	-	25	112
Kleentek®	1° increase farms	74	8	2487
Kleentek®	2° increase farms	92	4	3299
Local Quarantine	LSUAC	-	16	135
Research	LSUAC	-	-	4582
Totals		200		12,448

A field experiment was conducted at the St. Gabriel Research Station to evaluate the yield loss caused by SCYLV infection in HoCP 96-540. Yield components were compared in completely virus-infected and nearly virus-free plots. In plantcane, virus infection was found to cause reductions of 13% in both cane tonnage and sucrose per acre yields.

Table 8. Effect of *Sugarcane yellow leaf virus* (SCYLV) infection on plantcane yield components of HoCP 96-540.

Treatment	Stalks/acre	Stalk wt. (lbs.)	Sugar/ton (lbs.)	Tons of cane per acre	Sugar/acre (lbs.)
SCYLV -	40,763	2.3	211	43.1 A	9087 A
SCYLV +	38,987	2.1	211	37.6 B	7948 B

Values within columns followed by different letters were significantly different (P=0.05).

ROOT DISEASES

A soil applied pesticide, AgriTerra, was evaluated in a field experiment at the St. Gabriel Research Station for the potential to reduce plant parasitic nematode populations and increase yield of LCP 85-384. All AgriTerra treatments reduced spring, summer and end of season nematode populations (Table 9). The ranking of the treatments was the same for the spring and summer populations. The 1:100 dilution applied either at planting or with fertilizer in the spring was more effective in reducing nematode numbers than the 1:200 dilution applied at planting and with fertilizer. At the end of the season, nematode numbers had increased in the single at-planting treatment, but the population was still lower than in the non-treated treatment.

Sugarcane stalks per acre and individual stalk weight were numerically slightly higher for the AgriTerra treatments but not significantly different than the non-treated control (Table 10). Differences were detected among treatments in sucrose content of the stalks (sugar per ton of cane). Cane tonnage and sucrose per acre were determined two ways. When the individual stalk yield components were used to estimate the tons of cane and pounds of sucrose produced per acre, the values for the AgriTerra treatments were numerically higher but not significantly different than the non-treated control (Table 10). The increased amounts in sugar per acre would be economically significant to a farmer. However, the differences among treatments were not detected when cane tonnage was determined by a different method in which the weight of the total amount of cane passing through the harvester into the wagon was recorded for each plot (Table 11).

Table 9. Effects of AgriTerra on spring, summer and end of season nematode populations in a plantcane field of sugarcane variety LCP 85-384 during 2005.

Treatment	Nematodes/lb. of soil 23 May	Nematodes/lb. of soil 18 August	Nematodes/lb. of soil 8 December
Non-treated control	30,984 A	41,179 A	5,515 A
AgriTerra 1:100 at planting	3,727 C	4,202 C	1,030 B
AgriTerra 1:100 with spring fertilizer	4,305 C	4,531 C	761 BC
AgriTerra 1:100 at planting and spring fertilization	11,315 BC	12,863 BC	601 BC
AgriTerra 1:200 at planting and spring fertilization	19,560 B	22,580 B	216 C

Values within a column followed by the same letter were not significantly different (P=0.05).

Table 10. Effects of AgriTerra on plantcane crop yield components of sugarcane variety LCP 85-384 (cane tonnage and sugar per acre estimated from stalk counts, stalk weight, and sugar /ton).

Treatment	Stalks/acre (x1000)	Stalk weight (lbs.)	Sugar/ton (lbs.)	Cane/acre (tons)	Sugar/acre (lbs.)
Non-treated control	56.1	1.41	218.9 AB	39.6	8,663
AgriTerra 1:100 at planting	56.5	1.56	228.0 A	44.2	10,068
AgriTerra 1:100 with spring fertilizer	56.8	1.45	220.6 AB	41.2	9,141
AgriTerra 1:100 at planting and spring fertilization	54.8	1.49	226.3 A	40.8	9,210
AgriTerra 1:200 at planting and spring fertilization	56.4	1.56	210.8 B	43.8	9,240

Values within a column followed by the same letter were not significantly different (P=0.05).

Table 11. Effects of AgriTerra on sugarcane plantcane yield components of sugarcane variety LCP 85-384 (cane tonnage and sugar/acre determined from actual harvested cane weight).

Treatment	Stalks/acre (x1000)	Stalk weight (lbs.)	Sugar/ton (lbs.)	Cane/acre (tons)	Sugar/acre (lbs.)
Non-treated control	56.1	1.41	218.9 AB	38.4	8,414
AgriTerra 1:100 at planting	56.5	1.56	228.0 A	37.2	8,489
AgriTerra 1:100 with spring fertilizer	56.8	1.45	220.6 AB	37.8	8,340
AgriTerra 1:100 at planting and spring fertilization	54.8	1.49	226.3 A	36.6	8,274
AgriTerra 1:200 at planting and spring fertilization	56.4	1.56	210.8 B	39.1	8,232

Values within a column followed by the same letter were not significantly different (P=0.05).

NO-TILL SUGARCANE – AGRONOMIC AND ECONOMIC IMPLICATIONS

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In Louisiana sugarcane, tillage is used extensively to control weeds, eliminate ruts caused by harvest, destroy residue from the previous crop, and incorporate fertilizer. A common perception is that tillage also stimulates sugarcane regrowth in the spring by warming the seedbeds. The effect of tillage and weed control programs on LCP 85-384 sugarcane growth, yield and economics was evaluated over two growing seasons. In this study residue remaining from harvest of the previous crop was not a factor affecting sugarcane regrowth. When row shoulders and middles were not tilled in March, soil temperature in the sugarcane drill early in the growing season was equal to that where March tillage was performed. Weeds were effectively controlled with a March application of DuPont K-4 at 4 lb/A broadcast (2 lb/A banded). Sugarcane and sugar yield were each equivalent for the full season tillage (off-bar tillage in March plus layby tillage in May) and the no-till programs. Elimination of a single tillage operation reduced cost $6.59/A and herbicide applied on a band rather than broadcast reduced cost $12.34/A. For the no-till program with herbicide banded in March compared with full season tillage, net return was increased $13.18/A. In a subsequent study conducted at five locations sugar yield was increased 8.6% and net return was increased $61.79/A when sugarcane was not tilled in March. Sugar yield was increased 8.0% and net return was increased $58.23/A when layby tillage in May was eliminated.

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

RED MORNINGGLORY (*Ipomoea coccinea* L.) RESPONSE TO SHADE AND SOIL-APPLIED HERBICIDES

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Research was conducted over three years to evaluate red morningglory (tie-vine) emergence and growth in response to shade. Treatments included 0, 30, 50, 70, or 90% shade. Shade levels were established using 2 feet by 2 feet by 2 feet structures covered with shade cloth. Weed emergence, plant height, and leaf and stem dry weight data were collected 20 to 41 days after soil was tilled to a four-inch depth and shade enclosures were installed. At the time of data collection red morningglory in the no shade (full sun) treatment had three- to six-leaves. Data were expressed as percent of the full sun treatment. Emergence of red morningglory decreased 5 and 8% for the 30 and 50% shade treatments, respectively, compared with full sun. Increasing shade to 70 and 90% decreased weed emergence 37 and 43%, respectively. Shade did not affect height of red morningglory. Leaf weight per plant was reduced when compared with full sunlight only for the 90% shade treatment (48% reduction). Stem weight of red morningglory was reduced for both the 70 and 90% shade treatments (31 and 50% reduction, respectively).

A study also was conducted to determine seasonal changes in light penetration into the sugarcane canopy and to use these findings to help predict red morningglory emergence in the crop. An AccuPAR Linear Par Ceptometer was used to measure photosynthetically active radiation (PAR) at ground level in four sugarcane varieties: LCP 85-384, L 97-128, HoCP 96-540, and Ho 95-988. Sugarcane varieties did not differ in regard to PAR that penetrated the crop canopy at ground level for any of the sampling dates. On June 13, PAR reaching ground level for the varieties was 32 to 64% and decreased to 15 to 27% by July 6. On July 21, PAR reaching ground level was 7 to 12%. Using the red morningglory shade data it would be expected that plants would be able to emerge and grow into late July underneath a sugarcane canopy. Results also suggest that soil-applied herbicide with long residual activity would be needed to provide season long red morningglory control.

Residual control of red morningglory with soil-applied herbicides applied in late May and early June was evaluated over two years. Red morningglory control data were collected 5, 7, 9, and 11 weeks after treatment (WAT). To allow for evaluation of residual activity of the herbicides, Liberty (glufosinate) was applied after each rating to eliminate weed competition as a variable. Red morningglory control 5 WAT was at least 90% with Spartan DG (sulfentrazone) at 4, 5, 6, 7, and 8 oz/A; Atrazine at 3 and 4 qt/A; Dupont K4 (hexazinone plus diuron) at 3 and 4 lb/A; Sencor (metribuzin) at 3 lb/A; and Valor (flumioxazin) at 4, 6, and 8 oz/A. By 7 WAT, Spartan at all rates controlled red morningglory at least 93% and no other treatment provided more than 80% control. By 9 WAT, all rates of Spartan except 3 oz/A controlled red morningglory at least 83% and Spartan at 3 oz/A and the highest rates of DuPont K4 and Valor were the only other treatments controlling red morningglory at least 61%. Red morningglory control was still around 80% 11 WAT when Spartan was applied at 4 oz/A and higher.

Results clearly show that reported red morningglory control failures in sugarcane are related to the shade tolerance of red morningglory and the lack of long-term residual control with some soil applied herbicides. Findings show that red morningglory can emerge and grow under the sugarcane canopy into late July. To maximize the effectiveness of soil-applied herbicides, the layby application should be delayed until late June or early July to assure that sufficient herbicide is present in soil when germination of red morningglory seed can be expected. Of the herbicides evaluated, Spartan was most effective and at 4 oz/A provided around 90% control 7 WAT and around 80% control 11 WAT.

INTERFERENCE OF PURPLE NUTSEDGE (*Cyperus rotundus* L.) IN LOUISIANA SUGARCANE

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Over the past few years, nutsedge has become problematic in Louisiana sugarcane fields. This is likely due to the poor control of nutsedge from glyphosate products applied during the summer fallow period prior to planting of sugarcane in August and September and also to the limited herbicide options available for use in the crop. The possibility of cultivation as a control measure is not available since the sugarcane row top is not disturbed over the multi-year crop cycle. Research was conducted in August 2005 to evaluate purple nutsedge interference with sugarcane. One study evaluated growth response of sugarcane to varying purple nutsedge tuber densities and the other study compared the competitiveness of sugarcane varieties with purple nutsedge. For both studies in which experiments were repeated, 7-gallon pots with a surface area equivalent to 1 ft^2 were used and were placed outside under a drip irrigation watering system. In the density study, 0, 1, 2, 4, 8, and 16 purple nutsedge tubers were planted per pot along with one sugarcane seed piece of the variety LCP 85-384. In the other study, the sugarcane varieties, LCP 85-384, L 97-128, Ho 95-988, and HoCP 96-540, were subjected to purple nutsedge interference (0 and 4 tubers/pot). Both studies were terminated 62 days after planting and purple nutsedge tubers were counted and shoot and root biomass for both sugarcane and nutsedge were measured. Results from both studies showed that purple nutsedge is very competitive with sugarcane even at low initial tuber densities. An initial density of 4 tubers per pot ($4/ft^2$) changed to around 115 tubers per pot 62 days after planting. LCP 85-384 sugarcane was competitive with purple nutsedge when the initial density was 1 or 2 tubers per pot. With 4 purple nutsedge tubers per pot, however, sugarcane growth was severely limited and sugarcane shoot dry weight was reduced around 64%. Averaged across the four sugarcane varieties, an initial density of 4 tubers per pot decreased sugarcane height around 20%, shoot population around 50%, and shoot dry weight around 60%. In one of two experiments, L 97-128 was more competitive with purple nutsedge than LCP 85-384, Ho 95-988, or HoCP 96-540. Findings emphasize the importance of using viable sugarcane seed for planting and the need for soil moisture and warm temperatures that promote bud germination and rapid emergence and growth of sugarcane shoots. Use of efficacious soil-applied herbicide would enhance the competitiveness of sugarcane. Other ongoing research indicates that purple nutsedge is most detrimental to sugarcane at the time of planting in August and September. Once the sugarcane crop has become established its early emergence in the spring prior to that of purple nutsedge, and its ability to produce rapid growth and shading suggests that sugarcane will be much more competitive than other agronomic crops.

ALTERNATIVES TO TILLAGE/HERBICDE PROGRAMS IN FALLOWED SUGARCANE FIELDS

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Failure to effectively control bermudagrass and johnsongrass in fallowed sugarcane fields can have an economic impact on both the plantcane and stubble crops. A study was conducted at St. Gabriel, LA, in a fallowed sugarcane field to compare conventional tillage/herbicide programs with that of a no-till program where Roundup UltraMAX was used to kill sugarcane stubble and weeds. Another study conducted in Henderson, LA, evaluated only conventional programs. At both locations, standard herbicide programs at planting and throughout the first production year were used to allow for direct comparison of the effectiveness of the fallow treatments.

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

At Henderson, when a tillage alone program was used in fallow, bermudagrass ground cover was 73%, 247 days after sugarcane planting (DAP). In contrast, bermudagrass groundcover was no more than 5% when tillage and Roundup UltraMAX were used in fallow. Sugarcane shoot population 36 and 247 DAP was not negatively affected regardless of the conventional fallow program used, but by August of the first production year sugarcane height and stalk population were less when only tillage was used in fallow. When bermudagrass was not controlled in fallow, sugarcane and sugar yields were reduced around 40% compared with the other conventional programs. Even though the tillage alone fallow program was the lowest cost input program ($34.00/A), the significant sugar yield reduction resulted in net returns of $216 to $291/A less than when tillage and Roundup UltraMAX were used in fallow.

Other experiments addressed control of LCP 85-384 sugarcane in a fallowed field with various rates of glyphosate and with various glyphosate formulations. Maximum control 45 days after treatment (DAT) was achieved when Roundup UltraMAX was applied at 25.6 oz/A (1.0 lb ai/A) to 6 to 12 inch tall sugarcane (94% control). When application was delayed until sugarcane was 18 to 24 inches tall, 51 oz/A of Roundup UltraMAX was needed to obtain 95% control. Sugarcane was controlled 88 to 94% at 38 DAT with all glyphosate formulations applied at 2.0 lb ai/A to 8 to 10 inch sugarcane (Roundup WeatherMAX and Roundup OriginalMAX at 46.5 oz/A, Roundup UltraMAX at 51 oz/A, and Mirage and Honcho Plus at 64 oz/A). In a no-till system, less expensive glyphosate formulations and lower rates could be used to decrease input cost without sacrificing sugarcane destruction.

ALTERNATIVE CROPS FOR FALLOWED SUGARCANE FIELDS

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In sugarcane, three to five harvests are made from a single planting after which the stubble is destroyed and fields are fallowed and prepared for replanting. The fallow period usually starts in April and sugarcane is replanted in August or September. During the fallow period weed control programs are implemented to control perennial weeds which have become problematic over the multi-year crop cycle. Successful weed control in the fallow period is critical to reducing weed populations in the first crop production year. Costs associated with the fallow period include land preparation, herbicides, and seed and return on investment is not realized until the crop is harvested at the end of the following year. There is considerable interest in planting an alternative crop during the summer fallow period as a means to generate additional income, as long as the crop does not jeopardize either weed control or timely planting of sugarcane.

A field study was conducted in 2005 at the St. Gabriel Research Station in St. Gabriel, Louisiana, to evaluate the feasibility of growing corn or soybeans during the sugarcane fallow period compared with a conventional tillage non-crop system. For both the crop and non-crop treatments sugarcane stubble was destroyed in the fall and rows were formed to prepare for stale seedbed planting. Dekalb 69-71 RR BT corn was planted March 7 on sugarcane beds spaced 72 inches apart using a 36 inch row spacing (two rows per bed). Atrazine and Roundup Original Max were used during the growing season to control weeds. Recommended soil fertility practices based on a soil test were followed. Corn was harvested August 8 and yield was 138.4 bushels/A. Asgrow 4403 RR soybeans were planted April 14 on sugarcane beds using a 16 inch row spacing (three rows per bed). Roundup Original Max was applied at planting and as needed during the growing season. Insect and disease management programs followed the LSU AgCenter recommendations. Soybean was harvested on September 9 and yield was 24.4 bushels/A. For the non-crop fallow treatment weeds were controlled on an as needed basis using Roundup Original Max. On September 7, HoCP 96-540 sugarcane was planted and pre-emergence herbicide was applied.

Results showed that corn and soybeans can be grown during the sugarcane fallow period utilizing traditional sugarcane beds without delaying the planting of sugarcane or negatively affecting the planting operation. Weed control was not sacrificed when Roundup Ready corn or soybeans was grown in fallow compared with the conventional non-crop system. Based on economic analysis, production of corn during the fallow sugarcane period resulted in a net gain of \$105.27/A compared with \$28.66/A net gain for soybeans. The traditional non-crop fallow program resulted in a net loss of \$49.57/A. Compared with the conventional non-crop fallow program, shoot population 37 d after planting was reduced when sugarcane followed corn, but not when sugarcane followed soybeans. Reduced shoot population when sugarcane followed corn may or may not affect sugarcane production the first year, and this will be determined in 2006. Alternative crops are slowly gaining popularity among sugarcane farmers as a means to generate additional revenue, but there are concerns as to the added risks, time requirements, and overall economic benefit.

BILLET PLANTING RESEARCH

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Research continued to develop methods to maximize the chances of success with billet planting. During 2005, results were obtained from field experiments conducted at the St. Gabriel Research Station at St. Gabriel, LA. The research included second ratoon of experiments comparing dates and rates of billet planting of LCP 85-384 and a comparison in plantcane of billet and whole stalk planting of recently released and experimental varieties.

The collection and comparison of second ratoon results for the date and rate of billet planting experiment represents the completion of three, 3-year crop cycle experiments comparing the effects of these planting factors on billet planting performance of LCP 85-384. No significant differences were detected among original planting dates in second ratoon of the third experiment (Table 1). The results from all three crop cycle years of the third experiment are presented for comparison. Very early (beginning of August) and very late (October) planting dates were included in the first and third experiments, respectively. The lower cane tonnage yields detected for the October planting date in plantcane and first ratoon and lower plantcane sugar yield did not persist into second ratoon (Table 1). Yields from the early planting date were lower in plantcane only (results in 2003 Annual Report). No other consistent differences were detected among yields obtained for planting dates from mid-August to late September across the three experiments.

Table 1. Effect of planting date on three-year crop cycle yields of billet planted LCP 85-384.

	Tons cane per acre[1]			Sugar per acre (lbs.)[1]		
Planting date	Plantcane	1st ratoon	2nd ratoon	Plantcane	1st ratoon	2nd ratoon
Aug 18	36.9 A	32.2 A	26.0	7116 A	5888	4360
Aug 27	34.1 AB	28.1 AB	25.2	6534 AB	5466	4328
Sept 13	32.3 B	30.6 AB	25.1	6285 B	5569	4317
Oct 18	26.8 C	26.3 B	26.1	5072 C	4921	4294

[1]Values within a column followed by the same letter were not significantly different (P=0.05).

Differences were detected among billet planting rates in second ratoon cane tonnage and sucrose per acre yields for the August but not September planting dates (Tables 2 and 3). The one billet planting rate produced the lowest yields, as in the first two crop cycle years and in two previous experiments. The 12 billet planting rate produced the highest sucrose per acre yield.

Yield components were compared for billet and whole stalk plantings of four commercial varieties, LCP 85-384, Ho 95-988, HoCP 96-540, and L 97-128, and three experimental varieties, L 99-226, L 99-233, and L 00-266 (Table 4). The plantings in this experiment endured severe drought conditions after planting. Plantcane yield assessed as cane tonnage and sugar per acre were lower for LCP 85-384, Ho 95-988, HoCP 96-540, L 99-226, and L 00-266. The millable stalk population also was lower for all of these varieties except HoCP 96-540. Yields for

Ho 95-988 showed the largest reductions, and sugar per ton was higher for whole stalk than billet planted Ho 95-988. Yields were similar for billet and whole stalk plantings of L 97-128 and L 99-233. This experiment was replanted during Fall, 2005 to obtain additional needed information about the ability of recently released and experimental varieties to tolerate billet planting.

Varieties have been demonstrated to vary in tolerance to billet planting. In addition, planting practices have been shown to be very important with billets. They are more sensitive than whole stalks to any planting problem, and billet planting is more expensive than whole stalk planting. However, certain conditions, particularly severe cane lodging, result in the need to plant billets. Research results from this and previous years indicate 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 (three or more running billets in the planting furrow), covering with a uniform layer of no more than 3 inches of packed soil, and providing good drainage and careful weed control.

Table 2. Effect of rate of planting on three-year crop cycle cane tonnage yield of LCP 85-384 planted as billets at five rates on two dates.

	Plantcane[1]		1st ratoon[1]		2nd ratoon[1]	
Rate	Aug 15	Sept 16	Aug 15	Sept 16	Aug 15	Sept 16
1 billet	36.6 B	33.8 C	33.1 B	36.7	27.6 B	34.9
3 billets	41.2 AB	45.1 AB	38.0 AB	43.8	32.7 A	37.4
6 billets	45.4 A	43.6 B	42.3 A	39.0	30.9 A	35.7
9 billets	46.1 A	46.6 AB	41.5 A	36.6	32.6 A	35.0
12 billets	45.3 A	53.0 A	33.6 B	37.4	34.1 A	36.0

[1]Values within a column followed by the same letter were not significantly different (P=0.05).

Table 3. Effect of rate of planting on three-year crop cycle pounds of sucrose per acre yield of LCP 85-384 planted as billets at five rates on two dates.

	Plantcane[1]		1st ratoon[1]		2nd ratoon[1]	
Rate	Aug 15	Sept 16	Aug 15	Sept 16	Aug 15	Sept 16
1 billet	7074 B	6421 C	7037 B	7782 AB	4767 C	5809
3 billets	8034 AB	8508 B	7790 AB	9332 A	5416 BC	6031
6 billets	8811 AB	8616 B	8554 A	8357 AB	5114 BC	5884
9 billets	9275 A	9133 AB	8243 AB	7492 B	5496 B	5551
12 billets	9172 AB	10854 A	7046 B	7952 AB	6057 A	6161

[1]Values within a column followed by the same letter were not significantly different (P=0.05).

Table 4. Comparison of plantcane yield components for billet and whole stalk plantings of four commercial and three experimental varieties.

Variety	Treatment	Stalks/acre (x1000)[1]	Stalk wt. (lbs.)[1]	Sugar/ton (lbs.)[1]	Tons cane per acre[1]	Sugar/acre (lbs.)[1]
LCP85-384	Billet	32.8 B	1.75	202	28.4 B	5756 B
	Whole	50.0 A	1.61	206	40.2 A	8297 A
Ho95-988	Billet	18.7 B	1.98	189 B	18.6 B	3511 B
	Whole	36.2 A	1.94	205 A	35.2 A	7231 A
HoCP96-540	Billet	34.7	2.29	209	39.4 B	8241 B
	Whole	42.1	2.25	212	47.3 A	10018 A
L97-128	Billet	33.7	1.99	218	33.6	7298
	Whole	37.0	2.14	209	39.5	8256
L99-226	Billet	31.9 B	2.24	196	35.5 B	6973 B
	Whole	36.9 A	2.73	206	50.5 A	10401 A
L99-233	Billet	52.6	1.66	211	43.6	9212
	Whole	51.6	1.87	204	48.2	9844
L00-266	Billet	39.6 B	1.54	185	30.6 B	5652 B
	Whole	45.4 A	1.78	191	40.5 A	7761 A

[1]Values of different yield components within a variety followed by different letters were significantly different (P=0.05).

RESIDUE MANAGEMENT RESEARCH IN SUGARCANE IN 2005

C. W. Kennedy and A. E. Arceneaux
Department of Agronomy and Environmental Management

In cooperation with
St. Gabriel Research Station

The effect of residue size reduction and other treatments on soil respiration and productivity of LCP85-384 on a light-textured soil.

This study was initiated in 2004(plantcane harvest residue; 1st ratoon yield) and carried in place through 2005 (1st ratoon harvest residue; 2nd ratoon yield). There were eight methods to manage harvest residue: burn, sweep to middles, untreated, treated with 30 lb/a slow release N, soil incorporated, reduced particle size, reduced particle size + 30 lb/a slow release N , and reduced particle size and soil incorporated. Soil respiration data, based on four measurements taken in late winter to early spring, indicated residue reduced in particle size and soil incorporated resulted in a significantly higher decomposition rate compared to other treatments except those treated with slow release N (Fig 1). The soil incorporation of residue reduced in particle size consistently produced the highest respiration (decomposition) rates both years of the study. A higher rate of decomposition should reduce suggested negative effects on the developing crop that may occur from growing in a harvest residue blanket. This in turn should be expressed as increased productivity. Indeed, soil incorporated residue treatments did produce the highest sugar yields in 2005; significantly higher than the unincorporated counterparts (Fig. 2). The relationship between decomposition rate and productivity was not consistent, however, as respiration rate in the residue + incorporate treatment was low, but yield was high. Respiration rates may have increased at a later time after our measurements were completed. Regardless, the results of two years at this location indicated reducing residue particle size followed by soil incorporation consistently produced the highest yields. This method of residue management would dovetail well with efforts to reduce tillage in sugarcane production. No tillage or limited additional spring tillage would be required depending on the amount of field damage during harvest. This would be similar to the stale seedbed concept used for annual row crops in other areas of the state.

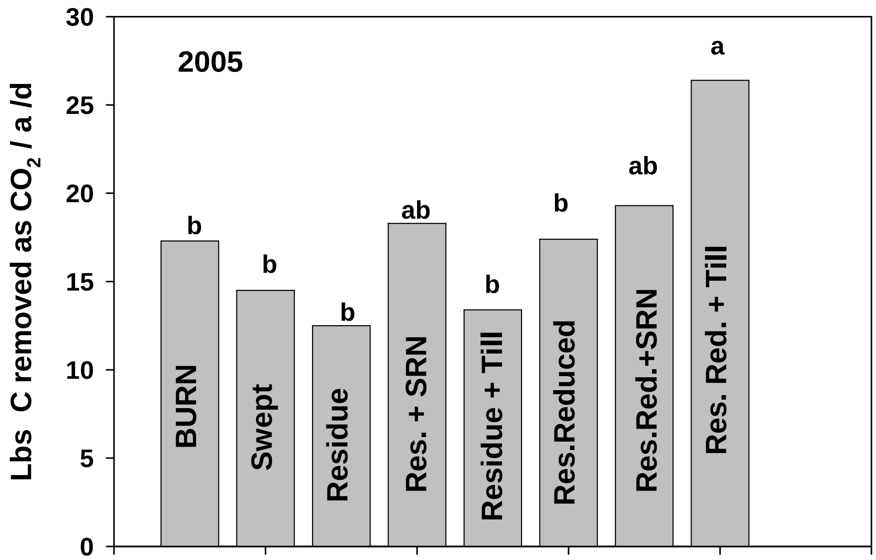

Fig. 1. The effect of harvest residue management input on carbon removed by soil (microbial) respiration. Average of 4 measurements, late winter-early spring.

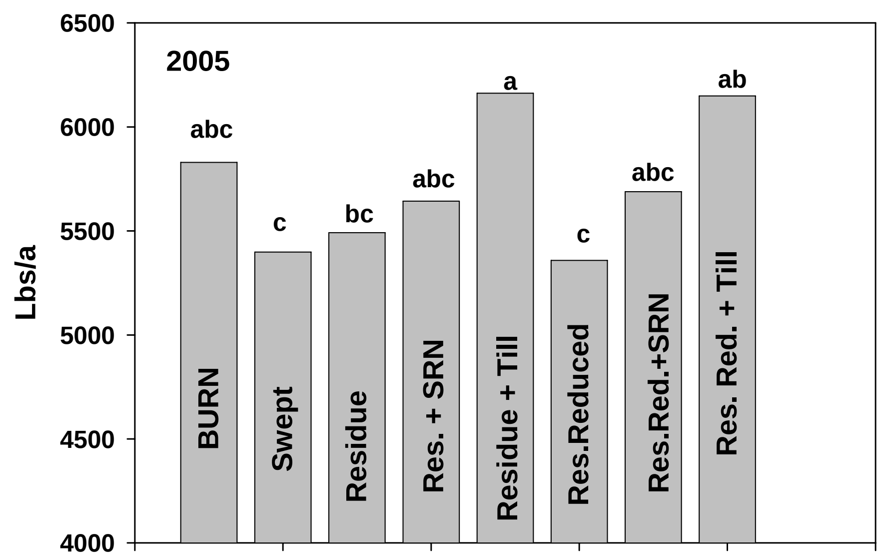

Fig. 2. The effect of harvest residue managment inputs on sugar yield of 2nd ratoon LCP85-384.

THE INFLUENCE OF FALLOW-PERIOD SOYBEANS ON SUGARCANE SEEDLING EMERGENCE AND PRODUCTIVITY

H. P. Viator, J. E. Richard and G. Williams
Iberia Research Station

Summary:

Sugarcane growers often plant immediately following soybean harvest to accommodate the rapidly approaching mill openings. While the adverse effects on yield for plantings made directly into the decomposing residue of green manure soybeans have been documented, such is not the case for sugarcane planted behind soybeans grown for seed harvest. A study designed to evaluate the influence of fallow-period soybeans on sugarcane seedling emergence and productivity was planted in the fall of 2005. Three plantings, spaced one to two weeks apart, were made following soybean harvest and a conventional fallow period, each with and without fertilizer (N-P-K lb/acre rate = 15-45-45). Seedling emergence counts were made approximately one month after each planting. The table below shows considerable variability in seedling emergence among the treatments. Averaged over fertilizer treatments, fewer plants emerged when sugarcane followed soybean harvest at each planting date. It appears, however, that fertilization at planting can help to mitigate poor emergence. These observations are based on fall emergence and may not hold when growth resumes in the spring. Spring stand counts and fall yield measurements will be taken during the 2006 growing season.

Comparison of Fall Seedling Emergence for Sugarcane Planted After a Conventional Fallow Period and Soybeans

Planting date	Fallow treatment	Fertilizer	Seedlings/acre
9/12/05	Conventional	Yes	38,358
		No	45,013
9/12/05	Soybeans	Yes	40,293
		No	28,920
9/20/05	Conventional	Yes	34,605
		No	36,058
9/20/05	Soybeans	Yes	30,008
		No	24,925
10/3/05	Conventional	Yes	17,545
		No	17,908
10/3/05	Soybeans	Yes	13,068
		No	11,980

DEVELOPMENT OF PRECISION FARMING SENSORS FOR SUGARCANE

R. R. Price
Department of Biological and Agricultural Engineering

Currently, no sensors exist to determine yield or density variances in sugarcane. Part of my work has been to develop sensors and systems that will help record yield and density variances in fields.

Work has been proceeding on a sensor to monitor sugarcane yield. A sensor was mounted on a combine harvester to monitor the amount of material in the conveyer. This sensor comprised of several optical eyes (that count the duty cycle of material on the conveyor slates) and an electrical box to record data with gps (global positioning system). The system was designed to easily fit on an existing harvester and only need three threaded nuts welded to the underside of the conveyor for placement. Results from the system (Figs. 1 & 2) indicate that the system may have potential to indicate variances in the field, although more work is needed to test this theory.

Work is also continuing on a multi-purpose sensor that can count the number of three foot skips in a field (fig. 3), plant stand indicator (fig. 4), or stalks. This system is being developed to operate on a multi-row cultivator. The system should allow farmers to obtain variance data of the sugarcane crops early in the season, before harvest. This data may be useful for pre-harvest management decisions.

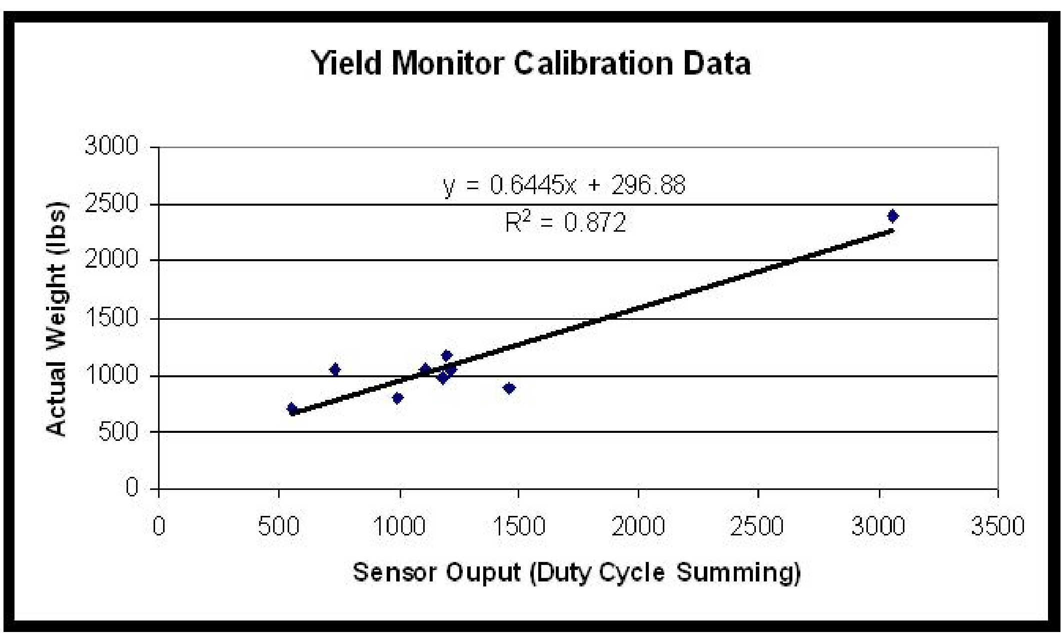

Figure 1: Calibration curve for optical yield monitor (more testing is needed to fill in points).

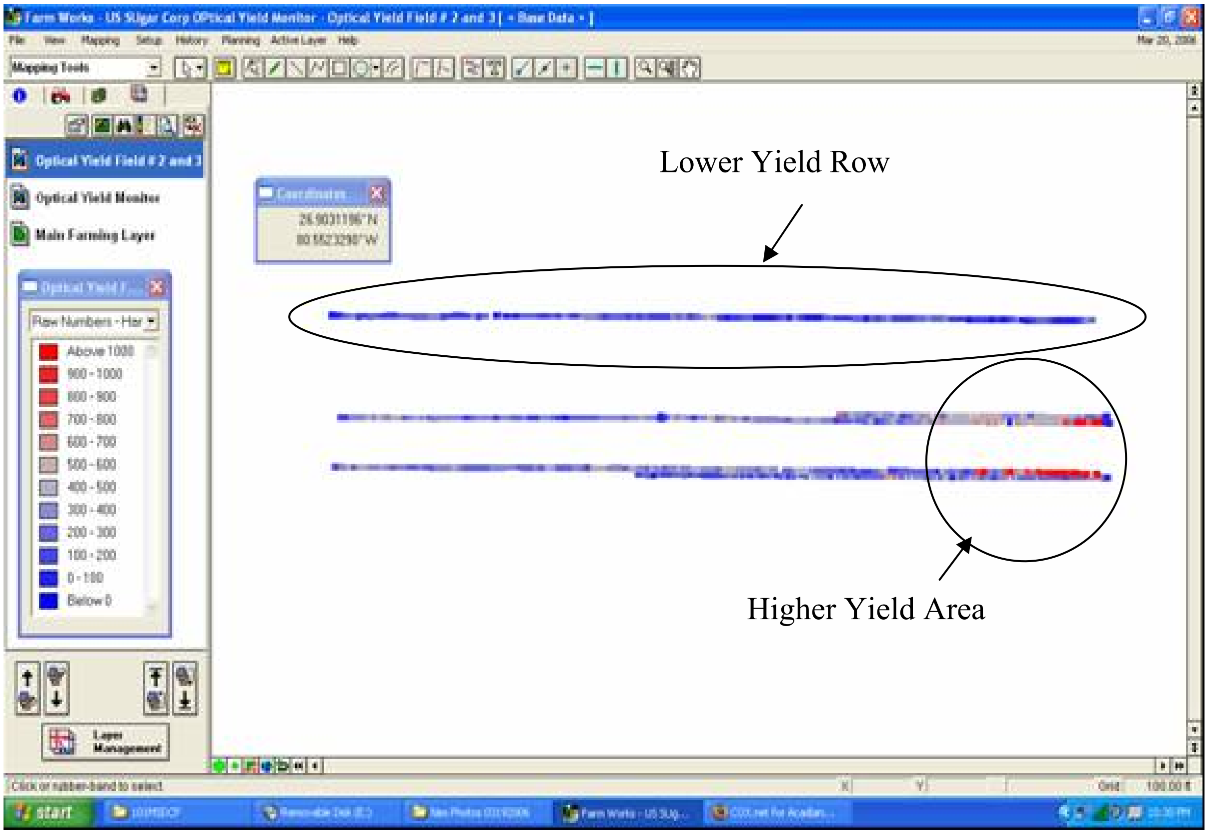

Figure 2: Variance in a field recorded with optical sensor (field length – ½ mile).

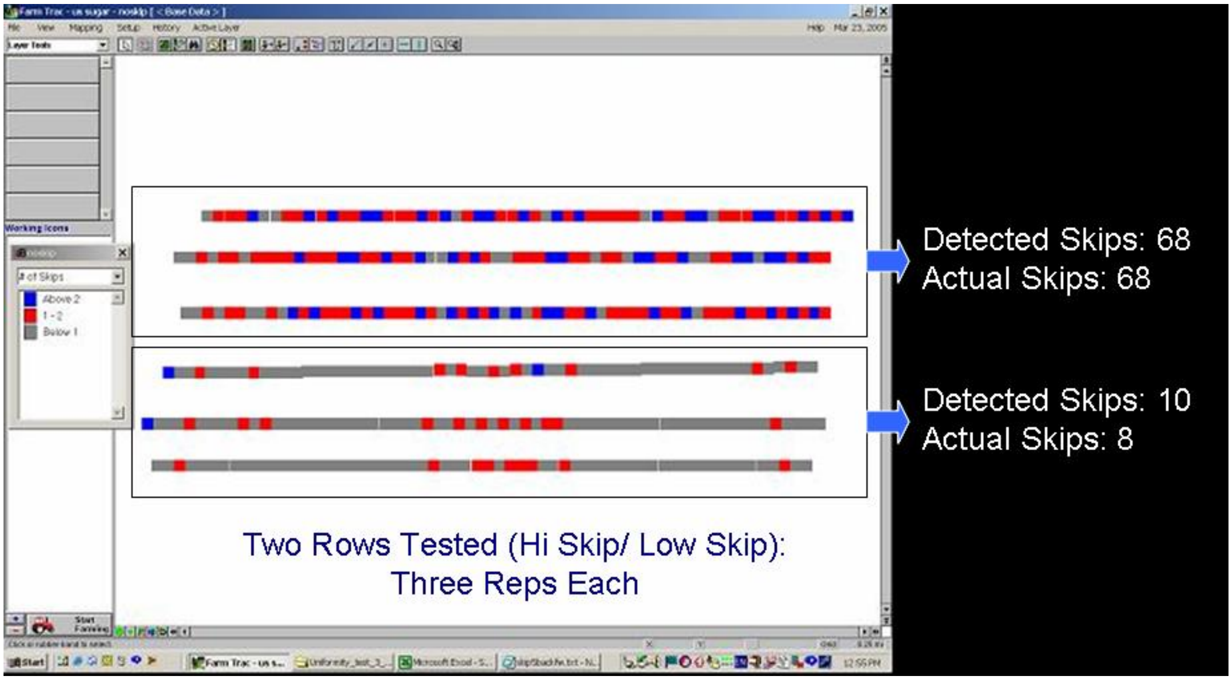

Figure 3: Three foot skip detection test on verification plot.

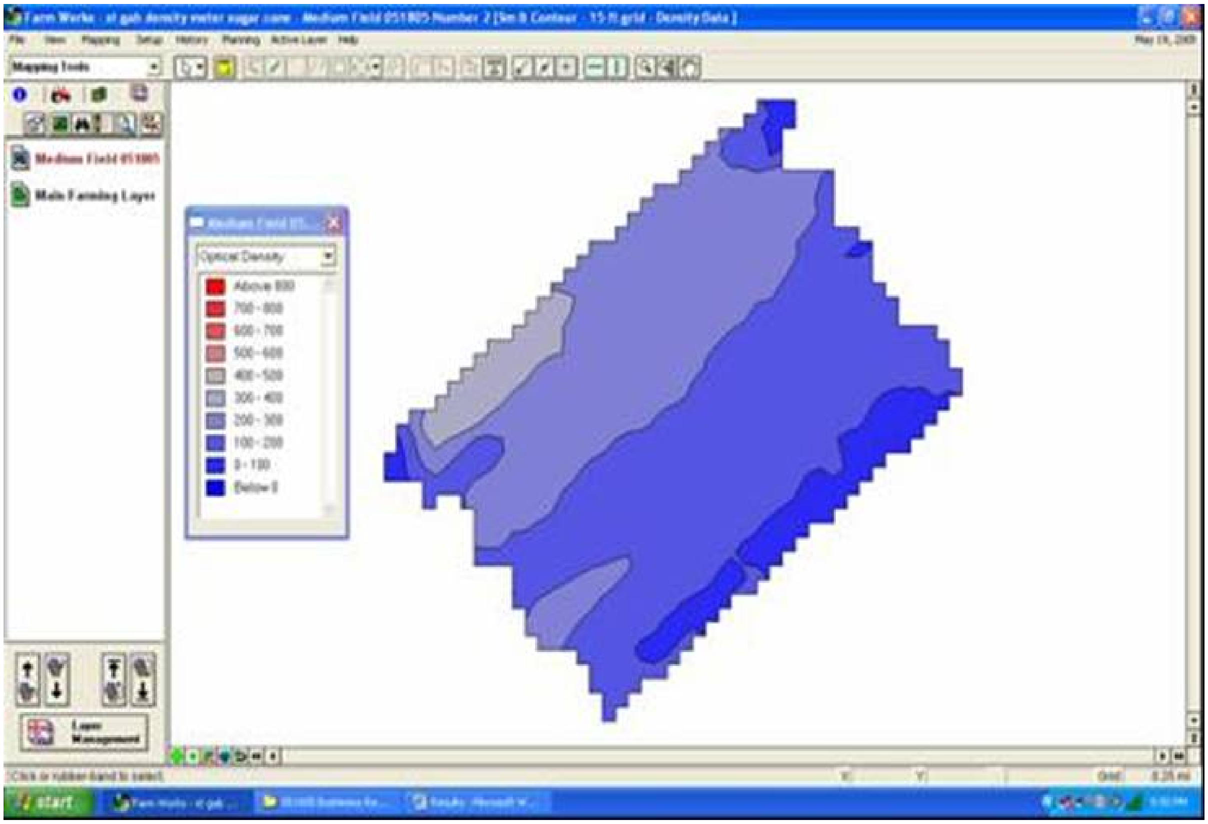

Figure 4: Mapping with a stand density indicator. Variances were the result of different varieties.

FERTILIZER STUDIES ON SUGARCANE IN 2005

C. W. Kennedy[1], A. E. Arceneaux[1], H. P. Viator[2], G. Williams[2]
and J. E. Richard[2]
[1]Department of Agronomy and Environmental Management
[2]Iberia Research Station

Two new varieties, L97-128 and Ho95-988, were compared with LCP85-384 for response to applied N in a plantcane study on medium textured soil. The results of this experiment underscored the general lack of response to inputs by plantcane crops as no variety showed significant trends with increasing N application rate. The new varieties produced greater sugar yields across all applied N rates compared to LCP85-384 (Fig. 1). Response to applied N in first ratoon was similar for CP70-321, HoCP85-555 and LCP85-384 (Fig. 2). Optimum sugar yields occurred within the 80-100 lb. applied N/ac recommended for LCP85-384. The data indicate the possibility that the reduction of N rate recommended for LCP85-384 is due more to changes in N application rate philosophy than in biological differences among old, contemporary, and newer varieties.

The use of slow release N (Nitamin) or N Stabilized with urease and nitrification inhibitors (Super U) as a complete winter broadcast or split half with a spring application of UAN was studied with two harvest residue managements (burning or left undisturbed). Only cane under the burn management produced significant differences among N treatments with Nitamin producing the numerically highest yields when broadcast in January (Fig. 3). The results suggest that broadcast winter application of fertilizer that is of a slow release or stabilized type may be a viable alternative to spring applied conventional N fertilizer. Cost would be the determining factor.

Nitrogen amendment by soil or foliar methods of a sugarcane crop found to be below the critical nutrient range was tested on first ratoon LCP85-384. Yields were low across all treatments making it difficult to assess response to mid-season amendment (Fig. 4).

The effect of slow release N fertilizer (Nitamin) compared to conventional UAN on sugar yield of first ratoon LCP85-384 was tested. Sixty lbs. of N as slow release Nitamin produced numerically higher yields than 100 lb. N as conventional UAN, but the 40 lb N/a Nitamin was the least effective (Fig. 5.). This experiment was in the same field as the low N amendment experiment and suffered from overall low yields.

A study on soil/foliar supplements/additives to normal fertilization on three varieties indicated no significant positive response in sugar yield for any treatment compared to normal fertilizer input (Fig. 6). Regardless, the supplement HM9480B had an average sugar yield slightly higher than the check in all varieties and may reflect some response due to the cooler spring temperatures in 2005.

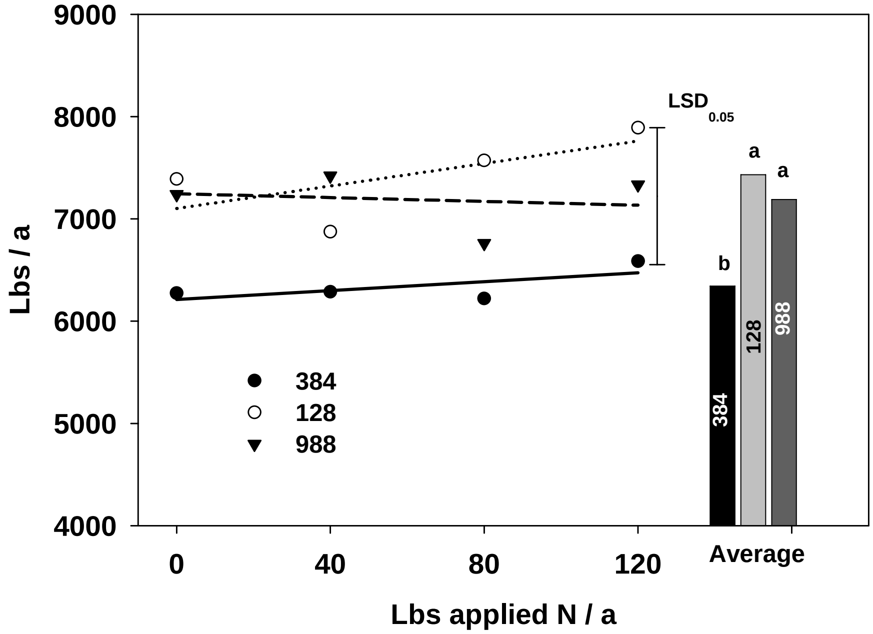

Fig.1. Variety x applied N rate test effect on sugar yield:
Plant cane on medium texture soil.

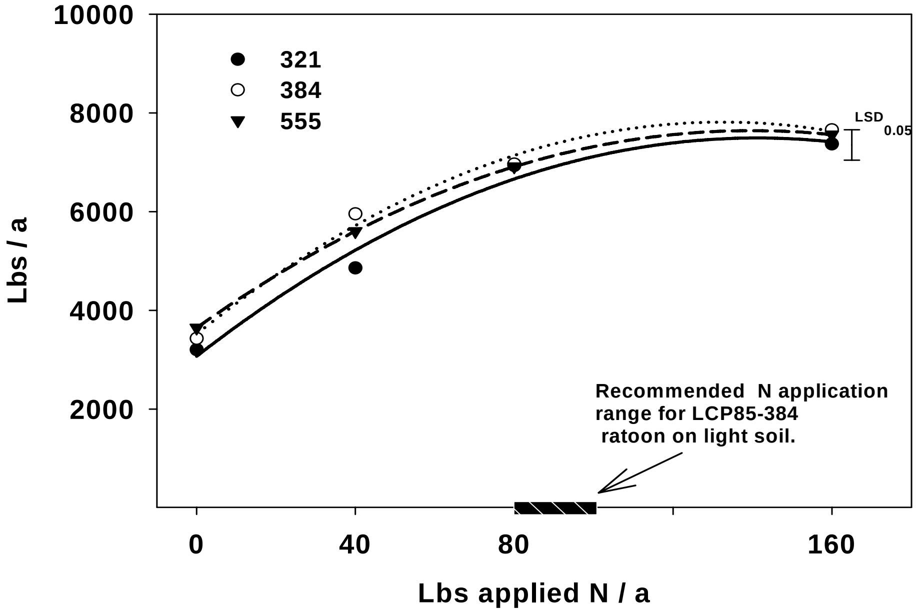

Fig.2. Variety x fertilizer N rate test effect on sugar yield:
1st stubble on light texture soil.

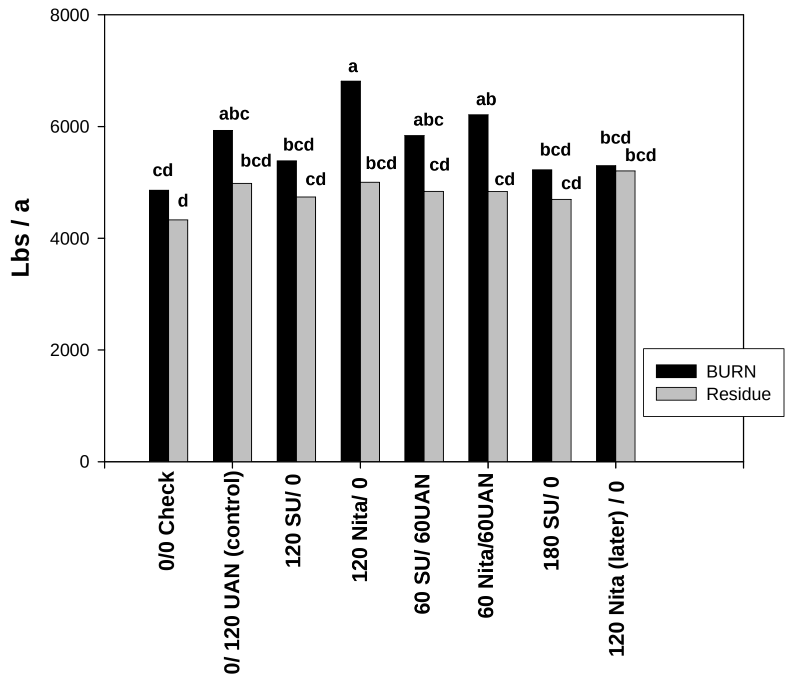

Fig.3. The effect of all or split Winter applied Stable N sources on sugar yield of ratoon LCP85-384 with or without a harvest residue mat. Nita=Nitamin; SU=super urea; Lbs N W/Sp applied.

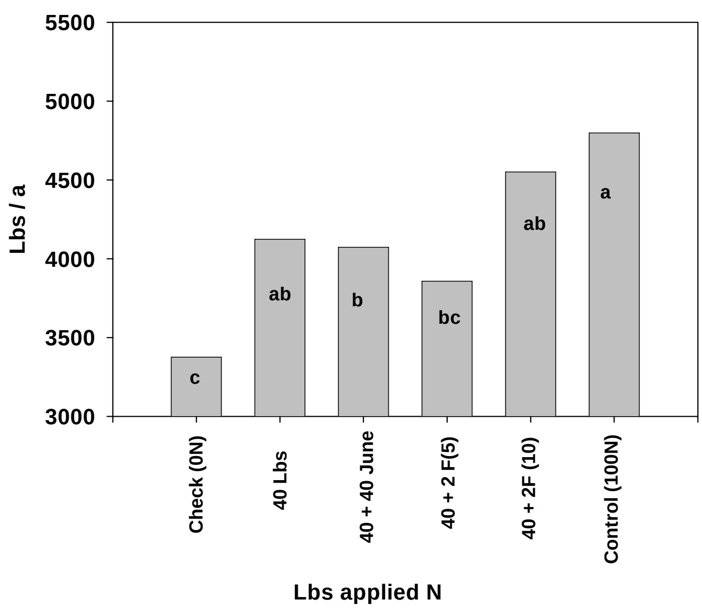

Fig. 4. The effectiveness of supplemental fertilizer N treatments on sugar yield of low N cane. F=foliar CORON applications

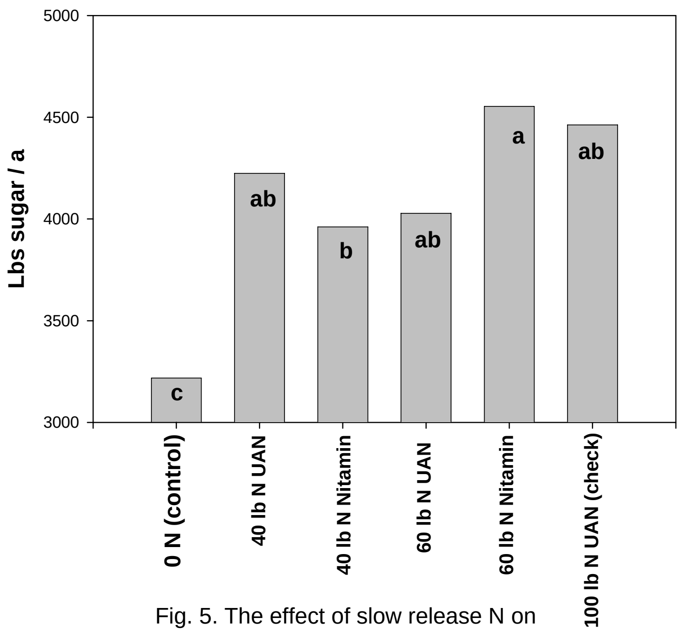

Fig. 5. The effect of slow release N on sugar production of 1st ratoon LCP85-384. Bars with the same letter are not statistically different.

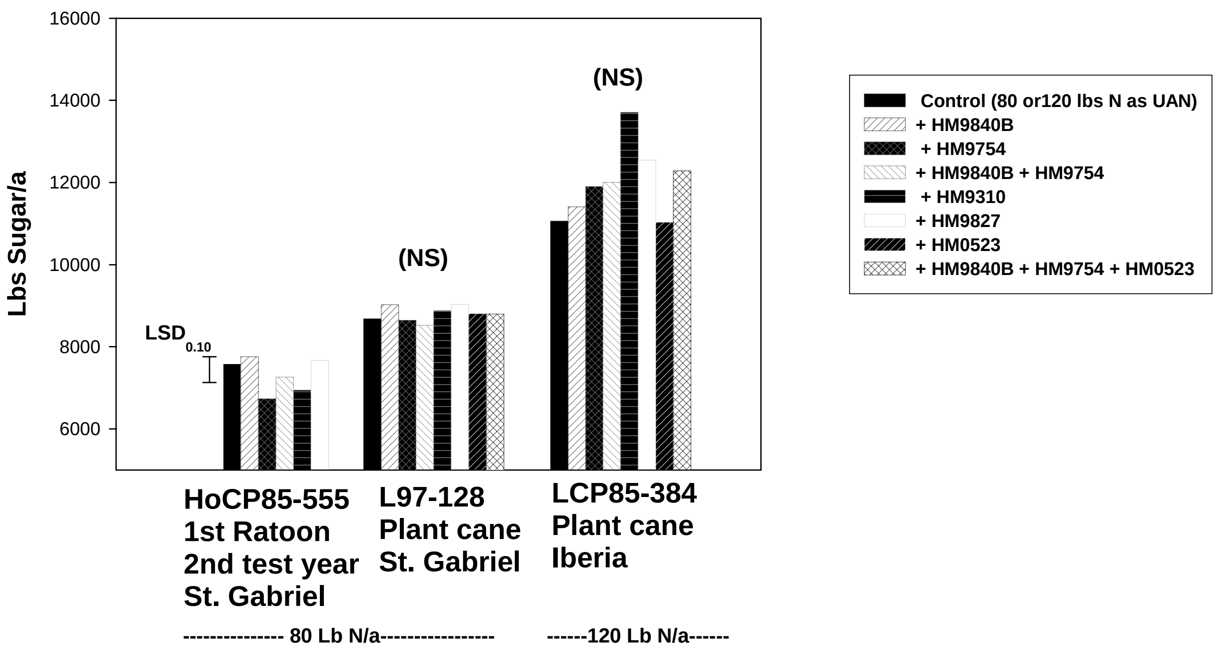

Fig. 6. The effect of fertilizer additives and supplements on sugar yield of three varieties.

VARIABLE-RATE NITROGEN FERTILZATION OF SUGARCANE

H. P. Viator, J. E. Richard and G. Williams
Iberia Research Station

Summary:

Without an "in season" method of determining sugarcane nitrogen requirements, recommended rates have been based on average yield responses to various application rates utilized in numerous N-rate studies conducted over the decades. This approach fails to take into account seasonal changes resulting from mineralization, year-to-year variability and varietal differences in nitrogen use efficiency. Several crops are employing optical sensors to measure the Normalized Difference Vegetative Index (NDVI) between crops areas of sufficient N and that scheduled for N fertilization. Calculations are then made to determine appropriate application rates. There are other approaches, including applying N to management zones based on soil texture differences. This method has been evaluated for the last four years. Soil textural changes within fields were measured using soil electrical conductivity (EC), which in turn was used to articulate management zones for fertilizer application. Cooperative Extension's nitrogen fertilizer recommendations are predicated on soil textural differences, with lower N rates recommended for the sandier areas and higher rates for the areas of greater clay content. Soil N fertilizer prescriptions, therefore, were based on these recommendations.

The table below shows the association of EC and sugar per acre yield for the four fields that were studied. Nitrogen fertilizer was applied by EC zone, with each zone representing a range of EC measurements arbitrarily grouped from low to very high. Differences in EC mimic changes in soil texture within fields. Heavy-textured clay soil is typically more fertile than coarser-textured soil but high yields on the clayey (high EC) areas of the fields occurred in only one of the four studies. The sandier (low EC) areas of the fields produced the highest yields in most years. Often times the potential yield advantage of the clayey soils is not expressed because of poor soil moisture conditions. Another situation that adversely affected the tests is the inability of LCP 85-384 to yield under stress. The variety simply has not yielded to expectations, which was undoubtedly related in part to its failure to yield well on heavy-textured soil in the low-yielding environments of the last few years.

Association Between EC and Sugar/acre Yield for Variable N Rates Studies

Study no. 1		Study no. 2		Study no. 3		Study no. 4	
EC	Sugar/a	EC	Sugar/a	EC	Sugar/a	EC	Sugar/a
Low	6,366 lb	Low	7,048 lb	Low	7,248 lb	Low	5,254 lb
Med.	6,979	Med.	6,639	Med.	6,239	Med.	4,706
High	7,893	High	5,994	High	6,504	High	4,037
				Very high	6,103	Very High	4,893

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

EVALUATION OF THE EFFECTS OF COMBINE-RESIDUE MANAGEMENT ON SUGARCANE PRODUCTION AND WATER QUALITY

H. P. Viator[1], J. W. Flanagan[2], S. G. Hall[3], J. W. Hoy[4], T. M. Hymel[1],
C. W. Kennedy[5], B. L. Legendre[6], and J. J. Wang[5]

[1]Iberia Research Station, [2]Iberia Parish Extension Service,
[3]Dept. of Biological and Ag. Engineering, [4]Dept. of Plant Pathology,
[5]Dept. of Agronomy and Environmental Management, [6]St. Gabriel Research Station

Summary:

The majority of Louisiana sugarcane acreage is located in watersheds that contain water bodies designated as impaired and are included on the EPA 303-d list of water bodies not meeting water quality standards or not supporting their designated uses. Efforts are presently being made to reduce non-point source discharge from agriculture by developing and implementing Best Management Practices (BMPs) in all the sugarcane producing parishes. Methods to reduce runoff of nutrients, sediments, organic residue and pesticides from sugarcane fields are necessary to improve water quality in the impaired waterways. The allowable level of pollution for a specific water body is called a total maximum daily load (TMDL). It is the upper limit of contaminates a body of water can contain which would result in impairment. At present, state water standards must be achieved around the end of the decade.

Two sites in the Vermilion-Teche watershed were selected to evaluate the effects of combine-residue management on sugarcane production and water quality. These locations are the Iberia Research Station (Baldwin silty clay loam) and a site near Youngsville (Memphis silt loam). Residue management treatments include two treatments designed to mitigate the adverse effects of retained residue on sugarcane: 1) the application of stabilized urea (containing a urease inhibitor) plus composted biologicals and 2) the shredding of the residue for accelerated decomposition; and two treatments currently employed by the industry, 3) ground burning of the residue and 4) full post-harvest retention of the residue.

Runoff is being captured and sampled for quality parameters, including sediment, dissolved oxygen, nutrients and biological oxygen demand. Changes in soil nutrient levels and pest populations are also being monitored. The principal objective is to measure the relative differences among the residue management treatments for water and soil quality parameters. A secondary objective is to measure the response of sugarcane productivity to the imposed treatments.

Findings will serve as a basis for possibly revising sugarcane BMPs for residue management and sediment control. Research has demonstrated the value of removing the residue from row tops, with the succeeding crop sustaining loses as high as 25%. Burning, therefore, will remain an essential tool for sugarcane growers until alternatives are proven to be both economically and environmentally viable.

Research sponsored by the Louisiana Department of Environmental Quality.

EFFECT OF SALT WATER STRESS ON SUGARCANE SHOOT EMERGENCE AFTER PLANTING

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Department of Entomology[1]
Extension Agent, St. Mary Parish[2]

Twenty-seven sugarcane varieties (including the L04 series) were planted on September 14, 2005 in 15-ft plots in a randomized complete block design near Burns Point in St. Mary Parish. The field was flooded during Hurricane Rita tidal surge (September 24) and remained under water for at least eight days. The numbers of emerging shoots in each plot were counted during the first week of October, and again in the middle of December. At this time ten soil sample probes for the top and bottom three inch layers (0-3", 3-6") from each quadrant in the field were taken using a soil augar. Data on numbers of seedlings (per 15-ft plot) were analyzed using Proc Glimmix (SAS Institute 2004).

Soil sample analysis indicated a pronounced increase in all of the nutrients in upper soil layer compared to the lower layer (Table 1). There were highly significant differences in numbers of emerging shoots among varieties ($P<0.0001$). L 04-417 showed the maximum (23.0) and HoCP 03-757 the least (3.0) number of emerged shoots (Table 2). Among the five commercial cultivars included in the test, LCP 85-384 depicted maximum tolerance as indicated by higher number of emerged shoots (17.8). However, Ho 95-988 was able to germinate only 4.0 shoots per 15-ft test plots.

Table 1. Amount of salt/nutrients in upper and lower layers of flooded field soil.

Salt/Nutrient	Upper Layer (ppm)*	Lower Layer (ppm)**
Calcium	2051.4	1655.1
Copper	2.2	1.9
Magnesium	798.6	579.6
Phosphorus	69.5	57.3
Potassium	264.2	163.4
Sodium	595.1	279.0
Sulfur	51.4	37.6
Zinc	2.5	1.5

* 0-3 inches soil depth on top of row
** 3-6 inches depth

Table 2. Number of emerged sugarcane shoots following hurricane tidal surge flooding, Burns Point, LA, 2005.

Variety	Number of Shoots
L 04-417	23.0a
HoCP 03-743	19.0ab
LCP 85-384	**17.8abc**
HoCP 00-950	17.5abc
HoCP 85-845	**17.3abc**
L 04-434	17.3abc
L 04-431	15.8abcd
HoCP 03-708	14.3abcde
L 04-409	14.0abcde
L 04-423	14.8abcde
L 04-410	13.0abcde
HoCP 96-540	**12.8abcde**
HoCP 91-555	**12.3abcde**
L 04-407	11.5bcdef
L 04-403	11.3bcdef
L 04-408	11.3bcdef
L 04-429	10.5bcdefg
HoCP 03-704	10.3bcdefg
L 04-404	9.3bcdefg
L 04-400	8.3cdefg
L 99-226	8.0cdefg
L 04-425	7.3defg
L 04-430	7.0defg
HoCP 03-716	6.8defg
CP 89-2143	6.3efg
Ho 95-988	**4.0fg**
HoCP 03-757	3.0g
F[a]	7.21
P > F	< 0.0001

Means within the same column followed by the same letter are not significantly different (*P* > 0.05; Tukey's HSD).

[a] df = 26, 78

A SURVEY OF SOIL SALT CONTENT RESULTING FROM HURRICANES KATRINA AND RITA

H. P. Viator[1], G. A. Breitenbeck[2], J. W. Flanagan[3], B. B. Joffrion[4], B. L. Legendre[5] and R. M. Louque[6]

[1]Iberia Research Station, [2]Department of Agronomy and Environmental Management, [3]Iberia Parish LCES Agent, [4]Terrebonne Parish LCES Agent, [5]St. Gabriel Research Station[5], and 6Assumption Parish LCES Agent

Hurricanes Katrina and Rita caused tidal surges along with concerns about salt deposition in soil. The unprecedented flooding inundated almost 40,000 acres of sugarcane in the coastal parishes of the state. While a considerable acreage of sugarcane was damaged or killed by the direct effects of the flood waters, the extent of the effects on sugarcane from the salt content of sea water is not completely known.

Representatives of several state and federal agencies met in October to discuss the hurricanes and their aftermath. A decision was made to develop a soil sampling protocol to be used to survey the soils in the flood zone for salinity. Initial sampling was limited in scope and specifically sought information on the enormity of the salt contamination problem. Seven sites across Iberia, St. Mary and Vermilion Parishes were chosen for the initial round of sampling. The sites were selected based on soil texture, depth and duration of the flood waters and distance from the coast. Soil cores were taken at depths of 0 - 3, 3 – 6 and 6 – 12 inches to determine the distribution of salt within the soil profile. The amounts of salt measured in the first samples varied widely as anticipated. The highest concentration was found at the 0 – 3 inch depth, ranging from 268 to 4,329 ppm. Though salt levels decreased with depth of sampling, the saltiest site contained almost 2,000 ppm in the 6 – 12 inch core. The level of salinity across sites was not predictable and did not appear to be associated with texture or any other variable.

Published reports suggest sugarcane is moderately sensitive to salt, with a saturated-extract electrical conductivity (EC) threshold for yield reduction at 1.7 dS m^{-1} (multiplying dS m^{-1} times 640 equals ppm). Research in Texas measured reductions in Brix, pol and purity and increases in fiber with each dS m^{-1} increase in EC. Because salt levels for most sites in the survey exceeded that of the salinity damage threshold of approximately 1,100 ppm, an additional 20 sites were sampled across a four-parish area in early November. A couple of the new sites contained levels of over 6,000 ppm in the surface three inches of soil.

Twelve of the original sites were re-sampled in early February to find out if sufficient leaching had occurred to reduce the salinity. Surprisingly, despite over 14 inches of rain at several sites, salinity levels increased at 5 of the 12 sites. At the time of the February re-sampling, a majority of the sampling sites contained salt at levels which exceeded that of the damage threshold of 1,100 ppm.

Flooding of agricultural land by hurricane storm surges can have both short and long-term effects on both crops and soil structure. While most of the ‘salt’ in seawater is sodium chloride (table salt), it also contains appreciable amounts of magnesium sulfate (Epson's salts) and other elements. After heavy rains, sodium and chloride will be preferentially lost in runoff and leachate. Therefore, within the next two years, much of the agricultural land flooded by last season's storm surges should naturally recover and return to previous levels of productivity. Recovery will occur more quickly in fields that received lower amounts of salt. A few areas that accumulated very high levels of salt are possibly at risk of becoming 'sodic', and may not recover without help.

The 'storm surge' analysis offered by the LSU AgCenter's Soil Testing Lab reports both salinity (ppm) and SAR (sodium absorption ratio). Salinity (ppm) is the better indicator of the salt impact on crops; however, if the SAR is greater than 15, this site should be carefully monitored. Not only will it take considerable time for salinity levels to drop, but this field is at risk of 'collapsing' during the process. Water will not infiltrate a collapsed soil, the pH will rise above 8, and toxic amounts of sodium will remain. Reclaiming such soils is costly and requires addition of large amounts of gypsum plus mechanical drainage.

None of the sites in our initial monitoring studies is currently in need of gypsum, but some would benefit from the addition of lime. If a field has an SAR >15 and low pH, application of agricultural lime will ensure that sodium is leached and sodic conditions avoided. Even where the SAR is <15, if soil pH is below 6.0 the addition of lime can help offset the effects of excessive salt and accelerate the leaching process.

Monitoring of soil salt levels will continue until sugarcane harvest, at which time a yield impact assessment will be made in an attempt to confirm the applicability of the salinity damage threshold for sugarcane in Louisiana.

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

A Four Year Study

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Department of Biological and Agricultural Engineering[1]
And Department of Agronomy and Environmental Management[2]

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

INTRODUCTION

Since 1995, the sugarcane industry in Louisiana has been using 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 burning 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, has 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 traditional 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 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, October 30, 2003, October 19, 2004, and October 25, 2005. Table 1 shows the sugarcane (biomass) yields for each treatment for 2002 to 2005. The biomass yields for the burned, swept, and mulch treatments were 64,947, 61753, and 60,240 kg/ha, respectively. The burned treatment increased biomass yields 7.8% over the mulch treatment. Table 2 shows the sugar yields for each treatment for 2002 to 2005. The sugar yields for the burned, swept, and mulch treatments were 7010, 6495, and 6386 kg/ha, respectively. The burned treatment increased sugar yields 9.8% over the mulch treatment.

Table 1. Annual Sugarcane (Biomass) Yields (kg/ha).

Treatment	Year 2002	Year 2003	Year 2004	Year 2005	Average
Burned	74180	71284	50213	64111	64947
Mulch	74180	67698	39677	59404	60240
Swept	74180	64784	43712	64335	61753

Table 2. Annual Sugar Yields (kg/ha).

Treatment	Year 2002	Year 2003	Year 2004	Year 2005	Average
Burned	8400	7377	5148	7113	7010
Mulch	8400	6457	4325	6363	6386
Swept	8400	6586	4180	6814	6495

During the period from September 1, 2001, to December 31, 2005, the average annual rainfall was 1472 mm (97% normal) (Table 3). The runoff for the burned, swept, and mulch treatments were 504, 514, and 530 mm, respectively. Table 4 shows the monthly rainfall and runoff values. There were no significant differences among the runoff values.

Table 3. Annual Rainfall and Runoff for St. Gabriel, Louisiana.

Year	Rain (mm)	Runoff (mm)		
		Mulch	Swept	Burned
2002	1697	582	559	546
2003	1306	472	456	444
2004	1581	687	645	643
2005	1302	377	388	380
Average	1472	530	512	503

Rain 97% Normal

The average annual soil losses for the period from September 1, 2001, to December 31, 2005, for the burned, swept, and mulch treatments were 7280, 7412, and 7252 kg/ha, respectively. (Table 5). A large portion of the soil erosion (41%) 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. Soil erosion during the second crop year was reduced 64%. This was because the rows were covered with vegetation and the soil had consolidated. Table 6 shows the monthly values. There were no significant differences in soil loss.

Table 4. Average Monthly Rainfall and Runoff for 2002-2005 at St. Gabriel, Louisiana.

Month	Rain (mm)	Runoff (mm)		
		Mulch	Swept	Burned
Jan	85	37	34	35
Feb	131	82	72	75
Mar	93	32	32	27
Apr	123	55	52	52
May	113	38	35	38
Jun	221	68	67	69
Jul	109	13	12	10
Aug	90	8	7	7
Sep	164	49	48	42
Oct	135	53	55	54
Nov	118	50	53	50
Dec	90	45	47	45
Total	1472	530	514	504

Rain 97% Normal

The average annual nitrogen losses for the period from September 1, 2001, to December 31, 2005, for the burned, swept, and mulch treatments were 15.9, 17.0, and 16.0 kg/ha, respectively (Table 7). The monthly values are shown in Table 8. There were no significant differences in nitrogen losses.

The average annual phosphorus losses for the period from September 1, 2001, to December 31, 2005, for the burned, swept, and mulch treatments were 8.6, 9.9, and 8.8 kg/ha, respectively (Table 9). The monthly values are shown in Table 10. There were no significant differences in phosphorus losses.

The average annual potassium losses for the period from September 1, 2001, to December 31, 2005, for the burned, swept, and mulch treatments were 73.1, 77.5, and 77.3 kg/ha, respectively

(Table 11). The monthly values are shown in Table 12. There were no significant differences in potassium losses.

Table 5. Annual Soil Loss for St. Gabriel, Louisiana.

Year	Soil Loss (kg/ha)		
	Mulch	Swept	Burned
2002	11865	11865	11865
2003	4294	4182	3465
2004	7032	6955	7107
2005	5816	6646	6681
Average	7252	7412	7280

Table 6. Average Monthly Soil Loss for 2002-2005 at St. Gabriel, Louisiana.

Month	Soil Loss (kg/ha)		
	Mulch	Swept	Burned
Jan	597	656	606
Feb	301	456	469
Mar	627	625	592
Apr	1482	1206	1177
May	834	964	820
Jun	1512	1486	1500
Jul	110	110	96
Aug	102	88	90
Sep	366	465	435
Oct	450	460	473
Nov	272	290	416
Dec	608	617	617
Total	7261	7422	7289

CONCLUSIONS

The burned treatment increased biomass yields by 7.8% and sugar yields by 9.8%. There was 11,865 kg/ha soil erosion from the plots during the first year. The soil erosion for the second year was 64% smaller. There were no significant differences among the soil, nitrogen, phosphorus, and potassium losses.

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Table 7. Annual Nitrogen Losses for St. Gabriel, Louisiana.

Year	Nitrogen Loss (kg/ha)		
	Mulch	Swept	Burned
2002	8.1	8.1	8.1
2003	11.3	8.7	8.2
2004	26.7	29.6	28.8
2005	17.8	21.4	18.5
Average	16.0	17.0	15.9

Table 8. Average Monthly Nitrogen Losses for 2002-2005 at St. Gabriel, Louisiana.

Month	Nitrogen Loss (kg/ha)		
	Mulch	Swept	Burned
Jan	0.5	0.5	0.5
Feb	1.1	1.0	1.0
Mar	1.0	1.4	0.9
Apr	3.7	4.0	3.6
May	3.5	3.6	3.5
Jun	3.1	3.1	3.5
Jul	0.4	0.5	0.4
Aug	0.2	0.2	0.2
Sep	0.6	0.7	0.6
Oct	0.9	0.9	0.8
Nov	0.5	0.6	0.5
Dec	0.5	0.5	0.4
Total	16.0	17.0	15.9

Table 9. Annual Phosphorus Losses for St. Gabriel, Louisiana.

Year	Phosphorus Loss (kg/ha)		
	Mulch	Swept	Burned
2002	12.5	12.5	12.5
2003	9.1	9.5	7.6
2004	6.8	9.8	7.4
2005	6.8	7.8	6.7
Average	8.8	9.9	8.6

Table 10. Average Monthly Phosphorus Losses for 2002-2005 at St. Gabriel, Louisiana.

Month	Phosphorus Loss (kg/ha)		
	Mulch	Swept	Burned
Jan	0.5	0.6	0.5
Feb	0.7	0.7	0.6
Mar	0.5	0.7	0.7
Apr	1.6	1.8	1.2
May	0.3	0.9	0.5
Jun	1.4	1.5	1.6
Jul	0.1	0.1	0.1
Aug	0.1	0.1	0.1
Sep	0.8	0.6	0.4
Oct	1.0	1.2	1.1
Nov	1.3	1.1	1.2
Dec	0.5	0.6	0.6
Total	8.8	9.9	8.6

Table 11. Annual Potassium Losses for St. Gabriel, Louisiana.

Year	Potassium Loss (kg/ha)		
	Mulch	Swept	Burned
2002	107.4	107.4	107.4
2003	74.8	65.3	64.5
2004	74.5	78.4	70.7
2005	52.4	59.0	49.8
Average	77.3	77.5	73.1

Table 12. Average Monthly Potassium Losses for 2002-2005 at St. Gabriel, Louisiana.

Month	Potassium Loss (kg/ha)		
	Mulch	Swept	Burned
Jan	4.6	5.0	4.6
Feb	4.8	5.4	5.1
Mar	3.3	3.6	3.6
Apr	9.7	8.6	6.6
May	4.0	4.5	3.7
Jun	8.7	9.6	9.2
Jul	1.0	1.0	0.9
Aug	0.9	0.8	1.1
Sep	7.0	6.3	6.0
Oct	7.9	8.6	8.0
Nov	16.9	15.2	15.6
Dec	8.5	8.9	8.7
Total	77.3	77.5	73.1

ECONOMIC RESEARCH IN SUGARCANE IN 2005

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Projected costs and returns for the various stages of sugarcane production in Louisiana were estimated for the 2005 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 2004 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 seedcane, planting cultured seedcane, field operations on plantcane, first stubble, second stubble, and third stubble, succession planting, as well as the costs of harvesting with wholestalk and combine harvesters. Costs and returns were estimated for tenant-operators, reflecting the predominant land tenure situation, and reflect a mill payment of 39 percent of production and a land rent payment of 20 percent 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 3rd stubble for alternative yield levels are shown in Table 1.

A study was conducted in 2005 to estimate actual harvest costs per ton of sugarcane harvested. Growers at Cora Texas sugar mill were surveyed in the summer of 2005 concerning their harvest operations during the 2004 harvest. Information was collected concerning specific harvest equipment used as well as daily harvest operation. Total fixed and variable average harvest costs were estimated based on the data collected. A summary of harvest operation data is listed in Table 2. Growers surveyed harvested an average area of 1,530 acres with a daily average mill quota of 612 tons. Average daily harvesting time requirements were 10 hours in the field and 8 hours cutting, with an average cutting rate of 45 tons per hour. Total harvest costs for 2004 were estimated at $5.20 per ton of cane harvested (Table 3.) Total fixed were estimated at $2.41 per ton and variable costs were $2.79 per ton. Fixed costs include depreciation, interest and insurance costs on the combine, wagons and tractors used for harvest. Variable costs include fuel, labor and repairs associated with harvest operations. Using a more current fuel price of $2.25 per gallon, total variable were estimated at $2.79 per ton, resulting in a total estimated harvest cost of $5.86 per ton of cane harvested.

Table 1. Projected breakeven selling prices for raw sugar for selected yield levels, harvest through third stubble, tenant-operators, Louisiana, 2005

	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	0.158	0.143	0.132	0.122	0.114
Total specified costs	0.209	0.188	0.172	0.159	0.147
Total costs plus overhead	0.250	0.225	0.205	0.188	0.175
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	0.152	0.138	0.126	0.117	0.109
Total specified costs	0.201	0.181	0.165	0.152	0.142
Total costs plus overhead	0.240	0.216	0.196	0.181	0.168

[1] Average farm yield across harvested acreage of plantcane, 1st stubble, 2nd stubble, and 3rd stubble (base yield of 36 tons plantcane, 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, plantcane, 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. Average harvest operation data, 2004 harvest season.

Item	Average per respondent
Total acres harvested in 2004	1,530 acres
Total tons harvested in 2004	45,285 tons
Average yield per harvested acres	29.59 tons
Daily quota	612 tons
Acres harvested per day	20 acres
Hours in field per day	10 hours
Hours actually cutting per day	8 hours
Cutting rate per hour (per combine)	45 tons/hour
Annual hours of use (per combine)	728 hours
Average number of combines used	1.6
Average number of wagons used	4.7
Average number of tractors used	4.9
Average combine insurance cost per year	$2,655
Average combine repair cost per year	$20,463

Table 3. Average estimated harvest costs per ton of cane harvested.

2004 Harvest Cost per Ton Item	Weighted Average per farm
Combine fixed cost	$1.43
Wagon fixed cost	0.26
Tractor fixed cost	0.71
Total harvest fixed cost	$2.41
Combine labor cost	$0.34
Combine fuel cost (@$1.45 per gallon)	0.48
Combine repair cost	0.45
Tractor labor cost	0.81
Tractor fuel cost (@$1.45 per gallon)	0.71
Total harvest variable cost	$2.79
Total harvest cost	$5.20
Diesel @ $2.25 per gallon	
Total variable cost	$3.45
Total harvest cost	$5.86

TIMING OF GLYPHOSATE APPLICATIONS, ALTERNATIVES TO THE USE OF GLYPHOSATE AND RESPONSE OF NEW VARIETIES TO GLYPHOSATE IN MAXIMIZING THE YIELD OF SUGAR PER ACRE OF LOUISIANA SUGARCANE IN 2005

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SUMMARY

In the first of three field experiments planned for 2005, 13 ripener treatments were applied on August 18, 2005 to the first-stubble crop of the sugarcane variety LCP 85-384. Ripener treatments included three or four rates of three glyphosate products, Polado-L, Roundup WeatherMAX and Touchdown Total and three rates of Palisade. All ripener treatments were compared to non treated plots as control. These same treatments had been superimposed to the same plots in the plantcane crop in 2004. The second field experiment was scheduled for treatment on September 15; however, because of Hurricane Katrina and the lodged condition of the crop, the treatments could not be applied as scheduled. Data were still obtained for the second experiment to measure the residual effect, if any, of the 13 ripener treatments on cane and sugar yield in the subsequent stubble crop following the application of the treatments in 2004. A third field experiment was scheduled for 2005 to test the efficacy of glyphosate on eight new varieties, Ho 95-988, HoCP 96-540, L 97-128, L 99-226, L 99-233, L 00-266, CP 89-2143 and TucCP 77-42 as well as LCP 85-384; however, it too was scrapped because of lodged conditions of the cane caused by Hurricanes Katrina and Rita.

In the first experiment, all ripener treatments with the exception of Palisade and Polado-L at the lowest rates studied tended to increase the yield of theoretical recoverable sugar per ton of cane (TRS/TC) at 28 and 42 days after treatment (DAT) when compared to control. Because of the lodged condition of the crop, it was not possible to count the number of millable stalks in each plot; therefore, estimated yield of cane or sugar per acre could not be calculated. There was a general trend for lower mean stalk weight (MSW) and reduced mean stalk length (MSL) as a result of all glyphosate treatments where the rates were equivalent to the 6-oz/A rate of Polado-L (0.1875 lb ae/A) or higher, regardless of product used. Accordingly, it would be anticipated that yield of cane per acre (TC/A) would also be reduced as a result of the higher glyphosate rates. It appeared that Palisade at the rates studied caused little or no reduction in MSW or MSL.

At 56 DAT, where plots were harvested by combine and weighed, there were no significant differences amongst treatments in TC/A or yield of theoretical recoverable sugar per acre (TRS/A). In general, there were significant increases in TRS/TC for many of the glyphosate as well as the Palisade treatments. There were no differences amongst treatments for MSW or MSL with the exception of one rate of Palisade (0.267 lb/A) where the MSW was significantly higher than control. However, because of the lodged condition of the crop, there was considerable variability in the data for all criteria measured which made interpretation of the data

more difficult.

It appeared that there was little or no residual effect on the subsequent stubble crop from the 13 ripener treatments applied on September 14, 2005 and harvested on November 17, 2005 for any of the parameters measured, TC/A, TRS/TC, TRS/A, MSW and MSL. However, there was a trend towards a lower TC/A for the Roundup WeatherMAX and Touchdown iQ treatments at the highest rate tested (equivalent to the 8-oz/A Polado-L rate or 0.2500 lb ae/A).

INTRODUCTION

In Louisiana, a sugarcane crop cycle usually consists of a fall-planted crop (plantcane), 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 through 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 and the environmental conditions. 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 use 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. Its use was and still is restricted to the stubble crops only. The label stipulates a use rate 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). In 2005, Syngenta discontinued the Touchdown iQ formulation and replaced it with the Touchdown Total® (with iQ technology) formulation (contains 4.17 lb of glyphosate acid in each gallon in the diammonium salt form) although there was still some Touchdown iQ left in some dealer's inventory for commercial use. Touchdown Total is labeled at 3.8 to 13.3 ounces per acre of the formulated product. Syntenta also had labeled another glyphosate formulation for use as a ripener, Touchdown Hi-Tech®, although none was used commercially in 2005. None of these products are labeled for plantcane 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.

Polado-L and Touchdown Hi-Tech are currently formulated without added surfactant. Research has demonstrated that a quality non-ionic surfactant can improve the efficacy of these products. All other products mentioned above are formulated with a surfactant and no additional surfactant is recommended.

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 $132/acre in increased revenue. This amounts to approximately $40 million in increased gross revenues each year. However, no current glyphosate formulations are labeled for plantcane use and can cause a loss of cane yield in the crop being treated. There is also the potential for these products to cause yield reduction in the subsequent stubble crop, especially when used at the higher rates. Therefore, additional research is needed to find alternative ripeners that can be used on the plantcane 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.

The objectives of this study were: 1) to evaluate the timing of application of three formulations of glyphosate on yield of sugar per acre at various intervals after treatment; 2) to evaluate alternatives to the use of glyphosate as ripeners; and 3) to evaluate the efficacy of glyphosate on the yield of sugar per acre of eight new varieties, Ho 95-988, HoCP 96-540, L 97-128, L 99-226, L 99-233, L 00-266, CP 89-2143 and TucCP 77-42 as well as LCP 85-384.

PROCEDURES

In the first of two field experiments, the same 13 ripener treatments as were applied in the plantcane crop were superimposed to all plots in the first-stubble crop of LCP 85-384 on August 18, 2005 (Test I) 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 (Legendre 2001). A nonionic surfactant, Induce® (0.25% v/v)(Helena), was added to all spray solutions of Polado-L only. Each experiment consisted of 13 ripener 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 Total 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 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 were sampled at 28 and 42 days after treatment (DAT) and harvested green by combine at 56 DAT and weighed. The mulch residue remained on the field after harvest.

From each plot, a 15-stalk sample was 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 mean stalk weight (MSW), mean stalk length (MSL), Brix by refractometer, sucrose by polarimetry, purity (the ratio of sucrose to Brix) and the yield of theoretical recoverable sugar per ton of cane (TRS/TC). From weighed plots, the yield of tons cane per acre (TC/A) was calculated adjusted to the plot size as well as the yield of theoretical recoverable sugar per acre (TRS/A).

For the second experiment (Test II), no ripener treatments were applied in 2005 because of the lodged condition of the crop; however, the same 13 ripener treatments as described in Test I had been applied on September 14, 2004. The configuration of the test field for Test II was similar to Test I; plots 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.

In order to determine the residual effect of the 13 ripener treatments in the subsequent stubble crop, a 15-stalk sample was removed from each plot on November 17, 2005. The samples were handled in the same manner as described in the previous paragraph. Each plot was then harvested by cane combine and the weights recorded. Data collected and/or calculated were also the same as described in the previous paragraph.

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

In the first experiment (Test I), all ripener treatments with the exception of Palisade and Polado-L at the lowest rates studied [0.223 lb/A and 4 oz/A (0.1250 lb ae/A, respectively)] tended to increase the yield of theoretical recoverable sugar per ton of cane (TRS/TC) at 28 and 42 days after treatment (DAT) when compared to control (Tables 1-2). Because of the lodged condition of the crop, it was not possible to count the number of millable stalks in each plot; therefore, estimated yield of cane or sugar per acre could not be calculated. There was a general trend for lower mean stalk weight (MSW) and reduced stalk length (MSL) as a result of all glyphosate treatments where the rates were 6 oz/A (0.1875 lb ae/A) and higher, regardless of product used. On the other hand, it appeared that Palisade caused little or no reduction in MSW or MSL at 28 DAT (Table 1). However, there was a trend towards reduced MSW and MSL at 42 DAT, especially at the two higher rates of Palisade although the differences were not significant from control (Table 2). It would be anticipated that yield of cane per acre (TC/A) would also be reduced as a result of the higher rates of glyphosate. However, because of the increase in TRS/A, no reduction in TRS/A would be anticipated (Legendre et al. 2004).

At 56 DAT, where plots were harvested by combine and weighed, there were no significant differences amongst treatments in yield of tons of cane per acre (TC/A) or yield of theoretical recoverable sugar per acre (TRS/A)(Table 3). In general, there was a trend towards higher TRS/TC for many of the glyphosate as well as the Palisade treatments; however, the data are quite variable, undoubtedly, because of the lodged condition of the crop. This variability made interpretation of the data more difficult. There were no differences amongst treatments for MSW or MSL with the exception of one rate of Palisade (0.267 lb/A) where the MSW was significantly higher than control. These data are very significant in that there was a perception by many producers that glyphosate actually reduced TRS/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 MSW and MSL. However, 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 Legendre et al. (2004, 2005) and Millhollon and Legendre (1996) where they indicated that glyphosate can reduce TC/A. They found that TRS/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 (Table 3). Although glyphosate is classified as a herbicide, when used as a ripener at the lower rates, it acts as a plant growth regulator. In general, it still causes a reduction in MSW and MSL, regardless of the rate applied.

It appeared that Palisade which is classified as a growth regulator, not a herbicide, had a less dramatic effect on TC/A and MSW at 56 DAT. In the current study, there was no increase in TRS/A although there was a trend towards increased TRS/TC. This is similar to the response reported in 2004 when applied at the same rates to the plantcane crop (Legendre et al. 2005).

There was no residual effect of the 13 treatments on the expression of TC/A, TRS/TC, TRS/A, MSW and MSL in the subsequent stubble crop although there was a trend towards a lower TC/A for the high rates of Roundup WeatherMAX (7.1 oz/A or 0.2500 lb ae/A) and Touchdown iQ (10.7 oz/A or 0.2500 lb ae/A) when harvested approximately one year after the application of the original treatment (Table 4). These results are similar to those publicized by Millhollon and Legendre (1996); however, in their study they applied Polado-L to the same plots in both the plantcane and first-stubble crops at 8 oz/A (0.2500 lb ae/A). They noted a significant reduction in TC/A in the second-stubble crop for the variety LCP 85-384 which they classified as very sensitive to glyphosate at the higher rates. It was from this study that the use rate for LCP 85-384 was reduced from 8 to 6 oz/A. In the current study, it appears that the 6-oz rate of Polado-L or the equivalent rate of the other formulations has little or no deleterious effects on the parameters studied.

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Table 1. Effects of 13 ripener treatments on yield of theoretical recoverable sugar per ton of cane (TRS/TC), mean stalk weight (MSW) and mean stalk length (MSL) in the first-stubble crop of LCP 85-384 when sampled at 28 days after treatment 1/.

Treatment	**TRS/TC (lbs)**		**MSW (lbs)**		**MSL (in)**	
Control	156		1.48		79.4	
Palisade @ 0.223 lb/A	170		1.46		78.1	
Palisade @ 0.267 lb/A	176	+	1.37		74.8	
Palisade @ 0.312 lb/A	176	+	1.45		77.4	
Polado @ 4 oz/A	170		1.31		76.8	
Polado @ 6 oz/A	182	+	1.24	-	72.2	-
Polado @ 8 oz/A	174	+	1.37		76.1	
RdUp Weather Max @ 3.6 oz/A	175	+	1.46		72.8	-
RdUp Weather Max @ 5.3 oz/A	181	+	1.42		78.1	
RdUp Weather Max @ 7.1 oz/A	185	+	1.34		74.1	-
Touchdown Total @ 5.30 oz/A	177	+	1.43		76.1	
Touchdown Total @ 6.65 oz/A	183	+	1.42		76.8	
Touchdown Total @ 8.00 oz/A	182	+	1.28		70.9	-
Touchdown Total @ 10.70 oz/A	179	+	1.42		73.5	-

1/ Treated, August 18; sampled, September 13, 2005. (+) or (-) denotes values in a column are statistically higher or lower than control, respectively.

Table 2. Effects of 13 ripener treatments on yield of theoretical recoverable sugar per ton of cane (TRS/TC), mean stalk weight (MSW) and mean stalk length (MSL) in the first-stubble crop of LCP 85-384 when sampled at 42 days after treatment 1/.

Treatment	TRS/TC (lbs)		MSW (lbs)		MSL (in)	
Control	186		1.51		87.7	
Palisade @ 0.223 lb/A	180		1.48		85.0	
Palisade @ 0.267 lb/A	211	+	1.35		78.7	
Palisade @ 0.312 lb/A	201		1.38		79.3	
Polado @ 4 oz/A	201		1.48		84.6	
Polado @ 6 oz/A	205	+	1.49		81.1	
Polado @ 8 oz/A	210	+	1.37		80.2	
RdUp Weather Max @ 3.6 oz/A	206	+	1.43		76.6	-
RdUp Weather Max @ 5.3 oz/A	209	+	1.51		84.3	
RdUp Weather Max @ 7.1 oz/A	183		1.31		74.3	-
Touchdown Total @ 5.30 oz/A	202		1.30		78.0	-
Touchdown Total @ 6.65 oz/A	193		1.23	-	79.9	
Touchdown Total @ 8.00 oz/A	202		1.33		76.4	-
Touchdown Total @ 10.70 oz/A	202		1.35		76.6	-

1/ Treated, August 18; sampled, September 28, 2005. (+) or (-) denotes values in a column are statistically higher or lower than control, respectively.

Table 3. Effects of 13 ripener treatments on yield of theoretical recoverable sugar per acre (TRS/A), yield of cane per acre (TC/A), yield of theoretical recoverable sugar per ton cane (TRS/TC), mean stalk weight (MSW) and mean stalk length (MSL) in the first-stubble crop of LCP 85-384 when harvested at 56 days after treatment 1/.

Treatment	TRS/A (lbs)	TC/A (tons)	TRS/TC (lbs)	MSW (lbs)	MSL (in)
Control	5979	28.1	214	1.32	78.7
Palisade @ 0.223 lb/A	6273	27.1	231	1.40	79.3
Palisade @ 0.267 lb/A	5696	25.5	224	1.52 +	78.2
Palisade @ 0.312 lb/A	5856	26.5	220	1.48	76.2
Polado @ 4 oz/A	6027	26.3	230	1.40	83.2
Polado @ 6 oz/A	5565	23.5	235 +	1.36	79.8
Polado @ 8 oz/A	6138	27.1	227	1.35	79.5
RdUp Weather Max @ 3.6 oz/A	5995	25.8	232 +	1.37	76.1
RdUp Weather Max @ 5.3 oz/A	5700	23.6	241 +	1.43	80.8
RdUp Weather Max @ 7.1 oz/A	5633	26.0	216	1.46	73.8
Touchdown Total @ 5.30 oz/A	5224	23.1	224	1.35	75.6
Touchdown Total @ 6.65 oz/A	6661	28.6	232 +	1.41	78.0
Touchdown Total @ 8.00 oz/A	5924	25.1	236 +	1.26	73.9
Touchdown Total @ 10.70 oz/A	5752	26.0	223	1.28	74.0

1/ Treated, August 18; harvested, October 13, 2005. (+) or (-) denotes values in a column are statistically higher or lower than control, respectively.

Table 4. Effects of 13 ripener treatments on yield of theoretical recoverable sugar per acre (TRS/A), yield of cane per acre (TC/A), yield of theoretical recoverable sugar per ton cane (TRS/TC), mean stalk weight (MSW) and mean stalk length (MSL) in the first-stubble crop of LCP 85-384 when harvested at approximately one year after treatment1/.

Treatment	TRS/A (lbs)		TC/A (tons)		TRS/TC (lbs)	MSW (lbs)		MSL (in)	
Control	8624		31.9		269	1.50		81.1	
Palisade @ 0.223 lb/A	6325	-	24.9	-	252	1.51		86.4	
Palisade @ 0.267 lb/A	8650		32.9		264	1.50		86.6	
Palisade @ 0.312 lb/A	9604		36.1		266	1.58		88.2	
Polado @ 4 oz/A	8508		33.0		257	1.55		88.5	
Polado @ 6 oz/A	8803		32.4		272	1.62		87.7	
Polado @ 8 oz/A	8564		32.9		261	1.62		90.6	+
RdUp Weather Max @ 3.6 oz/A	8951		33.7		266	1.41		84.8	
RdUp Weather Max @ 5.3 oz/A	9303		34.4		270	1.84	+	94.5	+
RdUp Weather Max @ 7.1 oz/A	7845		29.0		271	1.54		90.0	+
Touchdown iQ @ 5.30 oz/A	9302		33.9		274	1.51		87.4	
Touchdown iQ @ 6.65 oz/A	8466		31.2		272	1.50		87.4	
Touchdown iQ @ 8.00 oz/A	8124		30.5		266	1.53		86.6	
Touchdown iQ @ 10.70 oz/A	7275		27.2		268	1.50		86.1	

1/ Treated, August 18, 2004; harvested, November 17, 2005. (+) or (-) denotes values in a column are statistically higher or lower than control, respectively.

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