QUALITATIVE AND QUANTITATIVE PERFORMANCE OF SELECTED EXOTIC SUGARCANE (*SACCHARUM OFFICINARUM* L) VARIETIES IN NIGERIAN SOUTHERN ECOLOGIES

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ABSTRACT
Nigeria currently relies on the importation of over 95% of her sugar requirement due to a combination of factors which include low installed capacity of the existing sugar companies, inefficient factory operation as well as the dependent on the use of old and low yielding sugarcane varieties. One of the ways to ameliorate this situation is the use of high yielding and adapted sugarcane varieties. To this end, 28 of the sugarcane varieties were evaluated for four cropping cycles (2013 - 2017) at two sites in Nigeria. The trials were laid out as a randomized complete block design with four replicates. Each plot was 6 ridges of 10 m long and 1.4 m between the rows. Three-eyed cane setts of 6-7 months old which were disease free were laid horizontally end-to-end. Data were collected from a net plot (60 m^2) on brix, yield and yield components and data were analysed. Identification of the top yielding varieties from each site based on selection criterion (cane yield + acceptable brix, rank summation index (∑RSI) values for combination of cane yield and brix as well as ∑RSI value for Kg-brix and cane quality parameters). Results showed significant ($p \leq 0.05$) differences among the varieties for cane yield cane brix %, pol %, purity and expected sugar recovery for the selected varieties. Three varieties were identified: B80689, Co9906 and CoC671 with mean yield of 77.99, 61.26 and 59.93 t/ha, respectively. The identified varieties had acceptable cane brix ≥20 %, pol % of 18.00, purity of 90% and expected sugar recovery of 10.00 and above. These varieties exhibited good quality traits and their genetic potential. There are therefore recommended to for adoption by the sugarcane estates for cultivation in southern ecologies of Nigeria.

Keywords: Sugarcane, summation index, ratoon crop, cane brix, sugar recovery, southern Nigeria

INTRODUCTION

The versatility of sugarcane (*Saccharum officinarum* L.) makes it a very useful crop to produce sugar, ethanol, and electricity generation. The pharmaceutical industry uses alcohol, bagasse is used to make paper and chipboard, and press mud is a rich source of organic matter and nutrients for agricultural production, among many other beneficial byproducts.

The main factors impeding sugarcane production in Nigeria are the inadequate of suitable varieties and production technologies. Until and unless farmers and estates adopt promising varieties along with appropriate technologies, sugarcane production cannot be increased (Muhammad *et al.*, 2020). It is difficult to achieve self-sufficiency in sugar production due to the low productivity of the current varieties, which is also indirectly related to the current low output of the sugar industry in Nigeria. Therefore, the country must adopt new, high-yielding types with good ratoonability (Getaneh *et al.*, 2015).

The evaluation of domestic and foreign cane germplasm to gauge the genetic diversity in

sugarcane germplasm can alleviate these restrictions (Khalid *et al.*, 2014). For instance, in Nigeria, the bulk of the commercial sugarcane varieties are over 40 years old, and the existing sugar companies are also operating below installed capacity. The National Sugar Development Council (NSDC), Abuja, started importing improved sugarcane varieties from other countries with similar climatic requirements to Nigeria because variety plays a crucial role in sugar yield and the use of unapproved, inferior quality cane varieties negatively affects sugarcane production (Nirmodh and Ravinder, 2022). However, the above importation's success by NSDC depends on the adaptability of the varieties to Nigeria's agro-climatic conditions.

Sugarcane production could never be enhanced until and unless promising varieties together with suitable technologies are adopted by the growers (Getaneh *et al*., 2016). The inherent potential of a variety to give better yields in plant and ratoon crops is of paramount importance for sustaining high productivity (Arain *et al*., 2011). Acceptance of a variety by the farmers also depends very much on its ratooning potential. Thus, sugarcane varieties, which show good performance in plant and ratoon crops should be promoted for commercial cultivation (Khalid *et al.,* 2014).

It is therefore believed the availability of improved sugarcane varieties that are also resistant/tolerant of the prevalent pests and/or diseases will boost the overall production of sugar and its by-products. The selection of a proper variety to be grown in a particular agroecological zone is a prerequisite to exploring its quantitative and qualitative characteristics (Hassan *et al*. 2017). The objective of the study was therefore to high-yielding sugarcane varieties to enhance cane productivity in southern Nigeria.

Materials and Methods

Description of experimental sites

The two sites fall within the high rainfall ecologies of Nigeria. Agenebode is in the South-South zone of Nigeria and is located at longitude 7^0 6'N and latitude 6^0 42'E with an annual rainfall of 1300-1500 mm and a temperature range of 28^0C - 34^0 C. The soil belongs to the Inceptisols and Entisols (Orimoloye *et al.,* 2018). The field was previously used continuously for cassava-maize cultivation and the vegetation was dominated by *Panicum maximum* L, *Pennisetum polystachion* (L.) Schult, *Chromoleana odorata* (L.) R.M.King & Robinson and a few broadleaved species.

Ikenne is in Southwestern Nigeria (longitude 6^0 52'N and latitude 3^0 42'E) and has an annual rainfall and temperature range of 1000-1200 mm and 22^0C – 32.2^0C, respectively. The soil is described as Ultisol (Periaswamy and Ashaye, 1982). The land was previously cropped to maize and dominated by *Chromoleana odorata* (L.) R.M.King & Robinson, *Hyptis suaveolens* (L.) Poit and a few grassy weed species.

Rainfall distribution pattern over a five-year period (including the period of field trials) is multimodal on both sites, with the highest peak in September of every year at Agenebode and between July and September at Ikenne depending on the year. The dry months on both sites were between December of the preceding year and February of the following year.

Trial Establishment/Maintenance

Twenty-eight (28) varieties which comprised of six from Barbados, 8 from Mauritius, 8 from Coimbatore, four (4) from Brazil, one (1) from Sudan and one (1) from Demarara (Table 1) were evaluated for four cropping cycles (2013-2017). The trials were established at IAR&T site, Ikenne between 30th May and 3rd June, 2013 and at WEPPA site at Agenebode between 11th and 14th December, 2013. Each trial was laid out as a randomized complete block design with four replicates within a block and a block comprised twenty (20) varieties. Each plot was six (6) rows, 10m long and 1.6m between the

rows. Cane setts used were three-eyed cane setts of 6-7 months which were also free from diseases and pests. The cane setts were laid horizontally end-to-end or evenly spaced in rows inter-spaced at 1.5m apart. Weed was controlled by pre-emergence application of Primextra [a proprietary mixture of metolachlor (2chloro-N-(2-ethly-6-methly-phenly)-N-(2-methoxyl1-methly ethyl) acetamide) (290g/L) and atrazine (6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine 2,4-diamine) (370g/L) at 2.5 kg ai/ha was done immediately after planting followed by supplementary hoe weeding as necessary. NPK fertilizer was applied at the rate of 150kgN, 60KgP and 90kgK in equal halves (split dose) at planting and at 8 – 10 weeks after planting respectively.

Data Collection

Data were collected each year from the four inner rows (net plot) on various parameters including germination count at 21 days after planting (DAP) and 42 DAP respectively, rating for disease infection (especially smut) beginning from 3-4 months after planting (MAP), monthly tiller count, stalk length (tape measurement), stalk diameter (Vernier caliper) from 6MAP and Brix content (hand refractometer) from 8MAP. Ten stalks which were sampled for Brix content every month till harvest were also used to collect data on stalk height and diameter respectively. Ten randomly selected stalks within the net plot were cut at the base and the average of individual weights, using a weighing scale, was recorded as a single stalk weight for each variety while the total number of cane stalks with diameter ≥ 1.5cm was counted for each plot as

Data Analyses

Data collected were subjected to analyses of variance (ANOVA) for individual crop cycles before a combined ANOVA across crop cycles was performed for all the attributes measured or estimated. Significant means were thereafter separated using the least significant difference (LSD). Three (3) selection criteria were used to identify the top five varieties in each site. The first was based on superiority for cane yield with acceptable Brix content (≥20 in each of the crop cycles) while the second used the sum of ranking obtained by a variety in cane yield and Brix referred to as rank summation index (∑RSI). The third criterion was the use of kg-brix. A cane quality test was conducted on the selected varieties at Sunti Sugar Estate Laboratory to determine four qualitative (cane Brix %, polarity %, purity % and cane expected recovery) attributes.

Results and Discussion

Site Productivity

Agenebode showed superiority over Ikenne for cane yield and almost all the related traits in first three crop cycles (Table 2). The difference between the two sites for cane yield was 22.62 and 17.55 percent (%) in favour of Agenebode in the plant and second ratoon crops while Ikenne showed superiority in the second and third ratoon crops by 17.77%. Similarly, brix values were higher at Agenebode in the plant and first ratoon crops while single stalk weight, millable cane population and stalk length were also higher in every crop cycle at Agenebode except that canes were taller in the second ratoon crop while third ratoon was generally better at Ikenne. The peak for sucrose accumulation in the selected varieties on each site appeared to be between October and November since this period was the peak of brix value followed by either a drop in brix content or stabilized value until harvesting.

Varietal Performance for cane yield and related traits

Cane yield and related traits differed significantly ($P<0.05$) among the varieties from one cropping cycle to another regardless of the planting site, which also affected their ranking in each of the traits in different crop cycles. Majority of the test varieties also exhibited superiority over either of the check varieties (B47419 and Co997) for cane yield and other attributes. In Agenebode, var. BR971007 was

superior to others for cane yield in the plant crop while vars. M2256/88, SP 81-3250 and M1334/84 were the best for this trait in the first, second and third ratoon crops (Table 3). However, var. SP 81-3250 was the most consistent for cane yield having ranked 8th, 12th, 1st and 6th respectively in each of the crop cycles, with the least ∑RSI value of 27, thus making it the top yielding variety for this site. Other varieties with good consistency in performance for cane yield include vars. M1334/84, Co997 (check), and B85266 in that order. The varieties also changed rank for cane yield in each of the cropping cycles at Ikenne with var. M1334/84 showing superiority over others in the plant crop and 3rd ratoon crop while vars. M1246/84 and M1176/77 were the best in the first and second ratoon crops respectively (Table 4). Var. M1176/77 and one of the checks (B47419) were the most consistent with respect to high cane yield on this site and so had the lowest ∑RSI values across the cropping cycles. They were followed by vars. M1334/84, M1176/77 and B80689 in that order.

Var.B93757 was the most consistence in performance for brix content in Agenebode followed by var. RB 94/2991(Table 5). The two varieties had the lowest ∑RSI values across the cropping cycles for brix indicating that they were the most superior for brix on this site. In Ikenne, vars. C094102 and B80689 were the most consistent for brix content with the lowest ∑RSI values (19 and 22) across the cropping cycles (Table 6).

The trend in kg-brix at the two planting sites revealed differential performance of the varieties for this trait. In Agenebode, var. SP 81-3250 was the most consistent across the cropping cycles with lowest ∑RSI value of 28, followed by var. RB 94/2991 which also exhibited high kg- brix with fairly good consistency in performance, consequently ∑RSI of 38 (Table 7). Three (3) varieties (M1176/77, B80689 and B47419 (check)) were consistent in performance for kg-Brix in Ikenne (Table 8). However, var. M1176/77 was the most superior and consistent for kg-Brix, having the lowest ∑RSI value of 15, followed by var. B80689, M1334/84 in that order. One of the check varieties (B47419) also exhibited a fairly consistent performance for kg-brix with ∑RSI value of 22.

Ranking of varieties for the combination of cane yield and Brix content

Var. Co9906 was superior to others in Agenebode when they were ranked on the basis of superiority for cane yield along with acceptable Brix content (i.e. ≥ 20) in each of the crop cycles, followed by var. B80689 (Table 9). Other varieties which exhibited superiority for cane yield with acceptable Brix content include vars. RB 94/2991, SP 81-3250 and CoC671. At Ikenne, var. B80689 was the best in respect of this selection index, followed by vars. M1176/77, D8687, and CoC671 in that order (Table 9). The two check varieties performed better in Ikenne compared with their performance in Agenebode.

Identification of best varieties on each site

Identification of the top-yielding varieties which was based on three selection criteria (Table 10) revealed that most of the varieties which exhibited superiority for kg-Brix (Tables 7 & 8) were also among the top five (5) on each site either based on cane yield and acceptable Brix content or ∑RSI values for the combination of cane yield and Brix content across the four cropping cycles. These varieties were site-specific: SP 81-3250, M2256/88 and RB94/2991 (Agenebode); M1176/77 and D8687 (Ikenne) while varieties M1334/84, M1246/84, Co9906, B80689 and CoC671 exhibited superiority in both sites.

Cane Brix % and polarity % are important qualitative parameters used for maturity judgment (Sarwar *et al*, 2011). The second important qualitative parameter after cane Brix % is the polarity % of cane juice (Tripathi *et al,* 2017). Only three of the selected varieties showed superiority over the better check on

cane brix% and expected recovery (Table 10). The lowest Brix % (15.40) was recorded for D8687 whereas the highest (20.50) was displayed by CoC671. Similarly, a maximum polarity % of 18.90 was exhibited by Co9906 and D8687 had a minimum polarity % of 12.70. The check cultivar displayed good performance for cane Brix % and polarity %. These results are contrary to Zeqing *et al*. (2017) but similar to Sarwar *et al.* (2011) findings. This may be due to the uniform expression of genes for these attributes (Sarwar *et al.*, 2011).

Juice purity is the main factor that is used in maturity and quality judgment (Feven and Esayas, 2018). The analysis of variance displayed significant variations among the variations for purity % (Table 10). The highest value for this parameter recorded was 91.90 %, exhibited by the variety Co9906 whereas the lowest (78.8 %) was shown by the variety M2256/88. These results are identical to the finding of Khalid *et al*, (2014). The highest recovery (10.80) was exhibited by the variety Co9906 whereas the lowest (6.80) was observed for the variety D8687. The latter is lower than both the check cultivars.

Conclusion

This study concludes that B80689, Co 9906 and CoC 671 are the most superior varieties, their Brix % contents are within the acceptable range (i.e. $\geq$ 20) while their purity ranged between 89.10 and 91.90 % and expected sucrose recovery of 10.00 and above. It also shows that, these varieties possess general adaptation to the forest ecology of Nigeria and may be suitable for any of the rainforest ecologies. Since the trials were conducted under rainfed conditions, our results indicate that any of these varieties can be adopted by estates and out-growers in the respective zones of southern Nigeria.

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Table 1: List of the 28 sugarcane varieties evaluated in Ikenne and Agenebode

S/N	Variety	Point of collection	S/N	Variety	Point of Collection
1	B77602	Barbados	15	KN93067	Sudan
2	B80689	Barbados	16	M1176/77	Mauritius
3	RB82/5211	Brazil	17	M1246/84	Mauritius
4	BR971007	Barbados	18	M1334/84	Mauritius
5	BR98006	Barbados	19	M1672/90	Mauritius
6	BT871646	Barbados	20	M1861/89	Mauritius
7	Co6806	Coimbatore	21	M1954/91	Mauritius
8	Co8605	Coimbatore	22	M2238/89	Mauritius
9	Co88025	Coimbatore	23	M2256/88	Mauritius
10	Co91017	Coimbatore	24	RB86/3129	Brazil
11	Co94102	Coimbatore	25	RB94/2991	Brazil
12	Co9906	Coimbatore	26	SP81-3250	Brazil
13	CoC671	Coimbatore	27	B47419+	Barbados
14	D8687	Demarara	28	Co997+	Coimbatore

+; Check entry

Table 2: Means for cane yield and related traits in different crop cycles in two planting sites in southern, Nigeria

	Stalk characteristics					
Crop cycle(CC)	Length (cm)	Diameter (cm)	Millable population (number/plot)	Single stalk weight (kg)	°Brix	Cane yield (tc/ha)
	Agenebode (southern Guinea savannah Zone)					
Plant crop	197.30	2.52	164	2.41	21.73	76.83
First Ratoon	390.90	2.43	152	1.13	22.95	62.63
Second Ratoon	207.30	2.33	164	1.17	21.10	43.06
Third Ratoon	177.29	1.06	153	1.18	18.37	39.10
	Ikenne (Rain forest Zone)					
Plant crop	162.30	2.36	141	2.61	20.09	69.45
First Ratoon	158.00	0.78	109	1.23	18.43	52.38
Second Ratoon	253.20	1.08	110	1.08	22.00	51.64
Third Ratoon	253.00	2.29	195	2.14	21.18	45.02
LSDα 0.05 (PS)	19.14	0.06	9.27	0.34	0.53	7.25
LSDα 0.05 (CC)	10.98	0.18	53.40	0.06	1.30	28.30
LSDα 0.05 (PS x CC)	24.59	0.18	53.54	0.55	1.36	28.57

PS= Planting Site

Table 3: Trend in cane yield (tc/ha) with ranking in parenthesis among 28 exotic Sugarcane germplasm accessions in different cropping cycles (Agenebode, Nigeria)

Variety	Plant Crop	1st ratoon	2nd ratoon	3rd ratoon	∑RSI	Overall rank
B77602	84.3(11)	44.7(24)	0(28)	17.9(14)	77	26th
B80689	105(4)	66.7(9)	36.48(27)	8.2(25)	65	18th
BR 98006	95.3(7)	111.2(2)	38(26)	15.8(16)	51	10th
BR82/5211	75.5(14)	74.5(7)	41.17(25)	27.4(4)	50	9th
BR971007	158.9(1)	31.2(28)	51.67(24)	35(2)	55	13th
BT871646	61.8(19)	45(23)	52.57(23)	20.5(9)	74	24th
Co6806	90.3(10)	47.7(20)	53.2(22)	17(15)	67	20th
Co8605	50.4(24)	47.6(21)	53.5(21)	15.11(18)	84	27th
Co88025	104.1(5)	48.1(18)	54.4(20)	8.1(26)	69	22nd
Co91017	66(15)	62.2(11)	55(19)	0(28)	73	23rd
Co94102	53.6(22)	84(4)	55.02(18)	13(21)	65	18th
Co9906	92.1(9)	56.4(15)	56.13(17)	18.1(13)	54	11th

CoC671	83.5(12)	47.7(19)	56.6(16)	14.2(20)	67	21st
D8687	115.2(3)	54.2(17)	56.98(15)	14.4(19)	54	11th
KN93067	115.3(2)	54.7(16)	62.5(14)	7.2(27)	59	16th
M1176/77	24.8(27)	57.5(13)	63.25(13)	12.6(22)	75	25th
M1246/84	60.4(20)	87.4(3)	64.23(12)	20.2(10)	45	6th
M1334/84	77(13)	64.9(10)	66.8(11)	59.9(1)	35	2nd
M1672/90	51.9(23)	82.5(6)	67.8(10)	22.2(8)	47	8th
M1861/89	27.6(26)	40.5(27)	73.55(9)	9.4(24)	86	28th
M1954/91	44.5(25)	67.8(8)	75.5(7)	10.8(23)	63	17th
M2238/89	57.6(21)	44(26)	77.4(6)	31.2(4)	57	15th
M2256/88	8.5(28)	126.4(1)	78.27(5)	24.8(7)	41	4th
RB 94/2991	63.8(17)	56.5(14)	79.3(3)	19.1(11)	45	6th
RB86/3129	63.9(16)	44(25)	84.55(2)	18.5(12)	55	13th
SP 81-3250	92.6(8)	61.2(12)	111(1)	26.8(6)	27	1st
B47419+	62.4(18)	82.8(5)	78.67(4)	15.6(17)	44	5th
Co997+	103.5(6)	47.1(22)	74.4(8)	32.9(3)	39	3rd
LSDα 0.05			17.06			

∑RSI = Sum of ranking for a trait in individual crop cycle.

+; Check variety; ++, Variety eliminated from trial due to susceptibility to yellow leaf syndrome.

Table 4: Trend in cane yield (tc/ha) with ranking in parenthesis among 28 exotic sugarcane germplasm accessions in different cropping cycles (Ikenne, Nigeria)

Variety	Plant crop	First ratoon	Second ratoon	Third ratoon	∑RSI	Overall rank
B77602	46(24)	92.5(20)	26.4(26)	15.6(25)	95	27th
B80689	88.45(3)	191.3(4)	53.28(13)	74.5(4)	24	4th
BR 98006	74.92(7)	83.4(22)	44.92(19)	43(14)	62	16th
BR82/5211	65.66(10)	104.2(17)	38.79(22)	43.8(13)	62	16th
BR971007	56.88(15)	103.6(18)	38.16(23)	27.4(19)	75	21st
BT871646	54.01(18)	75.8(25)	40.78(21)	16.6(24)	88	25th
Co6806	59.8(14)	70.8(27)	68.57(6)	19(23)	70	19th
Co8605	63.85(11)	82.1(24)	38.01(24)	60.8(7)	66	18th
Co88025	23.58(28)	90.8(21)	9.3(28)	3(28)	105	28th
Co91017	75.17(6)	101.7(19)	18.67(27)	4.5(27)	79	24th
Co94102	56.76(16)	70.8(26)	34(25)	24.2(21)	88	25th
Co9906	53.96(19)	115.1(15)	49.38(15)	49(11)	60	15th
CoC671	54.8(17)	123.7(14)	47.86(18)	51.1(9)	58	14th
D8687	76.27(5)	162.5(6)	58.85(8)	26.8(20)	39	7th
KN93067	51.72(20)	66.7(28)	56.92(12)	42.2(15)	75	21st
M1176/77	67.53(9)	202.9(2)	85.53(1)	60.1(8)	20	3rd
M1246/84	60.98(13)	220.8(1)	57.28(11)	50.8(10)	35	6th
M1334/84	142.86(1)	134.2(10)	69.8(5)	114(1)	17	2nd
M1672/90	47.21(23)	198.7(3)	79.96(3)	36.8(18)	47	8th
M1861/89	69.24(8)	126.7(13)	57.34(10)	23.2(22)	53	12th
M1954/91	50.64(21)	107.9(16)	82.95(2)	41.8(16)	55	13th
M2238/89	44.92(25)	173.3(5)	58.66(9)	46(12)	51	10th
M2256/88	33.71(27)	143.7(9)	48.16(16)	14.5(26)	78	23rd
RB 94/2991	34.04(26)	133.8(11)	42.6(20)	41.4(17)	74	20th
RB86/3129	47.58(22)	156.9(8)	48.12(17)	73.5(5)	52	11th
SP 81-3250	86.98(4)	83.3(23)	52.32(14)	62.1(6)	47	8th
B47419+	89.25(2)	160(7)	78.97(4)	104.8(2)	15	1st
Co997+	61.88(12)	129.6(12)	59.7(7)	94.8(3)	34	5th
LSDα 0.05			19.16			

∑RSI = Sum of ranking for a trait in individual crop cycle.

+, Check variety

Table 5: Trend in brix content (ºBrix) with ranking in parenthesis among 28 exotic Sugarcane germplasm accessions in different cropping cycles (Agenebode, Nigeria)

Variety	Plant crop	First ratoon	Second ratoon	Third ratoon	∑RSI	Overall rank
B77602	21.63(18)	22.5(22)	20.85(18)	18.88(12)	70	21st
B80689	22.75(14)	24.65(8)	22.65(10)	23.38(2)	34	4th
BR82/5211	21.63(17)	25.93(2)	19.27(25)	17.12(21)	65	18th
BR971007	21.38(20)	23.98(12)	21.15(16)	17.5(19)	67	19th
BR98006	20.63(23)	22.83(20)	20.65(21)	19.25(10)	74	22nd
BT871646	21.13(21)	21.38(27)	19.9(23)	14.88(27)	98	28th
Co6806	22.88(11)	23.95(13)	20.9(17)	18(15)	56	14th
Co8605	24(3)	23.38(16)	24.9(2)	16.38(24)	45	9th
Co88025	23.63(5)	25.08(4)	19.95(22)	18.26(14)	44	7th
Co91017	22.88(11)	22.45(23)	0(28)	0(28)	90	25th
Co94102	23.5(6)	22.53(21)	23.22(8)	17.5(19)	54	11th
Co9906	24.13(2)	25.43(3)	23.82(5)	19.62(6)	16	1st
CoC671	24.38(1)	22.08(26)	25.15(1)	19.12(11)	39	6th
D8687	22.13(15)	22.33(25)	19.52(24)	20.12(5)	69	20th
KN93067	23.38(8)	23.8(14)	21.22(15)	16.25(25)	62	17th
M1176/77	21.38(19)	26.1(1)	23.5(6)	19.38(8)	34	4th
M1246/84	18.25(26)	24.73(7)	22.32(11)	19.25(10)	54	11th
M1334/84	17.88(27)	22.9(19)	17.57(26)	16.88(22)	94	26th
M1672/90	23(9)	18.8(28)	21.22(15)	16.75(23)	75	23rd
M1861/89	21(22)	23.15(17)	22.22(12)	19.5(7)	58	15th
M1954/91	23.38(8)	24.74(6)	22.15(13)	22.5(3)	30	3rd
M2238/89	20.25(24)	24.9(5)	23.15(9)	17.75(16)	54	11th
M2256/88	14.5(28)	23.4(15)	14.37(27)	14.88(26)	97	27th
RB 94/2991	22.75(14)	24.33(9)	24.57(4)	24.88(1)	28	2nd
RB86/3129	22.78(12)	23.98(11)	24.62(3)	17.5(19)	45	9th
SP 81-3250	23.5(6)	24.1(10)	23.4(7)	17.12(21)	44	7th
B47419+	19.5(25)	22.4(24)	20.72(20)	18.75(13)	82	24th
Co997+	22(16)	23(18)	20.72(20)	20.25(4)	58	15th
LSDα 0.05			1.80			

∑RSI = Sum of ranking for a trait in individual crop cycle.
+; Check variety; ++, Variety eliminated from trial due to susceptibility to yellow leaf syndrome.

Table 6: Trend in brix content (°Brix) with ranking in parenthesis among 28 exotic Sugarcane germplasm accessions in different cropping cycles (Ikenne, Nigeria)

Variety	Plant crop	First ratoon	Second ratoon	Third ratoon	∑RSI	Overall rank
B77602	19.9(17)	19.15(21)	24.05(4)	22.08(4)	46	9th
B80689	21.23(5)	21.7(5)	23.57(5)	21.91(7)	22	2nd
BR 98006	17.6(28)	18.12(25)	22.22(14)	19.66(19)	86	25th
BR82/5211	18.75(25)	21.95(3)	17.8(26)	16.91(23)	77	23rd
BR971007	19.4(23)	19.7(17)	18.87(23)	16.58(25)	88	26th
BT871646	21.35(4)	18.35(24)	23.12(8)	19.91(17)	53	11th
Co6806	19.55(22)	18.95(22)	21.45(18)	19.83(18)	80	24th
Co8605	20.65(8)	19.65(18)	19.95(20)	19.16(20)	66	17th
Co88025	19.85(18)	18.75(23)	18.22(24)	14.91(27)	92	27th
Co91017	20.1(14)	20.49(13)	19.05(22)	16.83(24)	73	22nd
Co94102	20.85(7)	22.48(1)	25.87(2)	21.66(9)	19	1st
Co9906	20.2(11)	20.52(12)	25.3(3)	22.25(2)	28	4th
CoC671	20.63(9)	21.15(7)	22.37(10)	22.08(4)	30	5th
D8687	20.1(14)	21.05(9)	23.2(7)	20.25(15)	45	8th
KN93067	18.35(27)	19.8(16)	22.22(14)	21.16(13)	70	20th
M1176/77	19.73(21)	21.7(5)	21.47(16)	19.91(17)	59	15th
M1246/84	20.08(15)	20.55(11)	21.45(18)	20.66(14)	58	14th
M1334/84	20(16)	21.25(6)	17.9(25)	18.5(22)	69	18th
M1672/90	20.45(10)	16.7(27)	22.55(9)	21.83(8)	54	12th
M1861/89	20.1(14)	19.4(19)	22.27(12)	21.49(10)	55	13th
M1954/91	19.8(20)	19.2(20)	22.1(15)	21.33(11)	66	16th
M2238/89	21.2(6)	22(2)	21.05(19)	21.25(12)	39	6th
M2256/88	19.15(24)	19.9(15)	26.77(1)	23.5(1)	41	7th
RB 94/2991	21.38(3)	20.95(10)	23.37(6)	21.99(5)	24	3rd
RB86/3129	21.65(2)	19.97(14)	16.8(27)	15(26)	69	18th
SP 81-3250	18.35(27)	17.95(26)	15.9(28)	14.25(28)	109	28th
B47419+	21.95(1)	16.5(28)	19.72(21)	18.75(21)	71	21st
Co997+	19.8(20)	21.05(9)	22.3(11)	21.91(7)	47	10th
LSDα 0.05			1.37			

∑RSI = Sum of ranking for a trait in individual crop cycle.
+; Check variety

Table 8: Trend in kg -brix with ranking in parenthesis among 28 exotic sugarcane germplasm accessions in different cropping cycles (Ikenne, Nigeria)

Variety	Plant crop	First ratoon	Second ratoon	Third ratoon	∑RSI	Overall rank
B77602	662(23)	1256(20)	444(26)	241(24)	93	27th
B80689	1338(3)	2907(3)	879(11)	1143(4)	21	2nd
BR 98006	926(8)	1025(25)	699(17)	592(16)	66	18th
BR82/5211	870(11)	1354(19)	483(25)	518(18)	73	20th
BR971007	762(17)	1018(26)	504(24)	318(22)	89	26th
BT871646	815(14)	963(27)	660(19)	231(26)	86	24th
Co6806	811(15)	1142(22)	1030(5)	264(23)	65	16th
Co8605	911(9)	1233(21)	531(23)	815(6)	59	15th
Co88025	328(28)	1429(18)	119(28)	31(28)	102	28th
Co91017	1076(5)	1429(18)	249(27)	53(27)	77	23rd
Co94102	833(13)	1115(23)	616(20)	367(20)	76	22nd
Co9906	756(18)	1638(15)	875(13)	763(9)	55	13th
CoC671	795(16)	1863(12)	749(16)	790(7)	51	11th
D8687	1083(4)	2450(5)	956(6)	380(19)	34	6th
KN93067	649(24)	895(28)	885(10)	625(13)	75	21st
M1176/77	951(7)	3076(2)	1285(1)	838(5)	15	1st
M1246/84	876(10)	3122(1)	860(15)	735(10)	36	7th
M1334/84	1987(1)	1976(9)	875(13)	1476(1)	24	4th
M1672/90	690(21)	2283(6)	1262(3)	562(17)	47	8th
M1861/89	970(6)	1747(14)	894(9)	349(21)	50	10th
M1954/91	678(22)	1460(16)	1283(2)	624(14)	54	12th
M2238/89	690(20)	2642(4)	864(14)	684(11)	49	9th
M2256/88	442(26)	2007(8)	902(8)	239(25)	67	19th
RB 94/2991	499(25)	1949(10)	697(18)	637(12)	65	16th
RB86/3129	708(19)	2203(7)	566(22)	772(8)	56	14th
SP 81-3250	436(27)	1067(24)	582(21)	619(15)	87	25th
B47419^{+}	1339(2)	1862(13)	1090(4)	1376(3)	22	3rd
Co997^{+}	862(12)	1915(11)	932(7)	1454(2)	32	5th

∑RSI = Sum of ranking for a trait in individual crop cycle.

+; Check variety

Table 7: Trend in kg -brix with ranking in parenthesis among 28 exotic sugarcane germplasm accessions in different cropping cycles (Agenebode, Nigeria)

Variety	Plant crop	First ratoon	Second ratoon	Third ratoon	∑RSI	Overall rank
B77602	1305(12)	702(25)	382(27)	237(12)	76	25th
B80689	1670(5)	1140(8)	534(26)	134(24)	63	17th
BR 98006	1402(11)	1761(2)	640(25)	213(16)	54	12th
BR82/5211	1122(13)	1346(4)	734(24)	328(6)	47	7th
BR971007	2333(1)	519(28)	766(23)	429(3)	55	14th
BT871646	948(17)	670(26)	781(22)	214(15)	80	26th
Co6806	1447(9)	809(19)	794(21)	214(15)	64	18th
Co8605	838(21)	778(20)	795(20)	173(20)	81	27th
Co88025	1712(4)	827(18)	815(19)	104(26)	67	20th
Co91017	1043(14)	1090(9)	875(18)	23(28)	69	22nd
Co94102	882(20)	1305(6)	906(17)	159(23)	66	19th
Co9906	1588(7)	1007(14)	913(16)	249(11)	48	8th
CoC671	1420(10)	706(24)	920(14)	190(19)	67	20th
D8687	1813(3)	844(17)	940(13)	203(18)	51	10th
KN93067	1874(2)	912(16)	969(12)	82(27)	57	15th
M1176/77	388(26)	1063(11)	1040(11)	171(21)	69	22nd
M1246/84	731(25)	1443(3)	1041(10)	272(8)	46	6th
M1334/84	946(18)	1018(13)	1079(9)	708(1)	41	3rd
M1672/90	828(22)	1089(10)	1093(8)	260(9)	49	9th
M1861/89	375(27)	655(27)	1141(7)	128(25)	86	28th
M1954/91	731(24)	1171(7)	1149(6)	170(22)	59	16th
M2238/89	803(23)	774(21)	1166(5)	388(4)	53	11th
M2256/88	127(28)	2037(1)	1227(4)	258(10)	43	4th
RB 94/2991	1014(15)	954(15)	1316(3)	333(5)	38	2nd
RB86/3129	1005(16)	733(23)	1396(2)	227(13)	54	12th
SP 81-3250	1498(8)	1023(12)	1851(1)	321(7)	28	1st
B47419+	883(19)	1321(5)	0(28)	205(17)	69	22nd
Co997+	1627(6)	758(22)	919(15)	466(2)	45	5th

∑RSI = Sum of ranking for a trait in individual crop cycle.
+; Check variety

Table 9: Ranking of 28 exotic sugarcane germplasm accessions based on combination of cane yield and brix content (across cropping cycles) using Rank Summation Index (∑RSI)

Variety	Cane yield	°Brix	∑RSI	Overall Rank	Variety	Cane yield	°Brix	∑RSI	Overall Rank
		Agenebode					Ikenne		
B77602	94	97	191	24th	B77602	134	67	201	20th
B80689	60	43	103	2nd	B80689	31	31	62	1st
BR 98006	63	109	172	18th	BR 98006	82	128	210	23rd
BR82/5211	65	91	156	10th	BR82/5211	82	111	193	19th
BR971007	68	92	160	12th	BR971007	100	129	229	27th
BT871646	95	136	231	27th	BT871646	122	81	203	21st
Co6806	97	79	176	20th	Co6806	99	117	216	25th
Co8605	95	65	160	12th	Co8605	89	102	191	18th
Co88025	73	64	137	9th	Co88025	148	109	257	28th
Co91017	116	128	244	28th	Co91017	108	105	213	24th
Co94102	88	75	163	16th	Co94102	125	28	153	13th
Co9906	54	20	74	1st	Co9906	78	42	120	5th
CoC671	73	54	127	5th	CoC671	77	43	120	5th
D8687	64	98	162	14th	D8687	53	66	119	4th
KN93067	92	85	177	21st	KN93067	104	102	206	22nd
M1176/77	114	44	158	11th	M1176/77	27	86	113	3rd
M1246/84	61	74	135	8th	M1246/84	47	86	133	10th
M1334/84	37	136	173	19th	M1334/84	21	102	123	7th
M1672/90	73	108	181	23rd	M1672/90	61	82	143	12th
M1861/89	143	80	223	25th	M1861/89	71	83	154	14th
M1954/91	96	37	133	7th	M1954/91	71	96	167	16th
M2238/89	86	76	162	14th	M2238/89	70	59	129	9th
M2256/88	90	139	229	26th	M2256/88	109	57	166	15th
RB 94/2991	76	35	111	3rd	RB 94/2991	98	37	135	11th
RB86/3129	107	62	169	17th	RB86/3129	70	100	170	17th
SP 81-3250	57	61	118	4th	SP 81-3250	64	154	218	26th
B47419+	65	115	180	22nd	B47419+	16	107	123	7th
Co997+	48	82	130	6th	Co997+	42	64	106	2nd

+, Check variety; ++, No value for variety in thesecond ratoon due to susceptibility to yellow leaf syndrome.

Table 10: Identification of best five (5) varieties at each site using different selection criteria

	Superiority for cane yield (tc/ha) and acceptable brix++		∑RSI (combination of cane yield and brix)+++		Kg-brix	
	∑RSI					
Variety	Cane yield	°Brix		∑RSI	∑RSI for Kg-brix	
			Agenebode (SS, Nigeria)			
SP 81-3250	27(1st)	47 (7th)	Co9906	74(1st)	SP 81-3250	28(1st)
M1334/84	35(2nd)	96 (26th)	B80689	103 (2nd)	RB 94/2991	38 (2nd)
M2256/88	41 (4th)	97 (27th)	RB 94/2991	111 (3rd)	M1334/84	41 (3rd)
M1246/84	45(6th)	54 (11th)	SP 81-3250	118 (4th)	M2256/88	43 (4th)
RB 94/2991	45(6th)	45 (9th)	CoC 671	127 (5th)	M1246/84	46 (6th)
B47419+	44(5th)	82(24th)	B47419	180 (22nd)	B47419	69 (22nd)
Co997+	39(3rd)	58(15th)	Co997	130 (6th)	Co997	45 (5th)
			Ikenne (SW Nigeria			
M1334/84	17 (2nd)	69 (18th)	B80689	62 (1st)	M1176/77	15 (1st)
M1176/77	20 (3rd)	59 (15th)	M1176/77	113 (3rd)	B80689	21 (2nd)
B80689	24(4th)	22 (2nd)	D8687	119 (4th)	M1334/84	24 (4th)
M1246/84	35 (6th)	58 (14th)	Co 9906	120 (5th)	D8687	34 (6th)
D8687	39(7th)	45 (8th)	CoC671	120 (5th)	M1246/84	36 (7th)
B47419+	15(1st)	71(21st)	B47419	123(7th)	B47419	22(3rd)
Co997+	34(5th)	47(10th)	Co997	120(5th)	Co997	32(5th)

+; Check variety
++; Acceptable brix reading ≥20 in each cropping cycle
++; Combination of individual raking for each trait in each crop cycle.

Table 10: Means for Cane brix%, pol%, purity% and cane recovery for selected exotic sugarcane germplasm for southern Nigeria

VARIETY	Juice weight (kg)	Extraction (%)	Brix (%)	Polarity (%)	Purity (%)	Expected Recovery
B80689	3.30	60.60	20.00	18.80	90.10	10.00
Co94102	3.35	65.00	17.00	14.70	86.30	8.10
Co9906	1.70	54.80	20.60	18.90	91.90	10.80
CoC671	1.25	59.50	20.50	18.60	90.60	10.50
D8687	1.80	60.00	15.40	12.70	82.50	6.80
M1176/77	2.45	66.20	17.80	16.00	89.70	9.00
M1246/84	1.45	65.90	17.40	15.30	87.70	8.50
M1334/84	4.10	63.10	15.30	13.20	86.30	7.20
M2256/88	2.35	67.10	18.20	14.30	78.80	7.40
RB 94/2291	1.45	64.40	16.80	13.50	80.10	7.00
SP 81-3250	1.55	64.60	17.80	15.80	88.80	8.80
B47419+	2.70	64.30	20.00	17.30	86.60	9.50
Co997+	3.20	62.70	20.00	18.30	91.30	9.40
LSDα 0.05	NS	NS	3.67	2.89	5.36	1.92

+; Check variety