

THE PERFORMANCE OF RECENTLY RELEASED SOUTH AFRICAN VARIETIES IN SWAZILAND

H ROSTRON, DWF BUTLER AND MD ZWANE

Swaziland Sugar Association, PO Box 367, Simunye, Swaziland

Abstract

Imported South African varieties N22, N23, N24 and N25 were compared with the industry standard, NCo376, on medium to high yield potential soils in four replicated, irrigated trials comprising a total of 19 crops harvested early in the milling season. Chemical ripeners ethephon (2-chloroethane-phosphonic acid) and Fusilade Super (fluazifop-p-butyl) were applied either alone, or as a combination treatment in all experiments.

The results confirmed that varieties N22, N23, N24 and N25 were less susceptible to smut than NCo376 and that N23, N24 and N25 produced more sucrose per hectare than NCo376 when they were not chemically ripened. N23 flowered more than the other varieties and this may restrict its yield if it is harvested late in the milling season. When ripened, the sucrose content of varieties NCo376 and N23 increased more than that of the other varieties on both a fresh and dry weight basis, resulting in higher sucrose yields per hectare than varieties N22 and N24. Variety N25, which did not respond as well as NCo376 to ripening, produced similar sucrose yields, mainly because of higher but more variable cane yields. There was an indication that ripening reduced the sucrose yield of N24 in some crops. The results suggest that in irrigated areas where chemical ripening is a standard practice, high population varieties with a relatively low sucrose content are more productive than those with lower yields of high quality sugarcane.

Introduction

Variety NCo376, which is highly susceptible to sugarcane smut disease, *Ustilago scitaminea* Sydow, constituted over 80% of the area of sugarcane in Swaziland in 1984, when it was estimated that 4,4% of all sugarcane stools were infected with smut disease (Pearse, 1989). Smut resistant varieties N14 and N19 were introduced from the South African Sugar Association Experiment Station (SASEX) in 1981 and 1985 respectively, in order to reduce the area under NCo376. N14 in particular was adopted rapidly in those areas of the industry most affected by smut. In 1990, NCo376 comprised 52% of the area under cane, N14 31% and N19 8% (Anon, 1991). However, following the introduction of rigorous smut control measures in Swaziland and the widespread use of chemical ripeners, to which NCo376 is particularly responsive, the area planted to NCo376 had increased to 61% in 1997. Over the same period, confidence in N14 waned, reflecting

the variety's poor performance early in the season and on the shallow soils that comprise approximately 60% of the industry. N14 was also found to ratoon poorly, possibly because of its high susceptibility to ratoon stunting disease (RSD). Consequently, the area planted to N14 has declined to 18% of the industry, whereas the area planted to N19 has remained at about 12% (Anon, 1998).

The reliance of the industry on NCo376 is a cause for concern. All new varieties released by SASEX for irrigated areas are imported into Swaziland by agreement and tested under a wide range of local conditions. The objective is to find smut-resistant varieties that are hardy, ratoon as well as does NCo376 and produce sucrose yields equal to, or better than, chemically ripened NCo376. New varieties are tested in experiments on a wide range of soils and harvested either early or late in the milling season. At present there are only limited data for late season experiments and experiments on poor soils have produced variable results, with no variety consistently out-performing ripened NCo376. Further experiments are needed before reliable conclusions can be drawn about the performance of varieties under these conditions. This paper reports the results of four replicated trials comprising four plant and 15 ratoon crops harvested early in the milling season.

Procedure

The trials were established on sites representing soils of medium and high yield potential and harvested at approximately 12 months of age between May and July over a period of five years. All trials were randomised blocks, with split plots replicated five times. Gross plot size ranged from 76,5 to 135 m² and net plot size from 39 to 72 m². Harvest dates, soil types and the varieties tested in each trial are given in Table 1. The soils were well-structured, medium to heavy textured and free draining. Each variety was planted once on a deep R set soil (Rondspring or Shortlands form) and once on a shallow (0-35 cm) S set soil (Sommerling or Glenrosa form) (after Nixon *et al.*, 1986).

Three varieties and three ripener treatments plus an untreated control were compared in each trial. Varieties N22, N23, N24 and N25 were each planted in two trials and NCo376 was the standard in all trials. Ripener treatments were either ethephon (2-chloroethane-phosphonic acid, 480 g ai/L), applied as Ethrel at 1,5 L/ha (720 g ai/ha), Fusilade Super (fluazifop-p-butyl, 125 g ai/L), applied at 0,45 L/ha (56 g

Table 1. Soil types, varieties and harvest dates of trials.

Trial	Soil set	Varieties	Crop				
			Plant	1R	2R	3R	4R
1	R*	N23 N24 NCo376	11-Jul-94	27-Jun-95	27-Jun-96	3-Jul-97	22-Jun-98
2	R*	N22 N25 NCo376	18-Jul-94	4-Jul-95	3-Jul-96	31-Jul-97	28-Jul-98
3	S^	N22 N23 NCo376	26-Jul-94	12-Jul-95	9-Jul-96	10-Jul-97	8-Jul-98
4	S^	N24 N25 NCo376	13-Jul-95	16-Jul-96	22-Jul-97	20-Jul-98	-

R* = Rondsring series, S^ = Somerling series

ai/ha), or a combination treatment of Ethrel at 1,5 L/ha followed about four weeks later by Fusilade Super at 0,45 L/ha (Rostron, 1985). Ripeners were applied using a constant pressure CO₂ gas-operated knapsack sprayer with a hand-held 'T' boom, delivering approximately 52 L/ha through two TK 1,5 nozzles. Ethrel treatments were applied between 12 and 15,4 weeks before harvest (mean 14,1) and Fusilade Super (Fusilade) between 7,3 and 11 weeks before harvest (mean 9,1).

To monitor the response of varieties to ripeners, samples of 16 stalks per plot were taken for full cane analysis before each ripener application, approximately three weeks before harvest and at harvest. The samples were trashed, topped at the natural breaking point and sent to the Mhlume Sugar Co laboratory for analysis. At harvest, cane from each net plot was burnt, cut by hand and weighed with a tractor-mounted boom fitted with a grab and an electronic load cell. Stalks removed for sucrose sampling were accounted for in the calculation of final yield.

All crops were fully irrigated, either by overhead sprinkler or surface drip irrigation systems until after the last ripener application, when the crops were dried off according to normal estate practice (usually to a soil moisture deficit of twice the total available moisture content). Rows were spaced 1,5 m apart and fertiliser application was based on the results of soil samples taken after harvest and leaf samples taken at 4-6 months of age.

The height of 20 randomly selected stalks per plot and the number of shoots in one net row per plot were recorded at irregular intervals from 5-6 months of age in all trials. Smut infection was assessed up to three times in each crop and all plots were rogued after each assessment. Smut infected shoots were expressed as a percentage of the total stalk population. The number of emerged flowers were counted just before harvest and expressed as a percentage of the total stalk population.

Results

Where varieties have been compared with variety NCo376, only data taken from the same trials have been used.

Stalk populations

Variety NCo376 maintained consistently higher populations than all other varieties in all experiments (Figure 1). Varieties N22, N23 and N25 all had similar populations at three to four months of age but the population of N22 declined at a faster rate than that of NCo376, N23 at a slower rate and N25 at a similar rate. At harvest, the population of N23 was closest to that of NCo376. The population of N24 was higher than that of varieties N22, N23 and N25 initially but the rate of decline was similar to that of N22 and its final population was the same as that of N25.

Smut infection

Smut infection was highest in NCo376 with a mean of 1,0% of stalks infected (maximum 5,6%, s.e. of the mean 0,3) and lowest in N22 and N25, with means of 0,03% (s.e. 0,01) and 0,08% (s.e. 0,03) respectively. Mean infection was less than 0,5% in varieties N23 (s.e. 0,09) and N24 (s.e. 0,3).

Flowering

Flowering was greatest in N23, with a mean of 20,3% for all experiments (s.e. 8,9) and a maximum of 85,0%. Comparable figures for NCo376 were 11,2% mean (s.e. 4,0) and 63,0% maximum. Other varieties had less than 2,0% flowered stalks (s.e. 0,7 to 1,1), with maxima of 10,0% or less.

Stalk sample analyses

Moisture contents ranged from 77,1% for N25 to 74,2% for N22 and N24 nine weeks before harvest, when crops were still being irrigated fully. Meaningful comparisons from sample data on a fresh mass basis were difficult because of this variability and sample results have been presented in terms of stalk dry weight, sucrose weight per stalk and

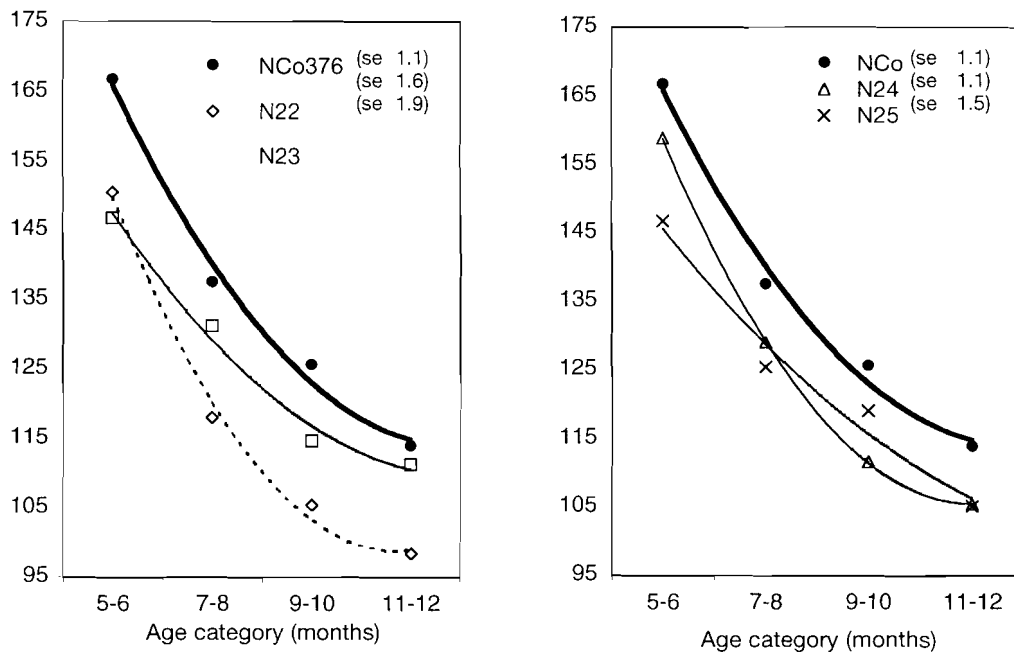


Figure 1. Mean stalk population ($\times 10^{-3}$ ha⁻¹) of varieties from canopy to harvest (se = standard error of mean at harvest; n = 16-36).

sucrose as a percentage of stalk dry weight. Where treatments had little effect on stalk weight and patterns of sucrose yield response were consistent and similar to those for sucrose percentage, these differences have been interpreted as true effects for both sample and harvest data.

Varieties

There were large, statistically significant differences among varieties in stalk dry mass, sucrose mass per stalk and sucrose per cent dry matter at harvest (Table 2). Results for sucrose mass of unripened varieties on other sampling occasions are summarised in Figure 2a and show that differences were consistent. Varieties N22, N24 and N25 had heavier stalks containing more sucrose and a higher sucrose per cent dry matter content than NCo376 and N23, which had similar sucrose contents.

At harvest, the unripened stalk dry mass of N24 was 17% higher than that of NCo376 and sucrose mass per stalk was 31% higher, while the unripened stalk mass of N25 was 15% higher and sucrose mass per stalk was 19% higher (Figure 2a). Variety N24 had the highest sucrose per cent stalk dry matter, followed by N22 and then N25.

Ripener treatments

Varieties N22 and N24 mature earlier than other varieties and this may have affected their response to ripeners, which need juice purities below 75% when Ethrel is applied and below 85% when Fusilade is applied, for maximum response. The average juice purity for all experiments at the time of Ethrel application was between 72,7 and 74,4% for varieties NCo376, N23 and N25 and was 80,4% for N22 and 81,5% for N24.

The combination treatment produced more consistent results

than either Ethrel or Fusilade applied alone and sucrose mass per stalk for this treatment was either similar to, or better than that of other ripener treatments in all experiments (Table 2). This treatment has been used in comparisons with the unsprayed control because it is also the standard treatment for NCo376 against which new varieties are compared.

The pattern of differences between ripened varieties was similar to that of unripened varieties (Figure 2b). Ripening increased the sucrose mass per stalk of NCo376 and N23 more than for varieties N24 and N25 and had less effect on stalk mass, resulting in an improvement in sucrose per cent dry mass, relative to other varieties. Although ripening reduced the stalk dry mass of varieties N24 and N25 at harvest (Figure 2b), they were both 8% heavier than NCo376 and contained 14% and 10% more sucrose than NCo376 respectively.

There were few statistically significant effects of ripeners on either sucrose mass per stalk (3/19 experiments), or stalk dry mass (1/19 experiments). In contrast, there were statistically significant effects of ripeners on sucrose per cent dry matter in 15 of 19 experiments.

There was a consistent increase in sucrose mass per stalk for treated NCo376 compared with untreated NCo376 in crops where it was compared with varieties N22, N24 and N25, but only in two out of five crops where it was compared with N23 (Figure 3). N22 responded poorly to ripening and there appeared to be an adverse effect of ripening on the sucrose mass per stalk of N24 in later ratoon crops. Ripening improved the sucrose mass per stalk of N23 in 3/5 crops and there was a similar, smaller response in N25 in 3/5 crops and one unusually large response in the third ratoon crop, due to the low mass of the control treatment.

Table 2. Mean sample results for all crops in each trial at harvest (0 weeks).

TRIAL 1	Sucrose weight (g/stalk)				Stalk dry weight (g/stalk)				Sucrose % dm			
Ripener treatment	NCo376	N23	N24	Mean	NCo376	N23	N24	Mean	NCo376	N23	N24	Mean
Control	142.0	142.8	185.2	156.7	275.3	274.3	317.9	289.2	51.5	52.0	58.3	54.0
Ethrel 1.5L/ha	156.9	161.4	183.4	167.2	285.7	298.0	312.8	298.8	54.9	54.1	58.6	55.8
Eth. 1.5L/ha + Fus. 0.45L/ha	153.9	157.2	184.8	165.3	273.4	284.0	312.1	289.8	56.2	55.4	59.2	56.9
Fusilade S.0.45L/ha	136.4	150.0	189.4	158.6	256.9	282.9	320.4	286.7	53.0	52.9	59.0	54.9
Mean	147.3	152.9	185.7	161.9	272.8	284.8	315.8	291.1	53.9	53.6	58.8	55.4
Significance - Variety	5 out of 5 crops				4 out of 5 crops				5 out of 5 crops			
" - Ripener	1 out of 5 crops				1 out of 5 crops				3 out of 5 crops			
" - Interaction	0 out of 5 crops				0 out of 5 crops				2 out of 5 crops			
CV % (range)	9.9 - 16.1				10.6 - 13.4				2.4 - 4.6			
TRIAL 2	Sucrose weight (g/stalk)				Stalk dry weight (g/stalk)				Sucrose % dm			
Ripener treatment	NCo376	N22	N25	Mean	NCo376	N22	N25	Mean	NCo376	N22	N25	Mean
Control	140.0	169.3	170.9	160.1	272.0	303.7	310.3	295.4	51.8	56.0	55.2	54.3
Ethrel 1.5L/ha	157.7	184.6	170.9	171.1	284.2	321.5	303.6	303.1	55.5	57.6	56.2	56.4
Eth. 1.5L/ha + Fus. 0.45L/ha	167.5	178.1	179.2	174.9	291.8	300.7	305.2	299.2	57.5	59.6	59.0	58.7
Fusilade S.0.45L/ha	145.3	174.5	170.7	163.5	270.7	304.7	299.1	291.5	53.7	57.5	57.4	56.2
Mean	152.6	176.6	172.9	167.4	279.7	307.7	304.6	297.3	54.6	57.7	56.9	56.4
Significance - Variety	5 out of 5 crops				3 out of 5 crops				4 out of 5 crops			
" - Ripener	1 out of 5 crops				0 out of 5 crops				5 out of 5 crops			
" - Interaction	1 out of 5 crops				0 out of 5 crops				0 out of 5 crops			
CV % (range)	9.4 - 16.7				9.7 - 16.9				3.3 - 8.4			
TRIAL 3	Sucrose weight (g/stalk)				Stalk dry weight (g/stalk)				Sucrose % dm			
Ripener treatment	NCo376	N22	N23	Mean	NCo376	N22	N23	Mean	NCo376	N22	N23	Mean
Control	140.8	157.0	150.8	149.5	265.3	283.8	290.3	279.8	53.0	55.2	51.9	53.3
Ethrel 1.5L/ha	141.8	160.3	148.3	150.1	257.3	282.8	275.2	271.8	55.0	56.6	53.8	55.1
Eth. 1.5L/ha + Fus. 0.45L/ha	141.5	159.7	151.1	150.7	251.7	280.5	272.8	268.3	56.1	56.9	55.3	56.1
Fusilade S.0.45L/ha	144.1	158.6	141.7	148.1	269.4	285.5	268.4	274.5	53.5	55.5	52.7	53.9
Mean	142.0	158.9	148.0	149.6	260.9	283.1	276.7	273.6	54.4	56.0	53.4	54.6
Significance - Variety	4 out of 5 crops				4 out of 5 crops				4 out of 5 crops			
" - Ripener	0 out of 5 crops				0 out of 5 crops				4 out of 5 crops			
" - Interaction	0 out of 5 crops				0 out of 5 crops				1 out of 5 crops			
CV % (range)	8.8 - 13.2				8.7 - 13.2				2.6 - 5.2			
TRIAL 4	Sucrose weight (g/stalk)				Stalk dry weight (g/stalk)				Sucrose % dm			
Ripener treatment	NCo376	N24	N25	Mean	NCo376	N24	N25	Mean	NCo376	N24	N25	Mean
Control	107.7	143.4	129.2	126.8	257.1	309.1	304.7	290.3	51.9	57.7	52.7	54.1
Ethrel 1.5L/ha	120.6	139.9	138.4	133.0	275.9	300.9	311.5	296.1	54.3	58.1	55.4	55.9
Eth. 1.5L/ha + Fus. 0.45L/ha	129.8	136.9	131.0	132.6	289.3	284.1	288.4	287.3	56.0	60.2	56.4	57.5
Fusilade S.0.45L/ha	118.9	140.7	135.9	131.8	278.2	292.2	312.3	294.2	53.1	60.2	54.3	55.9
Mean	119.2	140.3	133.6	131.0	275.1	296.6	304.2	292.0	53.8	59.1	54.7	55.9
Significance - Variety	4 out of 4 crops				3 out of 4 crops				4 out of 4 crops			
" - Ripener	1 out of 4 crops				0 out of 4 crops				3 out of 4 crops			
" - Interaction	0 out of 4 crops				0 out of 4 crops				0 out of 4 crops			
CV % (range)	9.6 - 16.7				10.5 - 16.2				3.6 - 5.3			

Significance indicates the number of crops in which there were statistically significant results (P=0.05)

CV % (range) indicates the range of CV% among crops

Figure 4 illustrates the differing effects of the combination treatment on varieties. This summary confirms that, generally, the combination treatment did not reduce the stalk mass of NCo376 and improved both sucrose mass per stalk and sucrose per cent stalk dry mass of this variety. There was a reduction in the sucrose yield of N24 because of a large adverse effect of ripeners on stalk dry mass. Ripening produced a similar increase in sucrose mass per stalk of varieties N22, N23 and N25 but there was an indication that the stalk dry mass of N25 was reduced more than that of N22 and N23.

Sucrose yield – varieties

There were statistically significant differences in sucrose yield among varieties in 13 of the 19 crops, mainly due to differences in either cane yield for N25 or cane yield and quality for N22 and N24 (Table 3). Untreated varieties N24 and N25 produced significantly more sucrose per hectare (ts/ha) than NCo376 because of the superior quality of N24 and the higher cane yield (tc/ha) of N25 (Figure 5). N22 produced consistently lower cane and sucrose yields than the other varieties, despite having better quality than NCo376, N23 and N25, while unripened N23 was similar to

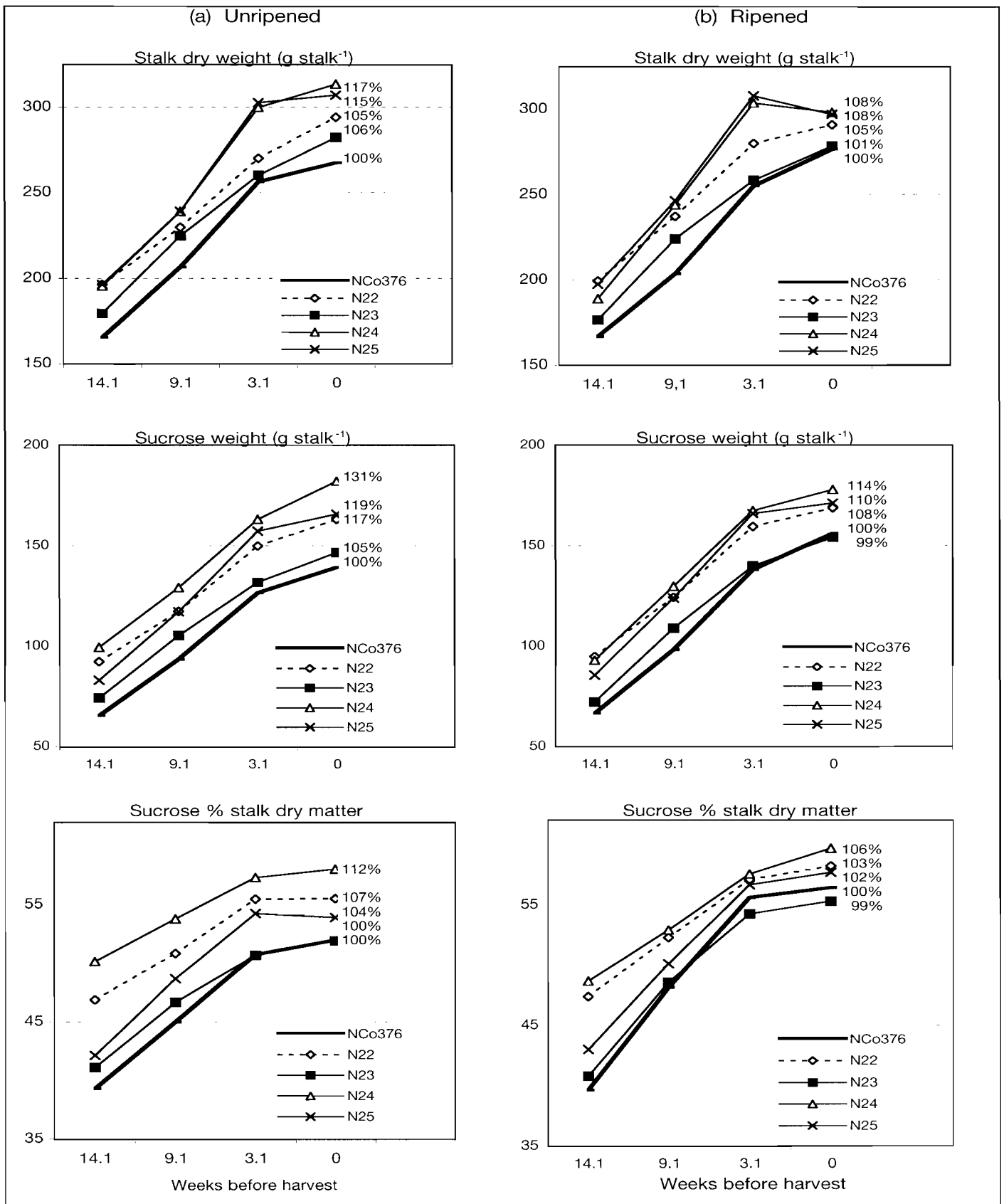


Figure 2. Sample means for all crops for sucrose percent dry matter and sucrose and stalk dry mass of each variety on all sampling dates (a. unripened; b. ripened with Ethrel plus Fusilade; data expressed as a percentage of the corresponding value for NCo376).

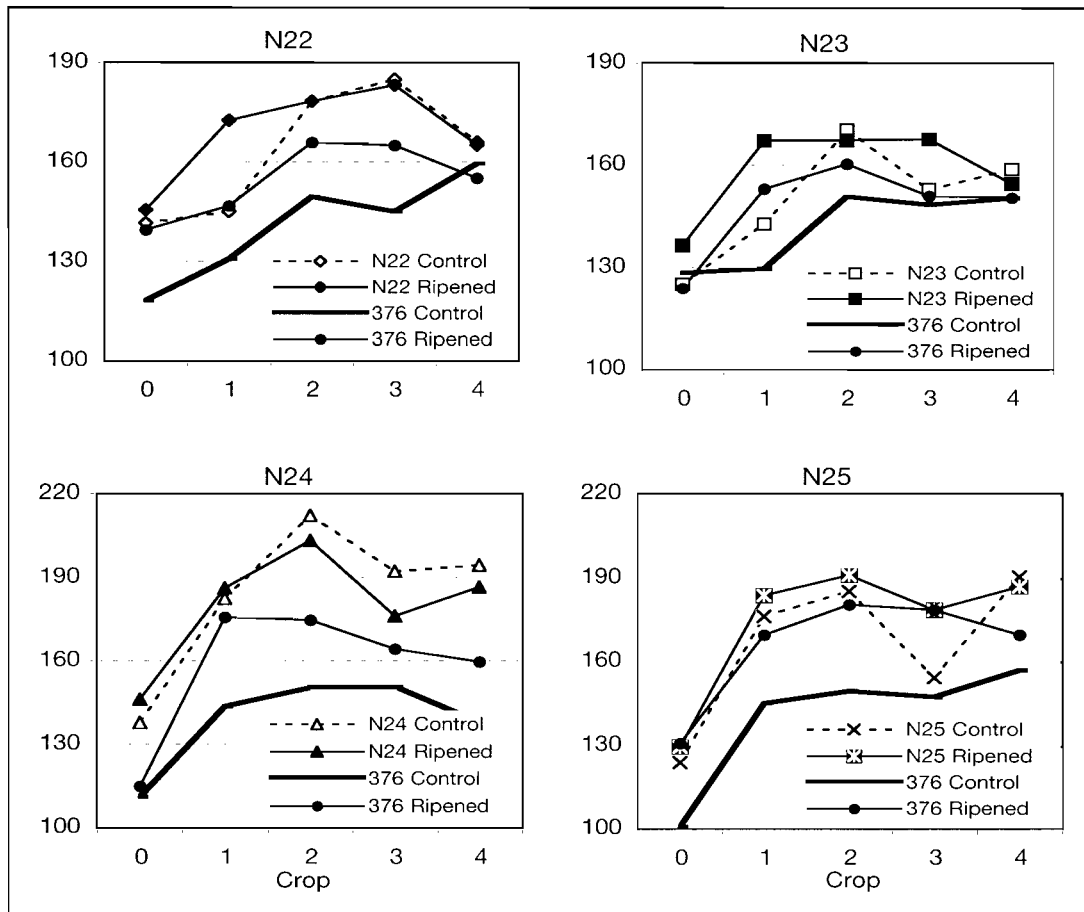


Figure 3. Mean sample sucrose weight (g stalk⁻¹) for control and treatment with Ethrel plus Fusilade by crop for each variety, compared with NCo376 (each point is the mean of 2 experiments with the exception of crop 4 of N24 and N25, and the corresponding values for NCo376, from one experiment).

NCo376 in both yield and quality.

Ripeners

Yield at harvest results confirmed the sample dry mass data, despite a similar lack of statistical significance for differences in cane and sucrose yields. There were often statistically significant differences for ripener treatments in sucrose percent cane fresh weight (17/19 comparisons) but not for cane (1/19) or sucrose yield (0/19) (Table 3). Statistically significant interactions for sucrose percent cane fresh weight were usually related to the poor quality of untreated NCo376, N23 and N25 compared with the higher sucrose contents of N22 and N24. The effects of the combination treatment on all varieties were either similar to, or better than Fusilade applied alone (Table 3). Responses to Ethrel were not consistent among the varieties.

NCo376 responded well to ripening and the results confirmed that the combination treatment was the best one for this variety (Figure 6). Ripened N23 and N25 were the only varieties to produce more sucrose per hectare than ripened NCo376 (Figure 5). The response of N23 was more consistent than that of N25, which yielded more sucrose than NCo376 in only 3/5 crops (Figure 7). Varieties N22 and N24

did not respond positively to ripening, confirming the sample results.

Discussion

When treatments are applied to successive sugarcane crops it is possible that residual effects of previous treatments may affect the response to a current treatment. Shoot counts before ripener application, together with sample data when new treatments were first applied, did not indicate any differences due to previous treatments in any of the experiments. Differences in sucrose yield between treated and untreated plots were similar from one crop to the next, indicating that there was no cumulative adverse effect of ripeners on any of the varieties. However, harvest results do indicate that cane and sucrose yields of ripened ratoon crops of N24 were consistently lower than those of untreated plots due to both a reduction in stalk dry mass and, in later ratoons, a reduction in sucrose mass per stalk.

The results from this comprehensive set of trials on good soils with minimal moisture stress show that the varieties fell into three distinct categories: those with a low stalk population, low cane yield and high sucrose (N22 and N24); those

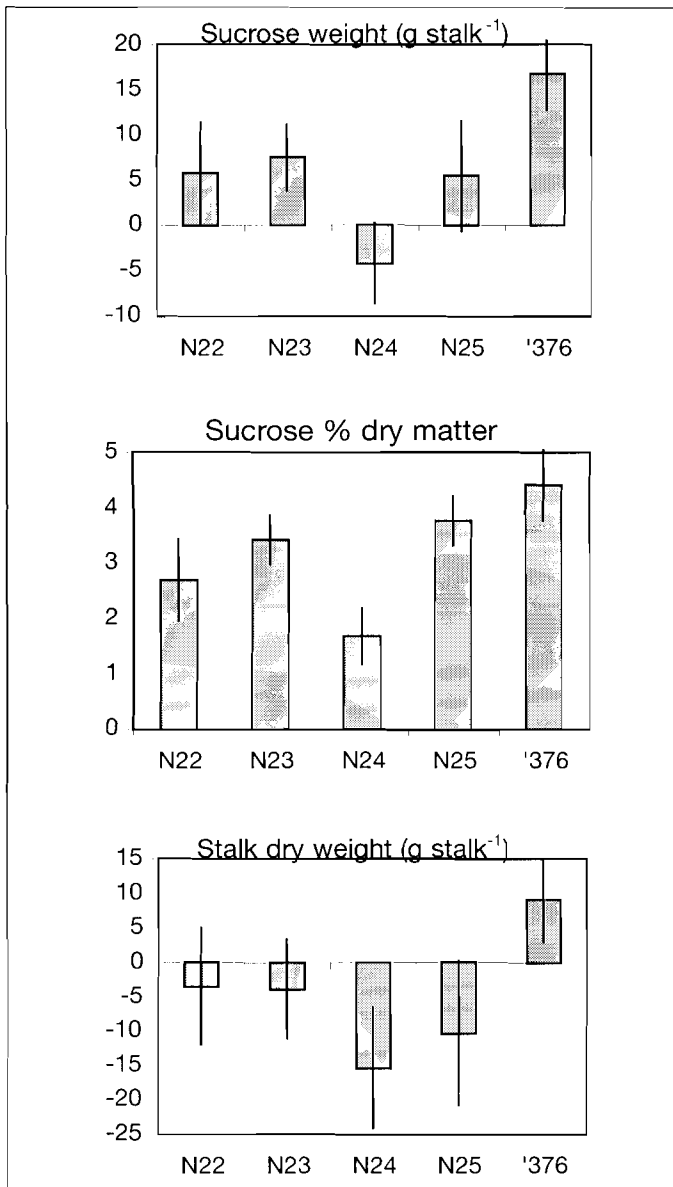


Figure 4. Mean differences in sucrose mass, sucrose per cent dry matter and stalk dry weight between Ethrel plus Fusilade and untreated samples at harvest per variety (NCo376 is a mean of 19 crops from four experiments; and other varieties are means of either nine or 10 crops from two experiments. Vertical bars represent the standard error of the mean).

with high population, moderate cane yield and low sucrose (NCo376 and N23); those with moderate population, high cane yield and low sucrose (N25).

It was confirmed that all the newer varieties were less susceptible to smut than NCo376 and that varieties N24, N25 and to a lesser extent N23, produced better sucrose yields than NCo376 when ripeners were not used. However, ripeners are an accepted management practice under irrigated conditions in Swaziland and it is estimated that 66 % of sugarcane in Swaziland is ripened, increasing industry profits by an estimated R8,4 million per year (Rostron, 1996). It is for this reason that, to be adopted in Swaziland, a new variety

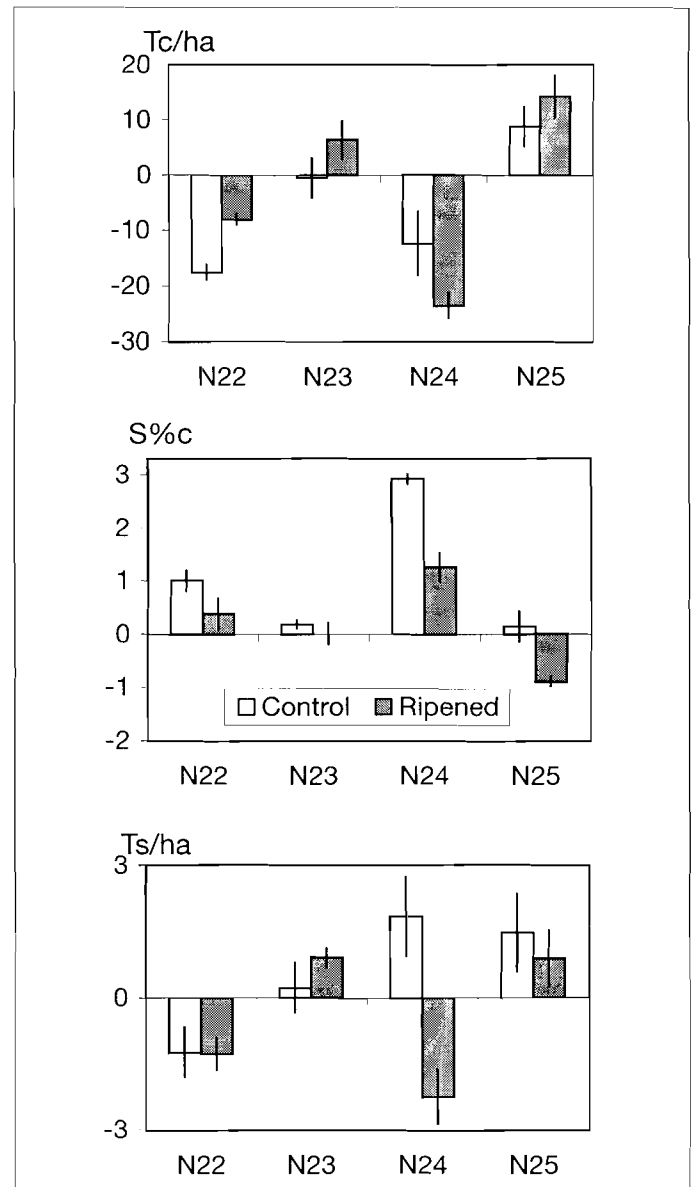


Figure 5. Mean differences from NCo376 for ripened (Ethrel plus Fusilade) and unripened varieties at harvest (vertical bars represent standard error of the mean).

must produce sucrose yields that are either equal to or better than NCo376 ripened with the combination treatment, but smut in NCo376 must be controlled by rigorous roguing.

The high cane quality of N22 and N24, reflected in high juice purities at the time of Ethrel application, meant that these varieties were unlikely to respond to chemical ripening. This indicates that care must be taken in commercial practice to ensure that these varieties are not too mature when sprayed with ripeners, or they will not respond to treatment. It may not be feasible to ripen these varieties successfully because there is an optimum time between ripener application and harvest, after which cane and sucrose yields

Table 3. Mean harvest results for all crops in each trial.

TRIAL 1	Tc/ha				S% cane				Ts/ha			
Ripener treatment	NCo376	N23	N24	Mean	NCo376	N23	N24	Mean	NCo376	N23	N24	Mean
Control	147.4	146.9	133.6	142.6	13.9	14.3	17.1	15.1	20.3	21.0	22.4	21.2
Ethrel 1.5L/ha	150.1	147.3	127.2	141.5	14.9	15.1	16.6	15.5	22.3	22.1	20.9	21.8
Eth. 1.5L/ha + Fus. 0.45L/ha	145.5	146.8	127.1	139.8	15.6	15.8	16.9	16.1	22.5	23.1	21.2	22.3
Fusilade S.0.45L/ha	138.7	145.7	125.7	136.7	14.5	14.9	17.6	15.7	19.9	21.6	21.9	21.1
Mean	145.4	146.7	128.4	140.2	14.7	15.0	17.1	15.6	21.3	22.0	21.6	21.6
Significance - Variety	4 out of 5 crops				5 out of 5 crops				3 out of 5 crops			
" - Ripener	0 out of 5 crops				4 out of 5 crops				0 out of 5 crops			
" - Interaction	0 out of 5 crops				4 out of 5 crops				2 out of 5 crops			
CV % (range)	7.2 - 10.5				2.9 - 7.7				7.4 - 13.6			
TRIAL 2	Tc/ha				S% cane				Ts/ha			
Ripener treatment	NCo376	N22	N25	Mean	NCo376	N22	N25	Mean	NCo376	N22	N25	Mean
Control	149.7	133.8	156.4	146.6	13.8	15.0	14.3	14.3	20.4	19.9	22.1	20.8
Ethrel 1.5L/ha	144.9	133.6	149.8	142.8	14.9	15.4	14.4	14.9	21.4	20.4	21.3	21.1
Eth. 1.5L/ha + Fus. 0.45L/ha	135.7	127.8	158.5	140.6	16.0	15.8	15.0	15.6	21.5	20.1	23.5	21.7
Fusilade S.0.45L/ha	142.2	134.3	156.2	144.2	14.3	15.4	14.6	14.7	20.1	20.5	22.7	21.1
Mean	143.1	132.4	155.2	143.6	14.7	15.4	14.6	14.9	20.9	20.2	22.4	21.2
Significance - Variety	4 out of 5 crops				4 out of 5 crops				4 out of 5 crops			
" - Ripener	0 out of 5 crops				4 out of 5 crops				0 out of 5 crops			
" - Interaction	1 out of 5 crops				2 out of 5 crops				0 out of 5 crops			
CV % (range)	6.7 - 11.4				3.5 - 6.1				7.1 - 12.8			
TRIAL 3	Tc/ha				S% cane				Ts/ha			
Ripener treatment	NCo376	N22	N23	Mean	NCo376	N22	N23	Mean	NCo376	N22	N23	Mean
Control	121.6	102.4	121.1	115.0	14.7	15.5	14.6	14.9	17.9	15.8	17.7	17.1
Ethrel 1.5L/ha	118.6	108.4	120.1	115.7	15.2	15.7	15.4	15.4	18.1	17.0	18.6	17.9
Eth. 1.5L/ha + Fus. 0.45L/ha	111.1	103.0	119.6	111.2	16.0	16.2	15.8	16.0	17.8	16.7	19.0	17.8
Fusilade S.0.45L/ha	124.7	106.6	115.0	115.5	14.9	15.6	14.9	15.1	18.6	16.7	17.1	17.5
Mean	119.0	105.1	119.0	114.4	15.2	15.7	15.2	15.4	18.1	16.5	18.1	17.6
Significance - Variety	5 out of 5 crops				4 out of 5 crops				3 out of 5 crops			
" - Ripener	0 out of 5 crops				5 out of 5 crops				0 out of 5 crops			
" - Interaction	1 out of 5 crops				1 out of 5 crops				0 out of 5 crops			
CV % (range)	7.8 - 10.5				2.4 - 4.5				8.8 - 11.7			
TRIAL 4	Tc/ha				S% cane				Ts/ha			
Ripener treatment	NCo376	N24	N25	Mean	NCo376	N24	N25	Mean	NCo376	N24	N25	Mean
Control	128.7	117.3	139.3	128.4	13.7	16.1	13.5	14.4	17.8	18.9	18.9	18.5
Ethrel 1.5L/ha	133.9	108.5	144.6	129.0	14.5	15.4	14.0	14.6	19.6	16.8	20.4	18.9
Eth. 1.5L/ha + Fus. 0.45L/ha	133.7	104.5	136.3	124.9	15.2	16.3	14.5	15.3	20.4	17.0	19.9	19.1
Fusilade S.0.45L/ha	128.6	104.3	138.3	123.7	14.5	16.7	14.4	15.2	18.7	17.5	20.0	18.7
Mean	131.2	108.6	139.6	126.5	14.5	16.1	14.1	14.9	19.1	17.5	19.8	18.8
Significance - Variety	4 out of 4 crops				4 out of 4 crops				3 out of 4 crops			
" - Ripener	1 out of 4 crops				4 out of 4 crops				0 out of 4 crops			
" - Interaction	0 out of 4 crops				3 out of 4 crops				1 out of 4 crops			
CV % (range)	6.5 - 10.3				4.1 - 7.3				8.2 - 12.2			

Significance indicates the number of crops in which there were statistically significant results (P=0.05)

CV % (range) indicates the range of CV% among crops

are affected adversely. The value of varieties N22 and N24 in Swaziland may well be restricted to regions and times of the year when ripening is not possible.

Of the varieties tested, only the high population, low sucrose variety N23 produced consistently higher sucrose yields than NCo376 when both were ripened. The propensity of N23 to flower may mean that it will have to be restricted to the early and middle part of the milling season, if flowering cannot be

controlled artificially. Experiments to investigate chemical control of flowering in N23 have been started.

The average yield of N25 when ripened with Ethrel plus Fusilade, or Fusilade alone, was also better than that of ripened NCo376 but the results were erratic from crop to crop and they reflected differences in cane tonnage rather than an improvement in cane quality. There was considerable variation in the cane yield of N25 from season to sea-

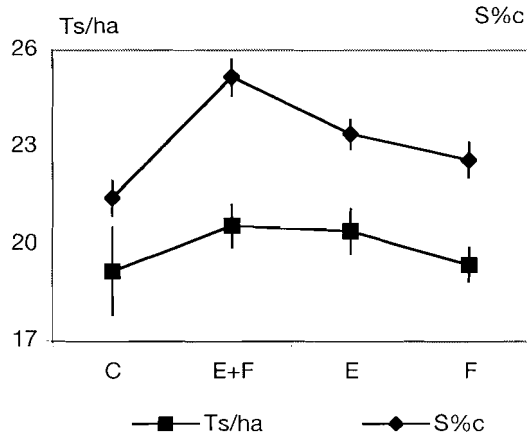


Figure 6. Mean cane quality and sucrose yield of NCo376 for ripener treatments (C, Control; E, Ethrel; F, Fusilade. Vertical bars represent standard error of the mean).

son, indicating that more information is needed before it can be recommended with confidence in Swaziland. Variety N25 is particularly sensitive to dry conditions and this may be one reason that yields fluctuated. There is also concern that the yield of N25 may decline in older ratoons, like N14, which is one of its parents.

It is interesting to note that, when they were ripened, there was little difference among varieties N22, N23 and N25 in terms of increases in sucrose mass per stalk and sucrose % stalk dry matter. Differences in the sucrose yields of ripened varieties were mainly determined by the numbers of stalks surviving to harvest. The decline in the stalk population of N22 relative to other varieties was the main reason for its low yields. Low stalk population was also the main reason for the low cane yields of N24.

A smut-resistant variety yielding more sucrose per hectare than chemically ripened NCo376 is highly desirable for Swaziland because it would eliminate the cost of applying ripeners as well as the cost of roguing. However, the results of this work suggest that, until such a variety is available, high population, high yielding, relatively low sucrose varieties are more suitable than low yielding, high sucrose varieties in irrigated areas where chemical ripening can be used to improve poor cane quality.

Conclusions

- All the new varieties tested were less susceptible to smut than NCo376.
- Varieties N23, N24 and N25 had higher sucrose yields

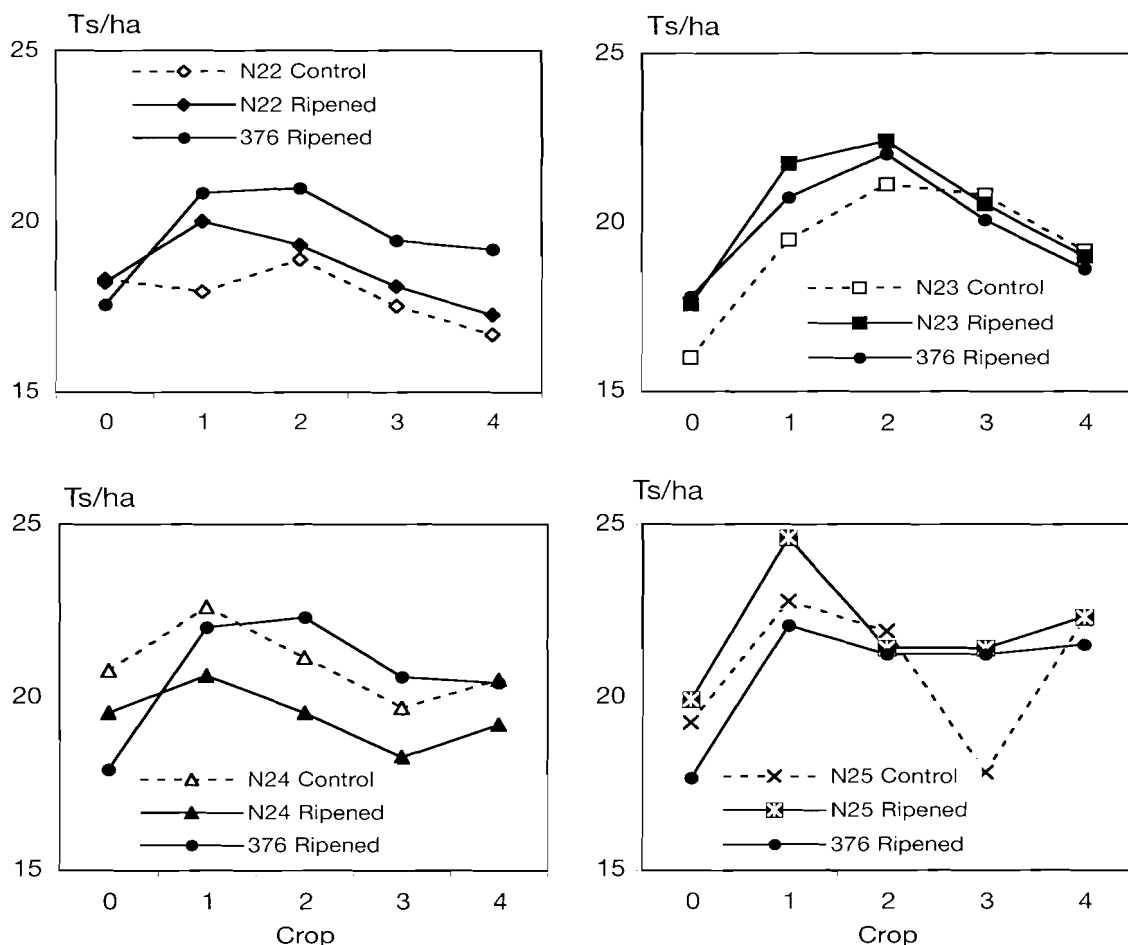


Figure 7. Mean sucrose yields at harvest of ripened (Ethrel plus Fusilade) and unripened varieties by crop, compared with ripened NCo376.

than NCo376 when chemical ripeners were not applied.

- Treatment with a combination of Ethrel followed by Fusilade Super improved the quality of N23 and NCo376 to a similar extent, resulting in higher yields of sucrose than when they were not ripened.
- When ripened, N25 produced sucrose yields similar to, or better than, ripened NCo376 but this was due to higher, more variable cane yields rather than better cane quality.
- Variety N22 produced low cane and sucrose yields whether or not it was ripened.
- There was an indication that ripening reduced the sucrose yield of N24.
- High population, high yielding, relatively low sucrose varieties may be more suitable than low yielding, high sucrose varieties in irrigated areas of Swaziland, where chemical ripening can be used to improve poor cane quality.

Acknowledgements

The authors wish to thank Ubombo Sugar Ltd. and the Royal Swaziland Sugar Corporation, for providing experimental

sites; also colleagues who have contributed to this programme of work over several years, in particular T. Nsibandze, for his dedicated supervision of experiments and assistance with statistical analyses.

REFERENCES

- Anon (1991). Report for the period May 1989 to April 1991. Swaziland Sugar Association Extension Services, p 8.
- Anon (1998). Annual Smut Report 1997-98. Swaziland Sugar Association Extension Services, p 5.
- Nixon, DJ, Workman, M and Glendinning, PJ (1986). Soil and land classification in Swaziland. *Proc S Afr Sug Technol Ass* 60: 216-222.
- Pearse, TL (1989). Influence of roguing on the incidence of smut in Swaziland. *Proc S Afr Sug Technol Ass* 63: 117-121.
- Rostron, H (1985). The chemical ripening of sugarcane with Fusilade Super. *Proc S Afr Sug Technol Ass* 59:165-175.
- Rostron, H (1996). Chemical ripening of sugarcane in Swaziland. Pp 172-175 In: Wilson, JR, Hogarth, DM, Campbell, JA and Garside, AL (Eds), *Sugarcane: Research Towards Efficient and Sustainable Production*. CSIRO, Division of Tropical Crops and Pastures, Brisbane, Australia.