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PERFORMANCE EVALUATION OF EIGHT MAURITIAN SUGARCANE VARIETIES IN SWAZILAND

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Abstract

In 2001, the Swaziland Sugar Association Technical Services (SSATS) imported eight sugarcane varieties (R570, M1176/77, M1186/86, M1246/84, M1400/86, M1551/80, M695/69 and M96/82) from the Mauritius Sugar Industry Research Institute (MSIRI). The objective was to select high sucrose yielding, pest and disease resistant and sustainable varieties to be grown in Swaziland conditions (harvest season x soil type) on a 12-month harvesting cycle. During the period 2004-2005, four replicated field trials were established, two on Z-set soils (poor drainage) and two on R-set soils (good drainage) harvested either early (May) or late (November) season, and irrigated by surface drip. For comparison, these varieties were planted alongside standard cultivars NCo376 (under all conditions) and N23, N25 and N40 (under specific conditions). Data collected over seven continuous crops included stalk heights and population, smut infection, leaf analysis, *Eldana saccharina* Walker (eldana) damage, cane and sucrose yields, sucrose and fibre contents. Variety M1176/77 yielded up to 13.4% more tons of sucrose per ha (tsh) than NCo376 under all conditions. In late x R-set, varieties M1400/86 (18.4 tsh) and M1551/80 (17.9 tsh) yielded 15% and 11% more sucrose than NCo376 (16.0 tsh) with no statistical differences (p=0.05) in other environments. In early x R-set, varieties M1176/77, M1400/86 and M1551/80 produced 1.7, 0.8 and 0.6 tsh more than N23 (16.5 tsh). In late x Z-set, variety M96/82 produced 107% the sucrose yield of NCo376 (17.5 tsh) and 94% of N25 (19.9 tsh). Although N25 and N40 yielded slightly better sucrose at their recommended harvest seasons and soils than these four varieties, the differences were not statistically significant (p=0.05). Smut infection was less than that of NCo376 (5.45%) for varieties M1551/80 (4.64%), M1176/77 (1.88%), M96/82 (0.7%) and M1400/86 (0.43%). Eldana damage ranged from 0.47% (NCo376) to 1.02% (M1551/80) and such damage was not statistically different (p=0.05) between varieties.

Keywords: sugarcane, varieties, sucrose, season, smut, *Eldana saccharina*

Introduction

Due to economies of scale, the Swaziland sugar industry does not have a sugarcane breeding programme, size being the major contributing factor. Secondly, the proximity of the industry to South Africa allows the utilisation of facilities and expertise for sugarcane breeding established at South African Sugarcane Research Institute (SASRI) using bilateral agreements. Since the late 1980s, a major function of the Extension Services of the Swaziland Sugar Association (SSA) has been to import newly released smut-tolerant irrigated sugarcane varieties from SASRI and evaluate their performance in the Swaziland Lowveld (Butler,

2001). It is without doubt that the Swaziland sugar industry greatly benefits from the existing relationship between the two industries.

However, to broaden and diversify the industry's variety base, SSA imported eight Mauritian varieties (R570, M1176/77, M1186/86, M1246/84, M1400/86, M1551/80, M695/69 and M96/82) in year 2001 for testing in Swaziland. The specific objective was to find varieties that are resistant to pests and diseases, with good ratooning ability, and producing sucrose yields equal to or better than the SASRI cultivars. The old varieties are becoming obsolete, thus evaluation of new prodigious sugarcane varieties possessing higher cane and sugar yield potential is necessary at this time for the betterment of growers and millers (Mari *et al*., 2011). Initially, variety NCo376 was used as a benchmark to assess the performance of imported varieties. However, due to its high susceptibility to sugarcane smut (*Ustilago scitaminea*), and the adoption of newer pest and disease resistant and good yielding varieties (N19, N23, N25 and N40) under specific conditions increased the pool of standard varieties against which performance of the imported varieties was measured.

The importation of the Mauritian varieties was administered under an agreement that exists between SSA and the Mauritian Sugar Industry Research Institute (MSIRI). For the purpose of assessing performance, these varieties were incorporated into the variety evaluation programme of SSA in year 2004. In an ongoing evaluation programme, imported varieties are planted in a series of replicated field trials, representing potential combinations of soil type and season of harvest (Butler, 2001). The success of a variety depends upon its adaptability to agro-climatic conditions of the area (Arain *et al.* 2011). The evaluation process of these varieties continued over seven successive crops, with the last year being 2012. Thus, the purpose of this paper is to present the performance results of the eight Mauritian sugarcane varieties over the past seven years under Swaziland conditions.

Materials and Methods

The varieties

Table 1 shows the imported varieties and their respective recommended harvest periods and soil types in Mauritius.

Quarantine and bulking

Prior to release as plantlets for bulking in Swaziland, the eight varieties were imported in 2001 from Mauritius as single-budded setts for quarantining at SASRI. This was necessitated by a condition entrenched in the SSA–SASRI agreement which states that prior to importation into Swaziland, all foreign-bred sugarcane varieties are to be quarantined at SASRI facilities. The purpose is to safeguard against importation of pest and disease infected sugarcane planting material which might pose a biosecurity threat within the region. In 2002, the varieties were imported from SASRI as plantlets which were eventually planted for seed build-up at SSA trial field 604, located at Simunye. Moreover, to obtain the required planting material for the evaluation programme, the following year (2003) the seedcane from the plantlets was further planted for multiplication in a bulking-up block within the same trial field.

Table 1. Recommended harvest time and soil types for the eight Mauritian varieties.

Variety	Recommended harvest period[#]	Recommended soil type[+]					
		B1/B2	F1/F2	H1/H2	L1	L2	P1/P2/P3
R570	Mid-Aug. to Nov.			x	x	x	x
M1176/77	Mid-Aug. to Oct.				x	x	x
M1186/86	Mid-Aug. to Nov.			x	x	x	x
M1246/84*	Aug. to Sept.			x	x	x	x
M1400/86**	Aug. to Sept.	x	x	x	x	x	x
M1551/80	Mid-Jul. to Mid-Sept.				x	x	x
M695/69*	Mid-Jun. to Mid-Aug.			x		x	
M96/82*	Aug. to Sept.			x	x	x	x

x Indicates a soil type where the variety can be planted.
*When flowering does not exceed 25%, harvest of M1246/84, M695/69 and M96/82 could be extended to October, Mid-September and October, respectively.
**When flowering does not exceed 40%, harvest of M1400/86 could be extended to end October.

Soil types
B1/B2: Latosolic brown forest; F1/F2: Humic ferruginous latosols; H1/H2: Humic latosols; L1,L2: Low humic latosols; P1/P2/P3: Latosolic reddish prairie.

[#]Information sourced from MSIRI Recommendation Sheet No. 162 of April 2008.
[+]Information sourced from MSIRI Recommendation Sheet No. 161 of April 2008.

Trial design

Between 2004 and 2005, four replicated trials were established at two SSA trial stations located at Mhlume and Simunye. Two trials were set up at Simunye field 604 under a Latin square design, each replicated ten times (100 plots) with gross plot and net plot sizes of 97.5 and 49.5 m^2, respectively. The other two trials established at Mhlume field 428 were conducted in a randomised complete block design replicated eight times (80 plots) with gross plot and net plot sizes of 114 and 51 m^2, respectively. In all the trials, plot spacing (distance between plots) ranged from 1-2 m while inter-row spacing was maintained at 1.5 m. A 1 m end of row effect was provided for in all plots.

Each trial site represented the major soil characteristics prevalent in the Swaziland sugar industry, these being poor drainage and good drainage. The Simunye trials represented good draining and moderate to well-structured soils (R-set). On the other hand, the Mhlume planted trials represented poor draining and weakly-structured soils (Z-set). On each site, one trial was set up to be harvested early season (April to July) and the other late season (October to December). On each soil x harvesting season interaction, the eight Mauritian varieties were planted alongside NCo376 and other South African cultivars recommended for these sets of circumstances in the Swaziland sugar industry. This information is summarised in Table 2.

Crop maintenance

The general management of the trials was carried out by the estate where they were established in accordance with industry standards. All trials were irrigated by surface drip with emitter spacing of 900 mm. Fertiliser in all crops was applied by the SSA agronomy team following soil analysis results. Composite soil samples were taken in a manner that ensured representativeness of all trial plots either six weeks before harvesting or immediately after harvesting, depending on whether the crop was heavily lodged or not. Chemical ripeners were not applied as treatments in these trials.

Table 2. General information on the four trials.

Trial no.	Mauritian varieties	S. African varieties	Harvesting season	Soil type	Location	Planting date
1	All 8	NCo376, N23	Early season (May)	R-set (*Hutton or Shortlands form*)	Simunye	12 Feb. 2004
2	All 8	NCo376, N40	Early season (May)	Z-set (*Sterkspruit form*)	Mhlume	19 Feb. 2004
3	All 8	NCo376, N25	Late season (November)	R-set (*Hutton or Shortlands form*)	Simunye	04 Nov. 2004
4	All 8	NCo376, N25	Late season (September)	Z-set (*Sterkspruit form*)	Mhlume	15 Sep. 2005

Soil forms in brackets are South African equivalents (Nixon, 2006)

Data collection

Data was collected either during the growing period of the crop or at harvesting (12-month cycle) on a plot basis, depending on the type of data, for seven consecutive crops (plant *plus* six ratoons). Data gathered during the growing period included stalk length and population, leaf analysis and smut infection levels. Leaf samples were taken at three to four months for the late cuts and five to six months for the early cuts between October and April. The leaf samples were sent to the Royal Swaziland Sugar Corporation (RSSC) Mhlume laboratory for analysis according to standard procedures. Flower counts, expressed as a percentage of flowered stalks over total stalk population, were done a week before harvesting. Data collected at harvesting include cane yield and *Eldana saccharina* Walker (Lepidoptera: Pyralidae) (eldana) internode damage. During harvesting, a total of 16 stalks were randomly selected from the weighed cane for quality assessment at the laboratory as per standard procedures. Cane quality data included juice purity, sucrose, moisture, fibre and brix contents. All agronomic data collection, either during the growing period or at harvesting, was done according to SSA's protocol of procedures for agronomy trials (Rostron *et al*., 1999). Where applicable, data was converted and expressed on a per hectare basis.

Data analysis

Using the statistical software Genstat 15th Edition (2012), an analysis of variance (ANOVA) was conducted on the data collected across ratoons. To compare treatment means where significant differences were realised, Fisher's protected least significant difference (LSD) test at 5% probability was used.

Results and Discussion

Pests and diseases

Pests and diseases recorded in these trials were eldana and smut. Eldana internode damage for the varieties used in the trials over the seven successive crops are presented in Table 3. The results indicated that there were no significant differences ($p=0.05$) in eldana internode damage between the varieties. This implies that the susceptibility of the Mauritian varieties to eldana damage is not significantly different ($p=0.05$) from the other varieties within the trials under Swaziland conditions.

Table 3. *Eldana S*accharina Walker (Lepidoptera: Pyralidae) results over seven crops.

Variety	Well drained soil		Poorly drained soil	
	Early season	Late season	Early season	Late season
NCo376	0.076	0.032	0.295	0.316
N23	0.137	-	-	-
N25	-	0.024	-	0.233
N40	-	-	0.227	-
R570	0.099	0.044	0.229	0.079
M1176/77	0.208	0.062	0.510	0.266
M1186/86	0.026	0.074	0.273	0.131
M1246/84	0.084	0.030	0.206	0.187
M1400/86	0.063	0.042	0.304	0.114
M1551/80	0.114	0.054	0.436	0.338
M695/69	0.093	0.041	0.242	0.213
M96/82	0.124	0.021	0.268	0.061
LSD (p=0.05)	***0.228 (NS)***	***0.067 (NS)***	***0.384 (NS)***	***0.331 (NS)***

Significant differences (p=0.05) were observed in smut infection between the varieties within the four trials, as indicated in Table 4. Variety M1186/86 had significantly higher (p=0.05) smut infection than all varieties under all conditions except for NCo376 planted late season on good draining soil. This observation is in line with MSIRI's Recommendation Sheet No. 161 of April 2008, that M1186/86 is susceptible to smut. Although varieties M1551/80 and M1176/77 had smut levels lower than that of NCo376 on well-draining soil planted early season, these differences were not statistically significant (p=0.05). In the late season x well drained soil, NCo376 had significantly higher (p=0.05) smut infection than N25 and the seven least infected Mauritian varieties. On poorly draining soil, apart from M1186/86 (all seasons) and M1551/80 (late season), all the other varieties had smut infection levels that were not statistically different (p=0.05).

Table 4: Smut infection results.

Variety	Well drained soil				Poorly drained soil			
	Early season		Late season		Early season		Late season	
	% NCo376		% NCo376		% NCo376		% NCo376	
NCo376	0.488^{b}	100	5.129^{a}	100	0.183^{b}	100	1.913^{bc}	100
N23	0.177^{cd}	36	-	-	-	-	-	-
N25	-	-	0.556^{bc}	11	-	-	0.283^{c}	15
N40	-	-	-	-	0.032^{b}	18	-	-
R570	0.155^{cd}	32	0.721^{bc}	14	0.009^{b}	5	0.431^{c}	23
M1176/77	0.291^{bcd}	60	1.477^{bc}	29	0.193^{b}	106	1.481^{c}	77
M1186/86	1.233^{a}	253	5.699^{a}	111	1.787^{a}	976	6.325^{a}	331
M1246/84	0.066^{d}	13	0.164^{c}	3	0.013^{b}	7	0.226^{c}	12
M1400/86	0.073^{d}	15	0.248^{c}	5	0.015^{b}	8	0.222^{c}	12
M1551/80	0.422^{bc}	86	2.466^{b}	48	0.436^{b}	238	3.354^{b}	175
M695/69	0.282^{bcd}	58	1.833^{bc}	36	0.368^{b}	201	0.775^{bc}	41
M96/82	0.055^{d}	11	0.503^{bc}	10	0.066^{b}	36	0.260^{c}	14
LSD (p=0.05)	***0.274***		***2.147***		***0.511***		***2.441***	

Numbers followed by similar letters indicate that they are not significantly different (p=0.05)

Growth measurements

Growth measurements for the Mauritian varieties are compared only to variety NCo376 because this variety was included in all the trials.

Table 5 presents stalk population results taken at full canopy over the seven crops. The analysis indicates that NCo376 had significantly higher (p=0.05) stalk population than all the Mauritian varieties in all the trials except N25 (late season), N23 (early season x R-set) and M1176/77 (all seasons x R-set and early season x Z-set). Amongst the Mauritian varieties, M1176/77 had significantly higher (p=0.05) stalk population than most of the other varieties. This observation was consistent in all the trials. A general observation was that trials in good draining soils had higher stalk population than their equivalent trials in poor draining trials. This observation may be attributed to reduced cane tillering as a result of prolonged soaking of cane stools in water.

Due to the heavy lodging of cane in these trials, representative stalk height measurements could not be taken at harvesting over the seven sequential crops.

Table 5. Average stalk population results in '000 at full canopy over seven crops.

Variety	Well drained soil		Poorly drained soil	
	Early season	**Late season**	**Early season**	**Late season**
NCo376	121.1^{a}	115.7^{a}	109.6^{a}	117.8^{a}
N23	114.7^{ab}	-	-	-
N25	-	110.8^{ab}	-	112.1^{a}
N40	-	-	97.9^{bc}	-
R570	97.5^{c}	94.8^{cde}	93.4^{cde}	92.0^{bc}
M1176/77	116.5^{ab}	104.4^{abc}	103.1^{ab}	100.8^{b}
M1186/86	91.8^{c}	80.0^{f}	87.9^{de}	76.7^{d}
M1246/84	97.7^{c}	91.9^{de}	91.4^{cde}	90.0^{c}
M1400/86	96.3^{c}	96.6^{cde}	90.7^{cde}	92.0^{bc}
M1551/80	93.5^{c}	87.9^{ef}	85.4^{e}	86.3^{cd}
M695/69	103.8^{bc}	100.8^{bcd}	96.4^{bcd}	95.9^{bc}
M96/82	104.1^{bc}	97.7^{cde}	94.0^{cde}	94.5^{bc}
LSD (p=0.05)	**14.4**	**11.5**	**8.6**	**10.7**

Numbers followed by similar letters indicate that they are not significantly different (p=0.05)

Leaf nutrient analysis

Leaf analysis data for five major elements nitrogen (N), phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg) was extracted and mean values were computed covering the seven year crops per trial (Table 6). The bottom row of the table shows threshold values established for variety NCo376 from a large number of fertiliser trials conducted on a wide range of soils throughout Swaziland. Nutrient levels below the threshold values will generally result in yield loss. Findings of this project revealed that in the trial 'early season x Z-set' there were K deficiencies in all the varieties except M1176/77. There is therefore a need to investigate the cause of these deficiencies. Otherwise in all the other trials, nutrient contents were above the threshold values. A general observation, apart from the results of K on the

‘early x Z-set’ trial, all the nutrient contents of all the varieties planted on poor draining soils (Z-set) were higher than those planted on good draining soils (R-set) irrespective of harvesting season.

Table 7 shows the ratio of the content of each element per variety relative to NCo376 expressed in percentages. These were calculated by averaging the results of each element across the trials. N and P leaf contents for the Mauritian varieties are similar to those of NCo376, implying that NCo376 threshold values may be used for these varieties. Correction factors for K need to be considered if NCo376 threshold values are to be used for the Mauritian varieties, although M96/82 (99.9%) concentration was similar. The Mauritian varieties appeared to have inherently higher Ca and Mg levels than NCo376 with the exception of Mg levels on M695/69 and M96/82. This suggests that Ca and Mg values for the Mauritian varieties need to be adjusted with the appropriate threshold for NCo376. The leaf analysis results indicate a need to incorporate the best performing Mauritian varieties in nutrition projects aimed at establishing threshold values for individual varieties, so that fertilizer recommendations are refined accordingly (where necessary).

Table 6: Leaf analysis results over the seven crops per trial.

Variety	Nitrogen				Phosphorus				Potassium				Calcium				Magnesium			
	Early Season		Late season		Early Season		Late season		Early Season		Late season		Early Season		Late season		Early Season		Late season	
	Z-set	R-set	Z-set	R-set	Z-set	R-set	Z-set	R-set	Z-set	R-set	Z-set	R-set	Z-set	R-set	Z-set	R-set	Z-set	R-set	Z-set	R-set
NCo376	2.13	1.96	2.02	1.98	0.24	0.21	0.24	0.22	0.79	1.01	1.35	1.20	0.41	0.30	0.26	0.23	0.34	0.26	0.23	0.21
R570	2.08	1.96	1.99	1.96	0.23	0.21	0.24	0.22	0.74	1.06	1.41	1.23	0.44	0.35	0.27	0.25	0.36	0.29	0.24	0.22
M1176/77	2.11	1.94	2.02	1.96	0.24	0.21	0.23	0.22	0.90	1.13	1.38	1.24	0.43	0.30	0.28	0.26	0.37	0.28	0.27	0.23
M1186/86	2.07	1.93	2.02	1.99	0.23	0.21	0.23	0.22	0.72	1.01	1.25	1.15	0.42	0.32	0.25	0.24	0.35	0.27	0.24	0.22
M1246/84	2.12	1.98	2.03	1.96	0.23	0.22	0.23	0.22	0.73	1.03	1.28	1.16	0.51	0.38	0.31	0.28	0.39	0.29	0.26	0.22
M1400/86	2.09	1.94	2.02	1.95	0.23	0.20	0.24	0.22	0.72	1.06	1.37	1.23	0.50	0.36	0.33	0.28	0.39	0.28	0.26	0.21
M1551/80	2.12	1.98	2.05	2.00	0.24	0.21	0.24	0.22	0.76	1.02	1.40	1.22	0.45	0.35	0.29	0.26	0.38	0.29	0.26	0.23
M695/69	2.08	1.96	1.99	1.99	0.23	0.21	0.24	0.22	0.74	0.97	1.33	1.21	0.43	0.33	0.27	0.25	0.33	0.26	0.23	0.20
M96/82	2.07	1.94	2.00	1.95	0.23	0.20	0.23	0.22	0.74	0.98	1.41	1.18	0.40	0.32	0.29	0.27	0.32	0.24	0.24	0.22
Threshold values%dm	1.8-1.9		1.6-1.8		0.19		0.19		0.85-1.00		1.05-1.10		0.15		0.15		0.08		0.08	

Table 7. Percentage of Mauritian variety nutrition elements relative to NCo376.

Variety	Nitrogen	Phosphorus	Potassium	Calcium	Magnesium
R570	98.9%	99.7%	103.5%	107.2%	105.9%
M1176/77	99.3%	98.3%	105.1%	105.8%	109.2%
M1186/86	99.4%	100.0%	95.2%	101.3%	103.7%
M1246/84	99.9%	100.7%	97.0%	121.6%	111.8%
M1400/86	98.9%	97.9%	102.0%	121.8%	109.7%
M1551/80	100.6%	101.6%	101.9%	112.9%	110.2%
M695/69	99.1%	98.5%	98.6%	105.3%	98.1%
M96/82	98.4%	99.8%	99.9%	105.6%	97.5%

Yields

An analysis of variance of the annual yield parameters such as tons cane per ha (tch), sucrose content (%), tons sucrose per ha (tsh) and fibre content (%) for the four trials was done using a computer based Anova, single factor. To verify the levels of differences among the individual yield averages, Fishers' Least Significant Difference (LSD) was performed. Results of these analyses are presented in Tables 8 to 11. Numbers in the same column (trial) followed by one or more similar letters are not significantly different (p=0.05) from each other. Cells highlighted in red show the top four performing varieties in that specific environment.

Table 8 presents the average cane yield results of the varieties across the seven crops for the different conditions. Early season x good draining soil, variety M1176/77 yielded significantly (p=0.05) more tons of cane than most varieties except NCo376, M1400/86, M1551/80 and M96/82. Late season under similar soil conditions, N25 had the highest cane yield but was only significantly (p=0.05) higher than varieties M695/69 and M1186/86, where yields were not statistically (p=0.05) different. Early season x poor draining soil, variety M1176/77 had the highest cane yield which was significantly higher than that of N40 and M695/69. Late season x poor draining soil, N25 yielded the most cane which was significantly (p=0.05) higher than that of the other varieties except M1176/77 and M96/82.

Table 9 shows the performance of these varieties in terms of sucrose content averaged over the seven crops. Early season x good draining soil, M695/69 had significantly (p=0.05) higher sucrose content than half of the varieties (R570, M1176/77, M1186/86 and M1246/84). Late season x good draining soil, M1551/80 and M1400/86 had the highest sucrose contents which were significantly (p=0.05) higher than the five poorest performing varieties. Variety N40 planted early season x poor draining soil, had significantly (p=0.05) higher sucrose content than all the varieties. Late season x poor draining soil, M1400/86 had the highest sucrose content which was significantly (p=0.05) higher than that of NCo376, M1176/77 and M96/82.

Table 8: Cane yield results (tons cane per ha, tch).

Varieties	Well drained soil		Poorly drained soil	
	Early season	Late season	Early season	Late season
NCo376	118.3^{ab}	99.1^{abc}	113.8^{ab}	104.4^{bcd}
N23	112.3^{bc}	-	-	-
N25	-	115.1^{a}	-	116.4^{a}
N40	-	-	100.1^{b}	-
R570	106.5^{bc}	99.2^{abc}	108.5^{ab}	92.6^{ef}
M1176/77	130.6^{a}	111.6^{ab}	128.1^{a}	111.8^{abc}
M1186/86	100.0^{c}	81.0^{c}	104.4^{ab}	78.4^{g}
M1246/84	113.0^{bc}	105.0^{ab}	110.4^{ab}	97.7^{def}
M1400/86	118.3^{ab}	106.8^{ab}	105.3^{ab}	102.6^{cde}
M1551/80	117.4^{ab}	103.7^{ab}	112.2^{ab}	100.7^{de}
M695/69	104.7^{bc}	92.4^{bc}	96.9^{b}	89.6^{f}
M96/82	115.6^{ab}	104.2^{ab}	107.0^{ab}	113.0^{ab}
LSD (p=0.05)	**15.32**	**20.70**	**25.41**	**10.19**

Numbers followed by similar letters indicate that they are not significantly different (p=0.05).

Table 9. Sucrose content results (%).

Varieties	Well drained soil		Poorly drained soil	
	Early season	**Late season**	**Early season**	**Late season**
NCo376	14.4^{ab}	16.2^{cd}	13.7^{bc}	16.7^{b}
N23	14.7^{ab}	-	-	-
N25	-	16.0^{cd}	-	17.1^{ab}
N40	-	-	16.2^{a}	-
R570	14.1^{bc}	16.1^{cd}	12.7^{cd}	17.3^{ab}
M1176/77	13.9^{bc}	16.3^{c}	12.4^{d}	16.7^{b}
M1186/86	14.1^{bc}	16.0^{cd}	13.0^{bcd}	16.9^{ab}
M1246/84	13.7^{bc}	16.6^{abc}	12.6^{cd}	17.4^{ab}
M1400/86	14.6^{ab}	17.1^{ab}	13.5^{bcd}	17.8^{a}
M1551/80	14.7^{ab}	17.3^{a}	13.3^{bcd}	17.2^{ab}
M695/69	15.3^{a}	16.5^{bc}	14.0^{b}	17.4^{ab}
M96/82	13.3^{c}	15.5^{d}	12.4^{d}	16.6^{b}
LSD (p=0.05)	**1.10**	**0.71**	**1.26**	**1.05**

Numbers followed by similar letters indicate that they are not significantly different (p=0.05).

Average sucrose yields of the varieties grown over the seven successive crops are presented in table 10. Early season x good draining soil, M1176/77 had the highest sucrose yield and performed significantly (p=0.05) better than varieties R570, M1186/86, M1246/84 and M96/82, but not statistically (p=0.05) better than the remainder. Late season x good draining soil, varieties N25, M1400/86, M1176/77 and M1551/80 had sucrose yields not statistically (p=0.05) different from each other, but significantly (p=0.05) higher than M1186/86. Although varieties N40, M1176/77, NCo376 and M1551/80, in sequence, were the top 4 sucrose yielding varieties early season x poor draining soil, the differences between all the varieties in this trial were not significant (p=0.05). Late season x poor draining soil, N25 had

the highest sucrose yield which was significantly (p=0.05) higher than NCo376, R570, M1186/86, M1246/84, M1551/80 and M695/69, but not M96/82, M1176/77 and M1400/86.

Table 10. Sucrose yield results (tons sucrose per ha, tsh).

Varieties	Well drained soil		Poorly drained soil	
	Early season	Late season	Early season	Late season
NCo376	17.0^{ab}	16.0^{ab}	15.6^{a}	17.5^{bcd}
N23	16.5^{ab}	-	-	-
N25	-	18.5^{a}	-	19.9^{a}
N40	-	-	16.1^{a}	-
R570	15.0^{bc}	16.1^{ab}	13.7^{a}	16.0^{de}
M1176/77	18.2^{a}	18.2^{a}	15.8^{a}	18.6^{abc}
M1186/86	14.0^{c}	13.1^{b}	13.5^{a}	13.2^{f}
M1246/84	15.5b^{c}	17.4^{a}	13.9^{a}	17.0^{cde}
M1400/86	17.3^{ab}	18.4^{a}	14.2^{a}	18.3^{abc}
M1551/80	17.1^{ab}	17.9^{a}	14.8^{a}	17.3^{bcde}
M695/69	16.0^{abc}	15.3^{ab}	13.5^{a}	15.6^{e}
M96/82	15.3^{bc}	16.1^{ab}	13.1^{a}	18.7^{ab}
LSD (p=0.05)	**2.49**	**3.54**	**3.16**	**1.71**

Numbers followed by similar letters indicate that they are not significantly different (p=0.05).

As a result of the demand for higher fibre varieties to meet cogeneration requirements, fibre analysis results are also included and these are presented in Table 11. Variety M1186/86 had the highest fibre content irrespective of soil type and time of harvesting, variety R570 being the second highest. The fibre content of M1186/86 was consistently and significantly (p=0.05) higher than that of M1176/77, M1246/84, M1400/86, M1551/80 and M96/82. In comparison to NCo376, variety M1186/86 had significantly (p=0.05) higher fibre content only in the early season. The downside with varieties M1186/86 and R570 is the generally lower cane yields which lessen the overall fibre yields compared to the other varieties. In addition, M1186/86 is highly susceptible to smut infection.

Table 11. Fibre content (%).

Varieties	Well drained soil		Poorly drained soil	
	Early season	Late season	Early season	Late season
NCo376	11.6^{bc}	13.0^{abc}	12.2^{bcd}	12.8^{abc}
N23	12.3^{ab}	-	-	-
N25	-	12.6^{bcd}	-	12.0^{bc}
N40	-	-	12.5^{bcd}	-
R570	12.3^{ab}	13.6^{ab}	13.1^{ab}	13.4^{ab}
M1176/77	10.9^{c}	11.3^{e}	11.4^{d}	11.6^{c}
M1186/86	13.4^{a}	13.7^{a}	13.8^{a}	14.0^{a}
M1246/84	11.5^{bc}	12.5^{cd}	11.7^{cd}	11.9^{bc}
M1400/86	11.3^{bc}	12.0^{de}	11.7^{cd}	11.7^{c}
M1551/80	11.0^{c}	11.8^{de}	12.1^{bcd}	11.9^{bc}
M695/69	12.0^{bc}	13.7^{a}	12.8^{abc}	13.5^{ab}
M96/82	11.5^{bc}	12.3^{cd}	11.9^{bcd}	11.8^{c}
LSD (p=0.05)	**1.21**	**0.96**	**1.21**	**1.65**

Numbers followed by similar letters indicate that they are not significantly different (p=0.05).

Figure 1 presents the tons cane per ha (tch) and tons sucrose per ha (tsh) results in a graphical form over the seven consecutive crops. Although variety M1176/77 performed slightly lower than N40 early season x poor draining soil in tsh, it yielded better than NCo376 in both tsh and tch. In good draining soil, varieties M1176/77, M1400/86 and M1551/80 performed better than NCo376 and N23 early season. Under similar soil conditions and harvested late season, the trio yielded more cane and sucrose than NCo376, although they did not outperform N25. Late season x poor draining soil, M96/82, M1176/77 and M1400/86 performed better than NCo376 but not N25. Late season x good draining soil, varieties M1400/86, M1176/77 and M1551/80 yielded better sucrose than all other varieties (including NCo376) except N25.

These results indicate that varieties M1176/77, M1400/86, M1551/80 and M96/82 under each of the specified conditions, had good yield performance and ratooning ability relative to NCo376. These are essential indicators of sustainable sugarcane varieties in addition to pest and disease resistance. Figure 2 shows the ratooning ability of these varieties alongside SASRI varieties under the different conditions. In all the growing conditions, the varieties assumed similar yield patterns, indicating that responses to environmental conditions and management practices were similar.

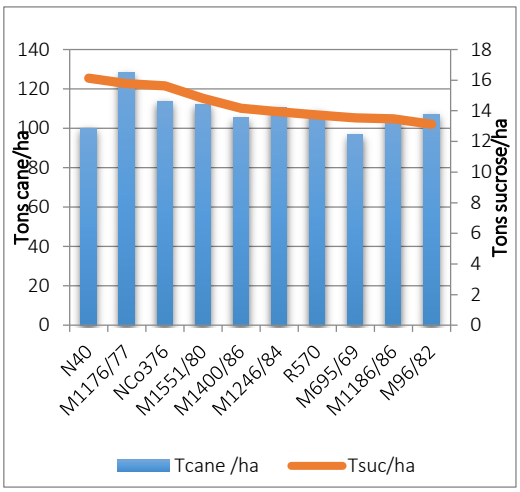

Figure 1a. Early season, poor draining soil,

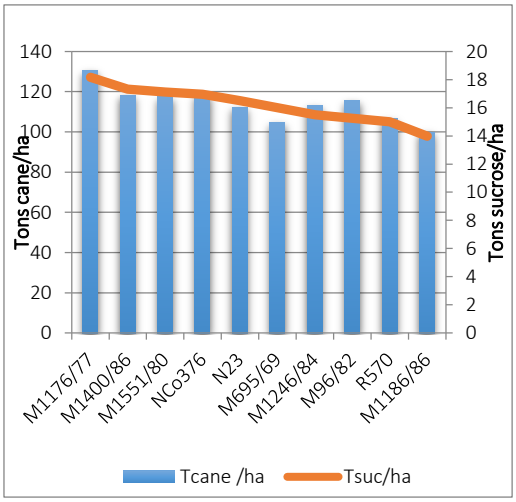

Figure 1b. Early season, good draining soil.

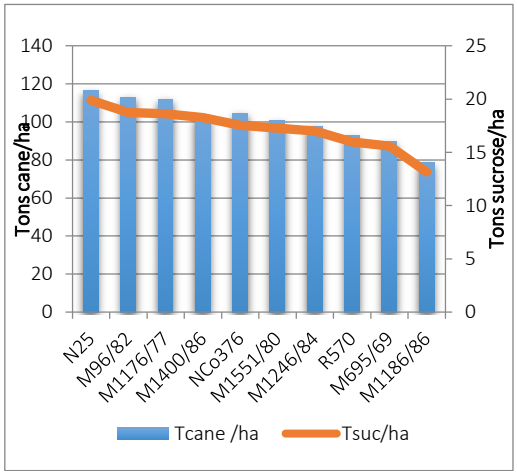

Figure 1c. Late season, poor draining soil.

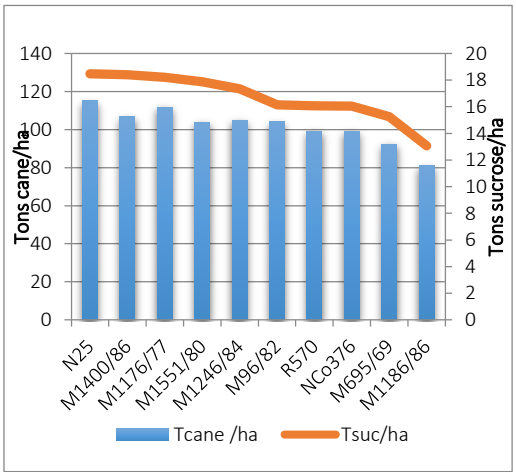

Figure 1d. Late season, good draining soil.

Figure 1. Average cane and sucrose yields over the seven crops for the season and soil.

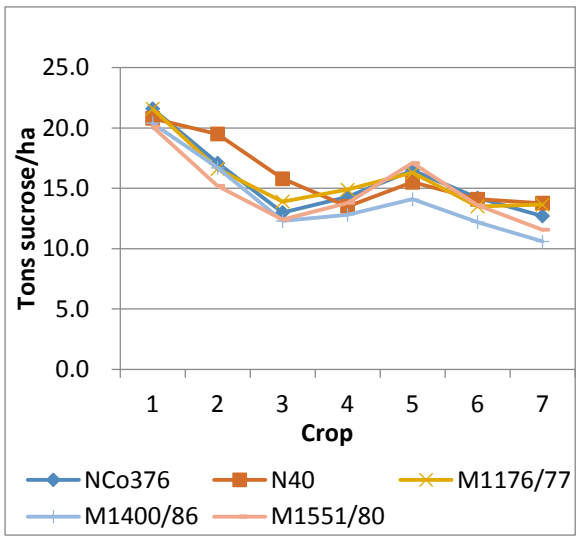

Figure 2a: Early season, poor draining soil

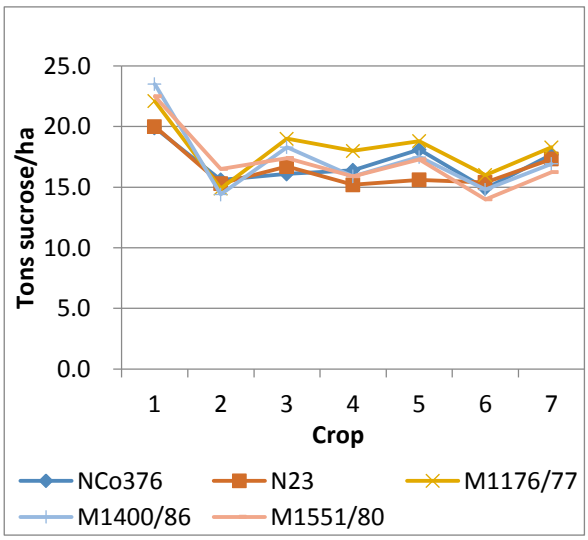

Figure 2b: Early season, good draining soil

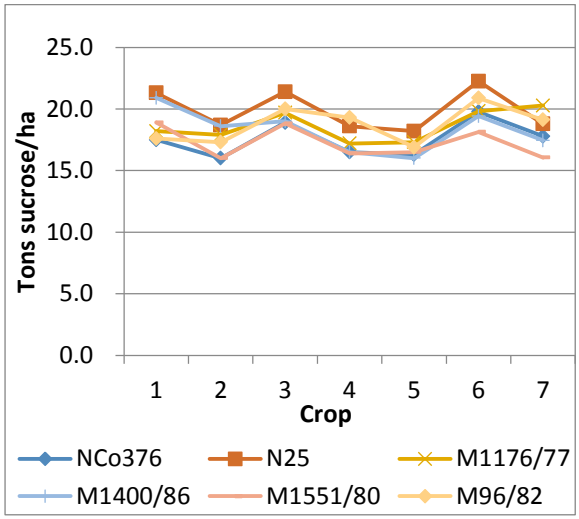

Figure 2c: Late season, poor draining soil

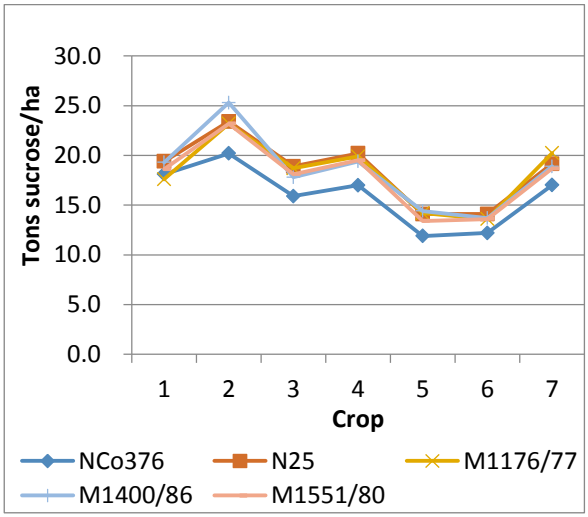

Figure 2d: Late season, good draining soil

Figure 2. Ratoonability of the top performing Mauritian varieties and South African cultivars.

Conclusion

- Varieties M1176/77, M1400/86, M1551/80 and M96/82 are recommended for growing within the Swaziland industry. In Table 12, the recommended soil and season in which each variety may be grown is shown, arranged in order of preference according to the sucrose yield results.

Table 12: Mauritian variety recommendations for the Swaziland sugar industry.

Soil category	Season + Variety	
	Early season	Late season
Good draining soils	M1176/77, M1400/86, M1551/80	M1400/86, M1176/77, M1551/80
Poor draining soils	M1176/77, M1551/80, M1400/86	M96/82, M1176/77, M1400/86, M1551/80

- Growers are encouraged to continue monitoring pests and diseases on these Mauritian varieties in particular sugarcane smut (*Ustilago scitaminea*) infections on varieties M1551/80 and M1176/77 which were shown to be relatively more susceptible than the other varieties (M1400/86 and M96/82).

- A rigorous study on the nutrient use efficiency of each variety would be necessary so that each crop is fertilised according to its specific requirement. The results of this study have shown that varieties M1176/77, M1400/86 and M1551/80 have higher K, Ca and Mg levels than NCo376, whose nutrient threshold values are used within the industry.

- The selected Mauritian varieties need to be incorporated into the SSA ripening programme to establish the response of each variety to chemical ripening so that growers can be advised accordingly.

- There is a need to include these varieties in the SSA variety evaluation programme in the other growing areas (Big Bend and Malkerns).

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