

Effect of Nitrogen Fertilization on Sugarcane Yield and Juice Quality in Bacita

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ABSTRACT

Field studies on the effect of different nitrogen levels on the yield and juice quality of Co. 957 commercial sugarcane variety was carried out at the production fields of the Nigerian Sugar Company, Bacita in the cropping seasons 1985-86 and 1986-87. The soil analysis reveals low pH (acid) and medium percent nitrogen. Nitrogen fertilisation did not affect percent brix, pol and fibres. Response of purity to nitrogen was, however, significant for the plant. A significant difference was observed for yield for both plant and ratoon but there was no response to TC/TS. Optimum N required for sugarcane was 80 kg N/ha. The yield obtained for the plant is higher than the ratoon crop. Even though there was no significant response to brix values, it tends to decrease with increase in N levels.

INTRODUCTION

In Nigeria, where sugarcane tonnage is low due to poor varieties, soil, climatic, pests and disease problems. Various efforts are directed to improve yields in sugarcane. Among them fertilization is an important agronomic practice in sugarcane production.

Several workers (Fasihi and Reuss, 1980; James, 1983; Thomas, 1978) have found nitrogen to be an essential input for successful sugarcane production. There have also been various reports on the effects of application of nitrogen on cane tonnage and juice quality in different parts of the world (Clements, 1984; Thomas, 1978; Castellanos *et al.* 1980) but in Nigeria less is known about its availability after each crop particularly in intensive cropping where a high intensity is followed.

Mutanda (1980) reported that high amounts of nitrogen fertilizer caused a reduction in the percent sucrose of sugarcane juice, while low applications reduced yield. The reports on fertilizer management in Hawaii showed that emphasis is given to controlling nitrogen in the cane during its life maintaining adequately high levels during the first few weeks of growth ending up eventually at low levels at the time of harvest for sucrose control in juice (Humbert, 1968). In Nigeria the common practice is early application of nitrogen in a single dose, sometimes with supplementary application before maturity (Odojin, 1981). The reports on yield performance of plant and ratoon crops due to application of nitrogen are confusing. Panol and Elevado (1972) obtained higher sugar yield while Ferraris and Lacson (1964) obtained lower sugar yield in plant than ratoon crops. Therefore, an experiment was conducted with the following objectives:

- (a) to determine the yield and juice quality of both plant and ratoon crops as influenced by split application of nitrogen.
- (b) to evaluate the nitrogen requirement of the commercial sugarcane variety Co 957.

MATERIALS AND METHODS

The trial was conducted at western 7 B field of the Nigerian Sugar Company, Bacita (Latitude 9°N). The commercial fertilizers NPK were applied at the rate of 120 kg N/ha; 60 kg P₂O₅/ha and 60 kg K₂O/ha respectively. Irrigation was done using sprinkler irrigation.

Prior to fertilizer application, the soil samples from different horizons were collected, processed and analysed for pH and total available nitrogen. The pH was determined with a digital pH meter in 1N KCl, while total nitrogen was determined by the standard macro-Kjeldahl method (Black, 1965). The experiment was set up following randomized complete block design, and the plot size was 10m x 10m. Four levels of nitrogen 0, 80, 160 and 240 kg N/ha were applied. Nitrogen was applied in two splits one half at four weeks after planting and rest half at 16 weeks after planting using calcium ammonium nitrate (CAN 26% N). Intercultural operations were done as and when required.

Juice Analysis : Quality of juice was also determined. The juice was analysed for brix, pol, fibres and apparent purity by standard methods as described by Meade and Chen (1977). Data obtained were analysed statistically.

RESULTS AND DISCUSSION

Table 1 shows that the soil is acidic (pH 4.8) while the total available nitrogen was found moderate. The effect of nitrogen fertilisation on the yield and juice quality of Co. 957 are presented in Tables 2 and 3. The different nitrogen levels did not affect percent brix, pol and fibres for both plant and ratoon crops (Tables 2 and 3). No significant difference was equally obtained for TC/TS. However, a significantly lower difference was obtained for purity in the plant crop at 160 kg N/ha (Table 2). Highest values for percent purity was observed at 80 kg N/ha. Even though N did not significantly affect purity in the ratoon (Table 3). Purity tends to decrease with increase in nitrogen levels. Values obtained in the ratoon are lower when compared with the plant crop. This observation is equally true for percent brix for both crop cycles (Tables 2 and 3). This report agrees with those (Clements, 1964; Mutanda, 1980) who obtained lower brix values at higher N levels, suggesting that nitrogen promotes succulence in sugarcane and might have caused reduction in the total soluble solids (brix).

The plant crop gave higher yields than the ratoon (Tables 2 and 3). This agrees with the report of Panol and Elevado (1972). A significantly higher difference was obtained for yield at 80 kg N/ha for both crop cycles (Tables 2 and 3) suggesting that a split application of 80 kg N/ha is adequate for good cane yield and juice quality.

Table 1. Soil analysis of experimental site.

Soil type	pH	%N	Textural class
Belle	4.8	0.10	Brown clay loam overlain by brown silt loam.

Table 2. Effect of different levels of nitrogen on the yield and juice quality of variety Co 957 (Plant).

Treatments	TC/ha	TS/ha	% Fibre	% Pol	% Brix	% Purity
0	51.0 a	9.8 a	16.2 a	17.2 a	19.4 a	89.4 a
80	74.7 b	10.0 a	16.2 a	17.0 a	19.1 a	89.8 a
160	72.3 b	11.4 a	16.5 a	17.0 a	18.8 a	86.7 b
240	72.5 b	11.0 a	16.4 a	16.9 a	18.7 a	89.5 a

Means followed by the same letter for a given column are not significantly different from each other by the DMRT.

Table 3. Effect of different levels of nitrogen on the yield and juice quality of variety Co 957 (Ratoon).

Treatment	TC/ha	TS/ha	% Fibre	% Pol *	% Brix	% Purity
0	54.0 a	10.5 a	16.7 a		19.4 a	85.3 a
80	71.6 c	11.3 a	16.0 a		19.6 a	85.1 a
160	63.0 b	11.9 a	17.7 a		18.8 a	85.0 a
240	54.3 a	11.4 a	17.0 a		17.9 a	83.1 a

* Not available

Means followed by the same letter for a given column are not significantly different from each other by the DMRT.

It is thus evident that the soil has a high level of residual elements and a survey of available nutrient elements in the other fields will reduce the cost of fertilization without degrading nutrient status of soils.

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