Ceylon Cocon. Q., (1980) **31**, 105–111
Printed in Sri Lanka

PERFORMANCE OF SUGARCANE VARIETIES UNDER COCONUT

M. de S. LIYANAGE

Coconut Research Institute, Lunuwila, Sri Lanka

ABSTRACT

Liyanage, M. de S., (1980). Performance of sugarcane varieties under coconut. *Ceylon Cocon. Q.*, **31**, 105–111.

The trial was conducted at Kirimetiyana Estate with a view to providing preliminary information on the relative performance of sugarcane varieties when grown under coconut in the Intermediate rainfall zone. For this purpose, data were collected from twelve varieties of a plant cane crop on the basis of several growth and yield characteristics.

Results show that tall varieties such as Q_{68} and Co_{775} with a few internodes of greater length and diameter and of moderate capacity for tillering performed better than the other varieties tested. Based on the cane tonnage and total sugar yields per hectare, Q_{68}, Co_{775} and Q_{70} performed better under coconut than other varieties such as Co_{527} and S_1 which are recommended for commercial cultivation as a monocrop. Furthermore, cane tonnage of Q_{68} was comparable with monoculture yields obtained at Kantalai indicating that it is more tolerant of the partial shade existing under coconut than the others. Q_{68} also tolerated drought conditions and this has important implications when sugarcane is grown as a rainfed crop in the Intermediate zone.

INTRODUCTION

At present, sugarcane (*Saccharum officinarum L.*) is extensively cultivated in the low country Dry zone as an irrigated crop and to some extent in the low country Wet zone as a rainfed crop. It is reported that sugarcane cultivation is also possible in the low country Intermediate zone as a rainfed crop with supplementary irrigation during drought (Wickremaratne, 1972). However, no information is available regarding the feasibility of growing sugarcane in the Intermediate zone, particularly as an intercrop under coconut.

If pasture and fodder grasses have been grown under coconuts in the Intermediate zone with no adverse effect on the nut yield (Santhirasegaram, 1966), it seems logical to evaluate the performance of other graminaceous crops such as sugarcane under a similar eco-climate. The cultivation and expansion of sugarcane in the Low Country Intermediate zone, where coconut is the predominant plantation crop, will require an evaluation of growth and yield performance of existing cultivars. For this reason a preliminary trial was conducted and the results from the plant cane crop are reported here.

MATERIALS AND METHOD

This was an observation trial conducted at Kirimetiyana Estate in the Intermediate rainfall zone during the Yala season 1976. The coconut plantation is over 60 years old planted 9.0 m apart on a sandy loam soil. Twelve varieties of sugarcane, *viz.*, Co_{775}, Co_{527}, Co_{1001}, Co_{1111}, Q_{70}, Q_{68}, Q_{86} Q_{66}, S_1, S_{30}, $P_{54/107}$ and $M_{13/56}$ obtained from the Sri Lanka Sugar Corporation were established to study their relative performance when grown under coconut as a rainfed crop with supplementary irrigation during drought period, to study their relative performance.

Each plot measured $112m^2$ covering two coconut squares and included six cane rows. The furrows were spaced 1.2 m apart and about 20 cm in depth. Three budded cane setts were pre-treated with a solution of Aldrex to protect against termite damage. They were placed horizontally in each furrow, end to end with their buds facing sideways. A basal dressing of NPK fertilizer mixture was applied at the rate of 30.5 kg ammonium sulphate, 61 kg super phosphate and 45.5 kg muriate of potash per hectare along the sides of cane furrows and covered with the soil prior to planting. The cane crop was top dressed at the rate of 244 kg ammonium sulphate and 45.5 kg of muriate of potash per hectare in two split doses at six weeks and twelve weeks after planting. On account of the fact that palms have not been fertilized for the last five years, they were fertilized with a CRI-"C" NPK mixture at the rate of 7 kg per palm per year. The cane plots were weeded manually for about three months after planting till canes closed in. The cane crop received four irrigations during the drought period. Control measures against pests and diseases were taken when required. Finally, the cane crop was harvested twelve months after planting.

Several growth parameters were measured until the cane crop was about eight months old. The total number of cane setts which germinated per plot was determined six weeks after planting. Three stools from each of the middle rows were selected at random and from each stool height, number, length and diameter of internodes and the number of fully opened leaves were recorded from vigourously grown tiller. Height was measured from ground level to the uppermost visible collar (dewlap). The tillering capacity was determined by the number of millable stalks from each of the tree stools in alternate rows from each plot.

To determine the brix value in juice three stools from each of three middle rows in each plot were selected at random nine months after planting and continued at monthly intervals till harvest. Readings were taken from the base, middle and apical regions of selected stalks with a hand refractometer. At harvest millable stalks were cut at the bottom, cleaned, topped and weighed. The yield of millable stalks per plot was recorded and the cane tonnage per hectare was computed from plot yields. Five stalk samples from randomly selected stools in each variety were chopped and peeled. Thereafter, 0.45 kg sub-samples were crushed for juice extraction using a hand operated crusher and the sucrose content in juice was estimated by titration. Finally, the total sugar yields of the plant cane crop was calculated on the basis of sucrose content and cane tonnage for each variety. For the purpose of recording the nut yield, 15 palms were selected along the three inner rows as effective palms and the rest of the palms served as border rows. Another 15 palms adjacent to the trial area were selected to serve as control palms. For this study the effects of the different varieties of sugarcane on coconut yield was considered negligible.

RESULTS

1. Growth Characteristics

1.1. Percentage of germination

Of the varieties tested, ten varieties showed more than 50 per cent germination six weeks after planting (Table 1). Varieties Co_{527}, and S_1 recorded the highest germination percentage while Co_{1111} and S_{30} recorded the lowest percentage. Co_{775}, Q_{70} and Q_{68} were moderate with respect to the germination capacity and ranged between 50 to 60 per cent (Table 1).

1.2. Number of fully opened leaves

Variety $P_{54/107}$ recorded the highest number of fully opened leaves per tiller (9.9) and Co_{1111} and Q_{66} produced the least number (4.8 and 4.7) per tiller. In all other varieties number of leaves per tiller varied between 6.0 and 7.0 (Table 1).

1.3 Height of tillers

Varieties Co_{775}, Co_{1001}, Q_{68} and S_1 were the tallest of all the varieties tested and on average it was around 170.0 cm (Table 1). The tillers in Q_{66}, Co_{527} and Co_{1111} were the shortest. Of the tall varieties it was observed that Q_{66} and S_1 did not lodge at maturity.

1.4 Number, length and diameter of internodes

Except for two varieties, *viz.*, Co_{527} and Q_{68} the number of internodes per tiller did not vary much and ranged between ten and twelve for all the varieties (Table 1).

Variety $M_{18/66}$ recorded the largest number of internodes per tiller (9.2).

The length of internodes was greater in tall varieties than in short varieties. Q_{68} had the longest internodes (17.6 cm) and the length was shortest in Q_{66} (9.0 cm) (Table 1).

Results show that except in Co_{1001}, the diameter of internodes was greater in varieties with longer internodes than those with shorter internodes (Table 1). For example, Q_{68} had the largest diameter and Co_{527} had the smallest diameter.

1.5. Productive tillers per stool

The number of tillers of different varieties was determined by counting the number of millable stalks per stool. Varieties S_1, Co_{527} and Q_{70} showed the greatest capacity for tillering while Co_{1001}, Q_{86} and $P_{54/107}$ produced a few productive tillers per stool (cf. 6.8 vs 3.3 in Table 1). The number of productive tillers per stool was moderate in all the other varieties and ranged between 4.3 and 5.8 (Table 1).

Table 1. *Germination and growth characteristics of sugarcane varieties*

Variety	*Germination (%) At 16 weeks*	*Fully opened leaves per tiller (No.) At 32 weeks*	*Internodes per tiller (No.) At 32 weeks*	*Length of internodes (cm) At 32 weeks*	*Diameter of internodes (cm) At 32 weeks*	*Height of tillers (cm) At 32 weeks*	*Productive tillers per stool (No.) At 32 weeks*
1. Co 775 ..	62.0	6.2	10.5	16.5	14.3	170.6	4.7
2. Co 527 ..	82.2	5.3	9.6	8.8	7.5	89.3	6.1
3. Co 1111 ..	31.0	4.8	10.4	9.1	8.0	91.1	5.8
4. Co 1001 ..	74.8	6.5	10.4	16.3	9.8	172.4	2.8
5. Q 70 ..	55.2	6.1	10.2	14.9	14.6	152.5	6.0
6. Q 68 ..	53.4	7.4	9.2	17.6	15.0	171.4	4.6
7. Q 86 ..	81.1	7.9	10.1	13.8	10.1	138.8	3.3
8. Q 66 ..	71.1	4.7	10.2	9.0	9.2	92.4	4.3
9. S 1 ..	84.1	6.3	10.2	17.0	13.0	171.6	6.8
10. S 30 ..	42.1	6.4	10.6	11.8	9.1	127.6	5.0
11. P 54/107 ..	73.2	9.9	11.3	13.1	10.5	154.3	3.6
12. M 13/56 ..	52.9	7.10	11.9	12.0	10.0	144.7	4.3

2. Yield characteristics

2.1. Brix value and sucrose content

Brix values represent the percentage of total solids in cane juice and there was no marked difference in the brix value among the varieties and varied between 16.5 and 18.5. Varieties $M_{13/56}$ recorded the highest brix value (19.3) and Co_{775}, Q_{70} had the lowest values (15.7) (Table 2). It was observed that values obtained from the bottom portion of stalks were higher than those obtained from the top portions (data not shown).

Furthermore, results in Table 2 show that there is a close relationship between the brix value and the percentage of sucrose in juice for many varieties.

2.2. Yield of cane

The cane yields of different varieties are presented in Table 2. Results show that yields of Q_{68}, Co_{775} and Q_{70} (54.00, 45.26 and 43.46 tons/ha respectively) were higher than the other varieties. S_1 recorded the lowest cane yield (17.6 tons/ha) and the rest were moderate in cane production giving around 30 tons/ha (Table 2).

Table 2. *Yield characteristics of sugarcane varieties*

	Variety	*Yield of cane tons/ha* (*)	*Brix value*	*Sucrose content* (%)	*Total sugar yield tons/ha*+
1.	Co_{775} ..	45.26 (97.0)	15.7	16.9	7.65
2.	Co_{527} ..	29.16 (44.0)	18.4	20.4	5.94
3.	Co_{1111} ..	32.54 (NA)	16.8	16.4	5.34
4.	Co_{1001} ..	39.86 (119.0)	17.0	16.6	6.62
5.	Q_{70} ..	43.46 (92.0)	15.8	15.2	6.61
6.	Q_{68} ..	54.00 (53.0)	18.8	15.4	8.32
7.	Q_{86} ..	30.48 (79.0)	17.9	16.1	4.91
8.	Q_{66} ..	30.14 (NA)	17.1	17.7	5.33
9.	S_1 ..	17.64 (97.0)	18.5	18.0	3.17
10.	S_{30} ..	29.71 (66.0)	16.5	17.7	5.26
11.	$P_{54/107}$ ..	36.94 (NA)	17.7	17.7	6.54
12.	$M_{13/56}$ ..	32.53 (NA)	19.3	21.6	7.02

(*) — Average yields obtained as a monoculture at Kantalai are given for comparison
\+ — Calculated on the basis of sucrose content and tonnage of cane
NA — Not available.

2.3. Yield of sugar

Except S_1 and Q_{86} all other varieties gave a mean yield of around 5 tons/ha (Table 2). Of these Q_{68}, Co_{775} and $M_{13/56}$ gave the highest sugar yields (8.3, 7.6 and 7.0 tons/ha), respectively while S_1 gave the lowest yield (3.2 tons/ha). In addition, it was observed that sweet varieties (e.g. Q_{68}, Co_{775}, $M_{13/56}$) are subject to damage by squirrel and field rats (data not presented).

DISCUSSION

Growth parameters

Varieties such as Co_{527}, S_1, Co_{775}, Q_{68} and Q_{70} showed a high to moderate germination indicating that they are better adapted to the Intermediate rainfall zone and hence do not pose any problems of establishing themselves under coconut.

Varieties Co_{775} and Q_{68} grew taller but remained erect without lodging, carrying 6.0 to 7.0 leaves per tiller. In addition Q_{68} had the longest and broadest internodes although their number was less than the other varieties. This suggests that tall varieties, with a few internodes of greater diameter and length, are desirable than the others. Results also show that tall varieties such as Co_{775} and Q_{68}, with a moderate capacity for tillering performed better than the others. The data suggest that, in addition to the number of productive tillers per stool, internodal length and diameter of tillers are important growth parameters that determine the yield of cane. A similar observation has been made with other varieties of sugarcane (James 1973).

Yield parameters

Results show that Q_{68}, Co_{775} and Q_{70} produced the highest cane yields per hectare (54.00, 45.26, 43.46 tons/ha respectively). King *et al.* (1953) also reported that Q_{68} which is a hybrid between Po_{2727} and Co_{1002} produced heavy cane crops on sandy loam soils in Tropical Australia. When compared with Q_{38} yields of Co_{775} and Q_{70} were reduced by 17–20% (Table 2). Furthermore, cane yields of Q_{38} were comparable with monoculture yields obtained in the Dry Zone (Kantalai) while those of Co_{775} and Q_{70} were reduced by 54 per cent when grown under coconut. This suggests that Q_{68} is apparently more tolerant of the partial shade existing under coconut than other cultivates tested. In terms of cane tonnage, other varieties such as Co_{1001} and S_1 performed poorly under coconut, reducing the yield by 66.5 and 82.5 per cent respectively, compared with monoculture yields (Table 2).

Similarly, Q_{38} produced the highest sugar yields per hectare and those of Co_{775} and Q_{70} were reduced by 8 and 21 per cent, respectively, compared with the former variety. Gonzalez-Molina *et al.* (1977) stated that varieties with a high cane tonnage, generally, had a low sucrose content in the juice. Results in the present trial seem to agree with this finding, although not consistent with all varieties tested. As shown previously, (Alers-Alers *et al.*, 1973), the cane yield and sucrose content in the present trial varied with different varieties. A comparison of cane yields given in Table 2 further suggests that varietal performance is partly dependent on the agro-ecological zone and the soil type. Gonzalez-Molina *et al.* (1977) also observed a similar variety-environment variation on several sugarcane varieties in Puerto Rico. The observation that bottom portion of the stalks had a higher brix value than the apical portion is supported by those reported by Lerch *et al.* (1977).

The cane yield data reported in this trial further indicate that varieties such as Co_{527} and S_1 recommended for commercial cultivation (Anon, 1973) performed poorly when grown under coconut in the Intermediate rainfall zone, in spite of the abnormally high light penetration due to advanced age and wide spacing of the coconut plantation. It is interesting to note that introduced varieties such as Q_{38}, Co_{775} and Q_{70} performed better than the local selection S_1. Of these Q_{68} tolerated drought conditions better than Co_{775} and Q_{70} and this has implications when sugarcane is grown as a rainfed crop in areas with a limited water supply.

Table 3. *Coconut yield* for the plant cane crop*

	1976				1977	
	3rd pick	*4th pick*	*5th pick*	*6th pick*	*1st pick*	*2nd pick*
Control palms ..	137	139	108	49	103	188
Effective palms ..	142	168	112	57	118	197

* Total of 15 palms in each case.

In this trial individual nut yield records of 15 effective palms were kept to study the increasing or decreasing trends in yield, when intercropped with sugarcane. Results in Table 3 indicate that there had been an increasing trend in the nut yield of effective palms when compared with the controls and suggest that sugarcane crop does not cause any adverse effects on the nut yield at least in the first year of cane growth.

ACKNOWLEDGEMENTS

I am grateful to Dr. U. Pethiyagoda, Director, Coconut Research Institute, for the encouragement and interest shown throughout the trial. I thank Mr. P. K. Jayatilake, Sri Lanka Sugar Corporation, Kantalai, for supplying the planting material and for valuable suggestions. I also wish to thank Mr. V. Abeywardena, Biometrician, Coconut Research Institute, for helpful discussions and to Mrs. J. D. Atputharajah, Chemistry Division, Coconut Research Institute, for analysing the cane samples. Finally I thank all the officers at Kirimetiyana Estate, particularly, Mr. K. P. C. Fernando, for his assistance and maintaining records during the trial.

REFERENCES

Alers-Alers, S., Frank, J. and Lugo Lopez, M. A. (1973). Effect of harvesting sugarcane at 12, 14 and 16 months of age upon yield at Isabela, Puerto Rico. *J. Agric.*, Univ. Puerto Rico, **57**, (1), 1–8.

Anon. (1973). Leaflet entitled *"Sugarcane"* Department of Agriculture, Sri Lanka, 1–5 p.

Gonzales-Molina, C., Perez, M. and Ramirez-Oliveras, G. (1977). Performance of commercial sugarcane varieties in the Aguirre clay soils of the Leejas valley. *J. Agric.*, Univ. Puerto Rico, **61**, (2) 126–136.

James, N. I. (1971). Yield components in randomly selected sugarcane populations. *Crop Sci.*, **11**, (6), 906–908.

King, N. J., Mungomery, R. W. and Hughes, C. G. (1953). *Manual of cane growing* (authors). Angus and Robertson Ltd., Sydney, Australia, 245. p.

Lerch, G., Reyes, R, Garcia, R. and Leal, P. P. (1977). The growth, development and variation in refractometric index (brix) in six promising sugarcane cultivares. *Giencias de la Agriculture*, **1**, 79–105.

Santhirasegaram, K. (1966). Utilization of the space among coconuts for intercropping. *Ceylon Cocon. Plrs. Rev.*, **4**, 43–46.

Wickramaratna, M. L. J. (1972). The development of the sugarcane industry. In: Y. D. A. Senanayake (Editor) *Proceedings of the Symposium on the development of Agriculture and animal husbandry under the five year plan held in Colombo, Sri Lanka* and *sponsored by the National Agricultural Society Ceylon*, 55–64.