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Effect of Interrow Spacing on Stalk Population, Yield and Quality of Sugarcane

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ABSTRACT

Trials were carried out on plant and ratoon crops with two commercial sugarcane varieties and a local clone to study the effect of interrow spacings 100, 150 and 200 cm on stalk population, yield and quality of sugarcane. The results showed that stalk population was higher in closer spacings than in wider spacings. With increase in interrow spacing, there was a progressive reduction in tiller mortality. The highest yield was obtained from the 150 cm interrow spacings, while cane planted in rows 200 cm apart gave the lowest yield. Cane quality was measured by the amount of the components of dry matter (sucrose, reducing sugars and fibre) in the stalks. except reducing sugars in the plant crop, only varietal differences were demonstrated. No differences between these characters were attributed to spacing. The implication of the findings for cane production is discussed.

INTRODUCTION

In sugarcane, stalk population and cane yield are correlated especially in sub-tropical cane growing areas (Kanwar and Sharma, 1974).

The stalk population is essentially governed by the variety grown, interrow spacing and the seed rate used. In tropical areas, interrow spacing varies from 120 to 200 cm. In the tropical cane growing belt of India, interrow spacing of 120 cm and sometimes as low as 60 cm is practised (Kanwar and Sharma, 1974). Matherne (1971) reported that a wider spacing of 180 cm is practised in Louisiana which has sub-tropical conditions. In some sugar estates in Nigeria, interrow spacing varies from 100 to 160 cm while local farmers use 100 cm within rows leaving space to interrow.

The row spacing required for maximum yields of sugarcane has been studied by many investigators with variable results. Matherne (1971) reported that in Louisiana the "narrower the row the larger the yield". Herbert *et. al.* (1965) reported significant yield increase in 112 cm compared to 145 and 180 cm rows. Cross (1921) obtained equal yields of cane and sugar with spacings of 100 to 200 cm. Thompson (1962) reported an increase of upto 22 tons/ha when row spacing was reduced from 200 cm to 50 cm. Herbert (1953) found that the planting rate with two whole stalks placed side by side with a 10 % overlap in a 150 to 160 cm rows was optimum. He mentioned that an amount of seed cane needed to plant a hectare of land varies from 6 to10 tonnes depending on the variety. The same author also reported that only 25-30 % of the buds germinated. Abbott (1936) reported that diseases, insect and mechanical damage accounted for a large percentage of the buds that failed to germinate.

The yielding potential of modern varieties is greater than that of older ones and higher plant population may be obtained from these new varieties by adjusting the interrow spacing. Therefore, a trial was conducted to study the effect of spacing on stalk population, yield and quality of sugarcane and to find out the best spacing of promising clones of sugarcane.

MATERIALS AND METHODS

The trial was conducted during two seasons 1980-81 and 1981-1982 on a plant and ratoon crops with three interrow spacings on Iwo soil series (pH 6.3, total N 0.10 %, organic matter content 1.47 %, and cation exchange capacity 3.11m Eq/100g. soil) at the experimental plots of NCRI, Moor Plantation, Ibadan.

The experiment was laid out in a randomised complete block design of a 3 x 3 factorial arrangement with four replications and a plot size of 6 X 6m using two commercial varieties Co 1001 and Co 957, and a local variety LS 1-027 identified as promising from the germplasm bank. Uniform seed rate of 25,000 two budded setts per hectare was used in all the treatments which are shown in Table 1.

Table 1. Seed rate used in the experiment.

Interrow spacing (cm)	No. of rows/plot of 6 m width	No. of setts/row of 6m length
100	6	15
150	4	23
200	3	30

Land was prepared with one ploughing and two rotavations. Fertilizers were applied as basal dressings at the rate of 125 kg/ha ammonium sulphate, 56 kg/ha each of single super-phosphate and muriate of potash. The final germination date were recorded 3 weeks after planting while tiller counts were recorded 3, 6 and 9 months after planting ; tiller population being at a maximum in the second week of July. The stalk population, height, thickness, weight and cane yield were recorded for each plot at harvest, 12 months after planting. Tiller mortality was expressed as the percentage between maximum tiller count and final cane stand at harvest. Six months after planting and at subsequent sampling dates (9 and 12 months), five cane stalks were randomly selected from each plot and cut at ground level. Each stalk was weighed separately while the brix (total solids in expressed sap of sugarcane juice) was determined with the aid of a hand refractometer.

Each set of the five stalks was ground in a Jeffcocutter grinder and 50 g samples of the resultant'brei'(groundcane) were put into a jar with 100 ml alcohol. The alcoholic extracts were later analysed in the laboratory for total and reducing sugars using the Berlin Institute methods (1964), and sucrose content was expressed as the percentage difference between total and reducing sugars. The residue remaining after extracting (the fibre) was expressed as a percentage of fresh weight.

Similar data were also recorded from the ratoon crop. The shoot population was counted in mid June when it was at a maximum. Except plouging or rotavations all other operations which were done in the case of plant crop were also perforemed in ratoon crops and fertilizers were applied around the ratoon stubbles.

RESULTS AND DISCUSSION

No significant differences in germination among the three interrow spacing were recorded (Table 2). Germination percentage was lowest at 200 cm spacing. Germination percentage gradually decreased with the increase of interrow spacing since the seed rate per row gradually increased with the increase of interrow spacing.

Tiller mortality, stalk population, yield and its components as influenced by varieties and interrow spacings are shown in Tables 2 and 3. Tiller mortality which was expressed as the percentage between maximum tiller count at 2nd week of July and final cane stand at harvest was higher in the closer spacings (100 cm interrow spacings) than in wider spacings. In both plant and ratoon crops there was a progressive decrease in tiller mortality with increase in interrow spacings. As an example tiller mortality was 59.7, 47.9 and 45.3 % in the 100, 150 and 200 cm interrow spacings respectively in the plant crop for variety Co 1001, while 57.3, 43.2 and 42.9 % were recorded for the ratoon crop in the 100, 150 and 200 cm interrow spacings respectively for the same variety (Tables 2 and 3).

Table 2. Tiller mortality, stalk population, yieldandits components as influenced by variety and interrow spacing in plant crops.

Variety	Interrow sapcing (cm)	Germina tion (%)	Germination Sin arc angles	Tiller mortality (%)	Stalk No. ($x10^3$/ha)	Stalk height (m)	Stalk thickness (cm)	Wt/cane (kg.)	Yield TCH
	100	61.7	51.8	59.7	130.2	1.8	1.32	1.8	105.0
Co 1001	150	60.7	51.0	47.9	75.0	1.8	1.36	2.0	105.6
	200	54.3	47.8	45.3	55.3	1.8	1.92	2.5	98.6
	100	66.4	54.4	55.1	100.5	1.5	1.32	1.6	93.8
Co 957	150	58.7	50.0	45.1	83.0	1.9	1.40	2.9	134.4
	200	47.6	43.7	48.3	50.3	1.7	1.62	2.3	82.2
	100	46.9	43.2	53.7	107.7	1.5	1.04	1.4	88.9
LS1-027	150	54.3	47.8	40.8	84.2	1.9	1.34	2.8	132.0
	200	49.8	44.9	46.5	46.4	1.7	1.86	1.9	63.9
LSD (0.05)									
Variety		-	NS	-	19.1	NS	NS	NS	11.6
Spacing		-	NS	-	21.9	NS	NS	NS	17.3
Spacing x variety		-	NS	-	NS	NS	NS	NS	NS

Stalk population on both the plant and ratoon crops increased significantly with reduction in interrow spacings (Tables 2and 3). Rows spaced 100 cm apart had the highest population than the 150 and 200 cm interrow spacings.There were also significant differences between varieties in stalk population (P-0.05), however, no significant interactions were demonstrated between spacings and varieties.

Table 3. Tiller mortality, stalk population, yield and its components as influenced by variety and interrow spacing in ratoon crops.

Variety	Interrow spacing (cm)	Tiller Mortality (%)	Stalk No. ($x10^3$/ha)	Stalk height (m)	Stalk thickness (cm.)	Wt/cane (kg)	Yield TCH
	100	57.3	112.4	1.6	1.06	1.5	103.9
Co 1001	150	43.2	71.8	1.6	1.32	1.7	103.7
	200	42.9	49.7	1.4	1.61	2.0	83.1
	100	50.6	90.3	1.4	1.28	1.3	89.7
Co 957	150	42.5	79.3	1.4	1.36	1.8	119.8
	200	41.9	46.2	1.6	1.48	2.1	76.9
	100	49.8	89.6	1.3	1.21	1.2	88.1
LS1-027	150	41.6	80.4	1.5	1.32	1.6	124.6
	200	40.2	42.6	1.8	1.51	1.6	54.2
LSD (0.05)							
Variety		-	23.2	0.2	NS	0.34	17.1
Spacing		-	19.5	NS	NS	NS	12.9
Spacing × Variety		-	NS	NS	NS	0.63	NS

No significant differences were recorded between varieties, spacings and their interactions in respect of stalks height and weight/cane in plant crop (Table 2), while varietal differences in stalk height were demonstrated in the ratoon crop (Table 3). Significant differences between varieties and interactions between spacing and variety in respect of weight/cane were recorded in ratoon crop (Table 3). Differences in stalk thickness were also not significant between spacings for both plant and ratoon crops, although stalk thickness showed a progressive increase with increased interrow spacings ; the cane being thickest at 200 cm spacing (Tables 2 and 3).

Only varietal differences in the components of dry matter (sucrose, reducing and fibre) were demonstrated in both the crops. Except for reducing sugars in the plant crop, no differences between these parameters were attributed to spacing (Tables 4 and 5). Cane yield as influenced by varieties and interrow spaings are shown in Tables 2 and 3. There were significant differences between varieties and interrow spacings (P 0.05). Cane planted in rows 200 cm apart gave the lowest yield. The highest yields were obtained from the 150 cm interrow spacings. No significant interactions were, however, demonstrated between varieties and spacings.

From the data presented, it can be seen that the highest yield was obtained from the 150 cm interrow spacings. Although the tiller population was higher at closer interrow spacings, the yield obtained from the 150 cm interrow spacing were higher than that

Table 4. Effect of interrow spacing on components of dry matter in plantcrops.

Variety	Interrow spacing (cm)	Sucorse (%)	Reducing sugar (%)	Fibre (%)
Co 1001	100	19.1	1.62	15.6
	150	11.9	1.33	15.7
	200	15.3	1.79	15.6
Co 957	100	15.1	1.65	14.8
	150	15.1	1.90	16.1
	200	15.3	1.94	15.1
LS1-027	100	13.7	1.52	15.1
	150	10.8	1.72	14.5
	200	16.5	1.70	15.5
LSD (0.05)				
Variety		2.9	0.21	NS
Spacing		NS	0.91	NS
Spacing x Variety		NS	NS	NS

Table 5. Effect of interrow spacing on components of dry matter in ratoon crops

Variety	Interrow spacing (cm)	Sucrose (%)	Reducing sugar (%)	Fibre (%)
Co 1001	100	18.5	1.49	14.5
	150	12.3	1.38	14.9
	200	14.2	1.80	15.0
Co 957	100	14.9	1.39	15.1
	150	13.8	1.82	16.0
	200	14.6	1.32	14.2
LS1-027	100	14.0	1.29	13.8
	150	11.9	1.63	13.7
	200	15.6	1.09	14.9
LSD (0.05)				
Variety		3.7	NS	NS
Spacing		NS	NS	NS
Spacing X Variety		NS	NS	NS

obtained from the 100 cm interrow spacings. It seems likely that the higher tiller mortality in the closer spacings may have accounted for the lower yield in the closer spacings. The apparent availability of more sunlight and less shade effect must also have contributed to the higher yield in the 150 cm interrow spacings. The difference in yield between the 200 cm spacings and other spacings (100 and 150 cm) may be attributed to the differences in stalk population. A higher number of millable cane was associated with higher cane and significant positive correlation between these characters was reported by Oworu (1975). The non-significant interraction effects between spacings and varieties in terms of yield and stalk population in the two crops suggested that the varieties apparently responed in the cane way to the spacings.

The conditions under which sugarcane is grown demand that an ample supply of seed cane be used to assure a good stand. What may apparently be a waste of seed cane in the closer spacing if the seed rate is not standardized appeared necessary becuase ordinarily only about 20 % of the planted buds germinated duringthe first germination count and the resultant overcrowding may bring about additional losses of plants.Itis important, therefore, that excess of cane shoots emerge to produce a normal crop in spite of high mortality. However, only a limited number of shoots can survive. The actual number of tillers that develop into mature stalk depends on growing conditions, but ordinarily the percentage of survival is between 25 and 35 %. Closer interrow spacings to increase the number of plants would only result in more of them being suppressed. The net gain, as demonstrated in these trials, is negligible.

Moisture may also be limiting. Although rainfall is usually adequate during the initial stage of growth, periods of moisture stress resulting in growth retardation do occur. Closer spacing under these conditions would result in greater mortality.

An important economic disadvantage of narrow interrow spacings is that the farmers would require a large quantity of seed cane. It is concludedthat interrow spacingsless than 150 cm are not economically profitable. The can planted on narrow rows yielded less than that planted on wide rows (150 cm). The cost of the additional seedcanes that would be required and of adapting present cultivation implements to narrow interrow spacing would not be justified from the present results.

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