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Evaluation of New Canal Point Sugarcane Clones

2010–2011 Harvest Season

Abstract

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Thirty replicated experiments were conducted on 10 farms (representing 4 muck and 2 sand soils) to evaluate 36 new Canal Point (CP) and 37 new Canal Point and Clewiston (CPCL) clones of sugarcane from the CP 06, CP 05, CP 04, CP 03, CPCL 06, CPCL 05, CPCL 02, CPCL 01, CPCL 00, and CPCL 95 series. Experiments compared the cane and sugar yields of the new clones, complex hybrids of *Saccharum* spp., primarily with yields of CP 89-2143 on muck soils and with CP 78-1628 on sand soils, and to a lesser extent, with CP 72-2086 on both soil types. All three reference clones were major sugarcane cultivars in Florida. Each clone was also tested for its tolerance to diseases, freezing temperatures, and its fiber content. Based on results of these and previous years' tests, CPCL 02-0926 and CPCL 02-1295 were released for commercial production on muck and sand soils, CPCL 00-4411 and CPCL 95-2287 were released for muck soils only, and CP 03-1912, CP 04-1566, CP 04-1844, and CP 04-1935 were released for commercial production on sand soils in Florida. In addition, after further testing, CP 05-1526 and CPCL 02-6848 were released for muck and sand soils, CPCL 05-1102 and CPCL 05-1201 were released for muck soils only, and CPCL 05-1791 was released for sand soils only.

The audience for this publication includes growers, agricultural researchers, extension agents, and individuals who are interested in sugarcane cultivar development.

Keywords: Brown rust, histosol, muck soil, orange rust, organic soil, *Puccinia kuehnii*, *Puccinia melanocephala, Saccharum* spp., *Sporisorium scitaminea,* sugarcane cultivars, sugarcane smut, sugarcane yields, sucrose yields, sugar yields.

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While supplies last, single copies of this publication can be obtained at no cost from Barry Glaz, USDA-ARS-SAA, U.S. Sugarcane Field Station, 12990 U.S. Highway 441 N, Canal Point, FL 33438; or by e-mail at Barry.Glaz@ars.usda.gov.

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Abbreviations

ARS	Agricultural Research Service
CP	Canal Point
CPCL	Canal Point and Clewiston
CV	Coefficient of variation
KS/T	Theoretical recoverable yield of 96° sucrose in kilogram per metric ton of cane
LSD	Least significant difference
NIRS	Near infrared reflectance spectroscopy
TC/H	Cane yields in metric tons per hectare
TS/H	Theoretical yields of 96° sucrose in metric tons per hectare
USSC	United States Sugar Corporation

Contents

Evaluation of New Canal Point Sugarcane Clones

2010-2011 Harvest Season

B. Glaz, S. Sood, S.J. Edmé, R.W. Davidson, J.C. Comstock, D. Zhao, N.C. Glynn, and R.A. Gilbert

Breeding and selection for clones that can be used for commercial production of sugarcane, complex hybrids of *Saccharum* spp., support the continued success of this crop in Florida. Though production of sucrose per unit area is a principal selection trait, it is not the only factor on which sugarcane is evaluated. In addition, analyses are made on the contents of sucrose and fiber of the cane. The economic value of each clone integrates its harvesting, transportation, and milling costs with its expected returns from sucrose production. Deren et al. (1995) developed an economic index for clonal evaluation in Florida. Evaluation of clonal suitability also includes its reactions to endemic pathogens.

This report summarizes the cane production and sucrose yields of the clones in the plant-cane, first-ratoon, and second-ratoon stage 4 experiments sampled in Florida's 2010–2011 sugarcane harvest season. This information is used to identify commercial cultivars in Florida and identify clones with useful characteristics for the Canal Point sugarcane breeding and selection program. The information is also used by representatives of other sugarcane research programs and industries to request Canal Point clones. Throughout this report, the term "clone" or "genotype" refers to a genetically unique sugarcane entry in the Canal Point sugarcane breeding and selection program. The term "sugarcane cultivar" refers to any genotype that was released for commercial production.

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The time of year and the duration that a clone yields its highest quantity of sucrose per unit area are important because the Florida sugarcane harvest season extends from October to April. Because sugarcane is commercially grown in plant and ratoon crops, clones are evaluated accordingly. Adaptability to mechanical harvesters is an important trait in Florida. All sugarcane sent to Florida mills and much of the sugarcane used for planting is mechanically harvested. Before a new clone is released, Florida growers judge its acceptability for mechanical operations.

Genotypes with desired agronomic characteristics also must be productive in the presence of harmful diseases, insects, and weeds. Some pathogens rapidly develop new, virulent races or strains. Because of these changes in pathogen populations, clonal resistance is not considered permanent. The selection team at Canal Point uses some genotypes as parents that are superior for agronomic traits but too susceptible to pests to be grown commercially, but does not advance these genotypes in its selection program.

Two rust fungi in Florida have infected a large number of genotypes in the Canal Point program. From 2000 to 2005, this program discarded 15 clones that were within 1 year of commercial release due to new infections of brown rust, caused by *Puccinia melanocephala* Syd & P. Syd. During the summer of 2007, orange rust, caused by *Puccinia kuehnii* E.J. Butler, was detected and infected commercial sugarcane fields in Florida (Comstock et al. 2008). Since 2007, the selection team at Canal Point has been applying increasingly stricter selection criteria against both rust fungi. This includes the use of *Bru1*, a major gene for brown rust resistance (Asnaghi et al. 2004 and Daugrois et al. 1996) as a consideration for genotype advancement in the breeding program. The methods used to detect *Bru1* are described in Glynn et al. (2012). This is the first reported use of marker-assisted selection in sugarcane. Therefore, fewer clones than had previously advanced to stage 4 are susceptible to brown or orange rust. Although the percentages of clones susceptible to either of the rust fungi began declining with clones of the CP 03 and CPCL 00 series advanced to stage 4 in 2009, there are still substantial improvements needed in this regard.

The pathogen against which this program has had its most success in selecting resistant cultivars is sugarcane smut, caused by *Sporisorium scitaminea* (Syd.) M. Piepenbring, M. Stoll, & F. Oberwinkler. Other diseases the Canal Point program must contend with are leaf scald, caused by *Xanthomonas albilineans* (Ashby) Dow; sugarcane mosaic strain E; and sugarcane yellow leaf virus, a disease caused by a luteovirus (Lockhart et al. 1996). Flynn et al. (2005) suggested that losses in sucrose yield due to sugarcane yellow leaf virus were as high as 8 percent in Florida. Dean and Davis (1990) reported that ratoon stunt caused by *Leifsonia xyli* subsp. *xyli* Evtsuhenko et al. caused sucrose yield losses of 5 percent in Florida. More recently, Comstock (2008) reported that ratoon-stunting infections in the plant-cane and first-ratoon crops reduced stalk number, cane yield, and sucrose yield. Reductions were not always significant when compared with healthy plants, but trends were consistent. A program proposed by Comstock et al. (2001) is used at Canal Point to improve resistance of clones to ratoon stunting. In addition to improved resistance, growers can also minimize yield losses by planting stalks that do not contain the bacteria that cause ratoon stunting. This can be accomplished either by planting stalks that have been treated with hot-water therapy that kills the ratoon-stunting pathogen or by using disease-free stalks derived from meristem tissue culture.

In addition to brown rust, orange rust, smut, sugarcane yellow leaf virus, and ratoon stunting, scientists at Canal Point also screen genotypes in their selection program for resistance to leaf scald, mosaic, and eye spot caused by *Bipolaris sacchari* (E.J. Butler) Shoemaker. Eye spot is not currently a commercial problem in Florida.

Recently, growers in Florida have begun applying fungicides to control orange rust. Otherwise, growers in Florida rely on cultivar resistance to sugarcane diseases. However, it is increasingly difficult to develop high-yielding cultivars that are resistant to all diseases, so growers are also accepting some new cultivars with tolerance, rather than resistance, to some sugarcane diseases. In the 2009 growing season, nine cultivars comprised 81.8 percent of Florida's sugarcane (Rice et al. 2011). Eight of these cultivars—CP 72-2086 (Miller et al. 1984), CP 78-1628 (Tai et al. 1991), CP 80-1743 (Deren et al. 1991), CP 84-1198 (Glaz et al. 1994), CP 88-1762 (Tai et al. 1997), CP 89-2143 (Glaz et al. 2000), CP 89-2376 (Glaz et al. 2005), and CP 96-1252 (Edmé, Tai et al. 2005)—were at least moderately susceptible to one or more of the following sugarcane diseases: brown rust, orange rust, mosaic, leaf scald, smut, and ratoon stunting. Glaz et al. (1986) presented a mathematical model and procedure to help growers distribute their available sugarcane cultivars while considering possible attacks of new pests.

Damaging insects in Florida are the sugarcane borer, *Diatraea saccharalis* (F.); the sugarcane lace bug, *Leptodictya tabida;* the sugarcane wireworm, *Melanotus communis*; the sugarcane grub, *Ligyrus subtropicus;* and the West Indian cane weevil, *Metamasius hemipterus* (L.).

Winter freezes are common in Florida where much of the sugarcane is produced. The severity and duration of a freeze and the tolerance of specific sugarcane cultivars are the major factors that determine how much damage occurs. The damage caused by such freezes ranges from no damage to death of the mature sugarcane plant. The rate of deterioration of juice quality after a freeze depends on cultivar tolerance and the ambient air temperature: Warmer post-freeze temperatures result in more rapid deterioration of juice quality. Freezes also damage young sugarcane plants. Stalk populations may decline after severe freezes kill aboveground parts of recently emerged plants. The most severe damage occurs when the growing point is frozen, which is more likely if the plant has emerged from the soil. Tai and Miller (1996) reported that fiber content was not significantly correlated with resistance to a light freeze (1.7 ^{o}C to -2.8 ^{o}C) but was significantly correlated with resistance to a moderate freeze (-5.0 ^{o}C).

The United States Sugar Corporation (USSC), based in Clewiston, Florida, discontinued its breeding program in 2004. Approximately the top 25 percent of clones in all selection stages from the USSC program were donated to the Canal Point program. While in the USSC program, these clones were designated with a CL (Clewiston) prefix. After they were donated to the CP selection program, each of these clones retained its original USSC number designation, but the prefix of each donated clone was changed from CL to CPCL (Canal Point and Clewiston).

Edm*é* and Miller et al. (2005) found that the CP program has been responsible for substantial sugarcane yield improvements in Florida. However, these yield improvements occurred on the muck soils on which sugarcane is grown in Florida (about 80 percent of Florida's sugarcane) and not on the 20 percent of Florida's sugarcane that is grown on sand soils. Based on this finding, there have been some major changes to the CP genotype selection program. The CP program adapted the recommendation of Glaz and Kang (2008) to drop one location with a muck soil from stage 4 and add one location with a sand soil. More fundamentally, the program has now divided into two separate programs, one that still selects for muck and sand soils and a second program that selects clones only for sand soils. In the next report of this series, we expect to report on clones that were developed in the two separate programs.

In the program that selects sugarcane genotypes for muck and sand soils (appendix 1), about 75,000 seedlings are evaluated each year at Canal Point. These seedlings are the progeny of crosses derived from a diverse germplasm collection. However, based on a pedigree analysis, Deren (1995) suggested that the genetic base of U.S. sugarcane breeding programs was too narrow. About 80 percent of the genome in commercial sugarcane is *Saccharum officinarum*. This year, in the crosses made for Florida, 76.0 percent of the female parents and 89.6 percent of the male parents originated from the Canal Point breeding program, while most of the remainder were developed by USSC (13.6 percent of the female parents were CL or CPCL clones and 8.1 percent of the male parents were CL or CPCL clones). Additional parents not adapted to Florida originated from Louisiana or Texas breeding programs as well as from programs outside the United States.

The seedling stage planted in 2011 at Canal Point contained approximately 75,000 new clones that originated from true seeds planted first in the greenhouse and later transplanted to the field. Once selected as seedlings, clones are vegetatively propagated. Because of this vegetative propagation, from this stage (seedling stage) on in the selection program, each plant (clone) is genetically identical to its precursor, assuming no mutations. The stage 1 trial planted in January 2011 contained 12,161 new genotypes. The stage 2 trial (of mostly CP 11 genotypes) planted in November 2011 at Canal Point had 1,552 new clones. There were 135 new clones in stage 3 of the CP 10 series that were tested in replicated experiments on 4 grower farms. Seedling, stage 1, and stage 2 tests were evaluated for 1 year in the plant-cane crop at Canal Point. Selection is visual in the seedling phase. In stage 1, the first selection process is visual. A hand-punched sample of juice is then taken from the clones that are selected visually and analyzed for Brix. Heavy emphasis is placed on these Brix values and disease resistance for the final selection. The primary selection criteria for stage 2 and all subsequent stages are sucrose yield (in metric tons of sucrose per hectare), theoretical recoverable sucrose, cane tonnage, and disease resistance. For several years, ratings for susceptibility to brown and orange rust have been made throughout the summer in stages 3 and 4, and during 2012, ratings for these diseases were made in June and July in stages 1 and 2 for the first time.

The stage 3 genotypes are evaluated for 2 years: 1 year in the plant-cane crop followed by 1 year in the first-ratoon crops. The stage 3 clones are grown on three muck soils and one sand soil. Using data from the muck locations separately and the sand location separately, the 13 most promising clones are advanced for 4 more years of testing in the stage 4 experiments where they are planted in successive years and evaluated in the plant-cane, first-ratoon, and second-ratoon crops. Usually between six and eight genotypes are advanced to all stage 4 tests, and the remainder are advanced independently to stage 4 tests on either muck or sand soil. Genotypes that successfully complete these experimental phases undergo 2 to 4 years of evaluation and expansion by the Florida Sugar Cane League, Inc., before commercial release. The League's evaluation and expansion generally occurs concurrently with the stage 4 evaluations.

There is now a separate Florida sugarcane cultivar selection program for sand soils (sand program) which complements the traditional program conducted for muck and sand soils. In the sand program, about 10,000 seedlings were planted on the sand soil at Townsite in 2011. While we are waiting to advance these clones, we also planted approximately 500 clones in a stage 2 test at Townsite in 2011. These clones were all the clones from the CP 10 stage 2 test planted at Canal Point in November 2010 that were not advanced to stage 3 or dropped due to disease susceptibility. A similar stage 2 test with mostly CP 09 clones was planted at Townsite in 2010, and 135 clones from this test were selected and planted in stage 3 at Townsite in November 2011. These clones will eventually go to stage 4 at Townsite, but this year at Townsite, a new stage 4 test was planted with 13 new genotypes from the CP 06 and 07 series that had been previously selected through stage 2 and 3 tests at Townsite. The framework of a new sand-only selection program for sugarcane cultivars in Florida is now in place at Townsite. If we find that sufficient seed cane is available from the seedlings to go directly to stage 2, then this sand-only program will not have a stage equivalent to stage 1 of the traditional muck-sand program. Clones with characteristics that may be valuable for sugarcane breeding programs are identified throughout the selection process. Even though the Canal Point program breeds and selects sugarcane in Florida, some CP clones have been productive commercial cultivars in Texas and outside of the United States. An example of the potential adaptability of Canal Point genotypes is CP 88-1165 (Juárez et al. 2008). CP 88-1165 was not selected for commercial use in Florida but scientists in Guatemala requested it for testing from Canal Point and later selected it for commercial use in Guatemala. Sugarcane geneticists in other programs often request clones from Canal Point. From May 2010 to April 2011, clones or seeds from the Canal Point program were requested from and sent to Argentina, Australia, Bahamas, China, Costa Rica, Egypt, El Salvador, France, Guatemala, Honduras, Mexico, Nicaragua, Pakistan, Panama, Philippines, and Tanzania.

Test Procedures

In 30 experiments, 72 new CP and CPCL clones (36 CP clones and 36 CPCL clones) were evaluated. Ten clones of the CP 06 series and three clones of the CPCL 06 series were evaluated at five farms with muck soils in the plant-cane crop. Eleven clones of the CP 06 series and two clones of the CPCL 06 series were evaluated at three locations with sand soils in the plant-cane crop. Eight of these clones—CP 06-2042, CP 06-2335, CP 06-2400, CP 06-2664, CP 06-2874, CP 06-2897, CPCL 06-3272, and CPCL 06-3432—were evaluated at all eight locations (muck and sand soils). The clones evaluated only at locations with muck soils were CP 06-2164, CP 06-2170, CP 06-2713, CP 04-3040, and CPCL 06-3332. The clones evaluated only at locations with sand soils were CP 06-2274, CP 06-2317, CP 06-2397, CP 06-3025, and CP 06-3098. Three clones of the CP 05 series, six clones of the CPCL 02 series, and four clones of the CPCL 05 series were evaluated at two farms with muck soils in the plant-cane crop and at five farms with muck soils in the first-ratoon crop. Three clones of the CP 05 series, seven clones of the CPCL 02 series, and three clones of the CPCL 05 series were evaluated at three locations with sand soils in the first-ratoon crop. Seven of these clones—CP 05-1526, CP 05-1740, CPCL 02-6848, CPCL 02-7610, CPCL 02-8001, CPCL 05-1201, and CPCL 05-1791—were evaluated at all 10 locations (muck and sand soils). The clones evaluated only at the seven locations with muck soils were CP 05-1466, CPCL 02-6225, CPCL 02-7190, CPCL 02-8071, CPCL 05-1102, and CPCL 05-1300. The clones evaluated only at locations with sand soils were CP 05-1679, CPCL 02-7080, CPCL 02-7386, CPCL 02-7500, CPCL 02-8072, and CPCL 05-1009.

Five clones of the CP 04 series, seven clones of the CPCL 02 series, and one clone of the CPCL 95 series were evaluated at two farms with muck soils in the first-ratoon crop and at five farms with muck soils in the second-ratoon crop. Eight clones of the CP 04 series and five clones of the CPCL 02 series were evaluated at three farms with sand soils in the second-ratoon crop. Eight clones—CP 04-1252, CP 04-1321, CP 04-1619, CPCL 02-0843, CPCL 02-0908, CPCL 02-0926, CPCL 02-1295, and CPCL 02-2913—were evaluated at all 10 locations (muck and sand soils). The five clones that were evaluated on muck soils only were CP 04-1367, CP 04-1426, CPCL 95-2287, CPCL 02-2273, and CPCL 02-2975; and the five clones that were evaluated on sand soils only were CP 04-1258, CP 04-1374, CP 04-1566, CP 04-1844, and CP 04-1935. Three clones of the CP 03 series, eight clones of the CPCL 00 series, and two clones of the CPCL 01 series were evaluated at two farms with muck soils in the second-ratoon crop.

Cultivar CP 89-2143 was the primary reference clone on muck soils, and cultivar CP 78-1628 was the primary reference cultivar on sand soils. In 2010, CP 89-2143 was the second most widely grown cultivar in Florida and CP 78-1628 the most widely grown cultivar on sand soils in Florida (Rice et al. 2011). CP 72-2086 was sometimes used as a reference clone for sucrose content measured as kg sucrose per ton of cane (KS/T). CP 72-2086 was the seventh most widely grown cultivar in Florida in 2010 (Rice et al. 2011).

Agronomic practices, such as fertilization, pest control, water management, and cultivation, were carried out by the farmer or farm manager responsible for the field in which each experiment was planted.

The plant-cane and second-ratoon experiments at A. Duda and Sons, Inc. (Duda), southeast of Belle Glade, five experiments (both plant-cane and first-ratoon experiments and the second-ratoon experiment planted in the successive rotation) planted in at Okeelanta Corporation (Okeelanta) south of South Bay, the two ratoon experiments at Sugar Farms Cooperative North—SFI Region S05 (SFI) near 20-Mile Bend in Palm Beach County, and the plant-cane and second-ratoon experiments at Knight Management, Inc. (Knight) southwest of 20-Mile Bend were conducted on Dania muck soil. As described by Rice et al. (2002), Dania muck is the shallowest of the histosols (organic soils) comprised primarily of decomposed sawgrass (*Cladium jamaicense* Crantz) in the Everglades Agricultural Area. The maximum depth to the bedrock of Dania muck is 51 cm. The other organic soils similar to Dania muck are Lauderhill muck (51 to 91 cm depth to bedrock), Pahokee muck (91 to 130 cm to bedrock), and Terra Ceia muck (more than 130 cm to bedrock).

The plant-cane experiments at Wedgworth Farms, Inc. (Wedgworth) east of Belle Glade and SFI, the first-ratoon experiments at Knight and Duda, and the second-ratoon experiments at Okeelanta (not in the successive rotation) and Wedgworth were conducted on Lauderhill muck. The first-ratoon experiment at Wedgworth was the only experiment conducted on Pahokee muck, and there were no experiments conducted on Torry muck this year.

The three experiments at Eastgate Farms, Inc. (Eastgate) north of Belle Glade were conducted on Torry muck. The three experiments at Hilliard Brothers of Florida, Ltd. (Hilliard) west of Clewiston were on Margate sand. All three experiments at Lykes Brothers, Inc. (Lykes) near Moore Haven in Glades County were on Pompano fine sand, and the plant-cane and first-ratoon experiments at United States Sugar Corporation—Townsite (Townsite) were on Margate sand.

At Okeelanta, clones of the CP 05, CPCL 02, and CPCL 05 series in the plant-cane crop, CP 04, CPCL 95, and CPCL 02 series in the first-ratoon crop, and the CP 03, CPCL 00, and

CPCL 01 series in the second-ratoon experiment were planted on fields in successive sugarcane rotations. In this rotation in Florida, a new crop of sugarcane is planted within about 2 months of the previous sugarcane harvest, a practice that increases the number of harvests per year but decreases cane yields per hectare by about 20 percent in the plant-cane crop and 8 percent in the first-ratoon crop (Glaz and Ulloa 1995). All other experiments were planted in fields that had not been cropped to sugarcane for approximately 1 year. In all experiments, plots were arranged in randomized-complete-block designs with six replications.

In all experiments of CP and CPCL clones, plots had three rows, a border row, and two inside rows used for yield determination. These two rows were 10.7 meters (m) long and 3.0 m wide (0.0032 hectare (ha)). The distance between rows was l.5 m on all soils, and 1.5-m alleys separated the front and back ends of the plots on muck soils and these alleys were 1.8 m on sand soils. The outside row of each plot was a border row and it was usually planted with the same genotype as the two adjacent rows. All rows of all plots were planted with two lines of stalks unless seed cane was not sufficient. When there was not enough seed cane of a genotype at a given location, then some or all border rows were planted with one line of stalks. Experiments were two clones (6 rows) wide, and each replication was 16 plots long. An extra 1.5 m of sugarcane protected each row at the front and back of each test.

Preharvest samples of 10 stalks were cut from 2 replications of all plant-cane experiments between October 12 and October 15, 2010. Throughout the harvest season, samples of 10 stalks were cut from unburned cane from a middle row of each plot in each experiment between September 27, 2010, and February 2, 2011. Once a stool of sugarcane was chosen for cutting, the next 10 stalks in the row were cut as the 10-stalk sample. The range of sample dates for each crop was as follows:

Plant-cane crop	January 3, 2010 to February 2, 2011
First-ratoon crop	October 29, 2010 to January 26, 2011
Second-ratoon crop	September 27, 2009 to October 22, 2011

After each stalk sample was transported to the USDA-Agricultural Research Service (ARS) Sugarcane Field Station at Canal Point, FL, for weighing and milling, crusher juice from the milled stalks was analyzed for commercial recoverable yield of 96^{o} sucrose, in kilogram (kg) per metric ton of cane, (kg sucrose per ton of cane: KS/T) which was determined as a measure of sucrose content. The KS/T of juice extracted from milled sugarcane is calculated with a formula that uses measurements of the juice Brix (soluble solids) and optical rotation (Arceneaux 1935). Brix is read by a hydrometer and is measured as gram per kilogram (g kg^{-1}), and the optical rotation is read on a polarimeter and is measured as ^{o}Z (International Sugar Scale). The fiber percentage of each clone was used to calculate commercial recoverable sucrose and referred to in this report as KS/T (Legendre 1992). The values of theoretical recoverable yield determined by the Legendre (1992) method were multiplied by 0.86 to estimate the commercial recoverable yield in a Florida sugarcane mill. Brix and optical rotation were usually estimated by near infrared reflectance spectroscopy (NIRS); Brix and optical rotation were measured for samples with unacceptable NIRS calibrations by refractometer and polarimeter, respectively.

Using 3-stalk samples collected from border rows, an average of 11, 17, 14, 16, 12, 16, 14, 14, and 16 fiber samples were calculated for the clones of the CP 03, CP 04, CP 05, CP 06, CPCL 95, CPCL 00, CPCL 01, CPCL 02, CPCL 05, and CPCL 06 series, respectively. Leaves were stripped from these stalks, which were then processed through a Jeffco1 cutter-grinder (Jeffries Brothers, Ltd., Brisbane Queensland, Australia). About 400 g of material (bagasse) processed through the cutter-grinder were collected and weighed. Juice was extracted from the bagasse by pressing it at 138 million pascals (Mpa) for 30 seconds. Brix of the juice was measured by refractometer. The pressed bagasse was then weighed, crumbled, placed in paper bags, and dried at 60 °C until it reached a constant weight. Fiber percentage was then measured as described by Tanimoto (1964). All fiber percentages calculated on a given day were corrected to the historical fiber percentage of the reference clone.

Total millable stalks per plot were counted between June 8 and September 15, 2010. Cane yields, in metric tons per hectare (tons cane per hectare: TC/H), were calculated by multiplying stalk weights by number of stalks. Theoretical yields of sucrose (in metric tons per hectare: TS/H) were calculated by multiplying TC/H by KS/T and dividing by 1,000.

To assess freeze tolerance, stage 4 clones were subjected to freezing temperatures in three field experiments established at the Hague Farm of the Florida Institute of Food and Agricultural Sciences, University of Florida, in Hague, near Gainesville, FL. Air temperatures usually go down to -8 °C at the testing site during winter months, which exposes the clones to harsher freeze temperatures than normally found in south Florida. Clones of the CP 03, CP 04, CPCL 00, CPCL 01, CPCL 02, and CPCL 95 series were planted on February 25, 2009, as randomized-complete-block experiments with four replications in single-row plots 2.4 m long and 3.0 m apart. Plots had 2.4 m breaks between replications, and clones were compared with three reference cultivars—CP 72-2086, CP 78-1628, and CP 89-2143. Five-stalk samples were collected from the first-ratoon crop (CP 04, CPCL 95, and CPCL 02 series) on December 10 and 17, 2010, and on January 10 and 27, 2011. Samples were collected from the CP 05, CP 06, CPCL 05, and CPCL 06 series in the plant-cane crop on November 9 and 30, 2011, January 6 and 25, 2012, and February 9, 2012. Freeze-tolerance rankings for all three experiments were based on KS/T declines of clones across sampling dates. The final rating for each clone, on a scale of 1-5, was based on a comparison of its KS/T values with those of CP 89-2143. CP 89-2143 was rated as 4, with ratings of 5 and 3 denoting excellent and good freeze tolerance, respectively. In addition, actual KS/T values were considered in the ratings. Thus, a clone could have the highest rate of decline (an indication of poor freeze tolerance) and still have a good ranking for freeze tolerance if its KS/T started high and remained high.

Prior to their advancement to stage 4, CP clones were evaluated in separate tests by artificial inoculation for susceptibility to sugarcane smut, sugarcane mosaic virus, leaf scald, and ratoon stunting. CP clones were inoculated in stage 2 plots to determine eye spot susceptibility. Since being advanced to stage 4, separate artificial-inoculation tests were repeated on clones for smut, ratoon stunting, mosaic, and leaf scald. Each clone was also field rated for its emergence, early plant height, tillering, and shading, as well as for its reactions to natural infection by sugarcane smut, sugarcane brown rust, sugarcane orange rust, sugarcane mosaic virus, and leaf scald in stage 4.

Statistical analyses of the stage 4 experiments were based on a mixed model using SAS software (SAS version 9.2, 2008; SAS Institute, Inc., Cary, NC) with clones as fixed effects and locations and replications as random effects. Least squares means were calculated for clones. Means of locations were estimated by empirical best linear unbiased predictors. Significant differences were sought at the 10-percent probability level. Differences among clones were tested by the least significant difference (*LSD),* which was used regardless of significance of F-ratios to protect against high type-II error rates (Glaz and Dean 1988). The SAS estimation of the mean square error used for separating clone means was the error term used to calculate this *LSD*. Clones that had significantly higher yields than the reference clone were also identified by individual t tests calculated by SAS. Although location was a random effect, values of *LSD* were also calculated to approximate significant differences among locations using the mean square error of replications within locations as the error term.

Results and Discussion

Table 1 lists the parents; increase status; percentage of fiber; and reactions to smut, brown rust, orange rust, leaf scald, mosaic, and ratoon stunting for each clone included in these experiments. Tables 2-5 contain the results of clones from the CP 06 and CPCL 06 series in plant-cane experiments at locations with muck soils, and tables 6-7 contain the results for plant-cane experiments of clones from these series at locations with sand soils. Tables 8-9 contain the results of plant-cane experiments of clones from the CP 05, CPCL 02, and CPCL 05 series, and tables 10-12 and tables 13-14 contain results of clones from these three series in first-ratoon experiments on muck and sand soils, respectively. Table 15 contains the results of the CP 04, CPCL 95, and CPCL 02 first-ratoon experiments, tables 16-18 contain the results of clones from these three series in second-ratoon experiments on muck soils, and tables 19-20 contain results of clones from these three series in second-ratoon experiments on sand soils. Table 21 contains the results of the CP 03, CPCL 00, and CPCL 01 from the final two second-ratoon experiments for this group of clones. Table 22 gives freeze-tolerance ratings for clones of the CP 03, CP 04, CP 05, CP 06, CPCL 95, CPCL 00, CPCL 01, CPCL 02, CPCL 05, and CPCL 06 series. Table 23 gives the dates that stalks were counted in each experiment.

Plant-Cane Crop, CP 06 and CPCL 06 Series on Muck Soils

When averaged across all five locations, five new clones—CP 06-2400, CP 06-2874, CP 06-2042, CP 06-2897, and CP 06-2335—yielded significantly more TC/H (metric tons of cane per hectare) and TS/H (metric tons of sucrose per hectare) than CP 89-2143 (tables 2 and 5). No new clone had a mean KS/T (theoretical recoverable yield of 96^{o} sucrose in kg per metric ton of cane) value significantly higher than that of CP 89-2143 (table 4). However, CP 06-2897 had a significantly higher KS/T value than CP 89-2143 at Knight, and the overall mean preharvest KS/T of CP 06-2335 was significantly higher than that of CP 89-2143 (table 3). The overall mean preharvest and harvest KS/T values of all five high-yielding new clones did not differ from those of CP 89-2143 except that both the harvest and preharvest KS/T values of CP 06-2400 were significantly lower than those of CP 89-2143 (tables 3 and 4). However, the overall mean TC/H of CP 06-2400 was not only significantly higher than that of CP 89-2143, it was also significantly higher than that of any other clone in the test (table 2).

Sugarcane in Florida is propagated by planting stem sections (referred to as seed cane) from which axillary buds emerge. In 2011, the Florida Sugar Cane League, Inc., began increasing seed cane of CP 06-2042, CP 06-2335, and CP 06-2874 at all stage 4 locations and began increasing seed cane of CP 06-2400 and CP 06-2713 at the five stage 4 locations with muck soils. In 2012, increases of CP 06-2042 and CP 06-2335 were discontinued due to their susceptibility to orange rust and leaf scald (table 1).

The TC/H yield of CP 06-2713 was significantly higher than that of CP 89-2143 (table 2) and its TS/H yield was almost significantly higher than that of CP 89-2143 (table 5). Although the preharvest KS/T values of CP 89-2143 and CP 06-2713 were similar (table 3), the overall mean harvest KS/T value of CP 06-2713 was significantly less than that of CP 89-2143 (table 4). CP 06-2897 had high yields, but it is not being increased due to its susceptibility to smut and mosaic (table 1).

As the Florida Sugar Cane League, Inc., continues increasing seed cane of these clones, more disease testing will be conducted. Currently, we are concerned about the susceptible rating of CP 06-2874 to mosaic. The fiber contents of CP 06-2042, CP 06-2335, CP 06-2400, CP 06-2713, and CP 06-2874, were 10.96, 8.98, 10.24, 10.13, and 10.13 percent, respectively. These are within acceptable ranges for Florida. CP 06-2042, CP 06-2335, CP 06-2713, and CP 06-2874 had moderately less freeze tolerance than CP 89-2134 (table 22). CP 06-2400 had freeze tolerance similar to that of CP 89-2143, and CP 06-2897 had poor freeze tolerance. Interesting parents of these high-yielding genotypes were cultivars CP 96-1252 (Edmé, Tai, et al. 2005), which was a parent of CP 06-2042; CP 94-1100 (Tai et al. 2004), which was a parent of CP 06-2400; CP 84-1591 (Shine et al. 1996), which was a parent of CP 06-2713 and CP 06-2897; and CP 84-1198 (Glaz et al. 1994), which was a parent of CP 06-2874.

Plant-Cane Crop, CP 06 and CPCL 06 Series on Sand Soils

When averaged across all three locations with sand soils, CP 06-2897 yielded significantly more TC/H, preharvest KS/T, and TS/H than CP 78-1628 (tables 6 and 7). In addition, CP 06-2335 had significantly higher harvest and preharvest KS/T yields than CP 78-1628 in these tests on sand soils (table 6). However, CP 06-2335, which yielded significantly more TC/H than CP 89-2143 on muck soils (table 2), nearly had significantly lower TC/H than CP 78-1628 on sand soils (table 7). As noted previously, the Florida Sugar Cane League, Inc., is not increasing seed cane of CP 06-2335 and CP 06-2897 due to concerns about leaf scald and mosaic, respectively (table 1).

One other clone—CP 06-2874—is being increased by the Florida Sugar Cane League, Inc., for potential release on muck and sand soils (table 1). This genotype did not differ significantly from CP 78-1628 in harvest KS/T, TC/H, or TS/H (tables 6 and 7). The fiber content of CP 06-2874 was 10.13 percent, and it was susceptible to mosaic (table 1). CP 06-2874 would be expected to deteriorate moderately more rapidly than CP 89-2143 after exposure to a freeze (table 22).

Plant-Cane Crop, CP 05, CPCL 02, and CPCL 05 Series on Muck Soils

Glaz et al. (2011) reported results from five locations with muck soils and three locations with sand soils of the CP 05, CPCL 05, and CPCL 02 series plant-cane crop. This year, plant-cane results for these clones are available from Eastgate and the successively planted test at Okeelanta (tables 8 and 9). Averaged across these two locations, no new genotype had significantly higher mean yields of preharvest or harvest KST, TC/H, or TS/H than CP 89-2143 (tables 8 and 9). Based on data from previous years, CP 05-1526, CPCL 05-1201, CPCL 05-1791, CPCL 02-6848, and CPCL 05-1102 have been released in Florida. Generally, their cane and sucrose yields were similar to those of CP 89-2143 at these two locations with muck soils this year, except that the harvest KS/T values of CP 05-1526 and CPCL 05-1791 were significantly less than the harvest KS/T of CP 89-2143 (table 8).

First-Ratoon Crop, CP 05, CPCL 02, and CPCL 05 Series on Muck Soils

When averaged across all five farms with muck soils in the first-ratoon crop, no new clone yielded significantly more TS/H than CP 89-2143 (table 12). As stated in the previous section, CPCL 05-1201, CPCL 05-1791, CPCL 02-6848, CPCL 05-1102, and CP 05-1526 have been released for commercial production in Florida (table 1). CPCL 05-1201 and CPCL 02-6848 had significantly higher yields of TC/H than CP 89-2143 (table 10). Otherwise, all of these genotypes had similar yields of KS/T, TC/H, and TS/H as CP 89-2143, except that CP 05-1526 had significantly lower KS/T than CP 89-2143 (table 11).

CPCL 05-1102 and CPCL 00-1201 have no major disease concerns (table 1). CPCL 02-6848 is susceptible to orange rust, and its reaction to leaf scald is undetermined. The reaction of CP 05-1526 to orange rust is undetermined. The reactions of CPCL 05-1791 to brown rust and leaf scald are undetermined. The fiber contents of all of these cultivars are greater than 10 percent. The fiber contents of CPCL 02-6848 (13.05 percent) and CPCL 05-1791 (12.28 percent) are unusually high, followed by the moderately high fiber content of CP 05-1526 (11.52 percent) and the more acceptable fiber contents of CPCL 05-1201 (10.26 percent) and CPCL 05-1102 (10.17 percent). CPCL 05-1102, CPCL 05-1201 and CP 89-2143 had similar freeze tolerance ratings (table 22). The freeze tolerance of CP 06-1526 was moderately worse than that of CP 89-2143, and the freeze tolerance ratings of CPCL 05-1791 and CPCL 02-6848 were worse than the rating of CP 06-1526.

First-Ratoon Crop, CP 05, CPCL 02, and CPCL 05 Series on Sand Soils

Four clones in this group—CPCL 05-1791, CPCL 02-7500, CPCL 05-1201, and CP 05-1526—had significantly higher mean yields of TC/H and TS/H than CP 78-1628 (table 14). Also, the mean KS/T and TS/H yields of CPCL 02-6848 were significantly higher than those of CP 78-1628 (tables 13 and 14). These genotypes had high TC/H yields at all three sand locations except CPCL 02-6848, which had average TC/H yields at Lykes, and the TC/H yield of CPCL 05-1201 at Hilliard was significantly less than that of CP 78-1628 (table 14). As plant cane, CPCL 05-1791, CP 05-1526, and CPCL 02-6848 had similarly high yields on sand soils, whereas CPCL 05-1201 and CPCL 02-7500 had mediocre yields (Glaz et al. 2011).

CP 05-1526 and CPCL 02-6848 have been released for all soils in Florida, CPCL 05-1791 has been released for sand soils, and CPCL 05-1201 has been released for muck soils in Florida (table 1). There are no major disease concerns for CPCL 05-1201, and CPCL 02-6848 is susceptible to orange rust (table 1). We are concerned about the reactions of CPCL 02-6848 and CPCL 05-1791 to leaf scald, the reaction of CPCL 05-1791 to brown rust, and the reaction of CP 05-1526 to orange rust. The fiber contents of CP 05-1526 and CPCL 05-1201 were 11.52 and 10.28 percent, respectively. The fiber contents of CPCL 02-6848 (13.05 percent) and CPCL 05-1791 (12.28 percent) were higher than is normally considered acceptable in Florida. As stated in the previous section, CPCL 05-1201 and CP 89-2143 had similar freeze-tolerance ratings, whereas the freeze tolerance of CP 05-1526 was rated moderately lower than that of CP 89-2143, and the freeze-tolerance ratings of CPCL 05-1791 and CPCL 02-6848 were lower than the rating of CP 05-1526 (table 22).

First-Ratoon Crop, CP 04, CPCL 02, and CPCL 95 Series on Muck Soils

The most recent report in this series contained information for the CP 04, CPCL 95, and CPCL 02 clones in the first-ratoon crop at five locations with muck soils and three locations with sand soils, and in the plant-cane crop at Eastgate and Okeelanta (Glaz et al. 2011). In addition, Glaz et al. (2010) reported on results of these clones from the plant-cane crop on muck and sand soils. This year, in the combined yields of the first-ratoon crop at Okeelanta and Eastgate, no new clone yielded more TC/H or TS/H or significantly more KS/T than CP 78-1628 (table 15). In addition, no new genotype had significantly higher yields in any of these categories than CP 89-2143.

Second-Ratoon Crop, CP 04, CPCL 02, and CPCL 95 Series on Muck Soils

Plant-cane yields of these clones were first reported by Glaz et al. (2010). The following year, Glaz et al. (2011) reported on plant-cane yields at two additional muck locations and first-ratoon yields of these clones on muck and sand soils. This year, as second ratoon at five locations with muck soils, no new clone had significantly greater TC/H or TS/H than CP 89-2143 (tables 16 and 18). CP 04-1321, a new genotype that has not had high yields in other years, had significantly more KS/T than CP 89-2143 (table 17).

CPCL 02-0926, CPCL 95-2287, and CPCL 02-1295 have been released for commercial production (table 1). This year in second ratoon on muck soils, CPCL 02-0926 had significantly more TC/H than CPCL 02-1295 (table 16), and CPCL 02-0926 and CPCL 95-2287 yielded significantly more TS/H and KS/T than CPCL 02-1295 (tables 17 and 18). CPCL 95-2287 did not have any major disease concerns (table 1). The susceptibility of CPCL 02-0926 to mosaic was undetermined, and CPCL 02-1295 was susceptible to leaf scald. The fiber content of CPCL 02-0926 (10.44 percent) was well within the acceptable range in Florida. However, the fiber contents of CPCL 95-2287 (11.30 percent) and CPCL 02-1295 (11.45 percent) were at the upper levels of acceptability for Florida. CPCL 02-0926 and CPCL 02-1295 had similar tolerance to freezing temperatures as CP 89-2143 (table 2). The freeze tolerance of CPCL 95-2287 has not been determined.

Second-Ratoon Crop, CP 04, CPCL 02, and CPCL 95 Series on Sand Soils

These clones were planted at three locations with sand soils and were first reported on as plant-cane yields by Glaz et al. (2010) and the following year as first ratoon (Glaz et al. 2011). As second ratoon, CP 04-1844 and CP 04-1935 yielded significantly more TS/H than CP 78-1628 (table 20). The mean TC/H yield of CP 04-1844 was also significantly greater than that of CP 78-1628, and CP 04-1844 yielded significantly more TC/H than CP 78-1628 at each of the three locations. However, CP 04-1844 had significantly less KS/T than CP 78-1628 at Hilliard (table 19). The TC/H yields of CP 04-1935 and CP 78-1628 were similar (table 20). However, the mean KS/T of CP 04-1935 was significantly greater than that of CP 78-1628 (table 19). Also, the KS/T values of CP 04-1935 at Lykes and Hilliard were significantly greater than those of CP 78-1628. Both CP 04-1844 and CP 04-1935 have been released for commercial production on sand soils in Florida (table 1). The fiber contents of CP 04-1844 and CP 04-1935 were 9.95 and 10.57 percent, respectively. The only disease concern for these two cultivars was that CP 04-1844 was susceptible to leaf scald. CP 04-1844 had better freeze tolerance than CP 89-2143, and the freeze tolerance ratings of CP 04-1935 and CP 89-2143 were similar (table 22).

CP 04-1566 was also released for sand soils, but its TS/H, TC/H, and KS/T yields were mediocre as second ratoon (tables 1, 19, and 20). Similarly, CPCL 02-1295 and CPCL 02-0926 were released for muck and sand soils, but their yields were mediocre as second ratoon at the three locations with sand soils this year. The percentage fiber contents of CP 04-1566, CPCL 02-1295, and CPCL 02-0926 were 9.73, 11.30, and 10.44, respectively (table 1). There were no disease concerns for CP 04-1566, but CPCL 02-1295 was susceptible to leaf scald and there were concerns regarding mosaic susceptibility for CPCL 02-0926. All three of these new cultivars and CP 89-2143 had similar ratings for freeze tolerance (table 22).

Second-Ratoon Crop, CP 03, CPCL 00, and CPCL 01 Series on Muck Soils

When combined across Okeelanta and Eastgate in the second-ratoon crop, no new clone had significantly greater TC/H, KS/T, or TS/H than CP 89-2143 (table 21).

In December 2010, CPCL 00-4111 (Glynn et al. 2011) was released for commercial production in Florida (table 1). Based on yields of the previous 3 years, CPCL 00-4111 was recommended for all soil types (Glaz et al. 2009, 2010, 2011). In its final year of testing in stage 4 as second ratoon this year, CPCL 00-4111 and CP 89-2143 had similar yields of TC/H, KS/T, and TS/H (table 21). CPCL 00-4111 was susceptible to ratoon stunting; otherwise this new cultivar had no disease concerns (table 1). The fiber content of CPCL 00-4111 was 11.23 percent. CPCL 00-4111 and CP 89-2143 had similar reactions to freezing temperatures (Glaz et al. 2011).

Summary

This is the fourth report in this long series in which clones in the plant-cane tests were advanced to stage 4 muck and sand locations independently. There were eight genotypes common to all tests on muck and sand soils of the CP 06 and CPCL 06 series reported on for the first time this year in stage 4. These tests had five additional genotypes planted on muck soils and five other genotypes planted on sand soils. For genotypes in this report for the second year from the CP 05, CPCL 02, and CPCL 05 series, seven genotypes were common to all tests, and there were eight genotypes in common from the CP 05, CPCL 95, and CPCL 02 series as well as the CP 03 and CPCL 00 series.

Clones from the CP 06 and CPCL 06 series were tested in the plant-cane crop at five locations with muck soils and at three locations with sand soils. Plantings of seed cane of CP 06-2874 is being expanded on both muck and sand soils by the Florida Sugar Cane League, Inc., for potential commercial release in Florida. In addition, plantings of CP 06-2400 and CP 06-2713 are being expanded on muck soils only. No genotype from this group is being expanded for potential release on sand soils only. Except for CP 06-2874, which is susceptible to mosaic, none of these promising clones has been rated as susceptible to any of the major sugarcane diseases prevalent in Florida.

Summaries of clone performance from the CP 05, CPCL 02, and CPCL 05 series were reported from plant-cane tests at two locations with muck soils and from first-ratoon tests at five locations with muck soils and three locations with sand soils. CP 05-1526 and CPCL 02-6848 have been jointly released by the USDA-ARS, the University of Florida, and the Florida Sugar Cane League, Inc., for muck and sand soils; CPCL 05-1102 and CPCL 05-1201 have been released for muck soils only; and CPCL 05-1791 has been released for sand soils only in Florida. CPCL 05-1101 and CPCL 05-1201 are not susceptible to any major disease of sugarcane prevalent in Florida. There are concerns that CP 05-1526 may soon become susceptible to orange rust and that CPCL 05-1791 may soon become susceptible to brown rust and leaf scald. CPCL 02-6848 is susceptible to orange rust, and there is concern that it may become susceptible to leaf scald.

Clones from the CP 04, CPCL 02, and CPCL 95 series were summarized based on tests in the plant-cane crop at two locations with muck soils in 1 year, and at five locations with muck soils and three locations with sand soils the prior year. Yields from these clones are also reported from the first-ratoon crop at two locations with muck soils and at eight locations (five with muck soils and three with sand soils); and in this report, from tests in the second-ratoon crop at five locations with muck soils and three locations with sand soils. CPCL 02-0926 and CPCL 02-1295 were released for muck and sand soils; CPCL 95-2287 was released for muck soils only; and CP 04-1566, CP 04-1844, and CP 04-1935 were released for sand soils only. There are no disease concerns with CP 04-1566, CP 04-1935, and CPCL 95-2287. CPCL 02-0926 is not susceptible to any of the major diseases, but there is concern regarding its resistance to mosaic. CPCL 02-1295 and CP 04-1844 are resistant to all major sugarcane diseases except leaf scald.

Stage 4 testing of the CP 03, CPCL 00, and CPCL 01 series was completed this year with two second-ratoon experiments on muck soil. Previous testing of these clones included 2 years and 10 locations as plant cane, 2 years and 10 locations as first ratoon, and 7 locations as second ratoon. The USDA-ARS, the University of Florida, and the Florida Sugar Cane League, Inc., jointly released CPCL 00-4111 for commercial production on muck soils in Florida and CP 03-1912 (Gilbert et al. 2011) for commercial production on sand soils in Florida. CPCL 00-4111 had consistently high KS/T yields across years and locations; its yields of TC/H and TS/H were high in the plant-cane and first-ratoon crop cycles, but were mediocre in the second-ratoon crop. The only disease concern of CPCL 00-4111 is its susceptibility to ratoon stunting. CP 03-1912 had consistently high yields of TC/H and TS/H with acceptable yields of KS/T at the two sand locations on which it was tested from the plant-cane through the second-ratoon crop cycle. There are no major disease concerns with CP 03-1912. This clone was not tested on muck soils in stage 4 due to concerns with broken tops related to its vigorous growth on those soils.

References

Arceneaux, G. 1935. A simplified method of making theoretical sugar yield calculations in accordance with the Winter-Carp-Geerligs formula. International Sugar Journal 37:264-265.

Asnaghi C., D. Roques, S. Ruffel, et al. 2004. Targeted mapping of a sugarcane rust resistance gene (Bru1) using bulked segregant analysis and AFLP markers. Theoretical and Applied Genetics 108:759-764.

Comstock, J. 2008. Sugarcane yield losses due to ratoon stunt. Journal of American Society of Sugar Cane Technologists 28:22-31.

Comstock, J.C., J.M. Shine, Jr., P.Y.P. Tai, and J.D. Miller. 2001. Breeding for ratoon-stunting disease resistance: Is it both possible and effective? *In* International Society of Sugar Cane Technologists: Proceedings of the XXIV Congress, vol. 2, September 17-21, 2001, pp. 471-476. Brisbane, Australia.

Comstock, J.C., S.G. Sood, N.C. Glynn, et al. 2008. First report of *Puccinia kuehnii*, causal agent of orange rust of sugarcane, in the United States and in the Western Hemisphere. Plant Disease 92:175.

Daugrois J., L. Grivet, D. Roques, et al. 1996. A putative major gene for rust resistance linked with a RFLP marker in sugarcane cultivar 'R570'. Theoretical and Applied Genetics 92:1059-1064.

Dean, J.L., and M.J. Davis. 1990. Losses caused by ratoon-stunting disease of sugarcane in Florida. Journal of American Society of Sugar Cane Technologists 10:66-78.

Deren, C.W. 1995. Genetic base of U.S. mainland sugarcane. Crop Science 35:1195-1199.

Deren, C.W., J. Alvarez, and B. Glaz. 1995. Use of economic criteria for selecting clones in a sugarcane breeding program. Proceedings of the International Society of Sugar Cane Technologists 21:2, March 5-14, 1992, pp. 437-447. Bangkok, Thailand.

Deren, C.W., B. Glaz, P.Y.P. Tai, et al. 1991. Registration of 'CP 80-1743' sugarcane. Crop Science 31:235-236.

Edmé, S.J., J.D. Miller, B. Glaz, et al. 2005. Genetic contributions to yield gains in the Florida sugarcane industry across 33 years. Crop Science 45:92-97.

Edmé, S.J., P.Y.P. Tai, B. Glaz, et al. 2005. Registration of 'CP 96-1252' sugarcane. Crop Science 45:423.

Flynn, J., G. Powell, R. Perdomo, et al. 2005. Comparison of sugarcane disease incidence and yield of field-run, heat-treated, and tissue-culture-based seedcane. Journal of American Society of Sugar Cane Technologists 25:88-100.

Gilbert, R.A., J.C. Comstock, B. Glaz, et al. 2011. Registration of 'CP 03-1912' sugarcane. Journal of Plant Registrations 5:318-324. doi: 10.3198/jpr2011.02.0075crc.

Glaz, B., J. Alvarez, and J.D. Miller. 1986. Analysis of cultivar-use options with sugarcane as influenced by threats of new pests. Agronomy Journal 78:503-506.

Glaz, B., J.C. Comstock, R.W. Davidson, et al. 2010. Evaluation of new Canal Point sugarcane clones: 2008-2009 harvest season. U.S. Department of Agriculture, Agricultural Research Service, ARS-171.

Glaz, B., R.W. Davidson, S. Sood, et al. 2011. Evaluation of new Canal Point sugarcane clones: 2009-2010 harvest season, ARS-172. U.S. Department of Agriculture, Agricultural Research Service, Washington, D.C.

Glaz, B., and J.L. Dean. 1988. Statistical error rates and their implications in sugarcane clone trials. Agronomy Journal 80:560-562.

Glaz, B., S.J. Edmé, J.C. Comstock, et al. 2009. Evaluation of new Canal Point sugarcane clones: 2007-2008 harvest season. U.S. Department of Agriculture, Agricultural Research Service, ARS-170.

Glaz, B., and M.S. Kang. 2008. Location contributions determined via GGE biplot analysis of multienvironment sugarcane genotype-performance trials. Crop Science 48:941-950.

Glaz, B., J.D. Miller, C.W. Deren, et al. 2000. Registration of 'CP 89-2143' sugarcane. Crop Science 40:577.

Glaz, B., J.M. Shine, Jr., C.W. Deren, et al. 1994. Registration of 'CP 84-1198' sugarcane. Crop Science 34:1404-1405.

Glaz, B., P.Y.P. Tai, J.D. Miller, et al. 2005. Registration of 'CP 89-2376' sugarcane. Crop Science 45:785.

Glaz, B., and M.F. Ulloa. 1995. Fallow and successive planting effects on sugarcane yields in Florida. Journal of American Society of Sugar Cane Technologists 15:41-53.

Glynn, N.C., C. Laborde, R.W. Davidson, et al. 2012. Utilization of a major brown rust resistance gene in sugarcane breeding. Molecular Breeding 30.3. doi: 10.1007/s11032-012-9792x.

Glynn, N.C., S.B. Milligan, R.A. Gilbert, et al. 2011. Registration of 'CPCL 00-4111' sugarcane. Journal of Plant Registrations 5:325-331. doi: 10.3198/jpr2010.12.0701crc.

Juárez, J.L., J.D. Miller, H. Orozco, et al. 2008. Registration of 'CP 88-1165' sugarcane. Journal of Plant Registrations 2:102-109.

Legendre, B.L. 1992. The core/press method for predicting the sugar yield from cane for use in cane payment. Sugar Journal 54(9):2-7.

Lockhart, B.E.L., M.J. Irey, and J.C. Comstock. 1996. Sugarcane bacilliform virus, sugarcane mild mosaic virus and sugarcane yellow leaf syndrome. *In* B.J. Croft, C.M. Piggin, E.S. Wallis, and D.M. Hogarth, eds., Sugarcane Germplasm Conservation and Exchange, pp. 108-112. Australian Centre for International Agricultural Research, Canberra, Australia, Proceedings No. 67.

Miller, J.D., P.Y.P. Tai, B. Glaz, et al. l984. Registration of 'CP 72-2086' sugarcane. Crop Science 24:2l0.

Rice, R., L. Baucum, and B. Glaz. 2011. Sugarcane variety census: Florida 2010. Sugar Journal 73(2):13-19.

Rice, R.W., R.A. Gilbert, and S.H. Daroub. 2002. Application of the soil taxonomy key to the organic soils of the Everglades Agricultural Area. Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, SSAGR246. Available online at http://edis.ifas.ufl.edu/AG151 (May 2002, verified February 10, 2011).

Shine, Jr., J.M., C.W. Deren, P.Y.P. Tai, et al. 1996. Registration of 'CP 84-1591' sugarcane. Crop Science 36:1075.

Tai, P.Y.P., J.D. Miller, B. Glaz, et al. 1991. Registration of 'CP 78-1628' sugarcane. Crop Science 31:236.

Tai, P.Y.P., J.D. Miller, B. Glaz, et al. 2004. Registration of 'CP 94-1100' sugarcane. Crop Science 44:1869-1870.

Tai, P.Y.P., and J.D. Miller. 1996. Selection for frost resistance in sugarcane. Sugar Cane 1996(3):13-18.

Tai, P.Y.P., J.M. Shine, Jr., C.W. Deren, et al. 1997. Registration of 'CP 88-1762' sugarcane. Crop Science 37:1388.

Tanimoto, T. 1964. The press method of cane analysis. Hawaii. Planters Record 57:133-150.

Tables

Notes (tables 2–21):

1. Clonal yields approximated by least squares (p = 0.10) within and across locations.

2. Location yields approximated by empirical linear unbiased predictors.

3. *LSD* = least significant difference.

4. *CV* = coefficient of variation.

Table 1. Parentage, fiber content, increase status, and ratings of susceptibility to smut, brown rust, orange rust, leaf scald, mosaic, and ratoon stunting for CP 72-2086, CP 78-1628, CP 89-2143, 36 new CP sugarcane clones, and 36 new CPCL sugarcane clones

	Parentage				Rating[*]					
			Increase	Percent		Rust		Leaf		Ratoon
Clone	Female	Male	status[H]	fiber	Smut	Brown	Orange	scald	Mosaic	stunting[I]
CP 72-2086	CP 62-374	CP 63-588	Commercial	8.97	R	L	S	R	S	R
CP 78-1628	CP 65-0357	CP 68-1026	Commercial	10.39	S	S	L	L	R	R
CP 89-2143	CP 81-1254	CP 72-2086	Commercial	9.85	R	R	R	L	L	L
CP 03-1160	CP 92-1435	CP 92-1435	None	10.83	L	S	R	R	R	S
CP 03-1173	HoCP 85-845	HoCP 85-845	None	9.37	R	L	R	L	L	S
CP 03-1401	CP 90-1424	CP 92-1167	None	12.05	L	S	R	R	R	L
CP 03-1491	CP 92-1561	CP 92-1167	None	10.44	R	S	S	R	R	R
CP 03-1912	CP 92-1167	CP 95-1039	Commercial	9.94	L	R	R	L	R	L
CP 03-1939	CP 82-1172	CP 95-1039	None	9.69	S	R	R	S	R	R
CP 03-2188	CP 95-1569	CP 97-1362	None	9.85	R	L	R	S	R	L
CP 04-1252	CP 97-2068	CP 97-1362	None	12.43	L	R	R	S	R	L
CP 04-1258	CP 96-1252	01 P04	None	10.94	R	L	L	R	R	L
CP 04-1321	CP 96-1252	01 P04	Muck	9.31	L	L	L	S	R	L
CP 04-1367	CP 97-2068	CP 94-1607	None	13.24	R	L	L	L	R	R
CP 04-1374	CP 97-2068	CP 94-1607	None	11.82	L	L	L	R	R	R
CP 04-1426	CP 95-1712	CP 84-1198	None	12.75	L	R	S	L	L	R
CP 04-1566	CP 89-2377	CP 96-1252	Commercial	9.73	L	R	R	R	L	R
CP 04-1619	CP 95-1569	CP 84-1198	None	10.45	R	R	L	R	R	R
CP 04-1844	CP 97-1989	CP 84-1198	Commercial	9.95	R	R	R	S	L	L
CP 04-1935	CP 94-2059	CP 84-1322	Commercial	10.57	R	R	R	L	L	L
CP 05-1466	CP 98-1497	02 P08	None	8.96	R	R	U	US	US	R
CP 05-1526	CP 98-1029	CP 88-1162	Commercial	11.52	R	R	R	R	R	R
CP 05-1679	US 99-1055	US 02-1339	None	10.58	L	R	R	R	R	L
CP 05-1740	US 99-1055	US 02-1027	None	11.45	S	R	R	R	R	R
CP 06-2042	CP 96-1252	01P04	None	10.96	R	R	L	S	R	L
CP 06-2164	CP 89-1509	CP 88-1762	None	11.39	L	R	R	L	L	S
CP 06-2170	L 00-273	02P24	None	10.27	R	S	R	R	R	S
CP 06-2274	CP 99-1896	CP 94-2203	None	9.14	S	R	R	L	R	R

Table 1. Parentage, fiber content, increase status, and ratings of susceptibility to smut, brown rust, orange rust, leaf scald, mosaic, and ratoon stunting for CP 72-2086, CP 78-1628, CP 89-2143, 36 new CP sugarcane clones, and 36 new CPCL sugarcane clones

	Parentage				Rating[*]					
			Increase	Percent		Rust		Leaf		Ratoon
Clone	Female	Male	status[H]	fiber	Smut	Brown	Orange	scald	Mosaic	stunting[I]
CP 06-2317	CP 00-2188	03P23	None	11.69	L	R	R	L	L	R
CP 06-2335	NG 51-144	03P23	None	8.98	S	R	R	S	R	L
CP 06-2397	CP 99-1896	03P29	None	11.55	R	R	R	S	R	S
CP 06-2400	CP 94-1100	03P29	Muck	10.24	R	R	R	L	R	L
CP 06-2664	CP 01-2365	CP 96-1252	None	10.68	L	L	R	L	L	R
CP 06-2713	CP 84-1591	CP 92-1167	Muck	10.13	R	R	R	L	R	R
CP 06-2874	CP 94-2203	CP 84-1198	All	10.13	L	R	R	L	S	R
CP 06-2897	CP 94-2095	CP 84-1591	None	11.01	S	L	L	R	S	L
CP 06-3025	CP 92-1167	CP 92-1167	None	10.51	L	R	R	S	R	R
CP 06-3040	CP 89-1509	CP 95-1039	None	11.07	R	R	L	R	R	R
CP 06-3098	Unknown	Unknown	None	10.55	L	R	R	L	R	R
CPCL 95-2287	CL 78-1120	CL 78-1600	Commercial	11.45	R	L	L	L	R	R
CPCL 00-0129	CL 84-3878	Mix 91V	None	10.40	R	L	L	R	R	R
CPCL 00-0458	CL 87-2882	CL 89-5189	None	10.59	R	S	S	R	R	S
CPCL 00-1373	CL 83-1900	CL 88-4730	None	12.27	R	S	L	R	R	L
CPCL 00-4027	CL 83-1364	CL 86-4590	None	11.78	R	S	S	R	R	L
CPCL 00-4111	CL 83-3431	CL 89-5189	Commercial	11.23	R	R	R	L	R	S
CPCL 00-4611	CL 80-1575	CP 85-1491	None	11.46	L	S	S	R	R	R
CPCL 00-6131	CL 87-1630	CP 84-1198	None	11.15	L	L	S	L	L	R
CPCL 00-6756	CL 83-1364	CL 92-5431	None	12.19	R	S	S	R	R	R
CPCL 01-0271	CL 86-4340	Poly 00-3	None	10.92	R	L	S	R	L	S
CPCL 01-0571	CL 87-2944	CL 86-4590	None	11.13	S	L	S	L	L	R
CPCL 01-0877	CL 90-4725	CL 88-4730	None	10.61	L	L	L	R	R	R
CPCL 02-0843	CL 89-5189	CP 80-1743	None	10.55	L	R	S	L	R	L
CPCL 02-0908	CL 92-0775	LCP 85-0384	None	9.83	R	S	S	S	R	L
CPCL 02-0926	CP 80-1743	CL 92-0046	Commercial	10.44	R	R	R	L	U	L
CPCL 02-1295	CP 88-1762	CL 91-1637	Commercial	11.30	R	R	L	S	R	R
CPCL 02-2273	CP 89-2143	CL 88-4730	None	11.54	R	L	L	L	R	R

Table 1. Parentage, fiber content, increase status, and ratings of susceptibility to smut, rust, leaf scald, mosaic, and ratoon stunting for CL 77-0797, CP 72-2086, CP 78-1628, CP 89-2143, 36 new CP sugarcane clones, and 36 new CPCL sugarcane clones

	Parentage				Rating[*]					
			Increase	Percent		Rust		Leaf		Ratoon
Clone	Female	Male	status[H]	fiber	Smut	Brown	Orange	scald	Mosaic	stunting[I]
CPCL 02-2913	CL 88-4730	CP 80-17434	None	10.32	R	S	S	L	S	L
CPCL 02-2975	CL 94-4155	CL 84-4302	None	10.36	L	S	S	R	S	L
CPCL 02-6225	CL 88-4730	Poly 01-6	None	10.37	R	U	R	U	R	R
CPCL 02-6848	CL 92-2533	Poly 01-9	Commercial	13.05	R	R	R	R	U	R
CPCL 02-7080	CP 94-1528	CL 98-5189	None	10.95	S	R	R	U	R	R
CPCL 02-7190	CP 89-2143	CL 88-4730	None	10.38	R	R	R	R	U	R
CPCL 02-7386	CL 88-4730	CL 89-2189	None	11.05	U	R	R	R	R	R
CPCL 02-7500	LCP 85-0384	CL 77-0797	None	12.19	U	R	R	R	R	R
CPCL 02-7610	CL 90-4500	CL 88-4730	None	11.82	L	R	U	U	R	L
CPCL 02-8001	Unknown	Unknown	None	10.19	U	U	R	R	R	L
CPCL 02-8071	CL 92-5431	LCP 85-0384	None	12.78	R	R	R	R	R	R
CPCL 02-8072	CL 92-5431	LCP 85-0384	None	12.22	S	R	R	R	U	R
CPCL 05-1009	CL 89-5189	CL 90-4727	None	11.92	S	R	R	R	R	R
CPCL 05-1102	CL 89-5189	CL 88-4730	Commercial	10.17	R	R	R	R	R	L
CPCL 05-1201	CL 87-2882	CL 93-2679	Commercial	10.26	R	R	R	R	R	R
CPCL 05-1300	CL 87-2882	CL 85-3715	None	13.20	R	R	R	R	R	R
CPCL 05-1791	CP 96-1252	CL 90-4725	Commercial	12.28	L	U	R	U	R	R
CPCL 06-3272	CL 87-1630	LCP 85-0384	None	10.00	R	R	R	S	R	R
CPCL 06-3332	CL 90-5017	CP 88-1762	None	9.89	SL	R	R	S	R	R
CPCL 06-3432	CP 88-1762	CL 94-4150	None	10.66	S	R	R	R	R	R

[*] R = resistant enough for commercial production; L = low levels of disease susceptibility; S = too susceptible for production; U = undetermined susceptibility (available data not sufficient to determine the level of susceptibility).

[H] Commercial = Released for commercial production; None = Not considered as potential release candidate; otherwise, increasing acreage of seed cane at all locations, locations with sand soils only, or locations with muck soils only.

[I] Ratoon stunting can be controlled by using heat-treated or tissue-cultured vegetative planting material.

[ ] 01 P04, Mix 98c, and Poly 00-3 refer to polycrosses. In 01 P04, female parent (CP 96-1252) exposed to pollen from many clones in 2001 crossing season; in Mix 98c, CL 83-3431 exposed to pollen from many clones in 1998 crossing season at United States Sugar Corp., and in Poly 00-3, female parent (CL 86-4340) exposed to pollen from many clones in 2000 crossing season at United States Sugar Corp.; and therefore, male parents of CP 04-1258, CPCL 99-2574, and CPCL 01-0271 unknown. Similar explanations for CP 04-1321, CP 05-1466, CPCL 00-0129, CPCL 01-0271, CPCL 01-0271, CPCL 02-6225, and CPCL 02-6848.

Table 2. Yields of cane in metric tons per hectare (TC/H) from plant cane on Dania muck and Lauderhill muck

	Mean yield by soil type, farm, and sampling date					
	Dania muck			Lauderhill muck		
Clone	Duda 1/3/2011	Knight 1/6/2011	Okeelanta 1/24/2011	Wedgworth 1/11/2011	SFI 1/18/2011	Mean yield, all farms
CP 06-2400	237.86*	178.85*	185.78*	202.78*	202.54*	201.56*
CP 06-2042	205.37*	171.26*	155.47*	183.67*	180.66*	179.28*
CP 06-2874	184.80	134.89	170.21*	204.25*	200.63*	178.95
CP 06-2713	177.09	147.71*	159.94*	179.57*	196.69*	172.20*
CP 06-2897	181.20*	179.47*	146.72*	159.66	180.22*	169.45*
CP 78-1628	174.48	159.27*	149.20*	179.02*	177.21*	167.84*
CP 06-2664	182.11*	120.50	146.36*	148.11	216.30*	162.68*
CPCL 06-3272	176.30	138.83	148.28*	181.92*	161.97	161.46*
CP 06-2170	166.98	147.95*	149.97*	162.69	173.68*	160.26*
CP 06-2335	170.54	134.80	125.86	168.18	168.77	153.63
CPCL 06-3432	199.31	103.76	126.94	168.18	167.37	153.11
CP 06-3040	138.96	144.86*	133.00	151.66	156.77	145.05
CP 72-2086	149.91	136.21	136.02	139.63	160.78	144.51
CP 06-2164	150.90	114.47	143.64*	145.83	155.72	142.11
CP 89-2143	156.65	119.35	125.75	156.79	151.82	142.07
CPCL 06-3332	143.92	120.61	126.73	139.24*	160.87	138.45
Mean	174.77	140.80	145.62	166.95	175.75	160.79
LSD (p = 0.1)†	24.67	18.26	14.50	16.58	17.35	14.48
CV (%)	14.68	13.49	10.37	10.33	10.26	1.83

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.
† *LSD* for location means of sugar yield = 7.29 TC/H at p = 0.10.

Table 3. Preharvest yields of theoretical recoverable 96° sugar in kg per metric ton of cane (KS/T) from plant cane on Dania muck and Lauderhill muck

	Mean yield by soil type, farm, and sampling date					
	Dania muck			Lauderhill muck		
Clone	Duda 10/12/2010	Knight 10/15/2010	Okeelanta 10/15/10	Wedgworth 10/15/10	SFI 10/15/10	Mean yield, all farms
CPCL 06-3332	116.2*	108.7	104.6*	111.2*	105.5	109.3*
CP 06-2335	111.4*	98.7	102.6*	94.6	109.7	103.4*
CP 06-2042	105.8	103.3	103.7*	99.4	101.6	102.8
CP 06-2897	103.4	99.0	105.7*	101.2	98.5	101.5
CP 06-2874	103.4	106.2	98.0	99.3	100.7	101.5
CP 06-3040	107.7	97.2	91.0	107.4*	100.2	100.7
CP 06-2170	108.6*	100.7	92.0	106.0*	93.8	100.2
CP 06-2713	96.7	97.7	101.7*	101.1	98.4	99.1
CP 89-2143	97.3	105.3	94.9	92.0	104.2	98.7
CPCL 06-3272	107.4	93.3	98.7	95.0	94.1	97.7
CP 72-2086	104.7	93.6	88.8	96.3	94.8	95.6
CPCL 06-3432	97.4	87.1	94.8	97.5	97.2	94.8
CP 06-2664	91.5	90.6	87.8	89.5	92.5	90.4
CP 06-2164	97.9	86.1	91.3	84.3	92.2	90.4
CP 06-2400	85.2*	93.2	87.4	89.3	87.9	88.6
CP 78-1628	93.2	89.0	81.9	86.2	87.4	87.5
Mean	101.7	96.8	96.8	96.9	97.4	97.6
LSD (p = 0.1)†	10.5	7.4	6.2	10.4	9.1	4.7
CV (%)	5.9	4.3	3.7	6.1	5.3	1.7

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.
† *LSD* for location means of sugar yield = 4.8 KS/T at p = 0.10.

Table 4. Yields of theoretical recoverable 96° sugar in kg per metric ton of cane (KS/T) from plant cane on Dania muck and Lauderhill muck

Clone	Duda 1/3/2011	Knight 1/6/2011	Okeelanta 1/24/2011	Wedgworth 1/10/2011	SFI 1/18/2011	Mean yield, all farms
	Mean yield by soil type, farm, and sampling date					
	Dania muck			**Lauderhill muck**		
CP 06-2335	117.5	107.0	123.2	126.6	126.7	120.2
CP 06-2897	110.8	122.9*	117.8	117.9	119.3	117.7
CP 89-2143	115.3	94.9	122.1	124.7	122.3	115.7
CPCL 06-3332	114.5	94.1	112.3	130.3*	120.4	114.6
CP 06-2874	116.5	91.3	115.4	124.1	121.0	113.6
CP 06-2042	111.6	92.8	117.2	119.2	118.7	111.9
CP 78-1628	108.2	99.1	115.4	117.3	117.2	111.4
CPCL 06-3272	105.9	96.9	115.6	116.7	116.4	110.3
CP 06-3040	108.5	88.0	111.8	118.6	121.3	109.6
CP 06-2170	112.2	99.0	106.1	119.3	110.5	109.4
CP 06-2400	108.0	89.0	114.4	117.3	114.8	108.7
CP 72-2086	115.9	102.6	81.3	120.7	118.1	107.7
CP 06-2713	109.9	88.1	114.3	115.1	106.4	106.8
CPCL 06-3432	109.8	97.1	94.8	117.3	112.0	106.2
CP 06-2664	104.9	87.1	106.2	119.3	109.4	105.4
CP 06-2164	90.7	66.3	96.0	106.3	96.7	91.2
Mean	110.0	94.7	110.2	119.4	115.7	110.0
LSD (p = 0.1)†	5.1	14.3	8.4	4.8	7.2	6.9
CV (%)	4.8	15.8	7.9	4.2	6.5	1.8

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.
† *LSD* for location means of sugar yield = 4.7 KS/T at p = 0.10.

Table 5. Yields of theoretical recoverable 96^{o} sugar in metric tons per hectare (TS/H) from plant cane on Dania muck and Lauderhill muck

	Mean yield by soil type, farm, and sampling date					
	Dania muck			Lauderhill muck		
Clone	**Duda 1/3/2011**	**Knight 1/6/2011**	**Okeelanta 1/24/2010**	**Wedgworth 1/10/2011**	**SFI 1/18/2011**	**Mean yield, all farms**
CP 06-2400	25.667*	16.048*	21.263*	23.787*	23.250*	22.003*
CP 06-2874	21.567*	12.413	19.603*	25.350*	24.248*	20.636*
CP 06-2042	22.898*	15.798*	18.212*	21.892*	21.442*	20.048*
CP 06-2897	20.040	21.870	17.297*	18.823	21.513	19.909*
CP 78-1628	18.855	15.667*	17.218	21.018	20.763	18.704*
CP 06-2335	20.078	14.473*	15.532	21.288	21.425*	18.559*
CP 06-2713	19.388	13.128	18.278*	20.667	20.955	18.483
CPCL 06-3272	18.595	13.385	17.097	21.243	18.903	17.845
CP 06-2170	18.742	14.590*	15.997	19.423	19.293	17.609
CP 06-2664	19.177	10.277	15.620	17.645	23.710*	17.286
CP 89-2143	18.095	11.273	15.345	19.628	18.575	16.583
CPCL 06-3432	21.915*	10.113	12.023	19.718	18.692	16.492
CPCL 06-3332	16.491	11.890	14.270	18.477	19.290	16.097
CP 06-3040	15.023	12.837	14.848	17.975	19.050	15.947
CP 72-2086	17.377	13.937	10.987*	16.863	18.980	15.629
CP 06-2164	13.737	7.742	13.957	15.520	15.022	13.195
Mean	19.228	13.465	16.097	19.957	20.319	17.814
LSD (p = 0.1)†	2.818	2.540	2.125	2.225	2.426	1.931
CV (%)	15.237	6.977	13.740	11.592	12.424	6.034

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.
† *LSD* for location means of sugar yield = 1.069 TS/H at p = 0.10.

Table 6. Yields of preharvest and harvest theoretical recoverable 96° sugar in kg per metric ton of cane (KS/T) from plant cane on Pompano fine sand and Margate sand

	Preharvest yield by soil type, farm, and sampling date				Harvest yield by soil type, farm, and sampling date			
	Margate sand		Pompano fine sand	Mean yield, all farms	Margate sand		Pompano fine sand	Mean yield, all farms
Clone	Hilliard 1/13/2011	Townsite 1/13/2011	Lykes 1/24/2011		Hilliard 1/13/2011	Townsite 1/13/2011	Lykes 1/24/2011	
CP 06-2335	124.3*	126.7*	131.6*	127.7*	136.2	145.0*	138.6*	139.6*
CP 06-2874	127.2*	123.6*	123.9*	124.9*	143.6	132.3	129.3	135.1
CP 06-3098	114.4*	111.7	122.5*	116.2*	131.2	135.4	134.8*	133.8
CP 89-2143	123.4*	118.6*	112.6	118.2*	133.7	135.6	130.0*	133.1
CP 78-1628	100.9	104.0	105.3	103.4	137.4	134.7	123.5	131.9
CP 06-2042	113.8*	119.7*	121.2*	118.2*	136.0	132.7	120.6	129.8
CPCL 06-3272	102.0	108.6	118.0*	109.5	125.8	136.9	126.6	129.8
CP 06-2897	116.5*	119.1*	121.4*	119.0*	132.8	133.4	122.4	129.5
CP 06-2274	120.7*	121.1*	125.9*	122.6*	135.4	131.4	121.3	129.4
CP 06-3025	110.7	111.5	111.1	111.1*	132.5	129.8	118.3	126.8
CP 72-2086	102.3	106.2	106.2	104.9	127.6	129.3	122.7	126.5
CPCL 06-3432	101.4	112.1	122.3*	112.0*	126.5	127.5	122.5	125.5
CP 06-2400	93.1	109.0	115.7*	105.9	127.2	128.8	115.0	123.7
CP 06-2397	115.3*	115.5	118.8*	116.5*	125.7	119.2	116.5	120.5
CP 06-2664	108.1	112.1	107.9	109.4*	120.2	119.2	117.0	118.8
CP 06-2317	104.7	97.4	93.2	98.4	118.6	113.1	105.3	112.3
Mean	111.2	113.5	116.1	113.6	130.6	130.3	122.8	127.9
LSD (p = 0.1)†	10.9	12.8	7.8	5.3	9.0	5.4	6.2	5.4
CV (%)	5.6	6.4	3.8	1.6	7.1	4.3	5.3	1.4

* Significantly greater than CP 78-1628 at p = 0.10 based on *t* test.
† *LSD* for location means of pre+harvest sugar yield = 1.4 KS/T and of harvest sugar yield = 4.6 KS/T at p = 0.10.

Table 7. Yields of cane and theoretical recoverable 96^{o} sugar in metric tons per hectare (TC/H and TS/H) from plant cane on Pompano fine sand and Margate sand

	Cane yield by soil type, farm, and sampling date				Sugar yield by soil type, farm, and sampling date			
	Margate sand		Pompano fine sand	Mean yield, all farms	Margate sand		Pompano fine sand	Mean yield, all farms
Clone	Hilliard 1/13/2011	Townsite 1/13/2011	Lykes 1/24/2011		Hilliard 1/13/2011	Townsite 1/13/2011	Lykes 1/24/2011	
CP 06-2897	103.36	93.29	224.34*	140.33*	13.672	12.440	27.792*	17.968*
CP 06-2397	105.08	104.34*	156.36	121.93	13.150	12.435	18.325	14.637
CP 78-1628	107.75	80.35	140.33	109.48	14.655	11.078	17.333	14.356
CP 89-2143	97.42	91.07	129.18	105.89	12.982	12.383	16.795	14.053
CP 06-2664	112.48	86.48	150.80	116.59	13.482	10.327	17.565	13.791
CP 06-2042	96.33	77.32	149.08	107.58	13.087	10.280	17.993	13.787
CPCL 06-3272	96.71	79.62	139.98	105.43	12.205	10.868	17.723	13.599
CP 06-2874	96.08	73.22	120.35	96.55	13.642	9.690	15.602	12.978
CP 06-2335	73.90	77.64	119.83	89.43	10.058	11.367	16.737	12.582
CP 06-2274	95.81	76.21	119.61	97.21	12.903	10.012	14.510	12.475
CP 06-3025	94.10	81.33	120.87	98.77	12.453	10.557	14.327	12.446
CP 06-2400	94.39	72.57	118.34	95.10	12.052	9.415	13.658	11.708
CPCL 06-3432	78.92	64.75	132.95	92.21	9.957	8.320	16.248	11.508
CP 72-2086	77.54	60.66	110.96	83.05	9.910	7.838	13.655	10.468
CP 06-3098	64.90	64.61	98.82	76.11	8.505	8.750	13.453	10.236
CP 06-2317	77.49	58.62	69.63	68.58	9.208	6.642	7.343	7.731
Mean	92.02	77.63	131.34	100.26	11.995	10.150	16.191	12.770
LSD (p = 0.1)†	12.99	19.22	50.27	21.44	1.757	2.731	6.454	2.714
CV (%)	14.68	25.74	39.81	3.54	15.247	27.968	41.446	9.903

* Significantly greater than CP 78-1628 at p = 0.10 based on *t* test.
† *LSD* for location means of cane yield = 16.05 TC/H and of sugar yield = 2.08 TS/H at p = 0.10.

Table 8. Yields of preharvest and harvest theoretical recoverable 96° sugar in kg per metric ton of cane (KS/T) from plant cane on Dania muck and Torry muck

Clone	Preharvest yield by soil type, farm, and sampling date			Harvest yield by soil type, farm, and sampling date		
	Dania muck	Torry muck		Dania muck	Torry muck	
	Okeelanta 1/10/2011	Eastgate 2/2/2011	Mean yield, both farms	Okeelanta 1/10/2011	Eastgate 2/2/2011	Mean yield, both farms
CPCL 02-7610	98.5	125.9*	112.2	130.5	117.9*	124.2
CPCL 02-8001	106.2	121.2	113.7	126.5	121.6	124.0
CPCL 05-1102	98.3	116.6	107.5	122.2	124.2	123.2
CP 89-2143	100.3	113.9	107.1	124.2	122.2	123.2
CP 78-1628	99.8	117.4	108.6	123.8	121.9	122.8
CP 05-1466	91.3	110.0	100.7	122.7	121.5	122.1
CPCL 02-6225	90.2	108.7	99.5	117.6	125.1	121.3
CP 72-2086	92.8	118.1	105.4	120.4	121.6	121.0
CPCL 02-7190	100.7	118.3	109.5	114.1	120.8	117.5
CPCL 02-6848	100.6	117.9	109.3	116.7	118.0	117.3
CP 05-1740	90.7	109.2	99.9	116.4	117.9	117.1
CPCL 05-1201	102.7	110.2	106.5	114.3	119.6	117.0
CPCL 02-8071	94.1	102.7	98.4	115.7	118.1	116.9
CP 05-1526	90.8	101.9	96.3	114.8	116.5	115.7
CPCL 05-1791	104.9	116.4	110.6	111.0	114.3	112.7
CPCL 05-1300	94.5	97.6	96.0	106.7	116.0	111.4
Mean	97.3	112.9	105.1	118.6	119.8	119.2
LSD (p = 0.1)†	8.0	7.4	7.8	6.3	3.8	6.4
CV (%)	4.7	3.8	2.0	5.6	3.3	1.6

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.

† *LSD* for location means of preharvest sugar yield = 4.0 KS/T and of harvest yield = 1.5 KS/T at p = 0.10.

Table 9. Yields of cane and of theoretical recoverable 96^{o} sugar in metric tons per hectare (TC/H and TS/H) from plant cane on Dania muck and Torry muck

	Cane yield by soil type, farm, and sampling date			Sugar yield by soil type, farm, and sampling date		
	Dania muck	Torry muck		Dania muck	Torry muck	
Clone	Okeelanta 1/10/2011	Eastgate 2/2/2011	Mean yield, both farms	Okeelanta 1/10/2011	Eastgate 2/2/2011	Mean yield, both farms
CP 05-1526	132.10*	245.06	188.58	15.162*	28.592	21.877
CP 78-1628	126.01*	230.74	178.37	15.582*	28.250	21.916
CPCL 05-1201	146.28*	207.01	176.65	16.687*	24.652	20.669
CPCL 02-6848	124.27	220.43	172.35	14.515	26.005	20.260
CP 89-2143	102.32	229.55	165.93	12.713	28.072	20.393
CP 05-1466	115.05	196.85	155.95	14.140	23.897	19.018
CPCL 05-1791	129.56*	179.24	154.40	14.447	20.600	17.523
CPCL 02-7610	109.34	190.29	149.82	14.257	22.537	18.397
CP 05-1740	90.96	204.60	147.78	10.562	24.113	17.338
CP 72-2086	107.33	185.91	146.62	12.903	22.620	17.762
CPCL 05-1102	103.35	182.41	142.88	12.653	22.677	17.665
CPCL 02-8001	103.58	176.52	140.05	13.107	21.402	17.254
CPCL 02-8071	102.97	165.55	134.26	11.928	19.677	15.803
CPCL 02-6225	107.21	150.17	128.69	12.593	18.840	15.717
CPCL 05-1300	74.33	179.22	126.78	7.912	20.790	14.351
CPCL 02-7190	112.79	128.38	120.59	12.895	15.403	14.149
Mean	111.72	192.00	151.86	13.253	23.008	18.131
LSD (p = 0.1)†	14.32	51.80	36.65	1.877	6.294	9.015
CV (%)	13.34	28.06	3.01	14.728	28.451	12.507

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.
† *LSD* for location means of cane yield = 17.89 TC/H and of sugar yield = 2.225 TS/H at p = 0.10.

Table 10. Yields of cane in metric tons per hectare (TC/H) from first-ratoon cane on Dania muck, Lauderhill muck, and Pahokee muck

	Mean yield by soil type, farm, and sampling date					
	Dania muck		Lauderhill muck		Pahokee muck	
Clone	**SFI 11/29/2010**	**Okeelanta 12/3/2010**	**Knight 10/29/2010**	**Duda 11/19/2010**	**Wedgworth 12/27/2010**	**Mean yield, all farms**
CPCL 05-1201	183.01	178.40*	127.14*	196.05*	178.53	160.86*
CPCL 02-6848	164.12	141.85	155.86*	167.88*	160.49	158.04*
CP 78-1628	151.34	165.71*	119.87	155.31	160.38	150.52
CP 05-1526	169.82	158.79	125.84	169.21*	109.43*	146.62
CPCL 05-1791	129.85	131.53	121.94	168.30*	119.70	146.03
CPCL 02-7610	140.57	157.55	128.95*	136.63	140.62	140.86
CP 89-2143	160.05	144.42	105.14	145.51	146.76	140.38
CP 05-1740	145.97	151.08	114.69	149.47	138.95	139.92
CPCL 05-1102	127.73	137.53	112.41	166.92*	135.63	136.04
CP 05-1466	124.30	136.82	115.45	137.72	127.36	128.29
CPCL 02-6225	95.74	140.13	93.10	147.09	140.69	123.33
CP 72-2086	126.39	125.46	76.49	162.06	125.31	123.14
CPCL 05-1300	126.02	116.14	69.88	146.21	122.20	116.09
CPCL 02-7190	119.67	122.53	103.28	114.91	113.45	114.77
CPCL 02-8001	98.86	128.76	122.28	110.65	113.72	113.67
CPCL 02-8071	90.15	127.63	68.99	138.74	105.17	106.14
Mean	134.60	141.52	110.08	150.79	133.65	134.04
LSD (p = 0.1)†	26.84	17.02	20.87	20.94	21.41	17.37
CV (%)	20.75	12.51	19.69	14.44	16.66	2.41

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.
† *LSD* for location means of cane yield = 10.47 TC/H at p = 0.10.

Table 11. Yields of theoretical recoverable 96^{o} sugar in kg per metric ton of cane (KS/T) from first-ratoon cane on Dania muck, Lauderhill muck, and Pahokee muck

	Mean yield by soil type, farm, and sampling date					
	Dania muck		Lauderhill muck		Pahokee muck	
Clone	SFI 11/29/2010	Okeelanta 12/3/2010	Knight 10/29/2010	Duda 11/19/2010	Wedgworth 12/27/2010	Mean yield, all farms
CPCL 05-1102	122.21	131.29	105.67	119.94*	133.12	122.44
CPCL 02-7610	127.14	131.11	106.55	109.48	132.71	121.39
CPCL 02-8001	122.95	128.95	106.89	118.50	127.90	121.03
CPCL 02-7190	119.30	128.05	110.27	115.14	129.03	120.36
CP 89-2143	121.44	127.38	107.00	113.79	127.26	119.37
CP 72-2086	119.48	121.33	97.30	125.55*	129.01	118.53
CPCL 02-6848	118.09	123.89	106.17	118.04	116.90	116.62
CPCL 05-1201	121.88	126.41	103.01	114.99	119.84	116.30
CP 05-1466	117.60	122.36	94.92	111.36	131.34	115.60
CPCL 02-8071	118.17	123.78	99.43	111.65	124.80	115.57
CP 05-1740	116.14	122.06	97.24	112.46	127.96	115.49
CPCL 02-6225	115.47	122.93	99.23	111.55	124.78	114.80
CPCL 05-1791	119.00	125.39	101.89	106.81	115.90	114.59
CP 05-1526	118.76	118.24	99.19	110.34	121.09	113.49
CP 78-1628	116.28	118.63	93.70	107.89	121.07	111.51
CPCL 05-1300	103.60	109.38	95.91	103.64	118.72	106.25
Mean	118.59	123.82	101.52	113.20	125.05	116.46
LSD (p = 0.1)†	6.13	3.95	4.62	5.12	7.04	7.62
CV (%)	5.37	3.32	4.73	4.71	5.86	1.83

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.
† *LSD* for location means of cane yield = 1.70 KS/T at p = 0.10.

Table 12. Yields of theoretical recoverable 96° sugar in metric tons per hectare (TS/H) from first-ratoon cane on Dania muck, Lauderhill muck, and Pahokee muck

	Mean yield by soil type, farm, and sampling date					
	Dania muck		Lauderhill muck		Pahokee muck	
Clone	SFI 11/29/2010	Okeelanta 12/3/2010	Knight 10/29/2010	Duda 11/19/2010	Wedgworth 12/27/2010	Mean yield, all farms
CPCL 05-1201	22.337	22.545*	13.063	22.583*	21.377	18.865
CPCL 02-6848	19.415	17.548	16.573*	19.743	18.703	18.397
CPCL 02-7610	17.902	20.643*	13.728*	14.985	18.667	17.185
CP 78-1628	17.665	19.723	11.143	16.768	19.422	16.944
CP 89-2143	19.557	18.402	11.260	16.637	18.655	16.902
CPCL 05-1102	15.797	18.063	11.870	20.040*	18.067	16.767
CPCL 05-1791	15.512	16.413	12.527	17.975	13.795	16.761
CP 05-1526	19.934	18.802	12.457	18.618	13.252	16.602
CP 05-1740	17.002	18.457	11.172	16.910	17.882	16.305
CP 05-1466	14.678	16.725	11.038	15.263	16.622	14.864
CP 72-2086	15.118	15.208	7.372	20.387*	16.125	14.842
CPCL 02-6225	11.087	17.180	9.276	16.493	17.528	14.304
CPCL 02-7190	14.278	15.672	11.438	13.233	14.697	13.864
CPCL 02-8001	12.348	16.603	13.174	13.027	14.548	13.800
CPCL 02-8071	10.707	15.770	6.880	15.688	13.150	12.439
CPCL 05-1300	12.945	12.700	6.735	15.128	14.495	12.401
Mean	16.018	17.528	11.232	17.092	16.686	15.703
LSD (p = 0.1)†	3.564	2.162	2.357	2.590	2.809	2.219
CV (%)	23.148	12.828	21.797	15.759	17.523	7.340

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.
† *LSD* for location means of cane yield = 1.157 KS/T at p = 0.10.

Table 13. Yields of harvest theoretical recoverable 96^{o} sugar in kg per metric ton of cane (KS/T) from first-ratoon cane on Pompano fine sand and Margate sand

	Sugar yield by soil type, farm, and sampling date			
	Pompano fine sand	Margate sand		
Clone	Lykes 11/19/2010	Hilliard 1/26/2011	Townsite 1/26/2011	Mean yield, all farms
CP 05-1679	127.9*	141.3	155.3*	141.5*
CPCL 02-6848	117.1*	149.7*	151.0*	139.3*
CPCL 02-8001	128.1*	136.6	134.7	133.1
CP 05-1740	124.6*	136.7	134.7	132.0
CPCL 02-7610	125.0*	135.8	132.3	131.0
CP 89-2143	121.6*	138.6	131.3	130.5
CPCL 02-7500	121.1*	130.5	136.5	129.3
CPCL 02-8072	120.0*	133.8	132.7	128.8
CP 72-2086	115.5*	133.2	130.9	126.6
CPCL 02-7080	114.4*	132.6	131.9	126.3
CPCL 05-1791	119.2*	128.3	129.9	125.8
CPCL 05-1201	118.6*	125.7	133.0	125.7
CP 78-1628	107.3	132.6	133.2	124.4
CP 05-1526	115.1*	125.1	124.1	121.4
CPCL 02-7386	103.2	127.6	129.6	120.1
CPCL 05-1009	102.6	121.4	128.1	117.4
Mean	117.6	133.1	134.3	128.3
LSD (p = 0.1)†	4.3	11.1	17.3	12.3
CV (%)	3.8	9.8	13.4	10.1

* Significantly greater than CP 78-1628 at p = 0.10 based on *t* test.
† *LSD* for location means of cane yield of sugar yield = 4.99 KS/T at p = 0.10.

Table 14. Yields of cane and theoretical recoverable 96° sugar in metric tons per hectare (TC/H and TS/H) from first-ratoon cane on Pompano fine sand and Margate sand

	Cane yield by soil type, farm, and sampling date				Sugar yield by soil type, farm, and sampling date			
	Pompano fine sand	Margate sand		Mean yield, all farms	Pompano fine sand	Margate sand		Mean yield, all farms
Clone	Lykes 11/19/2010	Hilliard 1/26/2011	Townsite 1/26/2011		Lykes 11/19/2010	Hilliard 1/26/2011	Townsite 1/26/2011	
CPCL 02-6848	133.53	106.01*	89.89	109.81	15.605	15.602*	13.263*	14.823*
CPCL 05-1791	143.09	112.09*	92.40	115.86*	17.062*	14.337*	12.000	14.466*
CPCL 02-7500	136.97	102.57*	97.45*	112.33*	16.587*	13.355*	13.407*	14.449*
CPCL 05-1201	168.41*	70.18	101.65*	113.41*	19.927*	8.900	13.503*	14.110*
CP 89-2143	134.94	105.52*	82.47	107.64	16.397*	14.623*	10.903	13.974*
CP 05-1526	160.40*	107.26*	77.95	115.20*	18.467*	13.392*	9.655	13.838*
CPCL 05-1009	154.84*	118.20*	86.71	119.91*	15.922	14.345*	10.927	13.731
CPCL 02-7386	153.73*	92.98	86.76	111.15	15.887	11.882	11.320	13.029
CPCL 02-7080	120.75	104.13*	77.00	100.63	13.788	13.798*	10.063	12.550
CPCL 02-7610	124.94	92.25	70.71	95.97	15.637	12.475	9.448	12.520
CP 05-1740	116.30	86.86	82.59	95.25	14.490	11.817	11.090	12.466
CP 78-1628	128.58	85.93	71.34	95.28	13.785	11.380	9.525	11.563
CP 05-1679	99.75	87.88	60.44	82.69	12.715	12.403	9.193	11.437
CPCL 02-8001	111.01	82.65	64.56	86.07	14.222	11.257	8.817	11.432
CP 72-2086	117.84	72.75	77.51	89.37	13.582	9.678	10.145	11.135
CPCL 02-8072	114.55	88.02	48.80	83.79	13.770	11.735	6.533	10.679
Mean	132.48	94.70	79.26	102.15	15.490	12.561	10.612	12.888
LSD (p = 0.1)†	17.62	12.25	24.67	16.84	2.166	1.837	3.431	2.194
CV (%)	13.83	13.45	32.37	3.08	14.541	15.208	33.628	8.823

* Significantly greater than CP 78-1628 at p = 0.10 based on *t* test.
† *LSD* for location means of cane yield = 9.37 TC/H and of sugar yield = 1.184 TS/H at p = 0.10.

Table 15. Yields of cane in metric tons per hectare (TC/H) and theoretical recoverable 96^{o} sugar in kg per metric ton (KS/T) and in metric tons per hectare (TS/H) from first-ratoon cane on Dania muck and Torry muck

	Cane yield (TC/H) by soil type, farm, and sampling date			Sugar yield (KS/T) by soil type, farm, and sampling date			Sugar yield (TS/H) by soil type, farm, and sampling date		
	Dania muck	Torry muck		Dania muck	Torry muck		Dania muck	Torry muck	
Clone	Okeelanta 12/3/2010	Eastgate 1/19/2011	Mean yield, both farms	Okeelanta 12/3/2010	Eastgate 1/19/2011	Mean yield, both farms	Okeelanta 12/3/2010	Eastgate 1/19/2011	Mean yield, both farms
CP 78-1628	117.84	231.74*	174.79	117.4	119.9	118.7	13.843	27.837	20.840
CP 89-2143	109.89	201.47	155.68	118.4	127.3	122.9	13.078	25.628	19.353
CPCL 02-0926	102.91	231.39*	167.15	112.8	115.1	113.9	11.705	26.555	19.130
CP 04-1367	98.83	224.32	161.57	107.1	115.0	111.1	10.593	25.790	18.192
CPCL 02-0908	90.46	202.07	146.26	121.6	121.8	121.7	11.090	24.647	17.868
CPCL 02-2913	83.40	201.28	142.34	119.6	125.5	122.6	10.060	25.310	17.685
CPCL 02-0843	105.30	200.19	152.74	107.9	117.4	112.6	11.345	23.482	17.413
CP 04-1426	86.85	220.53	153.69	110.1	114.0	112.1	9.563	25.160	17.362
CPCL 95-2287	104.87	183.74	144.30	118.8	116.8	117.8	12.503	21.445	16.974
CPCL 02-1295	88.01	215.04	151.53	109.4	112.4	110.9	9.645	24.175	16.910
CPCL 02-2975	90.99	184.12	137.56	120.3	118.5	119.4	10.935	21.908	16.422
CP 72-2086	60.10	200.29	130.20	112.3	124.3	118.3	6.735	24.903	15.819
CP 04-1619	95.45	148.95	122.20	111.6	122.4	117.0	10.635	18.243	14.439
CPCL 02-2273	52.92	190.61	121.77	107.1	121.3	114.2	5.670	23.183	14.427
CP 04-1252	56.96	190.00	123.48	105.2	109.8	107.5	6.013	20.965	13.489
CP 04-1321	41.18	158.96	100.07	123.3*	132.9*	128.1	5.108	21.142	13.125
Mean	86.62	199.04	142.83	113.9	119.6	116.8	9.908	23.773	16.841
LSD (p = 0.1)†	20.05	23.63	29.85	4.0	3.6	6.1	2.424	2.986	3.541
CV (%)	24.08	12.36	2.89	3.6	3.1	1.6	25.444	13.059	8.439

* Significantly greater than CP 89 2143 at p = 0.10 based on *t* test.

† *LSD* for location means of cane yield = 7.89 TC/H of sugar yield = 3.0 KS/T, and of sugar yield = 1.253 TS/H at p = 0.10.

Table 16. Yields of cane in metric tons per hectare (TC/H) from second-ratoon cane on Lauderhill muck and Dania muck

Clone	Mean yield by soil type, farm, and sampling date					
	Dania muck			Lauderhill muck		
	Knight 10/18/2010	SFI 10/26/2010	Duda 10/28/2010	Okeelanta 10/21/2010	Wedgworth 10/22/2010	Estimated yield, all farms
CP 78-1628	37.27	141.78	156.78*	104.53	135.95	116.73
CPCL 02-0926	29.45	149.33	136.61	122.37*	142.63	115.19
CPCL 95-2287	-----	145.97	135.62	109.11	138.93	108.74
CPCL 02-0843	23.25*	147.00	107.51	99.33	134.55	105.13
CP 89-2143	27.82	133.94	122.48	100.34	132.52	103.42
CPCL 02-2913	17.73	119.91	111.17	94.16	146.58	98.37
CP 04-1367	21.03	133.73	105.21	97.37	133.62	98.19
CPCL 02-1295	9.08	129.22	112.80	89.82	124.02	97.06
CPCL 02-2975	14.06	122.97	105.61	91.03	133.82	94.23
CP 04-1619	9.85	135.56	98.77	102.07	115.48	92.35
CP 04-1426	16.92	121.82	118.99	115.77*	87.24	92.15
CPCL 02-2273	20.04	109.23	100.84	91.77	105.39	83.26
CPCL 02-0908	25.02	93.61	82.97	83.16	116.05	79.81
CP 04-1252	3.94	110.29	79.89	83.44	113.82	78.27
CP 72-2086	3.89	106.98	60.76	79.39	98.44	69.89
CP 04-1321	2.07	26.00	58.54	27.13	59.92	34.73
Mean	17.43	120.46	105.91	93.17	119.93	91.72
LSD (p = 0.1)†	8.78	23.82	22.78	13.28	21.82	14.21
CV (%)	52.37	20.57	22.37	14.82	18.92	3.18

***** Significantly greater than CP 89-2143 at p = 0.10 based on *t* test.
† *LSD* for location means of cane yield = 8.72 TC/H at p = 0.10.

Table 17. Yields of theoretical recoverable 96° sugar in kg per metric ton of cane (KS/T) from second-ratoon cane on Lauderhill muck and Dania muck

	Mean yield by soil type, farm, and sampling date					
	Dania muck			Lauderhill muck		
Clone	**Knight 10/18/2010**	**SFI 10/26/2010**	**Duda 10/28/2010**	**Okeelanta 10/21/2010**	**Wedgworth 10/22/2010**	**Estimated yield, all farms**
CP 04-1321	101.30	117.73	127.71	117.91*	123.72*	117.67*
CPCL 02-0908	101.03	118.49	123.39	123.80*	110.79	116.10
CPCL 02-2913	95.48	117.98	123.37	114.58	113.54	114.35
CPCL 95-2287	-----	112.11	120.68	117.02*	108.68	113.44
CP 89-2143	102.22	113.98	121.19	112.17	113.83	112.68
CPCL 02-2975	108.69	116.26	119.99	113.25	116.52	112.30
CPCL 02-0926	100.48	110.37	119.90	113.46	110.04	110.96
CPCL 02-0843	104.01	109.01	117.74	111.02	108.69	108.98
CPCL 02-2273	102.26	104.16	119.08	108.66	101.88	107.37
CP 04-1426	106.31	110.88	114.34	109.72	93.71	106.99
CP 72-2086	96.77	109.46	108.81	111.87	103.31	106.04
CP 78-1628	98.43	103.90	119.84	107.83	99.22	105.47
CPCL 02-1295	103.08	107.60	112.83	106.86	99.00	105.35
CP 04-1619	95.35	108.04	119.50	102.32	100.81	105.21
CP 04-1367	92.41	102.31	108.04	102.49	98.84	100.82
CP 04-1252	91.68	96.65	107.09	103.46	90.38	97.85
Mean	99.97	109.93	117.72	111.03	105.81	108.85
LSD (p = 0.1)†	6.83	6.28	6.74	4.80	6.01	4.14
CV (%)	7.10	5.94	5.95	4.50	5.91	1.45

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.
† *LSD* for location means of cane yield = 2.38 KS/T at p = 0.10.

Table 18. Yields of theoretical recoverable 96^{o} sugar in metric tons per hectare (TS/H) from second-ratoon cane on Dania muck and Lauderhill muck

	Mean yield by soil type, farm, and sampling date					
	Dania muck			Lauderhill muck		
Clone	Knight 10/18/2010	SFI 10/26/2010	Duda 10/28/2010	Okeelanta 10/21/2010	Wedgworth 10/22/2010	Estimated yield, all farms
CPCL 02-0926	2.958	16.557	16.388	13.888*	15.707	13.013
CP 78-1628	3.658	14.695	19.007*	11.282	13.610	12.609
CPCL 95-2287	-----	16.470	16.408	12.853	15.145	12.481
CP 89-2143	2.870	15.333	14.820	11.238	15.085	11.869
CPCL 02-0843	2.407	16.157	12.783	11.022	14.648	11.654
CPCL 02-2913	1.662	14.158	13.812	10.818	16.702	11.499
CPCL 02-2975	1.527	14.357	12.618	10.333	15.577	10.909
CPCL 02-1295	0.943	13.902	12.747	9.607	12.322	10.307
CP 04-1367	1.948	13.570	11.320	9.957	13.205	10.000
CP 04-1426	1.790	13.493	13.632	12.793	8.137	9.969
CP 04-1619	0.940	14.765	11.767	10.463	11.687	9.924
CPCL 02-0908	2.527	11.057	10.250	10.302	12.842	9.371
CPCL 02-2273	2.005	11.440	11.948	9.983	10.657	8.994
CP 04-1252	0.335	10.692	8.558	8.650	10.398	7.727
CP 72-2086	0.375	11.775	6.620	8.862	10.208	7.568
CP 04-1321	0.235	3.083	7.550	3.172	7.512	4.310
Mean	1.745	13.219	12.514	10.326	12.715	10.138
LSD (p = 0.1)†	0.905	2.982	3.036	1.698	2.543	1.770
CV (%)	53.904	23.462	25.230	17.039	20.800	10.150

*Significantly greater than CP 89-2143 at p = 0.10 based on *t* test.
† *LSD* for location means of cane yield = 1.004 TS/H at p = 0.10.

Table 19. Yields of harvest theoretical recoverable 96° sugar in kg per metric ton of cane (KS/T) from second-ratoon cane on Pompano fine sand and Margate sand

	Sugar yield by soil type, farm, and sampling date			
	Pompano fine sand	Margate sand		
Clone	Lykes 10/27/2010	Hilliard 9/27/2010	Townsite 10/25/2010	Mean yield, all farms
CPCL 02-0908	117.2	116.4	130.7*	121.4*
CP 04-1321	117.8	115.4	124.8*	119.3*
CP 04-1935	119.6*	116.1	121.1*	118.9*
CPCL 02-2913	113.5	118.0*	121.5*	117.7
CP 89-2143	115.0	113.0	120.6*	116.2
CPCL 02-0926	121.8*	109.1	116.4	115.8
CPCL 02-1295	116.2	113.3	112.2	113.9
CP 72-2086	116.1	110.1	115.5	113.9
CP 78-1628	112.5	111.6	117.0	113.7
CP 04-1619	113.7	112.1	114.4	113.4
CP 04-1566	113.0	110.0	115.6	112.9
CP 04-1258	103.3	114.5	119.8	112.5
CPCL 02-0843	112.5	107.5	116.7	112.2
CP 04-1252	109.0	107.4	108.6	108.3
CP 04-1844	106.7	100.1	107.5	104.8
CP 04-1374	103.7	99.6	106.3	103.2
Mean	113.2	110.9	116.8	113.6
LSD (p = 0.1)†	6.6	5.0	3.6	4.8
CV (%)	6.1	4.7	3.2	1.5

* Significantly greater than CP 78-1628 at p = 0.10 based on t test.
† *LSD* for location means of sugar yield = 3.5 KS/T at p = 0.10.

Table 20. Yields of cane and theoretical recoverable 96° sugar in metric tons per hectare (TC/H and TS/H) from second-ratoon cane on Pompano fine sand and Margate sand

	Cane yield by soil type, farm, and sampling date				Sugar yield by soil type, farm, and sampling date			
	Pompano fine sand	Margate sand		Mean yield, all farms	Pompano fine sand	Margate sand		Mean yield, all farms
Clone	Lykes 10/27/2010	Hilliard 9/27/2010	Townsite 10/25/2010		Lykes 10/27/2010	Hilliard 9/27/2010	Townsite 10/25/2010	
CP 04-1844	123.51*	109.51*	130.12*	121.05*	13.313	10.972	13.990*	12.758
CP 04-1935	96.38	92.98	119.49*	102.95	11.480	10.747	14.510*	12.246
CPCL 02-2913	93.38	82.99	117.48*	97.95	10.612	9.717	14.263*	11.531
CP 04-1619	107.09	83.24	109.76*	100.03	12.163	9.357	12.587*	11.369
CP 89-2143	99.98	81.21	107.81*	96.33	11.465	9.245	13.002*	11.237
CPCL 02-0843	100.51	93.90	98.70	97.70	11.270	10.118	11.570	10.986
CPCL 02-1295	102.88	84.00	101.16*	96.02	11.930	9.502	11.382	10.938
CPCL 02-0926	101.84	90.50	89.55	93.96	12.417	9.915	10.418	10.917
CP 04-1258	94.19	94.16	100.29*	96.21	9.808	10.800	11.998*	10.869
CP 04-1374	110.87	90.96	111.67*	104.50*	11.518	9.083	11.853*	10.818
CP 04-1566	99.33	81.77	103.28*	94.79	11.298	9.000	11.957*	10.752
CPCL 02-0908	81.20	73.66	105.11*	86.66	9.523	8.543	13.767*	10.611
CP 78-1628	105.25	84.52	85.08	91.62	11.743	9.388	9.937	10.356
CP 72-2086	72.33	98.95	90.17	77.15	8.438	7.745	10.427	8.870
CP 04-1252	74.64	61.25	91.49	75.79	8.107	6.622	9.903	8.211
CP 04-1321	28.34	48.71	64.04	47.03	3.300	5.617	7.970	5.629
Mean								
LSD (p = 0.1)†	93.23	82.64	101.57	92.48	10.524	9.148	11.846	10.506
CV (%)	17.46	15.55	15.20	12.03	2.015	1.743	1.852	1.560

* Significantly greater than CP 78-1628 at p = 0.10 based on t test.
† *LSD* for location means of cane yield = 5.71 TC/H and of sugar yield = 3.500 TS/H at p = 0.10.

Table 21. Yields of cane in metric tons per hectare (TC/H) and theoretical recoverable 96^{o} sugar in kg per metric ton (KS/T) and in metric tons per hectare (TS/H) from second-ratoon cane on Dania muck and Torry muck

	Cane yield (TC/H) by soil type, farm, and sampling date			Sugar yield (KS/T) by soil type, farm, and sampling date			Sugar yield (TS/H) by soil type, farm, and sampling date		
	Torry muck	Dania muck		Torry muck	Dania muck		Torry muck	Dania muck	
Clone	Eastgate 10/19/2010	Okeelanta 10/20/2010	Mean yield, both farms	Eastgate 10/19/2010	Okeelanta 10/20/2010	Mean yield, both farms	Eastgate 10/19/2010	Okeelanta 10/20/2010	Mean yield, both farms
CPCL 00-1373	166.43	86.78*	126.60	99.5	118.6	109.1	16.620	10.298*	13.459
CP 03-1160	144.65	95.91*	120.28	104.1	122.6	113.3	15.165	11.743*	13.454
CPCL 01-0271	145.88	81.88*	113.88	107.8	131.2*	119.5	15.872	10.790*	13.331
CPCL 00-4111	147.48	79.07*	113.28	111.1	128.8	120.0	16.272	10.103*	13.188
CPCL 00-4027	158.02	69.01	113.51	111.6	120.5	116.0	17.795	8.343	13.069
CP 89-2143	148.75	61.52	105.13	112.6	125.9	119.3	16.980	7.740	12.360
CP 78-1628	144.96	53.40	99.18	112.0	120.6	116.3	16.412	6.492	11.452
CPCL 00-6756	139.12	61.63	100.37	106.0	116.5	111.3	14.792	7.207	10.999
CPCL 00-0129	124.24	65.65	94.94	104.1	122.5	113.3	13.065	8.152	10.608
CPCL 00-6131	139.87	65.94	102.91	95.8	117.2	106.5	13.388	7.823	10.606
CPCL 00-4611	131.86	53.43	92.64	100.7	112.4	106.5	13.308	5.965	9.637
CPCL 00-0458	124.80	36.72	80.76	111.8	117.3	114.5	14.080	4.373	9.227
CPCL 01-0571	108.20	48.73	78.47	113.8	115.7	114.7	12.262	5.613	8.938
CP 72-2086	128.52	26.68	77.60	108.3	121.0	114.7	13.997	3.205	8.601
CP 03-1491	108.85	31.63	70.24	117.0	126.1	121.5	12.822	3.985	8.403
CP 03-2188	82.35	48.96	65.65	115.1	104.1	109.6	9.400	5.030	7.215
Mean	134.00	60.43	97.22	108.2	120.1	114.1	14.514	7.304	10.909
LSD (p = 0.1)†	31.43	16.08	21.75	9.6	5.0	10.6	4.010	1.981	2.781
CV (%)	24.39	27.68	3.62	9.2	4.4	2.2	28.734	28.203	11.545

* Significantly greater than CP 89-2143 at p = 0.10 based on t test.
† *LSD* for location means of cane yield = 9.91 TC/H of sugar yield = 2.3 KS/T, and of sugar yield = 1.170 TS/H at p = 0.10.

Table 22. Rankings of clones and percent rating of CP 89-2143, by series, of damage to juice quality by freezing temperatures†

CP 06 and CPCL 06 Series		CP 05, CPCL 02, and CPCL 05 Series		CP 04, CPCL 95, and CPCL 02 Series	
Clone	**Rating**	**Clone**	**Rating**	**Clone**	**Rating**
CP 72-2086	3.0	CP 72-2086	3.0	CP 72-2086	3.0
CP 78-1628	4.0	CP 78-1628	4.0	CP 78-1628	4.0
CP 89-2143	4.0	CP 89-2143	4.0	CP 89-2143	4.0
CP 06-2042	3.0	CP 05-1466	3.0	CP 04-1252	2.0
CP 06-2164	3.0	CP 05-1526	3.0	CP 04-1258	4.0
CP 06-2170	3.5	CP 05-1679	3.0	CP 04-1321	4.0
CP 06-2274	2.0	CP 05-1740	3.5	CP 04-1367	4.0
CP 06-2317	1.0	CPCL 02-6225	1.0	CP 04-1374	4.0
CP 06-2335	3.0	CPCL 02-6848	2.0	CP 04-1426	3.0
CP 06-2397	3.0	CPCL 02-7080	4.0	CP 04-1566	4.0
CP 06-2400	4.0	CPCL 02-7190	4.0	CP 04-1619	4.0
CP 06-2664	4.0	CPCL 02-7386	3.0	CP 04-1844	4.5
CP 06-2713	3.0	CPCL 02-7500	3.0	CP 04-1935	3.0
CP 06-2874	3.0	CPCL 02-7610	3.0	CPCL 95-2287	---
CP 06-2897	2.0	CPCL 02-8001	3.0	CPCL 02-0843	3.0
CP 06-3025	2.0	CPCL 02-8071	2.0	CPCL 02-0908	5.0
CP 06-3040	3.0	CPCL 02-8072	2.0	CPCL 02-0926	4.0
CP 06-3098	5.0	CPCL 05-1009	3.0	CPCL 02-1295	4.0
CPCL 06-3272	3.0	CPCL 05-1102	4.0	CPCL 02-2273	4.0
CPCL 06-3332	2.0	CPCL 05-1201	4.0	CPCL 02-2913	3.0
CPCL 06-3432	1.0	CPCL 05-1300	2.0	CPCL 02-2975	3.0
		CPCL 05-1791	2.0		

† Freeze tolerance ratings: 5 = excellent; better than CP 89-2143; 4 = good; as good as CP 89-2143; 3 = moderate; lower tolerance than CP 89-2143; 2 = poor; 1 = very poor.

Table 23. Dates of stalk counts of 10 plant cane, first-ratoon, and second-ratoon experiments

	Crop		
Location	**Plant cane**	**First ratoon**	**Second ratoon**
Duda	07/13/10	08/06/10	09/01/10
Eastgate	06/08/10	08/04/10	08/13/10
Hilliard	08/02/10	08/26/10	09/13/10
Knight	07/26/10	08/05/10	09/15/10
Lykes	08/03/10	08/25/10	09/10/10
Okeelanta	07/14/10	08/18/10	09/14/10
Okeelanta (successive)	07/30/10	08/19/10	09/07/10
SFI	07/13/10	08/05/10	08/31/10
Townsite	08/03/10	10/04/10	---
Wedgworth	07/20/10	07/31/10	08/17/10

Appendix. Sugarcane Field Station Cultivar Development Program for Muck and Sand Soils

Timeline	Stage	Population	Field layout	Crop age at selection	Yield and quality selection criteria	Disease and other selection criteria	Seedcane increase scheme
Year 1	Crossing	400-600 crosses producing about 500,000 true seeds	—	—	Germination tests of seed (bulk of seed stored in freezers)	Field progeny tests planted by family	—
Year 2	Seedlings (single stool stage) Seedlings start in the greenhouse from true seed of the previous year	50,000-75,000 individual plants	Transplants spaced 12 in apart in paired rows on 5-ft centers	8-10 months	Visual selection for plant type, vigor, stalk diameter, height, density, and population; freedom from diseases	Family evaluation for general agronomic type and disease resistance against rust, leaf scald (LS)*, smut, etc.	One stalk cut for seed from each selected seedling
Year 3	Stage I (First clonal trial)	10,000-15,000 clonal plots	Unreplicated plots, 5 ft long on 5-ft row spacing	9-10 months	Essentially the same selection criteria as for Seedlings	Permanent CP-series number assignment made	Eight stalks planted for agronomic evaluation. One stalk planted for RSD screening (by inoculation)
Year 4	Stage II (Second clonal trial)	1,200-1,600 clones including five checks	Unreplicated 2-row plots, 15 ft long on 5-ft row spacing	12 months	Yield estimates based on stalk number, average stalk weight, and sucrose analysis; freedom from diseases	Family evaluation for disease resistance against RSD* and eye spot (by inoculation) and LS*, yellow leaf syndrome (YLS), and dry top rot (by natural infection)	Eight 8-stalk bundles cut for seed; two stalks used for RSD screening
Year 5-6	Stage III (Replicated test; first stage planted in commercial fields)	135 clones including 2 checks† per location	Four 2-replicate tests (3 organic and 1 sand site) on growers' farms; Two-row plots, 15 ft long	10-11 months Evaluated in plant-cane and first-ratoon crops	Yield estimates based on stalk number, average stalk weight, and sucrose analysis; clonal performance assessed across locations	Disease screening (inoculation) for LS*, smut, mosaic virus, and RSD; also rated for other diseases (rust, etc.)	Two 8-stalk bundles cut for seed at each location
Year 7-9	Stage IV (Final replicated test; planted in commercial fields)	16 clones including 2 checks† per location	Eleven 6-replicate tests (8 organic and 3 sand sites) on growers' farms; Three-row plots, 35 ft long on 5-ft row spacing	10-15 months Tests are analyzed in plant-cane and first- and second-ratoon crops	Cane tonnage, sucrose and fiber analyses; yield estimates based on stalk number and average stalk weight	Disease screening for LS*, smut, mosaic, and RSD; also rated for lodging and suitability for mechanical harvest	Initial seed increase for potential commercial release planted from first-ratoon seed following evaluation in the plant cane
Year 8-11	Seedcane increase and distribution	Usually 6 or fewer clones	Plots range from 0.1 to 2.0 ha	—	Seedcane purity; freedom from diseases and insects	Plots checked and certified for clonal purity and seedcane quality	Seedcane is increased at 9 Stage IV locations (7 muck and 2 sand)

* LS: leaf scald; RSD: ratoon-stunting disease; YLS: yellow leaf syndrome

† Checks in stages III and IV: CP 72-2086 (all locations), CP 78-1628 (sand soils), and CP 89-2143 (organic soils).