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Effect of Flowering on Yield and Quality of Sugarcane

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ABSTRACT

Canes from two exotic sugarcane varieties were marked before floral initiation in order to select canes of uniform age at maturity for the estimation of the effect of flowering on yield and quality in a plant and ratoon crops. Flowered and non-flowered canes of the same age were weighed and analysed.It was found that losses in cane and sugar yields associated with flowering differed with varieties. Flowering canes weighed less, has less brix % cane and contained more fibre than non-flowering canes. The tops of flowering canes were also lighter, lower in brix and had higher fibre. Estimated losses in sugar yield associated with flowering was 3.4% for B63118 at 30% flowering and 2.5% at 50% flowering for Co 440. Reasons for such varietal differences are discussed.

INTRODUCTION

Flowering of sugarcane has been a subject of interest to researchers in sugarcane agriculture for various reasons. To the plant breeder, flowering is desired because it is necessary for the breeding of new varieties. However, the agronomist and cane producers consider flowering deleterious because of its apparent adverse effect on cane yield and quality (Arceneaux, 1965).

In Nigeria, since flowering occurs during September to October and harvesting starts in December/January, lack of growth in flowering canes for more than four months is expected to reduce yield if flowering is heavy. However, no precise estimates of the magnitude of loss in yield and quality associated with flowering are available under Nigerian conditions. In other parts of the world, depending on the technique, variety and time between flowering and harvesting, yield reductions of 4 to 50% have been reported, while sucrose content was reported to have remained the same or decrease and increase by 10% (Burr, 1950; Hernandez, 1965; Evans, 1966, 1970; Brown and Chambers, 1968; Panje *et. al*, 1969). In all these studies, except the work of Burr, flowering and non-flowering canes were not of the same age and flowering was controlled by physical or chemical agents which caused some retardation in growth of non-flowering canes resulting in some underestimation in yield reduction due to flowering.

In Burr's experiments, flowering was controlled by a half-hour light interruption in the night and the author demonstrated a 1.5 TSA (tonnes sugar/acre) or 15% gain by preventing flowering. However, this technique although precise is laborious and expensive to adopt. In view of the fact that the future breeding strategy might consider incorporation of non-flowering mutants from some heavy flowering varieties, it is important to estimate the effect of flowering on yield and quality. Varieties with maximum potential could thus be chosen for irradiation (Rao, 1971). A simpler technique which allows the comparison of flowering and non-flowering canes of the same age is required. Also it is important to obtain estimates of the magnitude of loss in cane yield and quality. The present paper reports the results obtained from the comparative study of flowering and non-flowering canes of two sugarcane varieties during the 1983/84 and 1984/85 cropping seasons.

MATERIALS AND METHODS

The experiment was planted on 4th April 1983 on two soil series (Smyth and Montogomery, 1962) (pH 6.3,total N 0.10%, organic matter content 1.47% and cation exchange capacity 3.11m Eq/100g soil) on the experimental plots of NCRI at Moor Plantation Ibadan. The plot size was 6mx6m with rows spaced 1.5m apart. A randomised block design with four replicates was used. Fertilizers were applied as basal dressings in the form of ammonium sulphate, single super-phosphate and muriate of potash at the rate of 125,56 and 56 kg/ha respectively. Two exotic varieties were chosen for the study.

The variety B63118 flowers early to a maximum of 30%. Most of the flowering canes of this variety do not produce any side shoots. Pithiness in the stalks extends to the bottom internodes and flowering canes sometimes rot.Co440 flowers in mid season to a maximum of 50%. The flowering stalks produce about 2-3 side shoots and pithiness extends upto 3-5 internodes below the side shoots and the cane stay alive throughout the harvest season. Fifty canes were marked in each plot before floral initiation when the canes were about 4 months old by tying polythene strips on the 10th internode below the TVD (top visible dewlap) leaf to ensure uniformity in age and samplings were confined to these marked canes.

In November 1983, five stalks each of flowered and non-flowered canes, all of the same age as indicated by the number of internodes below the polythene marker were selected from each plot and weighed separately. Each stalk was cut into bottom and top sections at the 6th node below the initial position of TVD (i.e. 4

internodes above the polythene marker) on the assumption that internodes lower than the 6th below TVD would have completed growth and differentiation before floral initiation.

Whole canes and canes from each sections (top and bottom) were ground in a Jeffco cutter-grinder separately, and 500g from the resulting 'brei' (ground cane) were pressed using an hydraulic press to express the juice. The brix of juice was determined with the aid of a refractometer. Total sugars (brix % cane) and fibre % cane were calculated using Tanimoto's method (1964). The ratoon crop received similar treatments except that fertilizers were placed around the ratoon stubbles.

RESULTS AND DISCUSSION

The data on cane weight, brix % cane and fibre % cane for the flowering and non-flowering canes in the plant crop are presented in Table 1. There were significant differences (p=0.05) between flowering and non-flowering canes of the two varieties. Flowering canes weighed less than non-flowering cane (1.5 kg and 0.7 kg) and had 3.4 and 2.5% less brix for B63118 and Co440 respectively. The presence of 0.7 and 1.2% more fibre in flowering canes of the two varieties was however, not statistically significant. The tops of flowering canes were lighter, lower in brix and had higher fibre.

There were varietal differences in weight/cane, brix % cane and fibre % of ratoon crop (Table 2). Flowering canes weighed less in the two varieties, but the difference was not significant in Co440. Flowering canes had less brix (3.4 and 1.8%) and more fibre (2.3 and 1.5%) for B63118 and Co440 respectively. As in the plant crop, the tops of flowering cane were lighter, lower in brix and had higher fibre.

From the data presented, it can be seen that flowering had a considerable effect on the two varieties resulting in losses in weight of cane and brix % cane. At 30% flowering, losses in yield and quality as measured by cane weight and brix % cane appeared to be more for B63118. At 50% flowering the losses were less for Co440. At this intensity of flowering (50%), loss of total brix in B63118 would probably have been about twice the value for Co440. Presumably, this kind of difference associated with flowering between varieties indicates that in a varietal selection programme, it is not only the intensity of flowering but also the losses associated with flowering should be taken into consideration.

The difference between the two varieties in loss of total brix resulting from flowering may be attributed to the time of flowering extent of pithiness and pattern of

Table 1. Weight/cane, brix % cane and fibre % cane of flowering and non-flowering cane in two sugarcane varieties in a plant crop.

Variety	Type of cane	Whole Cane			Weight (kg)		Brix % cane		Fibre % cane	
		Wt/cane (kg).	Brix % cane	Fibre % cane	Top	Bottom	Top	Bottom	Top	Bottom
B63118	Flowering	1.72	15.25	12.56	0.77	1.05	14.52	15.55	12.75	11.25
	Non-flowering	3.25	18.68	11.82	1.94	1.44	16.75	17.93	11.23	10.75
	LSD (p=0.05) between F and NF	0.65	0.90	NS	0.68	0.25	0.39	0.87	0.54	0.73
Co440	Flowering	1.80	14.60	14.06	1.25	1.58	14.03	16.40	13.80	12.89
	Non-flowering	2.53	17.15	12.81	2.01	1.24	17.65	20.53	15.20	14.02
	LSD (p = 0.05) Between F and NF	0.52	0.48	NS	0.35	0.12	0.45	1.25	0.47	0.32
	Between varieties	0.42	0.38	0.25		—	—	—	—	—

Table 2. Weight/cane, brix % cane and fibre % cane of flowering and non-flowering cane in two sugarcane varieties in a ratoon crop.

Variety	Type of cane	Whole Cane			Weight (kg)		Brix % cane		Fibre % cane	
		Wt/cane (kg).	Brix % cane	Fibre % cane	Top	Bottom	Top	Bottom	Top	Bottom
B63118	Flowering	1.95	13.35.	13.24	0.65	1.45	12.22	15.24	14.74	13.62
	Non-flowering	3.89	16.75	10.95	1.85	1.92	14.35	16.84	12.20	11.65
	LSD (p=0.05) Between F and NF	0.68	0.25	0.12	0.78	NS	0.18	0.24	NS	0.14
Co440	Flowering	1.85	13.45	15.26	1.56	1.90	11.25	12.75	11.35	10.95
	Non-flowering	1.92	15.22	13.75	2.22	2.10	15.35	17.48	12.45	12.42
	LSD (p=0.05) Between F and NF	NS	0.13	0.34	0.32	NS	0.38	0.74	0.25	0.41
	Between varieties	0.78	0.21	0.32	—	—	—	—	—	—

NS — Not Significant
F — Flowering
NF — Non-flowering

sideshooting. Reduced weight/cane in B63118 was probably the result of loss of growth due to early flowering, inability to produce sideshoots and extensive pithiness resulting in lower density, which presumably may lead to deterioration of flowering stalks as the dry spell progresses during the harvest season. In Co440, these losses were minimised by late flowering, sideshooting and pithiness extending to only 3-5 internodes below the sideshoots. Although, growth is not pronounced in the sideshoots, they appeared to keep the stalks alive and may possibly be contributing some sugar into the storage tissue.

In B63118 extensive pithiness in the flowering cane may have resulted in a significant increase in fibre % cane of the flowering tops. However, since the flowering top is lighter in weight and non-flowering top heavier, the difference in the fibre % cane of whole cane between flowering and non-flowering canes gets smaller and this presumably may account for the non-significant difference obtained for fibre % cane between flowering and non-flowering canes of the two varieties in the plant crop. If some canes flower in a stool after October, the growth of non-flowering canes in the same stool may probably be more because of reduced competition between canes within the stool and this in turn may compensate for some of the losses in yield and quality associated with flowering. From this study, it is suggested that not only the intensity of flowering but also the losses associated with flowering should be taken into consideration in a varietal selection programme.

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