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## Planting rate effects on sugarcane yield trials

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**PLANTING RATE EFFECTS ON  
SUGARCANE YIELD TRIALS**

**A Thesis**

**Submitted to the Graduate Faculty  
of Louisiana State University and  
Agricultural and Mechanical College  
in partial fulfillment of the  
requirements for the degree of  
Master of Science**

**in**

**The Department of Agronomy**

**by  
Albert J. Orgeron  
B.S. Louisiana State University, 2000  
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## ABSTRACT

New varieties are provided to the Louisiana sugarcane industry by researchers at Louisiana State University AgCenter, the United States Department of Agriculture-ARS, and the American Sugar Cane League of the USA, Inc. Currently, Louisiana farmers plant sugarcane at rates ranging from two to five or more whole stalks. A two-stalk planting rate is used to plant all stages of the LSU AgCenter's sugarcane variety development program. The objective of this study was to determine the effect of planting rate on sugarcane variety trial data and interpretation.

A planting rate by variety experiment was conducted at the LSU AgCenter's Sugar Research Station. A randomized complete block design was used for the experiment with three replications, eight clones, and three planting rates consisting of two, three, and four whole stalks.

Increasing planting rate from two to four stalks significantly increased sugar yield by 11 to 15%. Cane yield and stalk population significantly increased when planting rate increased from two stalks to either three or four stalks in the 2001 plant cane crop. Stalk population and mean stalk weight were negatively correlated, thus the lower stalk populations tended to compensate with greater mean stalk weight. Theoretical recoverable sugar was not significantly different regardless of planting rate. As expected, clones differed for sugar yield and its components. Of utmost importance, the planting rate by clone interaction was not significant for any trait in any of the experiments. Thus, increasing the planting rate from two stalks to three or four stalks did not change sugarcane variety / clone ranking.

A germination study was also conducted in the Fall of 2002. A randomized complete block design was used in this experiment, consisting of eight sugarcane clones replicated three times. The planting rate was two stalks planted at two locations at the Sugar Research Station.

Sugarcane variety / clone germination was similar for both soil types. The Pearson correlation coefficients indicated taller stalks also had more buds per stalk than did shorter stalks. Mean stalk weight was greater for taller varieties. Mean stalk weight tended to increase as the number of buds increased on a stalk.

## INTRODUCTION

New sugarcane varieties are needed in Louisiana due to widespread cultivation of LCP 85-384. Approximately 85% of Louisiana's 2002 sugarcane acreage was cultivated with this variety (Legendre and Gravois 2003). New varieties are provided to the Louisiana sugarcane industry by researchers at Louisiana State University AgCenter, the United States Department of Agriculture-ARS, and the American Sugar Cane League of the USA, Inc. Developing new commercial varieties is a time consuming and labor intensive process. This process takes 12 years to complete from the time a cross is made to release of a new variety to farmers.

The LSU AgCenter Sugarcane Breeding Program consists of several stages. The stages are crossing, seedling selection, line-trials, assignment, nursery, infield, and outfield. At the conclusion of the 12 year cycle, maybe one new variety will be released to farmers for clonal propagation. As varieties advance through the breeding program stages, location number, plot size, and replication are increased.

The LSU AgCenter Sugarcane Breeding Program currently makes between 400 and 600 crosses annually. Photoperiod houses are used to induce flowering in sugarcane (*Saccharum spp.*) in Louisiana. Sugarcane does not flower naturally in Louisiana due to cool temperatures in late fall. According to Duncelman and Legendre (1982) sugarcane crossing was conducted in Grand Isle, Louisiana, by the Louisiana Agricultural Experimental Station beginning in 1948. Grand Isle was chosen because of warmer temperatures than most of the Louisiana sugarcane producing region allowing for natural sugarcane flowering. Photoperiod greenhouses were built in South Africa and India in 1950-51, and successfully produced viable sugarcane flowers. Photoperiod houses were first built and utilized in Baton

Rouge, Louisiana, in 1953. Sugarcane flowering is initiated by shortening the day-length artificially using photoperiod treatment.

Crossing occurs from September through November each year. The fuzz (true seed) collected will produce approximately 400,000 or more viable seed. The fuzz for each cross is planted into individual trays. Each emerged plantlet is considered a heterozygous clone. In February, approximately 100,000 seedlings are planted in the greenhouse. The seedlings are then transplanted into the field on paired rows in April. The spacing between each plant is approximately 40.6 centimeters (16 inches). Check varieties, LCP 85-384, HoCP 85-845, and HoCP 91-555 are planted throughout the seedling field. These check varieties accounted for 96% of Louisiana's sugarcane acreage in 2002 (Legendre and Gravois 2003). Selection of seedlings begins in early September. Selections are only made in the first-ratoon seedling crop. In the first-ratoon crop, each heterozygous clone is evaluated for the following agronomic characteristics: stalks per stool, stalk diameter, pith (parenchyma cells in the stalk), tube (empty space in the stalk's center), absence of disease, and Brix level. The Brix level measures the amount of total soluble solids (weight/weight) in the sugarcane juice. Breaux (1973) reported that there is a high correlation between Brix level and juice sucrose. Juice samples are taken from check varieties to determine a Brix level threshold. If a clone is selected, a hand-held refractometer is used to estimate the juice's Brix level. Two stalks are harvested from desirable ratoon seedling stools and are planted in a subsequent stage referred to as first-line trials.

Approximately 4,000 clones are advanced to the first-line trial stage in mid-September. The two stalks harvested from the seedling stage are planted side by side in a 1.8 meter, single row plot. Selected clones are planted as families in the first-line trials. Each

clone is identified by crossing series (year the cross was made), cross number, and first-line trial plot number. The first-line trial plant cane crop is rated in August. The rating is based on visual evaluations for disease, stalk height, stalk diameter, stalk population, and lodging. In early-fall, plots with desirable ratings are then evaluated for pith, tube, and again for lodging. If one of these conditions occurs, the clone is dropped from the testing program. Six stalks are harvested from selected clones, and two stalks are tested for Brix level with a hand held refractometer. Elite clones are advanced to second-line trials.

Second-line trials are planted in late-September. Clones are evaluated in 4.9 meter (16 ft), single-row plots. Advanced clones are planted randomly throughout the test field along with commercial checks. A planting rate of two stalks is used to plant all plots. Stalk counts are made for all plots in the plant cane crop of second-line trials in August. Plots also are evaluated for diseases, borers, lodging, and again checked for pith and tube. A stalk population threshold is determined based on commercial check variety stalk population levels and is used as a criterion for advancement. In early-October, stalks are harvested from second-line trial plots that meet advancement criteria. The selected stalks are used to plant increase plots. Increase plots are planted in heavy soil and light soil, with only one replication per soil type. Plant cane second-line trial plots are sampled in early December. These samples are used to determine pounds of theoretical recoverable sugar per ton of cane (TRS). The stalk samples along with TRS are used to calculate cane yield and cane yield for clones. First-line first stubble plots that correspond to plant cane second-line trial plots are sampled for TRS in late October.

The increase stage serves as a seedcane source for on-station nurseries, but also have data collected for yield. Increase trials are planted on single-row plots that are 4.9 meters

(16 ft) long. A two stalk planting rate is used to plant the increase stage. Check varieties are planted throughout the field and are used to determine minimal TRS and cane yield levels. Visual evaluations of plots are made in the summer, and stalk counts are made. Seedcane is typically cut out of the plots in mid-October to plant on-station nurseries. Stalk samples are harvested and used to determine sugar yield, cane yield and TRS.

The assignment process is the next stage of the LSU AgCenter Sugarcane Breeding Program. Data which was collected on plantcane second-line trials, first-ratoon second-line trials, first-ratoon first-line trials, plant cane heavy soil increase, and plant cane light soil increase are used to evaluate clones available for assignment. In plantcane and first-ratoon second-line trials, stalk population are determined for each plot. Stalk sample are hand harvested from each plot and are used to calculate TRS and stalk weigh. Stalk sample and stalk populations are then used to calculate sugar yield and cane yield. TRS and mean stalk weight data are collected in first-ratoon first line trial plots. In heavy and light soil plant cane increase plots, stalk population data are collected. Combined yield data along with comments made on each plot are used to determine which clones will be assigned permanent identification numbers. The clone identification begins with a prefix which signifies the location where the variety was selected. The LSU AgCenter Sugarcane Breeding Program is signified by “L” and the USDA-ARS Sugarcane Research Unit, Houma sugarcane breeding program is signified by the “Ho” prefix. When the prefix “CP” is placed behind “L” or “Ho” it refers to Canal Point, Florida. Canal Point is the primary commercial crossing unit used by the USDA-ARS Sugarcane Research Unit, Houma for commercial seed production. If only “L” or “Ho” occurs in a variety name, the cross was made and selected by that particular breeding program.

All assigned varieties are planted at on-station nurseries. The on-station nurseries are located at the Sugar Research Station, St.Gabriel, Louisiana, the USDA-ARS Sugarcane Research Unit, Chacaloula Farm, Houma, Louisiana, and the Iberia Research Station, Jeanerette, Louisiana. This stage of the testing program introduces the clones to additional soil and environmental conditions. On-station nurseries plots are single row, 4.9 meter (16 ft) long, with two replications; they are planted in mid-October. A two stalk planting rate is used to plant all plots. Stalks are counted in August to estimate stalk population, and stalk samples are used with stalk population to determine estimated sugar yields and cane yields.

Off-station nurseries are planted the following year. The commercial breeding programs of the LSU AgCenter and the USDA-ARS begin evaluating experimental clones together at all off-station nurseries. The plot size at off-station nurseries is single-row, 6.1 meters (20 ft) long, with two replications. All plots are planted at a two stalk rate. The three off-station nurseries are located throughout the sugarcane belt. The Westfield nursery is located in Paincourtville, Louisiana and is in the Bayou Lafourche area. The Stoute's nursery is located in Cecilia, Louisiana and is in the Bayou Teche area. The Newton nursery is located in Bunkie, Louisiana and represents the northern most point of the variety testing program. These nurseries provide an array of environments representing the three distinct areas of the sugarcane belt. For nursery trials, stalk counts are made in August and sucrose samples are taken to determine each clone's TRS. Cane yield, is estimated based on mean stalk weight and stalk population. Sugar yield is the product of cane yield and TRS.

The infield stage is planted the same year as off-station nurseries. The infield stage is the first time that mechanical harvesters are used to obtain plot weights. Prior to this stage, cane yield is estimated. Infield testing is conducted at Blackberry Farms, Vacherie,

Louisiana and Sugarland Farms, Youngsville, Louisiana. Blackberry is located in the Mississippi River area, and Sugarland is located in the Bayou Teche area. Plots are harvested with a sugarcane combine harvester, and cane billets are deposited in a wagon with load weight cells for plot weight determination. Infield plots are two rows 7.6 meters (25 ft) long, with two replications. They are planted at a two stalk rate. Stalk counts are made in August, and a sucrose sample is taken at the time of harvest to provide TRS for sugar yield data. Data are collected in the plant cane, first-ratoon, second-ratoon, and sometimes third-ratoon crops. Elite clones are introduced into the outfield testing stage the following year (year nine of the testing program).

The introduction clones are planted the year prior to outfield testing, in order to increase seedcane availability. Outfield testing is the final stage of the variety testing program. Plot size consists of two rows, 15.2 meters (50 ft) long. Plots are planted at a continuous two stalk planting rate. All varieties / clones are replicated three times in the outfield testing stage. Ten outfield sites are located throughout the Louisiana sugarcane industry. Data are collected through the second- and/or third-ratoon crops. All plots are harvested with a sugarcane combine harvester and are weighed with a wagon fitted with load cells. A 15-stalk sample is taken from each plot and is used to determine TRS. The cumulative data from all stages is evaluated before an experimental clone is released as a new variety to the industry.

The sugarcane clones introduced to the outfield stage also are planted at three primary seed increase locations by personnel with the American Sugar Cane League of the USA, Inc. Those clones advancing through the testing program are subsequently increased leading to one to two acres of available seedcane at each

location. Seedcane is increased twice at the primary stations. Seedcane is cut from the primary stations and used to plant 42 secondary increase stations. Seedcane is increased once at the secondary stations and is then available for growers throughout the state who request seedcane of the new variety. The following year seedcane is sold for \$36 per ton and is distributed by the American Sugar Cane League of the USA, Inc. to Louisiana sugarcane growers.

Researchers for the American Sugar Cane League of the USA, Inc., USDA-ARS, and LSU AgCenter meet in August to review all data collected on all active experimental clones. The data represent a cumulative summary of the clone's performance through multi-year testing. Keep or drop decisions are made based on the data to maintain experimental clones in the testing and seedcane increase programs.

The LSU AgCenter recommends a hand planting rate of three stalks with at least a 20% overlap of mature internodes for commercial varieties (Legendre 2001). However, many farmers plant whole-stalk sugarcane at seeding rates of three, four, five, or more stalks to compensate for damage done during mechanical planting, stalk rot diseases, and stand losses due to severe freezes. The variable planting rates achieved by mechanical planters also cause farmers to plant sugarcane at higher rates than are recommended. The planting rate for all stages in the sugarcane variety development program is two stalks. This seeding rate is not reflective of current industry planting practices. A two-stalk planting rate was chosen because there is a lack of available seedcane and the amount of labor needed to handle greater volumes of sugarcane. Another reason for using a two-stalk planting rate, is less damage

caused to the seedcane during hand harvesting and hand planting in the variety development program.

The main objective of this study was to determine the effect of planting rate on sugarcane yield and its components in sugarcane variety / clonal evaluation trials. A second objective was to determine characteristics affecting germination of buds of different sugarcane varieties/ clones.

## LITERATURE REVIEW

### **The Effect of Row Width on Plant Population**

There are many factors that affect the stalk population of sugarcane. Many authors report that the key component in determining cane yield is stalk population (Roach 1976). Roach was interested in the effects of dual drilling into a wide planting furrow in Australia. In 1974, sugarcane varieties Pindar, Q 90, Q 100, and Triton were planted on a dual drill 50 cm apart with 140 cm between centers. Cane was only planted in one of the dual drills for the control. This experiment was planted by hand because of wet weather. It was reported to have a low stand count. Roach reports that dual drilled out yielded single rows by 54%. The variety Pindar was removed from this experiment because of the germination problems encountered due to the saturated conditions. Roach cautions that using this data may be hazardous. He also performed research on a dual planted test using a mechanical planter. This test was ploughed out after only one growing season.

Hand planting proved difficult and a whole stalk mechanical planter was developed in 1975 to follow up on the 1974 double drill research (Roach 1976). Four trials were planted with the mechanical planter. Trial A used the same varieties used in the hand planted experiment. Plot size was four rows by 10 m. Row spacing for A was dual drill 50 cm apart with 150 cm between centers. Single row spacing (150 cm) was used for the control. Only Q 92 was used for Trial B with similar treatments having a plot size of six rows by 12m. Trial C used the cultivar Triton with treatments planted on a dual drill 50 cm apart with 140 cm between centers and single row spacings planted on 140 cm centers. Plot size was six rows by 12m. Trial D also

used the variety Triton planted in plots consisting of six rows by 140 m. The treatments were dual drill 50 cm apart and with 180 cm between centers, and the remainder of the field was planted on single row spacing of 140 cm. Roach determined that the dual row spacing had a greater amount of early tillering than that of single row spacings. He concluded that there may be less competition in the dual spacing because of the better spacing of tillers. This would increase cane yield by allowing for more millable stalks per plot. Roach determined that dual rows, with centers of approximately 180 cm, would benefit the Australian sugarcane industry by increasing the number of millable stalks per acre while providing a practical method of cultivation and harvesting in the highly mechanized industry.

The concept of high density planting (HDP) according to Bull and Bull (2000) could increase sugarcane yields by 20 to 60 tons of cane per hectare (TCH) without additional fertilizer or irrigation. In theory, more light would be intercepted prior to canopy closure in HDP. An increase in cane yield would occur because of more efficient use of nutrients, water and light interception. Field plot trials were used to compare row spacings of 0.5 m (HDP), 1.5 m (traditional), and paired rows 0.5 m apart with 1.8 m (dual) centers. The variety Q 124 was used at eight different locations to compare the three row spacing treatments. They determined that a “close row” system, where rows were 0.5 m apart could yield 60 additional TCH, but new machinery would be needed to harvest this cane. Also, if sugarcane was double drilled on the 0.5 m row, cane yield may be increased by 20 TCH. According to Bull and Bull (2000), the physiological basis for the yield increase lies in the more effective utilization of the available light, water and nutrient resources by the HDP

crops in the period before canopy closure. However, this increase in cane yield may become reduced to null or to a negative production state if non optimal rainfall is received in rainfed growing systems. The authors acknowledge at one location that the lodging of sugarcane was more severe in dual and close row planting systems. The authors also mention the potential for an increase in insect and disease pressure.

Ridge and Hurney (1994) reviewed Australia's sugarcane row spacing studies. In the early 1970's, row spacing experiments compared dual row planting to traditional single row planting in the Queensland industry. Eight locations throughout the industry were used in the studies. Single row spacings of 1.4 to 1.5 m were compared to dual row spacings of 1.6 m x 0.2 m, 1.75 m x 0.3-0.4 m, and 1.83 m x 0.5 m in strip trials. There were no significant differences between the dual and single row methods of row spacing. However, many of these tests lacked replication. Higher stalk populations occurred in dual planting rates as compared to single row spacings. In the late 1970's researchers began replicating these experiments. Three trials were performed and provided similar conclusions. Dual row treatments with centers of 1.85 m or greater tended to have lower yields. In trial two, "dual row evaluation", no cane yield loss was detected in dual rows with centers 1.6 m apart. When single rows were increased from standard 1.37 m to 1.66 or 2.06 m, there was no significant loss of yield. The two varieties used in experiment two and three were Q 87 and CP 44-101. Q 87 had a greater yield loss than that of CP 44-101 at wider row spacing. The primary reason for this yield loss was the lower stalk population of Q 87. Two other replicated trials in the late 1970's harvested on the Tully Sugar Experiment Station showed no clear conclusion. Varieties Q 82, Q 90, Q 91, and

Q 100 were used in trial 1, whereas Q 90, Q 91, and Q 100 were used in trial 2.

Single row spacings of 1.45, 1.65, 1.85 m were used, and dual row spacings of 1.85 m x 0.4 m and 1.85 m x 0.5 m were used in trial 1. Also, double planting rates (double planting material) were used in single row spacings for 1.45 m and 1.85 m. In trial 2, single row spacing of 1.45 m and dual row spacings of 1.65 X 0.3, 1.65 X 0.4, 1.85 X 0.3, 1.85 X 0.4, and 1.85 X 0.5 m were evaluated. Due to the amount of variability in the data no clear conclusions were drawn.

A sugarcane stalk population study in Australia was reviewed by Ridge and Hurney (1994). The study measured solar radiation utilization and its effect on stalk population. Bundaberg, Samford, and Condong were the locations for the trials in the southern sugarcane growing area of Australia. Varieties that had a range of stalk populations at maturity were used. In Bundaberg, varieties Q 110, Q 124, Q 141, and Q 144 were used. At Samford, Q 110 and Q 124 were used. At Condong, Q 110, Q 124, CP 44-101, and Co 740 were used. Single row spacings of 0.6, 0.9, 1.5, and 1.8 m, along with a dual row spacing of 1.8 m X 0.3 m were used at all three locations. At Bundaberg, cane yields were significantly higher for the single row spacing of 1.5 m and the dual row spacing of 1.8 m X 0.3 m. However, there was no significant difference in cane yield for any row spacing treatment at the other locations. Ridge and Hurney concluded that row spacings could be widened from conventional spacing of 1.45-1.50 m to 1.65 m without cane yield loss in southern Queensland. However in northern Queensland, there was a significant cane yield loss when single row spacing was increased to 1.65 m. Row spacings of 1.60-1.65 m or 1.80-1.85 m centers by 0.3 to 0.5 m dual rows produce similar cane yield to the single row

spacing. There was an increased stalk population at narrower row spacings, thus giving a more rapid canopy development, but there were no clear benefits for this higher stalk population, such as cane yield.

In Natal, South Africa, several experiments were performed by Thompson and du Toit (1965) on the effect of row spacing in sugarcane. In one of the experiments, the effect of high and low fertilizer rates on row spacings of 0.457 m (1 ft 6 in), 0.914 m (3 ft 0 in), and 1.372 m (4 ft 6 in) were tested. There was a trend with the low fertilizer rate of 60-60-60 (N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O) that suggested cane yield was highest at the smallest row spacing and lowest at the largest row spacing. Also, 0.914 m (3 ft 0 in) and the 1.372 m (4 ft 6 in) row spacings were planted with single and double sett seed pieces. The double sett had a higher cane yield than the single sett rows. The opposite was true with the high rate of fertilizer 120-120-120 (N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O). The larger row spacing produced higher cane yields. The 0.914 m single sett row produced the highest cane yield.

In another experiment, Thompson and du Toit (1965) hypothesized that the cane yield of a variety with a low stalk population could be increased by decreasing row width from 1.372 m (4 ft 6 in) to 0.914 m (3 ft 0 in) or 0.457 m (1 ft 6 in). The variety NCo 376 and the unselected seedling N 58/2239 were two high stalk population varieties, along with the unselected seedling N 58/2242 as a low stalk population variety, were used in this experiment. The experiment was planted in Waldene on a fine sandy loam soil. There was a significant decrease in the yield by all three cultivars in tons of cane per acre as row spacing decreased from a 1.372 m (4 ft 6 in) to 0.457 m (1 ft 6 in), thus disproving their hypothesis.

From 1944 to 1957, Hebert et al. (1965) performed three experiments to determine the effect of row width on yields of cane and sugar in Louisiana. In their first experiment, the row widths used were 1.8 m (6 ft) centers and an alternating width of 1.2 m (4 ft) and 1.8 m (6 ft) centers to produce an average of 1.5 m (5 ft) between row centers. Varieties Co 290, CP 34-120 CP 36-183 and CP 33-425 were selected for these experiments based on shading characteristics. Co 290 is an excellent shading variety, CP 34-120 is good, CP 36-183 is fair, and CP 33-425 is poor. Plantcane, first-ratoon, and second-ratoon crops were evaluated for cane yield and sucrose. Hebert reported a significant difference in producing a higher cane yield with narrower row spacings in the second-ratoon with variety CP 34-120. However, there was no difference in cane yield among the three other varieties. Hebert et al. (1965) concluded that cane grown on 1.1 m (3 2/3 ft) to 1.8 m (6 ft) row width showed little to no effect on cane yield in Louisiana. They also showed that cane grown on alternating 1.2 m (4 ft) and 1.8m (6 ft rows) on light soil, provided a greater yield than the normal 1.8 m (6 ft) row. Hebert et al. (1965) concluded that growing cane on less than a 1.5 m (5 ft) row was not economical because there is a cost of additional seedcane along with the cost of changing or adjusting equipment.

A row spacing study was conducted over a 10 year period (1967-1976) in Houma, Louisiana by Matherne and Irvine (1978). In the ten year period they used a range of interrow spacing from 0.3 m (12 in) to 2.1 m (84 in). In several of the experiments they also compared double drill interrow spacing to single interrow spacing. Varieties used in Matherne and Irvine tests were CP 61-37 and CP 48-103 planted at 1.5- and 2-stalk rate in 1967, CP 61-37 and CP 60-25 planted at 2- and 3-

stalk rate in 1969, CP 52-68 planted at a 2-stalk rate in 1970, CP 65-357 planted at 2- and 4- stalk rate in 1971, CP 65-357 and L 62-96 planted at 2- and 4- stalk rate in 1972, L 62-96 planted at 2- and 4- stalk rate in 1972, CP 65-357 planted at 2- and 4- stalk rate in 1974, and CP 65-357 planted at 1- and 2- stalk rate in 1974. Matherne and Irvine reported that the greatest yields were obtained at row spacing of 0.305 and 0.610 m (12 and 24 in) compared to conventional 1.829 m (72 in) row spacing. However, these tests were not replicated. Decreasing row spacing from 1.829 m (72 in) to 0.914 and 1.219 m (36 and 48 in) increased yields 56% and 23%, respectively. The 0.914 m (36 in) row spacing yielded 50 tons of cane per acre. Double drill on 2.134 m (84 in) rows with 0.762 m (30 in) between drills yields were 4 to 21 % higher than 1.829 m (72 in) row spacing. Matherne and Irvine reported that there is a close association of high yields with high stalk population.

### **Planting Rates**

Rice (1981) reported that planting rates of one, two, three, and four stalks can commonly be observed in Florida's 1.524 m (5 ft) rows. Rice conducted two experiments. In the first, he used three different sugarcane cultivars (C1 41-223, CP 50-28, and CP 56-59) with planting rates of one, two, and three stalks of seedcane in the furrows. In plant cane, there was no statistical difference in cane yield from planting rate, but there was a slight numeric increase in cane yield as the planting rate was increased. The first-ratoon data showed that the one-stalk planting rate yields were equal to or numerically greater than the two higher planting rates. Results from the second-ratoon showed that the lowest planting rate yielded significantly greater than the two, three, and four stalk rates. The four stalk planting rate had the lowest

cane yield of any treatment. In his second experiment using six varieties, Rice found that a planting rate of two stalks yielded higher than rates of one and three stalks in plant cane and first-ratoon with no significant difference in second-ratoon. Rice concluded that, if proper care is given to the eyes of sugarcane prior to planting a planting rate of one running stalk is adequate under Florida's planting conditions.

The Louisiana State University Agricultural Center (Legendre 2001) recommends that a planting rate of three stalks be used with a lap of at least two mature joints.

Ricaud and Arceneaux (2000) studied sugarcane planting rates in Louisiana and showed a significantly greater yield in tons of cane per acre in plant cane was achieved with a planting rate of five whole stalks compared to rates of four whole stalks, four billeted stalks, and three whole stalks when cane was planted in September or October. However in 1998 (Ricaud and Arceneaux 1999), a planting rate of four stalks had a statistically higher yield than that of any other planting rate. A planting rate of four whole stalks out yielded the planting rate of four billeted stalks.

### **Other Sugarcane Articles**

Milligan et al. (1990) conducted a study on crop effects on genetic relationships among sugarcane traits. The experiment consisted of 34 experimental genotypes and three commercial check cultivars. Five locations throughout the Louisiana sugarcane growing area were chosen. The test was planted in 1983 and replanted in 1984. Data were collected on the plant cane, first-ratoon, and second-ratoon crops beginning in Fall, 1984 and ending in 1987. Path analysis was used to

find genetic correlation among sugar cane traits. Milligan et al. reported that the most important determinant of sugar yield was cane yield ( $r = 0.91$ ), and the most important determinate of cane yield was stalk number ( $r = 0.77$ ). The older the ratoon crop the more pronounced this effect is.

Kang et al. (1991) studied genetic and phenotypic path analyses in sugarcane. The study examined the possible effect of the artificially created relationships on the relative importance of cane yield and TRS in determining sugar yield in genetic and phenotypic path analyses. The four path interrelationships evaluated were weighed cane yield and TRS  $\rightarrow$  weighed sugar yield, estimated cane yield and TRS  $\rightarrow$  estimated sugar yield, estimated cane yield and TRS  $\rightarrow$  weighed sugar yield, and weighed cane yield and TRS  $\rightarrow$  estimated sugar yield. Kang et al. reported at the phenotypic level, artificial relationships tended to inflate the relative importance of cane yield and lower that of TRS, but at the genetic level, the artificial relationship did not greatly inflate or decrease the relative importance of cane yield and TRS. He also stated that multiplying cane yield and TRS reflect false phenotype associations that can be circumvented by using genetic correlations in path analysis.

Gravois et al. (1991) studied ways of effectively improving sucrose yield, via indirect selection, in early sugarcane testing stages. They used 80 randomly-selected genotypes from a first clonal testing stage. Data were collected beginning with the plant cane crop in 1986 through the second-ratoon crop in 1988. Gravois et al. reported that path-coefficient analysis revealed that purity and Brix were the main factors increasing sucrose content. They also reported that stalk volume had a positive and much larger effect on mean stalk weight than stalk density.

Gravois (1988) used path-coefficient analysis to study phenotypic, broad-sense and narrow sense variation in sugarcane at St. Gabriel, Louisiana. He calculated broad-sense genotypic and phenotypic correlations to study direct and indirect effects in a set of cause and effect relationships involving sucrose yield. He reported that cane yield should be given greater emphasis over TRS when selecting for sugar yield. When cane yield cannot be measured directly, stalk number should be giving greater emphasis over mean stalk weight and its components.

Diaz et al. (1996) conducted experiments in Cuba on improving germination of seedcane with treatment of ethephon. They evaluated varieties Ja 60-5, Ty 76-16 C 266-70, and C 1616-75 at the Havana Sugarcane Research Station. They evaluated ethephon at 35 and 60 days after planting. The ethephon concentrations used were 0, 120, 240, 360, and 480 ppm. The control rate had a lower percent germination than all other ethephon concentrations. Diaz et al. concluded that sett dipping with ethephon can increase germination significantly.

Croft (1998) performed experiments on improving the germination of sugarcane along with the control of pineapple disease in Australia. He compared the germination Q158 billeted sett 30 - 50 mm, 120 – 140 mm, and 260 - 280 mm long. Setts were either not treated or treated with polyethylene coating. The mean number of shoots which germinated 41 days after treatment for the control was 31 shoots compared to 25 shoots for the polyethylene treated setts.

## MATERIALS AND METHODS

### Planting Rate Study

A planting rate by sugarcane clone experiment was conducted during 2000 through 2002 at the Sugar Research Station in St. Gabriel, Louisiana. The experiment was planted in a Commerce silt loam (*Fine-silty, mixed, nonacid, thermic Aeric Fluvaquent*) soil. Two commercial varieties LCP 85-384 and HoCP 91-555, and six experimental clones L 97-105, L 97-126, L 97-128, L 97-129, L 97-137, and L 97-147 were hand harvested and hand planted on August 29, 2000 and replanted on August 22, 2001. A total of 216 stalks of each sugarcane clone as needed to plant each test.

A randomized complete block design was used for each experiment. Each experiment consisted of the eight sugarcane clones, three planting rates, and three replications. The three treatments consisted of planting rates of two, three, and four hand-cut whole-stalks. Plot size consisted of two adjacent 1.8 m wide rows that were 6.1 m long with a 1.5 m alley between each plot. Each plot was filled randomly with one clone at the particular treatment planting rate in a factorial treatment arrangement. There was at minimum two mature internodes overlapped for all clones, however due to stalk height differences among clones a greater overlap of mature internodes occurred for the taller clones. Fertilizer was applied at the standard rate of 120-0-80 (N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O).

In each plant cane crop, shoot counts were taken from each plot in the fall after planting and in the spring after winter reemergence. Millable stalk counts were

taken in late summer prior to harvest for each test in 2001 and 2002. Stalk population was calculated as the number of millable stalks per hectare.

In 2001, a random 10-stalk hand-harvested sample was taken from each plot for sucrose analysis. Each sample was also evaluated for the following categories: stalk diameter (mm), stalk height (cm), and mean stalk weight (kg). Due to Tropical Storm Isidore and Hurricane Lily, severe lodging occurred in 2002. Therefore, a 15-stalk hand-harvested sample was removed from each plot for both the plant cane and first-ratoon crop to increase the accuracy in estimation of mean stalk weight. In 2002, stalk diameter and stalk height were not measured due to the extreme lodging that occurred. A sucrose analysis was conducted on each sample at the St. Gabriel sucrose laboratory. Brix and pol readings were used to determine theoretical recoverable sugar (TRS, g/kg) (Gravois and Milligan 1992). Plots were harvested with a sugarcane combine/weigh-wagon system. Each plot was weighed in a modified dump wagon fitted with load cells. No burning of leafy material occurred prior to the harvest of the experiment. The combine's topper was not used to remove the immature internodes from each stalk. Cane yield (Mt/ha) for each plot was estimated by plot weight, less 14% to adjust for leaf-trash weight. Weighed sugar yield (kg/ha) was estimated as the product of cane yield and TRS. Estimated sugar yields were calculated by multiplying estimated cane yield (stalk population X mean stalk weight/1000) by TRS.

The linear model  $Y_{ijk} = \mu + R_i + P_j + V_k + PV_{jk} + \varepsilon_{ijk}$  was used to analyze the data for 2001.  $Y_{ijk}$  is the observed response of planting rate  $j$  in replication  $i$  and clone  $k$ .  $\mu$  is the overall mean;  $R_i$  is the replication effect;  $P_j$  is the planting rate effect;  $V_k$  is the

clone effect;  $PV_{jk}$  is the planting rate by clone interaction;  $\varepsilon_{ijk}$  is the experimental error.

Table 1. Harvest dates for the planting rate by clone study conducted during 2001-2002 at the St. Gabriel Research Station.

Crop	Year	
	2001	2002
Plant-cane	November 15	December 13
First-ratoon		December 13

The 2002 planting rate data was analyzed using the following linear model  $Y_{ijkl} = \mu + C_i + R_{j(i)} + P_k + V_l + CP_{ik} + CV_{il} + CPV_{ikl} + \varepsilon_{ijkl}$ .  $Y_{ijkl}$  is the observed response of crop  $i$  in replication  $j(i)$  of planting rate  $k$  and variety  $l$ .  $\mu$  is the overall mean;  $C_i$  is the crop effect;  $R_{j(i)}$  is the replication effect nested in crop;  $P_k$  is the planting rate effect;  $V_l$  is the variety effect;  $CP_{ik}$  is the crop by planting rate interaction;  $CV_{il}$  is the crop by variety interaction;  $CPV_{ikl}$  is the crop by planting rate by variety interaction;  $\varepsilon_{ijkl}$  is the experimental error. SAS v8.2 was used to analyze the data collected from the experiments. The proc mixed procedure was used to analyze the linear models.

Mean separation used least square means probability differences ( $P=0.05$ ). Coefficient of variation CV (%) was estimated as the (square root of residual / mean) \* 100. Pearson and Spearman correlation coefficients were obtained with the proc corr procedure (SAS v8.2).

### **Bud-germination Study**

A germination study was conducted in the Fall of 2002 at the Sugar Research Station in St. Gabriel, Louisiana. Seedcane for this study was acquired from the 2001 plant cane planting rate study. Thirty-six stalks were removed from the first replication of the four stalk planting rate plots. The average mean stalk weight for the

first replication plots were multiplied by the number of stalks removed from each plot and added to the plot weight to account for missing stalks. Leaves were removed by hand from each stalk. The number of viable buds was then recorded for each stalk. Other measurements taken were stalk height (cm), stalk diameter (mm), and bundle weight (kg). Bundle weight was divided by stalk number to obtain mean stalk weight (kg).

A randomized complete block design was used in this experiment. The experiment consisted of the eight sugarcane clones that were replicated three times. The planting rate was two stalks. The planting material included two commercial varieties, LCP 85-384 and HoCP 91-555, and six experimental clones, L 97-105, L 97-126, L 97-128, L 97-129, L 97-137, and L 97-147. The experiment was planted at two different locations on the Sugar Research Station. Each location had a different soil type. The experimental field located on the west side of the research station had a Commerce silt loam (*Fine-silty, mixed, nonacid, thermic Aeric Fluvaquent*) soil, and the experimental field located on the east side had a Sharky clay (*Very fine, montmorillontic, nonacid, thermic, Vertic Halaucept*) soil. Plot size consisted of a single 1.8 m row, 6.1 m (20 ft) long, with a 1.5m alley between plots. Shoot counts were collected in late September and expressed as number of shoots per plot. Shoots per plot were divided by viable buds per plot to obtain germination percentage. Buds per meter of stalk were calculated by dividing (buds per stalk by stalk height) \* 100.

The 2002 germination data were analyzed using the linear model

$Y_{ijkl} = \mu + S_i + R_{j(i)} + V_k + SV_{ik} + \epsilon_{ijkl}$ .  $Y_{ijk}$  is the observed response of soil type  $i$  in replication  $j(i)$  for variety  $l$ .  $\mu$  is the overall mean;  $S_i$  is the soil type effect;  $R_{j(i)}$  is the

replication effect nested in soil type;  $V_k$  is the clone effect;  $SV_{il}$  is the soil type by clone interaction;  $\varepsilon_{ijk}$  is the experimental error. SAS v8.2 was used to analyze the linear model using the proc mixed procedure. Mean separation used least square means probability differences ( $P=0.05$ ).

## RESULTS AND DISCUSSION

### Planting Rate Study

The analysis of variance results for the 2001 plant cane crop indicate significant ( $P \leq 0.05$ ) planting rate effects for weighed sugar yield, estimated sugar yield, weighed cane yield, estimated cane yield, mean stalk weight, and stalk population (Table 3). As expected, clones were significantly different for all traits. Of particular interest, the planting rate by clone interaction was not significant for any trait. The nonsignificant planting rate by clone interaction indicates clonal ranking was consistent regardless of planting rate. This contradicts the finding of Matherne (1972) that of interrow spacing and planting rate affected stalk population and cane yield in Louisiana. Matherne found a significant interaction between CP 61-37 and planting rates of 1.5 and 2 stalks. Due to the nonsignificant planting rate by clone interaction, trait means were averaged across clones and planting rates.

Spearman correlation coefficients also were used to evaluate sugarcane clonal ranking. Clonal ranking among planting rates were analyzed for sugar yield and cane yield in 2001 and 2002 (Table 2). The clonal ranking for sugar yield for the 2-stalk planting rate was highly significant and positively correlated with the 3-stalk planting rate. The Spearman correlation coefficients for 2001 and 2002 were  $r = 0.976$  and  $r = 0.881$ , respectively. The Spearman correlation coefficients for the 2- stalk and 4-stalk planting rates were  $r = 0.905$  and  $r = 0.857$  for sugar yield clonal ranking in 2001 and 2002, respectively. The 2001 and 2002 Spearman correlation coefficients for clonal ranking among sugar yield were  $r = 0.881$  and  $r = 0.786$  for the 3-stalk planting rate

and 4-stalk planting rate. These correlations were significant and positively correlated.

The clonal ranking for cane yield for the 2-stalk planting rate was highly significant and positively correlated with the 3-stalk planting rate. In 2001 and 2002, Spearman correlation coefficients were  $r = 0.833$  and  $r = 0.922$ , respectively.

Spearman correlation coefficients for the 2-stalk and 4-stalk planting rates for clonal ranking among cane yield were  $r = 0.976$  and  $r = 0.970$ , respectively. The clonal ranking for cane yield for the 3-stalk planting rate was highly significant and positively correlated with the 4-stalk planting rate. In 2001 and 2002 the Spearman correlation coefficients for the 3-stalk and 4-stalk planting rates were  $r = 0.857$  and  $r = 0.881$ , respectively.

Table 2. Spearman correlation coefficients for sugarcane yield and cane yield varietal ranking for the 2001 and 2002 planting rate experiments conducted at St.Gabriel, Louisiana.

	Sugar yield		Cane yield	
	3-stalk	4-stalk	3-stalk	4-stalk
2-stalk	0.976† **	0.905 **	0.833 **	0.976 **
	0.881 **	0.857 **	0.922 **	0.970 **
3-stalk		0.881 **		0.857 **
		0.786 *		0.881 **

N = 8.

† Upper values are for the 2001 experiment; lower values are for the 2002 experiment.

\*, \*\* Denotes statistical significance at the P#0.05 and P#0.01 level, respectively.

The main factors which comprise sugar yield are cane yield and TRS.

Weighed sugar yield for planting rates ranged from 10483 kg/ha (2-stalk rate) to 12198 kg/ha (4-stalk rate) for the 2001 planting rate study (Table 4). The 3- and 4-stalk planting rates yielded significantly (P#0.05) greater sugar yield than did the 2-

stalk rate. Increasing the planting rate from 3- to 4-stalk rates provided no significant increase in sugar yield.

Weighed cane yield measures sugarcane mass per land unit. It is a function of mean stalk weight (kg) and stalk number (stalks/ha). Cane yield varied from 88.0 Mt/ha (2-stalk rate) to 99.9 Mt/ha (4-stalk rate) in 2001 (Table 4). The 2-stalk planting rate yielded significantly ( $P \leq 0.05$ ) lower cane yield than the 3- and 4-stalk planting rates. No significant increase in cane yield occurred when the planting rate was increased from 3- to 4-stalks. However, Rice (1981) found no differences in cane yield in Florida when 1-, 2-, 3-, and 4-stalk planting rates were tested. Stalk height, stalk diameter, and stalk density are the key components of mean stalk weight. Stalk density was not measured in the experiment. Gravois (1988) reported stalk density to be only a minor component of cane yield. In 2001, mean stalk weight ranged from 1.30 kg (3-stalk rate) to 1.40 kg (2-stalk rate). Mean stalk weight was significantly higher at the 2-stalk planting rate compared to the 3- and 4-stalk rates. Mean stalk weight for the 3-stalk and 4-stalk planting rates was equal.

Stalk population is a measurement of millable stalks and appears to be inversely related to mean stalk weight. Stalk population varied from 76997 stalks/ha to 91061 stalks/ha for the 2- and 4-stalk planting rates in 2001, respectively (Table 4). Stalk population for the 3- and 4-stalk planting rates was significantly ( $P \leq 0.05$ ) higher than the 2-stalk planting rate. There was no significant difference in stalk population among the 3- and 4-stalk planting rates.

Planting rate had no effect on TRS. TRS ranged from 120 g/kg (2-stalk rate) to 122 g/kg (3- and 4-stalk rates) in 2001 (Table 4).

Table 3. Analysis of variance of fixed effects for the plant cane experiment involving eight sugarcane clones and three planting rates conducted at St. Gabriel, Louisiana in 2001.

Source	Sugar yield (Weighed)	Sugar yield (Estimated)	Cane yield (Weighed)	Cane yield (Estimated)	TRS	Mean stalk weight	Stalk population	Stalk height	Stalk diameter
	-----P-value-----								
Planting rate	<.0001	0.022	<.0001	0.035	0.466	0.036	<.0001	0.338	0.051
Clone	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.000	0.001
Planting rate*clone	0.331	0.971	0.828	0.914	0.116	0.442	0.514	0.901	0.304
	-----%-----								
CV	10.0	15.4	7.6	13.4	6.0	10.6	9.3	5.5	6.8

Table 4. Planting rate means averaged across eight sugarcane clones for the plant cane experiments conducted in St. Gabriel, Louisiana in 2001.†

Planting rate	Sugar yield (Weighed) (kg/ha)	Sugar yield (Estimated) (kg/ha)	Cane yield (Weighed) (Mt/ha)	Cane yield (Estimated) (Mt/ha)	TRS (g/kg)	Mean stalk weight (kg)	Stalk population (stalks/ha)	Stalk height (cm)	Stalk diameter (mm)
2-stalk	10483 B	12760 B	88.0 B	107.3 B	120 A	1.40 A	76997 B	307 A	23.3 A
3-stalk	12132 A	13942 AB	99.0 A	114.5 AB	122 A	1.30 B	88764 A	305 A	22.4 B
4-stalk	12198 A	14488 A	99.9 A	119.0 A	122 A	1.31 B	91061 A	313 A	22.7 AB

† Means in a column sharing the same letter are not significantly different at P#0.05.

The product of estimated cane yield and TRS is estimated sugar yield. In 2001, estimated sugar yield was significantly ( $P \leq 0.05$ ) lower for the 2-stalk planting rate (12760 kg/ha) compared to the 4-stalk planting rate (14488 kg/ha) (Table 4). The 3-stalk rate estimated sugar yield did not statistically differ from the 2- or 4-stalk planting rate.

Estimated cane yield varied from 107.3 Mt/ha (2-stalk rate) to 119.0 Mt/ha (4-stalk rate) in 2001 (Table 4). The 3- and 4-stalk planting rate estimated cane yield was significantly ( $P \leq 0.05$ ) higher than the 2-stalk planting rate. Estimated cane yield for the 3-stalk rate was not statistically different from the 2- or 4-stalk planting rate.

Other stalk traits measured include stalk height and stalk diameter (Table 4). Stalk height was not affected by planting rate. Stalk height in 2001 varied from 305 cm (3-stalk rate) to 313 cm (4-stalk) at harvest. Stalk diameter was significantly ( $P \leq 0.05$ ) greater for the 2-stalk rate (23.3 mm) than the 3-stalk rate (22.4 mm); however, no statistical differences for stalk diameter occurred between the 3- or 4-stalk planting rate and 2- or 4-stalk planting rate.

The eight sugarcane clones used in the studies were chosen to represent a range of phenotypic characteristics that commercial sugarcane breeding programs encompass. As expected, weighed sugar yield for clones varied greatly. The commercial varieties LCP 85-384 and HoCP 91-555 were used to compare all experimental clones in this experiment. Currently, LCP 85-384 and HoCP 91-555 account for 88% of Louisiana's 2002 sugarcane acreage (Legendre and Gravois 2003). Weighed sugar yield for clones varied from a high of 14414 kg/ha to a low

Table 5. Sugarcane clonal means averaged across planting rates for the plant cane experiment conducted at St. Gabriel, Louisiana in 2001.†

Variety	Sugar yield (Weighed) (kg/ha)	Sugar yield (Estimated) (kg/ha)	Cane yield (Weighed) (Mt/ha)	Cane yield (Estimated) (Mt/ha)	TRS (g/kg)	Stalk weight (kg)	Stalk population (stalks/ha)	Stalk height (cm)	Stalk diameter (mm)
LCP 85-384	12499 B	15622 A	105.3 B	132.0 A	119 CD	1.27 DE	104454 A	293 C	22.8 AB
HoCP 91-555	13017 B	15297 ABC	106.9 AB	125.7 AB	122 BCD	1.25 DE	100322 AB	299 C	22.0 BC
L 97-105	10283 CD	13502 C	88.3 C	115.2 B	117 D	1.43 AB	81043 CD	312 BC	23.1 AB
L 97-126	9641 DE	11120 D	77.7 D	89.6 C	125 ABC	1.29 CDE	69637 E	298 C	23.1 AB
L 97-128	14414 A	15565 AB	112.5 A	121.9 AB	128 AB	1.42 ABC	86373 C	327 AB	22.8 AB
L 97-129	8667 E	10478 D	71.2 D	86.0 C	122 BCD	1.16 E	74219 DE	304 C	21.0 C
L 97-137	10873 C	13581 BC	100.6 B	125.5 AB	108 E	1.35 BCD	94394 B	295 C	23.8 A
L 97-147	13440 AB	14676 ABC	102.8 B	112.2 B	131 A	1.51 A	74419 DE	336 A	23.7 A

†Means in a column sharing the same letter are not significantly different at P#0.05.

of 8667 kg/ha for L 97-128 and L 97-129, respectively (Table 5). L 97-128 sugar yield was significantly ( $P \leq 0.05$ ) greater than all other clones, except L 97-147. L 97-147 weighed sugar yield was statistically equal to LCP 85-384 and HoCP 91-555.

In 2001, the estimated sugar yield clone ranking was similar to weighed sugar yield clone ranking. LCP85-384, HoCP91-555, L97-128 and L97-147 estimated sugar yield were significantly ( $P \leq 0.05$ ) greater than all other clones (Table 5). L97-129 and L 97-126 were ranked last in estimated sugar yield.

Weighed cane yield varied greatly among clones (Table 5). In 2001, L97-128 had the highest cane yield, 112.5 Mt/ha, and was significantly ( $P \leq 0.05$ ) higher than all other clones, except HoCP 91-555 (106.9 Mt/ha). HoCP 91-555 cane yield was not significantly different than LCP 85-384. The lowest cane yield was obtained from L 97-129 (71.2 Mt/ha).

Estimated cane yield for sugarcane clones ranged from 132.0 Mt/ha (LCP 85-384) to 86.0 Mt/ha (L 97-129) (Table 5). Clonal ranking varied only slightly between estimated and weighed cane yield in 2001.

As expected, TRS differed among clones (Table 5). L 97-147 had a TRS level of 131 g/kg which was significantly ( $P \leq 0.05$ ) higher than all other clones except for L 97-128. L 97-128 TRS level was not significantly ( $P \leq 0.05$ ) different than HoCP 91-555, but it was significantly higher than LCP 85-384. The lowest TRS was 108 g/kg (L 97-137).

Mean stalk weight is a function of stalk height, stalk diameter, and stalk density. Mean stalk weight ranged from 1.16 kg (L 97-129) to 1.51 kg (L 97-147) in 2001 (Table 5). LCP 85-384 and HoCP 91-555 tend to have moderately low mean

stalk weights. The two commercial varieties had the same ranking as L 97-129, which has the lowest mean stalk weight. L 97-147, L 97-105, and L 97-128 had the highest mean stalk weights.

LCP 85-384 had the highest stalk population with 104454 stalks per hectare, and was significantly ( $P \leq 0.05$ ) greater than the other clones, except HoCP 91-555. L 97-137, L 97-105, and L 97-128 had the next highest stalk populations; L 97-147, L 97-129, and L 97-126 had the lowest millable stalk populations.

Stalk height at harvest ranged from 293 cm (LCP 85-384) to 336 cm (L 97-147) for the 2001 planting rate study (Table 5). L 97-147 was statistically taller than all other clones except for L 97-128. Shorter clones were L 97-129, L 97-126, HoCP 91-555, L 97-137, and LCP 85-384.

Stalk diameter varied among clones. L 97-137 had the largest diameter (23.8 mm), but it was only significantly greater than HoCP 91-555 and L 97-129.

The analysis of variance for the 2002 plant cane and first-ratoon crops indicated significant ( $P \leq 0.05$ ) planting rate effects for weighed sugar yield, estimated sugar yield, weighed cane yield, estimated cane yield, and stalk population (Table 6). As expected, all traits were significantly ( $P \leq 0.05$ ) different among clones. The planting rate by clone interaction and the three-way interaction, among crop, planting rate, and clone were nonsignificant. Weighed sugar yield, weighed cane yield, estimated cane yield, and mean stalk weight were significant for the crop by clone interaction, and clone means for these traits were reported by crop. Estimated sugar yield, weighed cane yield, TRS, and mean stalk weight had means

Table 6. Analysis of variance of fixed effects across crops for the experiments involving eight sugarcane clones and three planting rates conducted at St. Gabriel, Louisiana in 2002.

Source	Sugar yield (Weighed)	Sugar yield (Estimated)	Cane yield (Weighed)	Cane yield (Estimated)	TRS	Mean stalk weight	Stalk population
	-----P-value-----						
Crop	0.157	0.524	0.248	0.450	0.414	0.068	0.590
Planting rate	0.010	0.000	0.042	0.001	0.129	0.188	<.0001
Clone	<.0001	<.0001	<.0001	<.0001	0.004	<.0001	<.0001
Crop*planting rate	0.619	0.008	0.829	0.035	0.172	0.230	0.002
Crop*clone	0.001	0.191	0.004	0.039	0.067	0.008	0.607
Planting rate*clone	0.912	0.920	0.810	0.929	0.517	0.803	0.886
Crop*planting rate*clone	0.540	0.500	0.776	0.796	0.536	0.596	0.595
	-----%-----						
CV	18.9	16.3	17.4	15.1	6.9	9.4	13.3

Table 7. Planting rate means averaged across varieties for the plant cane and first-ratoon experiments involving eight varieties and three planting rates conducted at St.Gabriel, Louisiana in 2002.†

Crop	Plant cane			First-ratoon			TRS (g/kg)	Mean stalk weight (kg)	Plant cane		First-ratoon	
	Sugar yield (Weighed) (kg/ha)	Sugar yield (Estimated) (kg/ha)	Cane yield (Weighed) (Mt/ha)	Sugar yield (Estimated) (kg/ha)	Cane yield (Weighed) (Mt/ha)	Cane yield (Estimated) (Mt/ha)			Stalk population (stalks/ha)	Stalk population (stalks/ha)		
2-stalk	8711 B	9789 B	10401 A	69.2 B	79.5 B	80.7 A	126 A	1.00 A	74624 C	87475 A		
3-stalk	9247 AB	11669 A	10697 A	71.7 AB	90.1 A	83.6 A	129 A	0.97 A	88522 B	90446 A		
4-stalk	9824 A	12544 A	10872 A	75.7 A	97.0 A	84.0 A	130 A	0.97 A	95582 A	91565 A		

† Means in a column sharing the same letter are not significantly different at P#0.05.

that were averaged across planting rates. The crop by planting rate interaction was significant ( $P \leq 0.05$ ) for estimated sugar yield, estimated cane yield, and stalk population. These traits had planting rate means that were reported by crop. Estimated sugar yield, TRS, and stalk population had means averaged across varieties due to nonsignificant interactions.

Weighed sugar yield for planting rates ranged from 8711 kg/ha (2 stalk rate) to 9824 kg/ha (4-stalk rate) in the 2002 planting rate studies (Table 7). The 4-stalk planting rate had a significantly greater weighed sugar yield ( $P \leq 0.05$ ) than did the 2-stalk rate. Increasing planting rate from 2- to 3-stalks provided no significant increase in sugar yield. Sugar yield was not significantly different between the 3- and 4-stalk planting rates.

In 2002, weighed cane yield varied from 69.2 Mt/ha (2-stalk rate) to 75.7 Mt/ha (4-stalk rate) (Table 7). Cane yield for the 2-stalk planting rate was significantly ( $P \leq 0.05$ ) lower than the 4-stalk planting rate. No significant increase in cane yield occurred when the planting rate was increased from 2- to 3-stalks or from 3- to 4-stalks.

TRS was not significantly different among planting rates and ranged from 126 g/kg (2-stalk rate) to 130 g/kg (4-stalk rate) (Table 7). Mean stalk weight also was not significantly different among all planting rates for 2002. Mean stalk weight ranged from 1.00 kg to 0.97 kg for the 2-stalk and 3- and 4-stalk planting rate, respectively.

Estimated sugar yield for planting rates in the 2002 plant cane crop was significantly ( $P \leq 0.05$ ) higher for the 3- and 4-stalk rate than the 2-stalk rate (Table 7).

The 3-stalk rate estimated sugar yield did not statistically differ from the 4-stalk rate. Estimated sugar yield ranged from 9789 kg/ha (2-stalk rate) to 12544 kg/ha (4-stalk rate). The first-ratoon crop in 2002 exhibited no statistical differences for estimated sugar yield. The estimated sugar yield varied from 10401 kg/ha (2-stalk rate) to 10872 kg/ha (4-stalk rate).

In 2002, the plant cane crop estimated cane yield varied from 79.5 Mt/ha (2-stalk rate) to 97.0 Mt/ha (4-stalk rate) (Table 7). Estimated cane yield for the 3- and 4-stalk planting rates were significantly ( $P \leq 0.05$ ) higher than the 2-stalk rate. The 3-stalk rate estimated cane yield was not statistically different from the 4-stalk planting rate. However, in 2002, the first-ratoon crop had no statistical differences in estimated cane yield among planting rates. This was likely due to no differences in first-ratoon stalk populations. Estimated cane yield varied from 80.7 Mt/ha (2-stalk rate) to 84.0 Mt/ha (4-stalk rate).

Stalk population for the 2002 plant cane crop ranged from 74624 stalks/ha (2-stalk rate) to 95582 stalks/ha (4-stalk rate) (Table 7). The 4-stalk planting rate stalk population was significantly ( $P \leq 0.05$ ) different than the 2 and 3-stalk planting rate. Stalk population was significantly ( $P \leq 0.05$ ) greater for the 3-stalk planting rate as compared to the 2-stalk planting rate in the plant cane crop. However, the first-ratoon crop showed no statistical differences among all planting rates. Low sugarcane stalk populations tended to compensate in the first-ratoon crops. Stalk population varied from 87475 stalks/ha (2-stalk rate) to 91565 stalks/ha (4-stalk rate) in 2002.

Weighted sugar yield for varieties varied between plant cane and first-ratoon crop. In the 2002 plant cane crop, weighed sugar yield ranged from 5947 kg/ha

Table 8. Sugarcane clonal means averaged across planting rates for the plant cane and first-ratoon experiments involving eight sugarcane clones and three planting rates conducted at St. Gabriel, Louisiana in 2002 †

Crop	Plant cane		First-ratoon		Plant cane		First-ratoon		Plant cane		First-ratoon	
	Sugar yield (Weighed) (kg/ha)	Sugar yield (Estimated) (kg/ha)	Cane yield (Weighed) (Mt/ha)	Cane yield (Estimated) (Mt/ha)	TRS (g/kg)	Mean stalk weight (kg)	Stalk population (stalks/ha)					
LCP 85-384	9803 AB	10152 BC	12828 A	76.8 AB	77.5 BCD	96.8 A	101.0 A	129 BC	0.95 C	0.95 B	104281 AB	
HoCP91-555	9486 AB	11182 B	11705 AB	77.7 AB	85.8 B	103.9 A	82.9 BC	126 BC	0.96 C	0.83 C	104879 A	
L 97-105	5947 D	9144 C	10539 B	45.5 D	70.8 CD	78.6 BC	83.6 BC	130 AB	0.97 C	0.93 B	85427 C	
L 97-126	7607 CD	7413 D	8928 C	59.4 C	58.0 EF	73.5 BC	65.9 DE	128 BC	1.02 BC	0.84 C	76036 D	
L 97-128	10748 AB	13115 A	12834 A	85.6 A	99.5 A	104.2 A	95.7 AB	129 BC	1.25 A	1.11 A	85452 C	
L 97-129	7663 CD	6864 D	8242 C	60.5 C	56.0 F	72.1 C	59.8 E	125 BC	0.95 C	0.77 C	77607 D	
L 97-137	11079 A	9549 C	12094 A	86.5 A	80.0 BC	96.8 A	98.6 A	124 C	1.06 B	0.98 B	96933 B	
L 97-147	9013 BC	9402 C	10793 B	68.1 BC	67.9 DE	84.9 B	74.6 CD	136 A	1.19 A	0.98 B	73670 D	

† Means in a column sharing the same letter are not significantly different at P#0.05.

(L 97-105) to 11079 kg/ha (L 97-137) in the planting rate study (Table 8). L 97-128, LCP 85-384, and HoCP 91-555 had weighed sugar yields similar to L 97-137. L 97-105, L 97-126, and L 97-129 had the lowest weighed sugar yield for the plant cane crop. The first-ratoon crop weighed sugar yield varied from 6864kg/ha (L97-129) to 13115 kg/ha (L97-128). Weighed sugar yield numerically increased in first-ratoon as compared to plant cane for LCP 85-384, HoCP 91-555, L 97-105, L 97-128, and L 97-147.

Estimated sugar yield for varieties varied from 8242 kg/ha (L 97-129) to 12834 kg/ha for (L 97-128) in 2002 (Table 8). LCP 85-384, HoCP 91-555, L 97-128, and L 97-137 had statistically higher sugar yields than the other clones.

The plant cane crop ranged in weighed cane yield ranged from 45.5 Mt/ha to 86.5 Mt/ha for L 97-105 and L 97-137, respectively (Table 8). Weighed cane yield paralleled weighed sugar yield varietal rankings in the 2002 crop. L 97-128, LCP 85-384, and HoCP 91-555 weighed cane yields were the same as L 97-137. The overall cane yield for the first-ratoon crop as compared to the plant cane crop was numerically greater for all clones except L 97-126, L 97-129, and L 97-137. L 97-128 yielded 99.5 Mt/ha and was significantly ( $P \leq 0.05$ ) higher yielding than all other clones. In the first-ratoon crop, the lowest weighed cane yields were obtained from L 97-129 (56.0 Mt/ha) and L 97-126 (58.0 Mt/ha).

L 97-147 had a significantly higher TRS than all other clones with the exception of L 97-105 (Table 8). TRS for clones ranged from 124 g/kg for L97-137 to 136 g/kg for L97-147. The lack of variation in TRS for 2002 may be due to the late harvest date.

The highest stalk population, averaged across planting rates, of any clone in 2002 was HoCP 91-555 with a stalk population of 104879 stalks/ha (Table 8). HoCP 91-555 had a significantly ( $P \leq 0.05$ ) higher stalk population than all other clones except for LCP 85-384 (104281 stalks/ha). L 97-147, L 97-129, and L 97-126 had the lowest stalk populations in 2002.

Mean stalk weight was numerically higher for all clones in the plant cane crop compared to the first-ratoon crop, except for LCP 85-384, where it was numerically equal (Table 8). Mean stalk weight ranged from 1.25 kg (L 97-128) to 0.95 kg (LCP 85-384 and L 97-129) for the plant cane crop and 1.11 kg (L 97-128) to 0.84 (L 97-129) for the first-ratoon crop in 2002.

Sugar yield and cane yield were both weighed and estimated for the 2001 and 2002 experiments. Coefficient of variation (CV %) was used to measure the amount of data variability. CV is defined by Freund and Wilson (1993) as “the ratio of standard deviation to the mean, expressed in percentage terms.” Thus, a smaller CV indicates less variability in the data. In 2001, the experiment was erect when harvested. In contrast, the 2002 sugarcane crop was severely lodged due to Hurricane Lily and Tropical storm Isidore. The CV for weighed sugar yield in 2001 was 10.0 % as compared to 15.4 % for estimated sugar yield. In 2001, weighed and estimated cane yield CV's followed the same trend as sugar yield. The CV for weighed cane yield in 2001 was 7.6 % as compared to 13.4 % for estimated cane yield. In 2002, there was a trend for lower CV values for estimated sugar yield and estimated cane yield. The CV for weighed sugar yield in 2002 was 18.8 % as compared to 16.3 %

for estimated sugar yield. The CV for weighed cane yield in 2002 was 17.4 % as compared to 15.1 % for estimated cane yield.

In plant cane 2001, first-ratoon 2002, and plant cane 2002, weighed sugar yield was highly significant ( $P < 0.01$ ) and positively correlated with estimated sugar yield (Table 9). The Pearson correlation coefficients for the three crops were  $r = 0.755$ ,  $r = 0.568$ , and  $r = 0.594$ , respectively. Weighed sugar yield was highly significant and positively correlated with weighed cane yield. Correlation coefficients for the three sugarcane crops were  $r = 0.912$ ,  $r = 0.943$ , and  $r = 0.963$ , respectively. Weighed sugar yield was highly significant and positively correlated with estimated cane yield. The correlation coefficients for the three crops were  $r = 0.572$ ,  $r = 0.480$ , and  $r = 0.558$ , respectively. Weighed sugar yield and TRS were highly significant or not significant depending on crop. The 2001 plant cane and 2002 first-ratoon-crops Pearson correlation coefficients were highly significant and positive,  $r = 0.505$  and  $0.354$ , respectively. Although significant, these correlation coefficients only indicated a weak association. However, the 2002 plant cane crop correlation coefficient was nonsignificant ( $P > 0.05$ ). The 2002 first-ratoon crop weighed sugar yield and mean stalk weight correlation coefficient was highly significant and  $r = 0.410$ ; however, the magnitude was low. The 2001 plant cane and 2002 plant cane crops correlation coefficients were not significant for weighed sugar yield and mean stalk weight. Weighed sugar yield was highly significant and positively correlated with stalk population. The correlation coefficients for the three crops were  $r = 0.522$ ,  $r = 0.311$ , and  $r = 0.461$ , respectively. Again, the magnitude indicated only a weak association.

Table 9. Pearson correlation coefficients among sugarcane yield and yield components for the 2001 plant cane, 2002 first-ratoon, and 2002 plant cane experiments conducted at St.Gabriel, Louisiana.

	Sugar yield (Estimated)		Cane yield (Weighed)		Cane yield (Estimated)		TRS		Mean stalk weight		Stalk population	
Sugar yield (Weighed)	0.755†	**	0.912	**	0.572	**	0.505	**	0.134	NS	0.522	**
	0.568	**	0.943	**	0.480	**	0.354	**	0.410	**	0.311	**
	0.594	**	0.963	**	0.558	**	0.183	NS	0.154	NS	0.461	**
Sugar yield (Estimated)			0.726	**	0.912	**	0.329	**	0.425	**	0.644	**
			0.515	**	0.945	**	0.277	*	0.686	**	0.634	**
			0.528	**	0.954	**	0.283	*	0.220	NS	0.790	**
Cane yield (Weighed)					0.713	**	0.110	NS	0.094	NS	0.701	**
					0.536	**	0.029	NS	0.396	**	0.400	**
					0.572	**	-0.086	NS	0.150	NS	0.475	**
Cane yield (Estimated)							-0.082	NS	0.388	**	0.761	**
							-0.046	NS	0.668	**	0.722	**
							-0.012	NS	0.220	NS	0.832	**
TRS									0.148	NS	-0.190	NS
									0.167	NS	-0.203	NS
									0.056	NS	-0.039	NS
Mean stalk weight											-0.293	**
											-0.019	NS
											-0.350	**

† Upper values are for the 2001 plant cane experiment; middle values are for the 2002 first-ratoon experiment; lower values are for the 2002 plantcane experiment.

\*, \*\*Denotes statistical significance at the P#0.05 and P#0.01 level, respectively. N = 72.

Pearson correlation coefficients for estimated sugar yield and weighed cane yield were highly significant and positively correlated for all three crops (Table 9). The correlations were  $r = 0.726$  (2001 plant cane),  $r = 0.515$  (2002 first-ratoon), and  $r = 0.528$  (2001 plant cane). Estimated sugar yield and estimated cane yield Pearson correlation coefficients were highly significant and positively correlated for all crops. The correlation coefficients for the three crops were  $r = 0.912$ ,  $r = 0.945$ , and  $r = 0.954$ , respectively. Correlation coefficients for estimated sugar yield and TRS were highly significant for the 2001 plant cane crop ( $r = 0.329$ ) and significant for the 2002 crops ( $r = 0.277$  and  $r = 0.283$ , respectively). These correlation coefficients indicate a weak association. Estimated sugar yield and mean stalk weight correlation coefficients were highly significant for 2001 plant cane and 2002 first-ratoon crops, but not significant for the 2002 plant cane crop. Positive relationship between estimated sugar yield and mean stalk weight were  $r = 0.425$  and  $r = 0.686$  for the 2001 plant cane and 2002 first-ratoon crop, respectively. Correlation coefficients for estimated sugar yield and stalk population were highly significant and positively correlated for all crops. The correlation coefficients for the three crops were  $r = 0.644$ ,  $r = 0.634$ , and  $r = 0.790$ , respectively.

The weighed cane yield and estimated cane yield Pearson correlation coefficients for the three crops were highly significant and positively correlated (Table 9). The correlation coefficients for weighed and estimated cane yield were  $r = 0.713$  (2001 plant cane),  $r = 0.536$  (2002 first-ratoon) and  $r = 0.572$  (2002 plant cane). There were no significant correlation coefficients for weighed cane yield and, TRS regardless of crop. The correlation coefficient between weighed cane yield and stalk

number was highly significant and positively correlated in the 2002 first-ratoon crop ( $r = 0.396$ ), but the 2001 and 2002 plant cane crops correlations were not significant. Again, this association was considered weak, at best. In all three crops, the weighed cane yield and stalk population was highly significant and positively correlated. The correlation coefficients between weighed cane yield and stalk population were  $r = 0.701$ ,  $r = 0.400$ , and  $r = 0.475$ , respectively.

Estimated cane yield and TRS Pearson correlation coefficients were nonsignificant ( $P \neq 0.05$ ) for all three crops (Table 9). In the 2001 plant cane ( $r = 0.388$ ) and 2002 ( $r = 0.668$ ) first-ratoon crop, highly significant correlation coefficients for estimated cane yield and mean stalk weight were observed, but the 2002 plant cane crop correlation coefficient was nonsignificant. All three crops correlation coefficients for estimated cane yield and stalk population were highly significant and positively correlated. The correlation coefficients for estimated cane yield and stalk population were  $r = 0.761$ ,  $r = 0.722$ , and  $r = 0.832$ , respectively.

Pearson correlation coefficients between TRS and mean stalk weight for all three crops were nonsignificant (Table 9). TRS and stalk population correlation also were nonsignificant.

A highly significant negative correlation was observed between mean stalk weight and stalk population in each plant cane crop (Table 9). Mean stalk weight and stalk population correlation coefficients were  $r = -0.293$  (2001 plant cane) and  $r = -0.350$  (2002 plant cane).

Table 10. Analysis of variance of fixed effects for the germination tests involving eight sugarcane clones conducted at St. Gabriel, Louisiana in 2002.

Source	Stalk height	Buds per Meter	Buds per stalk	Emergence	Percent germination	Mean stalk weight
	-----P-value-----					
Soil type	0.286	0.947	0.505	0.486	0.482	0.116
Variety	<.0001	<.0001	<.0001	0.002	0.082	<.0001
Soil type*variety	0.313	0.743	0.930	0.808	0.949	0.489
	-----%-----					
CV	3.1	5.7	6.3	22.4	23.7	9.5

## **Bud-germination Study**

The analysis of variance for the 2002 bud-germination study indicated significant ( $P \leq 0.05$ ) variety effects for mean stalk weight, stalk height, buds per meter, buds per stalk, and percent emergence (Table 10). Soil type and soil type by variety interactions were nonsignificant for all traits. Due to the nonsignificant soil type by variety interaction traits were averaged across soil types.

As expected, varietal characteristics for the eight clones influenced clonal parameter performance. Mean stalk weight at planting ranged from 0.71 kg (L 97-105, L 97-126, HoCP 91-555) to 0.97 kg (L 97-128) in 2002 (Table 11). L 97-128 had a significantly ( $P \leq 0.05$ ) heavier mean stalk weight than all other varieties at planting in 2002.

At planting, L 97-128 (207 cm) and L 97-147 (205 cm) were significantly ( $P \leq 0.05$ ) taller than all other clones (Table 11). The next tallest group of clones consisted of LCP 85-384, HoCP 91-555, L 97-105, and L 97-129. The shortest clone at planting was L 97-126 (149 cm). Bud number per meter of sugarcane varied from 4.8 buds/m (L 97-126) to 6.4 buds/m (L 97-129). L 97-129 has significantly ( $P \leq 0.05$ ) more buds per meter than all other cultivars, except LCP 85-384 and L 97-137.

Buds per stalk is a function of stalk height and buds per meter of stalk. Buds per stalk ranged from 8.9 buds (L 97-105 and L 97-126) buds to 11.7 buds (L 97-128) (Table 11). L 97-128, L 97-129, and L 97-147 had significantly ( $P \leq 0.05$ ) more buds per stalk than all other varieties, except LCP 85-384.

Shoot emergence was significantly ( $P \leq 0.05$ ) higher for LCP 85-384 (Table 11). Emergence ranged from 14.0 shoots per plot (L 97-105) to 27.8 shoots per plot

Table 11. Sugarcane clonal means averaged across soil types for the bud germination experiments conducted at St. Gabriel, Louisiana in 2002.†

Variety	Mean stalk weight (kg)	Stalk height (cm)	Buds per meter (No./m)	Buds per stalk (No.)	Emergence (No./plot)	Percent germination (%)
LCP 85-384	0.79 BC	188 B	5.9 ABC	11.2 AB	27.8 A	41.4 A
HoCP 91-555	0.71 C	185 B	5.3 D	9.7 C	23.5 ABC	40.4 A
L 97-105	0.71 C	184 B	4.8 E	8.9 D	14.0 D	26.2 A
L 97-126	0.71 C	149 D	6.0 BC	8.9 D	18.3 CD	34.8 A
L 97-128	0.97 A	207 A	5.6 CD	11.7 A	22.0 BC	31.4 A
L 97-129	0.75 C	182 B	6.4 A	11.6 A	24.5 AB	35.4 A
L 97-137	0.76 C	173 C	6.1 AB	10.5 B	21.2 BC	33.9 A
L 97-147	0.86 B	205 A	5.6 CD	11.5 A	23.5 ABC	34.2 A

† Means in a column sharing the same letter are not significantly different at P#0.05.

(LCP 85-384). LCP 85-384, HoCP 91-555, L 97-129 and L 97-147 shoot emergence per plot were not different.

Percent germination was not statistically significant (Table 11). However, LCP85-384 and HoCP 91-555 had the numerically highest bud germination percentages at 41.4% and 40.4%, respectively. Germination percentage varied from 26.2% (L 97-105) to 41.4% (LCP 85-384).

Pearson correlation coefficients were averaged across soil types due to no statistical significance for the main effect. The correlation coefficient for stalk height and buds per meter was not significant ( $P \geq 0.05$ ) for the bud germination experiment in 2002 (Table 12). Stalk height and buds per stalk correlation coefficient was highly significant and positively correlated. The correlation coefficient for stalk height and buds per meter was  $r = 0.641$  in 2002. Correlation coefficients were not significant for stalk height and emergence or for stalk height and percent germination. The correlation coefficient for stalk height and mean stalk weight was highly significant ( $P \leq 0.05$ ) and positively correlated bud test. The correlation coefficient for stalk height and mean stalk weight was  $r = 0.677$  in 2002.

Buds per meter was highly significant and positively correlated with buds per stalk and its Pearson correlation coefficient was  $r = 0.595$  (Table 12). The correlation coefficient for buds per meter and emergence was significant and positively correlated ( $r = 0.316$ ) in 2002. Although significant these correlation coefficients indicated a weak association. Both buds per meter and percent germination and buds per meter and mean stalk weight correlation coefficients were not significantly correlated.

Table 12. Pearson correlation coefficients among sugarcane germination traits for the 2002 experiments averaged across soil types at St.Gabriel, Louisiana.†

	Buds per meter	Buds per stalk	Emergence	Percent germination	Mean stalk weight
Stalk Height	-0.234 NS	0.641 **	0.229 NS	-0.067 NS	0.667 **
Buds per Meter		0.595 **	0.316 *	0.087 NS	0.124 NS
Buds per Stalk			0.446 **	0.022 NS	0.645 **
emergence				0.897 **	0.199 NS
Percent germination					-0.078 NS

† N = 24.

\*, \*\*Denotes statistical significance at the P#0.05 and P#0.01 level, respectively.

Buds per stalk and Pearson emergence correlation coefficient was highly significantly correlated at  $r = 0.446$ ; however, the magnitude was low (Table 12). The correlation coefficient for buds per stalk and percent germination was not significantly correlated in 2002. Buds per stalk and mean stalk weight correlation coefficient was highly significant and positively correlated. The correlation coefficient for buds per stalk and mean stalk weight was  $r = 0.645$ .

Emergence and percent germination was highly correlated 2002 bud germination test. Its Pearson correlation coefficients was  $r = 0.897$ . Pearson correlation coefficients for emergence and mean stalk weight were not significantly correlated in 2002. Percent germination and mean stalk weight correlation coefficient was not significant in 2002.

## SUMMARY

### **Planting Rate**

In 2001 and 2002, studies were conducted at the LSU AgCenter's Sugar Research Station in St. Gabriel, Louisiana to determine the effect of planting rate on sugarcane clone trial data and interpretation. Six experimental clones and two commercial varieties were planted at 2-, 3-, and 4-stalk rates.

Mixed model analysis for the 2001 plant cane crop indicated no statistical significance for the planting rate by clone interaction for all traits measured. A nonsignificant interaction indicates that clonal ranking did not change due to planting rate. This was verified by large and highly significant Spearman correlation coefficients.

In regard to planting rate, maximum sugar yield (weighed), cane yield (weighed), and stalk population were achieved at the 3- and 4-stalk planting rates. The highest mean stalk weight was produced at the 2-stalk planting rate indicating a compensatory relationship between mean stalk weight and stalk population. TRS was not affected by planting rate. A large range of significant differences were observed for individual clonal characteristics, which was expected.

In 2002, the planting rate by clone interaction also was nonsignificant. Again, a nonsignificant interaction indicates that clonal ranking did not change due to planting rate. The crop and planting rate by clone interaction was also nonsignificant indicating that the planting rate by clone interaction was not crop dependent. Again, this was verified by large and highly significant Spearman correlation coefficients.

Maximum sugar yield (weighed) and cane yield (weighed) were obtained at the 4-stalk planting rate. Crop affected millable stalk population. The four-stalk planting rate had the highest stalk population of all planting rate treatments in the plant cane crop. However, the difference was not seen in the first-ratoon crop.

Sugar yield and cane yield were both weighed and estimated for 2001 and 2002. One Hurricane (Lily) and one Tropical storm (Isidore) occurred in 2002, causing the sugarcane crop to severely lodge. The coefficient of variation (CV) was lower for estimated sugar yields and estimated cane yields in 2002 compared to weighed sugar yields and weighed cane yields. In 2001, the CV was lower for weighed yields, as one may expect with more erect crop conditions. These results indicate that estimated yields are more precise when sugarcane is severely lodged and harvested under muddy conditions.

Again, the clone by planting rate interaction was not significant. Therefore, planting yield trials at a 2-stalk rate did not bias clone data. Clonal ranking among planting rates was significant ( $P \leq 0.05$ ) and positively correlated for sugar yield and cane yield, regardless of year.

### **Bud Germination**

In 2002, studies were conducted on Sharky clay and Commerce silt loam soils to determine clonal characteristics affecting germination of buds in sugarcane variety trials. Clonal germination was similar for both soil types. The Pearson correlation coefficients indicated taller stalks also had a more buds per stalk than did shorter stalks. Mean stalk weight was greater for taller varieties. Mean stalk weight tended to increase as the number of buds increased on a stalk.

## REFERENCES CITED

- Breaux, R.D.** (1973). Selecting commercial sugarcane varieties from large seedling and clonal populations. *Proc. American Soc. Sugar Cane Technol.*, 2(NS):58-66.
- Bull, T.A. and J. K. Bull.** (2000). High density planting as an economic production strategy: (b) theory and trial results. *Proc. Aust. Soc. Sugar Cane Technol.*, 22: 104-112.
- Croft, B J.** (1998). Improving the germination of sugarcane and the control of pineapple disease. *Proc. Aust. Soc. Sugar Cane Technol.*, 20: 300-306.
- Diaz, J.C., F. Gonzalez-Tellez, L. Perez, H. Guevara, and R. Zuaznabar.** (1996) Effects of seedcane treatment with ethephon on germination, population, and yields of sugarcane. *Proc of Int. Soc. Sugar Cane Technol.*, 2:70-73.
- Dunckelman, P.H. and B.L. Legendre.** (1982). Guide to sugarcane breeding in the temperate zone. Agricultural Research Service, Agricultural Reviews and Manuals, Southern Series, No. 22:1-26.
- Gravois, K.A.** (1988). Path-coefficient analysis: Phenotypic, broad sense and narrow sense variation in sugarcane. Ph.D. diss. Louisiana State Univ., Baton Rouge (Diss. Abstr. 89-17818).
- Gravois, K.A., S.B. Milligan, and F.A. Martin.** (1991). Indirect selection for increased sucrose yield in early sugarcane testing stages. *Field Crops Research.*, 26:67-73
- Hebert, L.P., R.J. Matherne, and L.G. Davidson.** (1965). Row spacing experiments with sugar cane in Louisiana. *Proc. International Soc. Sugar Cane Technol.*, 12:96-102.
- Legendre, B.L. and K.A. Gravois.** (2003). The 2002 Louisiana sugarcane variety survey. *The Sugar Bulletin.*, 81(No.9). In press.
- Lengendre, B.L.** (2001). Sugarcane production handbook – 2001. Louisiana State University Agricultural Center. Pub.2859.
- Manjit, S.K., P. Tai, and J. Miller.** (1991). Genetic and phenotypic path analyses in sugarcane: Artificially created relationships. *Crop Science.*, 31:1684-1686.
- Matherne, R.J.** (1972). Influence of interrow spacing and planting rate on stalk population and cane yield in Louisiana. *Proc. International Soc. Sugar Cane Technol.*, 12:640-645.

- Matherne, R.J. and J.E Irvine.** (1978). The influence of row spacing on sugarcane stalk population, sugar content and cane yield. Proc. American Soc. Sugar Cane Technol., 7(NS):96-100.
- Milligan, S.B., K.A. Gravois, K.P. Bischoff, and F.A. Martin.** (1990). Crop effects on genetic relationships among sugarcane traits. Crop Science., 30:927-931.
- Ricaud, R. and A. Arceaneaux.** (2000). Cultural and land management practice research in sugarcane in 1999. Louisiana State University Agricultural Center 2000 Annual Sugarcane Report. 124-135.
- Rice, E. R.** (1981). Effects of planting rates on yield of sugarcane in Florida. Proc. American Soc. Sugar Cane Technol., 8(NS):53-53.
- Ridge, D. R. and A.P. Hurney.** (1994) A review of row spacing research in the Australian sugar industry. Proc. Aust. Soc. Sugar Cane Technol., 16: 63-69.
- Roach B.T.** (1976). Observations on the effect of row spacing on sugar cane yield. Proc. Qd. Soc. Sugar Cane Technol., 95-101.
- Thompson, G.D. and J.L. du Toit.** (1965). The effect of row spacing on sugarcane crop in Natal. Proc. International Soc. Sugar Cane Technol., 12:103-112.

## VITA

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