

COMPARISON OF SUGARCANE DISEASE INCIDENCE AND YIELD OF FIELD-RUN, HEAT-TREATED, AND TISSUE-CULTURE BASED SEEDCANE

Jeff Flynn¹, Gerald Powell², Raul Perdomo², German Montes²,
Kenneth Quebedeaux¹, and Jack Comstock³

¹Certis U.S.A., LSU Business and Technology Center, South Stadium Dr.,
Baton Rouge, LA, 70803

²Okeelanta Corp., P.O. Box 86, South Bay, FL, 33439

³USDA-ARS Sugarcane Research Unit, HCR Box 8, Canal Point, FL, 33438

ABSTRACT

Two experiments, one fallow planted and one successive planted, were established at Okeelanta Corp., South Bay, FL to determine disease levels, increase rates, and estimates of cane and sugar yields obtained from three seedcane sources: (1) Kleentek®, commercial tissue-culture based seedcane (KT), (2) progeny of hot water treated seedcane (HT), and (3) field-run seedcane without any recent history of hot water treatment (FR). Four commercial sugarcane cultivars were planted in each experiment. Incidences of ratoon stunting disease (RSD), caused by *Leifsonia xyli* subsp. *xyli* and yellow leaf, caused by *Sugarcane yellow leaf virus* (SCYLV), were assessed for the plant-cane and ratoon crops. RSD incidence varied between the FR seedcane sources and cultivars. Although RSD was initially absent in the KT and HT seedcane sources, nearly equivalent spread occurred in HT and KT by the second ratoon crop in most cultivars. The initial incidence of SCYLV was greater than 95 % in the plant-cane crop for the HT and FR seedcane sources. The plants in the KT seedcane source initially tested free of SCYLV, but the incidence gradually increased to approximately 20 % by the second ratoon crop harvest. One cultivar (CP 80-1743) had a significantly lower rate of disease increase. Among seedcane sources, there were significant differences for cane yield and sugar yield but not for sucrose concentration in both trials. Overall, the KT seedcane source produced over 6 % greater stalk population than the HT and FR seedcane sources. KT produced approximately 12 % more cane yield and sugar yield than the FR seedcane source and approximately 7 and 4 % more cane yield and sugar yield than HT in the fallow trial and successive trial, respectively. The HT seedcane source was significantly higher for stalk population, cane yield, and sugar yield than FR seed sources in the successive trial. Although there were significant differences across cultivars, there were significant cultivar by seedcane source interactions. These results suggest that managing diseases with healthy seedcane can increase both cane and sugar yields by relatively equivalent amounts in successive and fallow planted fields. In addition, planting tissue-culture based seedcane that is free of SCYLV can provide both higher cane and sugar yields compared to HT seedcane.

INTRODUCTION

Systemic diseases, including ratoon stunting disease (RSD) caused by *Leifsonia xyli* subsp. *xyli*, and sugarcane yellow leaf caused by *Sugarcane yellow leaf virus* (SCYLV), are widely distributed among sugarcane growing areas of the world (Davis and Bailey, 2000; Lockhart and Cronje, 2000). The incidence of SCYLV in Florida commercial fields has been reported to be 85 % or higher in susceptible cultivars (Comstock et al., 1999). The impact of these diseases on yield has been documented

(Comstock and Miller, 2004; Dean and Davis, 1990; Flynn et al., 2003; Grisham, 1991; Grisham et al., 2002; Koike, 1982; Vega, et al., 1997) and is affected by cultivar susceptibility and growing conditions. Healthy seedcane programs have been deployed in several countries to combat these and certain other systemic diseases. Such a program based on meristem propagation has been demonstrated to be highly effective in controlling RSD in commercial fields in Louisiana (Hoy et al., 2003; Hoy and Flynn, 2001). If appropriately performed, tissue-culture can be therapeutic in the elimination of certain viruses (Chatenet, et al., 2001; Fitch, et al., 2001; Lehrer et al., 2001). Kleentek, a commercial seedcane producer, currently utilizes apical meristem tissue-culture for the elimination and propagation of pathogen-free plants for both the Louisiana and Florida sugarcane industries.

Benefits derived from this type of seedcane program are contingent on disease spread and increase rates being sufficiently low to allow several years of production before disease re-infection. RSD is spread both mechanically and through planting of infected stalk cuttings. Spread rates are related to cultivar susceptibility and proximity to infected plants from which mechanical harvester cutting blades can transmit infected sap (Damann, 1992; Hoy, 1999). Hot water treatment of seedcane can be an effective means for managing RSD (Davis and Bailey, 2000). Spread of SCYLV is by aphids and planting infected cuttings (Lehrer, et al., 2001; Lockhart and Cronje, 2000; Schenck and Lehrer, 2000; Scagliusi et al., 2000). SCYLV is not controlled by hot water treatment of seedcane. SCYLV spread in Florida has been shown to be dependent on cultivar susceptibility and proximity to infection sources. In the Florida CP cultivar development program, an incidence of 55 % was found in stage IV clones (four to five years of exposure). After two years of exposure in trials at the Canal Point station, SCYLV incidence ranged from 20 to 86 % among cultivars received as virus-free tissue cultures (Comstock, unpublished data). Another Florida experiment reported infection levels ranging from 10 to 27 % in a second ratoon crop of four commercial cultivars (Flynn, et al., 2003). Significant yield response was reported in both of these experiments from the use of virus-free planting material compared to traditional sources.

The objective of this study was to compare three types of seedcane available to growers in Florida (heat-treated, field-run, and tissue-culture) with respect to disease incidences and yields over the crop cycle under commercial production conditions.

MATERIALS AND METHODS

Adjacent field sections in organic (muck) soils located in the East Area of Okeelanta Corp. farms near South Bay, FL were selected for the test site. One of the field sections had been in rice cultivation for the previous cycle (hereafter referred to as the Fallow Trial), and the other site had been in continuous sugarcane production (hereafter referred to as the Successive Trial). Identical plot size and treatment arrangements were used for each experiment. The experimental design was a randomized complete block with four blocks per experiment and a split plot arrangement of treatments. Main plots consisted of cultivars of sugarcane. For the fallow trial, cultivars included CP 72-2086, CP 80-1743, CP 84-1198, and CP 89-2143. For the successive trial, the same cultivars were planted, except CP 80-1827 replaced CP 72-2086 (limited seed availability).

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Within each main plot, sub-plots of four, 1.5 m rows by 10.7 m were planted with seedcane obtained from one of three different source types: (1) Kleentek (KT), (2) progeny of hot water treated (HT) seedcane (for control of RSD), and (3) untreated field-run (FR). Three-meter alleys separated each main plot. A buffer row of CP 72-2086 bordered the experiments. The KT seed source was obtained from a commercial seedcane operation. This seedcane was generated through meristem propagation of disease indexed stock plants and field propagated at an isolated field nursery in south Florida. All of the KT seedcane, except for CP 72-2086, was from seed plots that were first progeny of meristem cultured plants. For CP 72-2086, only stalks of first year planted meristem cultures were available. For the HT plots, seedcane was obtained from on-farm field sources that had a recent history of hot water treatment for control of RSD. The FR seedcane came from on-farm field sources that did not have any recent history of hot water treatment.

Experiments were planted on December 7, 1999 at the standard two line planting rate and chopped into approximately 60 cm setts before covering. Care was taken to avoid disease spread by separately chopping the seedcane of the three seed types and using disinfected knives before cutting the KT and HT plots. Because of the short and young plants that were used for the KT CP 72-2086, these plots were not chopped. Each experiment was subjected to standard agronomic practices with respect to cultivation, herbicide and insecticide applications, fertilization, and irrigation.

The youngest fully emerged leaf was collected (six per plot) on May 3, 2000 (plant-cane) and tested for presence of the SCYLV using midvein blot enzyme immunoassay (MB-EIA) (Schenck et al., 1998). Leaf samples also were collected in the first ratoon crop on April 18, 2001 and in the second ratoon crop on April 25, 2002, and again on October 10, 2002 (prior to final harvest). While leaves were collected from all KT plots for each sample date, as HT and FR treatments tested 100 % in the plant-cane crop, only representative plots were selected for testing in the first ratoon crop and at harvest of the second ratoon crop. Also, since HT and FR among cultivars common to both trials tested similarly, HT and FR from only one experiment were tested for the spring first ratoon crop and final harvest for the second ratoon crop sampling dates. Basal stalk pieces (three node cuttings) from five plants per plot were collected on September 6, 2000 (plant-cane) and tested for RSD. Plots were again sampled in the second ratoon crop (10 stalks/plot) on October 10, 2002. In both instances, tissue blot immunoassay was performed (Hoy et al., 1999).

Millable stalk counts were taken from the middle two rows of each plot on August 31, 2000 to estimate stalk population (#/ha). Stalk counts for the first and second ratoon crops were done on July 3, 2001 and August 2, 2002, respectively. Yield evaluations were made on January 12-13, 2001 in the plant-cane crop, December 10, 2001 in the first ratoon crop, and October 7, 2002 in the second ratoon crop. Plots were hand harvested so that knives could be disinfected between plots for the plant-cane and first ratoon crops. Whole plot weights were obtained using a tractor mounted weigh rig with hydraulic load cell. For the second ratoon crop, 30-stalk samples were collected from each plot to obtain average stalk weights (kg). The product of stalk weight and stalk population was divided by 2000 and used as an estimate of cane yield (Mt/ha). Ten stalks were collected from each plot to estimate sucrose concentration (%), which was

performed at the Okeelanta Corp. Mill. Sugar yield (Mt/ha) was estimated as the product of cane yield and sucrose concentration and then dividing by 100.

Means were separated by LSD ($P = 0.05$) values. For the final analysis, main and sub-plot effects were evaluated in a combined model including data from all three crop years. For 3-year averages with significant cultivar by seedcane type interactions, Student-Neuman-Keuls means separations were performed ($P = 0.05$) (CoHort Software, 2001. CoStat.www.cohort.com. Monterey, CA). Values within a column of means followed by the same letter were not significantly different ($P = 0.05$).

RESULTS AND DISCUSSION

Disease testing in plant-cane did not detect the presence of RSD in any of the KT or HT seed sources (Table 1). In the FR seedcane source, high incidences of RSD were found in CP 80-1743 (90-100 %) and CP 80-1827 (65 %). Cultivar CP 84-1198 had a low incidence (10 %) in the successive trail, and no RSD was detected in the other cultivars. By the second ratoon crop, there was essentially no change in the fallow trial results. Infection levels of 5 % or less were detected in one treatment each of CP 89-2143 and CP 72-2086. In the successive trial, however, some level of RSD could be detected in all cultivar and seed treatments. Overall, RSD levels in the second ratoon crop of the successive trial averaged 10.0 and 11.3 % in the KT and HT, respectively, compared to an average of 60 % in the FR.

HT and FR seed sources of all cultivars had nearly 100 % infection with SCYLV (Table 2). SCYLV was not detected in any of the KT seedcane source in the plant-cane crop. A gradual increase in SCYLV was noted in the KT for the crop cycle in both trials with averages of 16.9 % and 28.8 % by final sample in fallow and successive trials, respectively. A similar pattern of infection occurred in either trial with the exception of the KT for CP 84-1198. The final SCYLV infection levels in the successive trial were inexplicably much higher than in the fallow trial of CP 84-1198 (averaging 10.0 % in the fallow trial and 57.5 % in the successive trial). The field was destroyed before re-sampling could confirm these results. The spread rate of SCYLV into the KT CP 80-1743 was slower than for the other cultivars for both trials. The average SCYLV levels (last three sample dates) indicated that the CP 80-1743 had approximately three to four times lower infection than the other cultivars ($P < 0.05$). For both trials, SCYLV infection levels averaged 15.4, 12.6, and 4.2 % in the CP 84-1198, CP 89-2143 and CP 80-1743, respectively. For CP 70-2086 (fallow trial only), the level was 17.5 %, and for CP 80-1827 (successive trial only) the level was 14.3 %.

Significant stalk population differences among the seedcane sources were noted in both trials (Table 3). In the fallow trial, KT had a significantly greater stalk population than HT in the plant-cane crop, second ratoon crop, and the 3-year model but not in the first ratoon crop. KT had a significantly greater stalk population than FR in the second ratoon crop and the 3-year model, but not in the plant-cane and first ratoon crops. HT and FR did not differ. Significant cultivar X seed interactions were found only in the combined 3-year data. In the successive trial, KT produced more stalks than the other treatments for all crops. By the first ratoon crop, the HT produced more stalks than FR.

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Significant cultivar X seed interactions were found for all but the plant-cane results. The variable incidence of RSD in FR among cultivars and the variable impact of SCYLV among cultivars likely explains the significant seedcane X cultivar interactions. For instance, the FR in the two cultivars with high RSD averaged nearly 12.6 % lower counts than the HT and KT compared to a 7.5 % difference (FR vs. HT and KT) in the two cultivars where RSD was not detected in FR. SCYLV impact on CP 89-2143 appears to be greater than for other cultivars. The KT advantage over HT was 15.3 % in CP 89-2143 compared to a range of -1.2 to 8.5 % in the other cultivars. Likewise, in the fallow trial, the KT advantage over HT was 16.8 % for CP 89-2143 compared to a range of 1.8 to 4.0 % in the other cultivars. Overall, KT seed sources produced 6.4 % more stalks than HT in the successive and fallow trials. For the FR seed source, the KT stalk population advantage was 13.4 and 6.0 % in successive and fallow trials, respectively. The HT seed sources produced a 6.5 % greater stalk population than FR in the successive trial.

Results for cane yield also revealed differences among seedcane sources (Table 4). In the fallow trial, KT was superior to the other seedcane sources in all but the first ratoon crop. Despite having similar stalk population, HT was significantly better than FR in the second ratoon crop and the 3-year model. In the successive trial, KT was superior to FR across all crops. Although the KT seedcane source was numerically superior to HT in all crops, only for the plant-cane and the 3-yr combined model were these differences significant. HT was significantly better than FR in all but the plant-cane crop. Significant cultivar X seedcane interactions noted in the second ratoon crop and 3-year model of both trials followed similar patterns as noted with stalk population. Student-Neuman-Keuls separation of cultivar-seedcane means ($P = 0.05$) indicated that the KT source of CP 89-2143 was superior to all other treatment combinations for the successive trial. The FR CP 80-1743 was inferior to all other treatment combinations except FR CP80-1827. Overall, KT was 4.6 % and 7.6 % better than HT and 13.5 % and 12 % better than FR in successive and fallow trials, respectively. Comparing HT and FR, the respective differences in successive and fallow trials were 8.5 % and 4.0 %.

No significant seed source differences were noted for sucrose concentration (Table 5). A significant cultivar X seed interaction was noted only for the second ratoon crop fallow trial. Sugar yield results were similar to stalk population and cane yield. In the fallow trial, KT produced significantly greater sugar yield than FR over the crop cycle. Compared to HT, only in the first ratoon crop was KT not significantly better. HT was superior to FR in the second ratoon crop and the 3-year model. Significant cultivar X seed interactions occurred in the second ratoon and 3-year model. In the successive trial, KT was superior to FR across all crops but only significantly better than the HT in plant-cane and the 3-year model. The HT was superior to FR in the first and second ratoon and the 3-year model. Significant cultivar X seed interactions were found in the 3-year model. Averaged over the crop cycle for successive and fallow trials, KT produced 4.6 and 9.0 % more sugar yield than HT, respectively. Compared to FR, the KT increase was 12.3 and 14.0 %. Likewise, the HT produced 7.3 and 4.6 % more sugar yield than FR.

After evaluating cultivar X seedcane interactions for the 3-year average of sugar yield (Tables 7 and 8), it became apparent that the response to seedcane source was higher for KT compared to HT in CP 89-2143 in both trials. Overall sugar yield

differences between KT and HT sources of CP89-2143 of 14.6 % and 14.9 % were noted for successive and fallow trials, respectively. For KT and HT seedcane sources of the other cultivars, a range of response was noted for respective successive and fallow trials: CP 80-1743 (2.3 % and 8.0 %), CP 84-1198 (-3.4 % and 6.1 %), CP 72-2086 (2.6 %), and CP 80-1827 (2.1 %). Since SCYLV was the only detectable pathogen difference between the HT and KT treatments, we suggest that these differences represent the relative impact of SCYLV among cultivars. It also should be noted that, in the absence of SCYLV (i.e. KT seed), CP89-2143 produced higher cane yield and sugar yield than the other cultivars. In the presence of SCYLV, cane and sugar yields were similar for CP89-2143, CP80-1743, and CP84-1198. These results emphasize the impact that diseases can have on the relative comparison of cultivars.

In the fallow trial, cane and sugar yields between the HT and FR seedcane sources were similar, except for CP 80-1743, which had a high level of RSD in FR. The same scenario occurred in the successive trial, except that both RSD infected varieties (CP 80-1743 and CP 80-1827) showed lower yields compared to the HT, whereas the two cultivars without RSD infected FR performed similarly to the HT.

In summary, seedcane planted free of RSD and SCYLV remained sufficiently low in disease incidence, under these trial conditions, to allow the evaluation of the relative impact of these diseases. These results confirm that HT seedcane free of RSD can provide a yield advantage over FR seedcane. Significant additional yield benefits can be realized from the use of tissue-culture based seedcane that is free of SCYLV, which is now occurring with high incidence in commercial sugarcane cultivars in Florida.

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Table 1. RSD infection levels among cultivars and seedcane types in the plant-cane and second ratoon crops for the trials conducted at South Bay, FL during 1999 through 2002.

Cultivar	Seedcane source ^a	% RSD Fallow Trial		% RSD Successive Trial	
		Plant-cane	Second ratoon	Plant-cane	Second ratoon
CP84-1198	FR	0.0	0.0	10.0	22.5
CP84-1198	HT	0.0	0.0	0.0	10.0
CP84-1198	KT	0.0	0.0	0.0	7.5
CP80-1743	FR	100.0	100.0	90.0	97.5
CP80-1743	HT	0.0	0.0	0.0	5.0
CP80-1743	KT	0.0	0.0	0.0	2.5
CP80-1827	FR			65.0	100.0
CP80-1827	HT			0.0	15.0
CP80-1827	KT			0.0	22.5
CP89-2143	FR	0.0	0.0	0.0	20.0
CP89-2143	HT	0.0	0.0	0.0	15.0
CP89-2143	KT	0.0	5.0	0.0	7.5
CP70-2086	FR	0.0	0.0		
CP70-2086	HT	0.0	2.5		
CP70-2086	KT	0.0	0.0		
ALL	FR	25.0	25.0	41.3	60.0
ALL	HT	0.0	0.6	0.0	11.3
ALL	KT	0.0	1.3	0.0	10.0

^a Seedcane sources are FR (field-run seedcane with no history of heat treatment for any disease; HT (recent history of hot water treatment, 50 C for 2 hours); KT (Kleentek® tissue-culture derived).

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Table 2. *Sugarcane yellow leaf virus* (SCYLV) infection among cultivar and seed types in the fallow and successive trials over four separate sampling dates for the experiments conducted at South Bay, FL during 1999 through 2002.

Cultivar	Seedcane source ^a	% SCYLV Fallow Trial				% SCYLV Successive Trial			
		Plant-cane	First ratoon	Second ratoon	Second ratoon	Plant-cane	First ratoon	Second ratoon	Second ratoon
		5/3/00	4/18/01	4/25/02	10/10/02	5/3/00	4/18/01	4/25/02	10/10/02
CP84-1198	FR	100.0	ND ^b	100.0	97.5	100.0	ND	100.0	ND
CP84-1198	HT	100.0	ND	100.0	97.5	100.0	100.0	100.0	ND
CP84-1198	KT	0.0	3.3	7.5	10.0	0.0	2.5	10.0	57.5
CP80-1743	FR	100.0	ND	100.0	95.0	100.0	ND	100.0	ND
CP80-1743	HT	95.8	ND	100.0	96.7	83.3	100.0	100.0	ND
CP80-1743	KT	0.0	0.0	2.5	15.0	0.0	0.0	0.0	7.5
CP80-1827	FR					100.0	ND	100.0	100.0
CP80-1827	HT					91.5	100.0	100.0	92.5
CP80-1827	KT					0.0	7.8	15.0	17.5
CP89-2143	FR	100.0	ND	100.0	85.0	100.0	ND	100.0	ND
CP89-2143	HT	100.0	ND	100.0	100.0	100.0	100.0	100.0	ND
CP89-2143	KT	0.0	2.5	2.5	25.0	0.0	7.5	2.5	32.5
CP70-2086	FR	100.0	ND	100.0	100.0				
CP70-2086	HT	100.0	100.0	100.0	100.0				
CP70-2086	KT	0.0	10.3	25.0	17.5				
ALL	FR	100.0	ND	100.0	94.4	100.0	ND	100.0	100.0
ALL	HT	97.9	100.0	100.0	98.6	93.7	100.0	100.0	92.5
ALL	KT	0.0	4.0	9.4	16.9	0.0	4.4	6.9	28.8

^a Seedcane sources are FR (field-run seedcane with no history of treatment for any disease; HT (recent history of hot water treatment, 50 C for 2 hours); KT (Kleentek® tissue-culture derived).

^b ND indicates that no data were collected.

Table 3. Comparison of stalk population among seedcane sources in the fallow and successive trials over the crop cycle.

Seedcane source ^a	Fallow Trial				Successive Trial			
	Plant-cane	First ratoon	Second ratoon	3 yr. average	Plant-cane	First ratoon	Second ratoon	3 yr. average
----- #/ha -----								
KT	93452A	103597A	111897A	102982A	96834A	92223A	100215A	96526A
HT	86997B	102060A	101137B	96834B	89149B	88534B	94375B	90686B
FR	88841AB	103597A	98371B	97141B	86689B	81771C	86997C	85152C
LSD 0.05	5257	3750	4919	2121	5195	3658	1845	2459
Cultivar X seed	NS	NS	NS	P<0.01	NS	P<0.05	P<0.05	P<0.01

^a Seedcane sources are FR (field-run seedcane with no history of treatment for any disease; HT (recent history of hot water treatment, 50 C for 2 hours); KT (Kleentek® tissue-culture derived).

Table 4. Comparison of cane yield among seedcane sources in the fallow and successive trials over the crop cycle.

Seedcane source ^a	Fallow Trial				Successive Trial			
	Plant-cane	First ratoon	Second ratoon	3 yr. average	Plant-cane	First ratoon	Second ratoon	3 yr. average
----- Mt/ha -----								
KT	153.7A	149.4A	144.0A	148.9A	138.8A	118.8A	126.7A	128.0A
HT	141.0B	125.5A	128.9B	138.3B	129.2B	117.6A	120.0A	122.5B
FR	140.5B	140.1A	118.3C	132.9C	128.0B	104.7B	105.7B	112.9C
LSD 0.05	7.9	8.1	7.4	5.2	7.2	7.7	6.2	4.4
Cultivar X seed	NS	NS	P<0.05	P<0.01	NS	NS	P<0.05	P<0.01

^a Seedcane sources are FR (field-run seedcane with no history of treatment for any disease; HT (recent history of hot water treatment, 50 C for 2 hours); KT (Kleentek® tissue-culture derived).

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Table 5. Comparison of sucrose concentration among seedcane sources in the fallow and successive trials over the crop cycle.

Seed type ^a	% theoretical sucrose Fallow Trial ^a				% theoretical sucrose Successive Trial ^a			
	Plant-cane	First ratoon	Second ratoon	3 yr. average	Plant-cane	First ratoon	Second ratoon	3 yr. average
	----- % -----							
KT	12.31	11.43	11.13	11.62	12.97	11.34	11.19	11.83
HT	12.16	11.28	11.04	11.49	12.84	11.38	11.33	11.85
FR	11.87	11.17	11.28	11.44	12.95	11.51	11.33	11.93
LSD 0.05	0.63	0.25	0.29	0.29	0.39	0.20	0.37	0.15
Cultivar X seed	NS	NS	P<0.05	NS	NS	NS	NS	NS

^a Seedcane sources are FR (field-run seedcane with no history of treatment for any disease; HT (recent history of hot water treatment, 50 C for 2 hours); KT (Kleentek® tissue-culture derived).

Table 6. Comparison of sugar yield among seedcane sources in the fallow and successive trials over the crop cycle.

Seedcane source	Fallow Trial				Successive Trial			
	Plant-cane	First ratoon	Second ratoon	3 yr. average	Plant-cane	First ratoon	Second ratoon	3 yr. average
	----- Mt/ha -----							
KT	18.92A	17.00A	16.03A	17.31A	18.00A	13.46A	14.18A	15.14A
HT	17.14B	14.15AB	14.22B	15.88B	16.67B	13.39A	13.61A	14.52B
FR	16.67B	15.64B	13.34C	15.19B	16.57B	12.05B	11.98B	13.46C
LSD 0.05	1.24	1.01	0.89	0.72	1.02	0.87	1.03	0.55
Cultivar X seed	NS	NS	P<0.01	P<0.01	NS	NS	NS	P<0.01

^a Seedcane sources are FR (field-run seedcane with no history of treatment for any disease; HT (recent history of hot water treatment, 50 C for 2 hours); KT (Kleentek® tissue-culture derived).

Table 7. Cultivar by seedcane source 3-year means for sugar yield, stalk population, cane yield, and sucrose concentration for the fallow trial.

Cultivar- Seedcane source ^a	Sugar yield Mt/ha	Stalk population #/ha	Cane yield Mt/ha	Sucrose concentration %
CP 89-2143 KT	19.12 A	116815 A	159.3 A	12.00
CP 84-1198 KT	17.78 B	98678 CD	154.4 AB	11.52
CP 80-1743 KT	17.46 BC	110975 B	150.4 ABC	11.61
CP 84-1198 FR	16.75 BCD	97141 D	141.0 CD	11.87
CP 84-1198 HT	16.67 BCD	94682 D	143.8 BCD	11.59
CP 89-2143 HT	16.25 BCDE	99908 CD	137.8 CD	11.79
CP 80-1743 HT	16.13 CDE	109130 B	138.3 CD	11.66
CP 89-2143 FR	15.44 DE	100523 CD	134.4 DE	11.48
CP 72-2086 KT	14.99 EF	85460 E	131.2 DE	11.44
CP 72-2086 FR	14.91 EF	85152 E	133.4 DE	11.18
CP72-2086 HT	14.60 EF	83000 E	133.9 DE	10.91
CP 80-1743 FR	13.76 F	104826 BC	123.5 E	11.13

^a Seedcane sources are FR (field-run seedcane with no history of treatment for any disease; HT (recent history of hot water treatment, 50 C for 2 hours); KT (Kleentek® tissue-culture derived).

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Table 8. Cultivar by seedcane source three year means for sugar yield, stalk population, cane yield, and sucrose concentration for the successive trial.

Cultivar- Seedcane source ^a	Sugar yield Mt/ha	Stalk population #/ha	Cane yield Mt/ha	Sucrose concentration %
CP 89-2143 KT	17.46 A	110052 A	145.5 A	12.01
CP 80-1743 KT	15.31 B	106671 A	125.0 B	12.25
CP 84-1198 HT	15.17 B	91915 B	125.7 B	12.07
CP 80-1743 HT	14.99 BC	103597 A	124.0 B	12.10
CP 89-2143 HT	14.92 BC	95297 B	122.8 BC	12.16
CP 84-1198 KT	14.60 BC	90993 B	120.0 BC	12.16
CP 89-2143 FR	14.57 BC	97756 B	120.5 BC	12.10
CP 84-1198 FR	14.40 BC	83000 C	118.3 BC	12.17
CP 80-1827 KT	13.21 CD	78082 C	121.3 BC	10.89
CP80-1827 HT	12.97 D	71934 D	117.3 BC	11.06
CP 80-1743 FR	12.74 D	91608 B	104.5 D	12.20
CP 80-1827 FR	12.08 D	67937 D	107.4 CD	11.24

^a Seedcane sources are FR (field-run seedcane with no history of treatment for any disease; HT (recent history of hot water treatment, 50 C for 2 hours); KT (Kleentek® tissue-culture derived).