

The Efficacy of a Liquid Fertilizer (Agromax) on Yield and Its Components in Sugarcane

O. O. Oworu

Sugarcane Improvement Programmes

National Cereals Research Institute

P. M. B. 5042, Moor Plantation, Ibadan, Nigeria.

ABSTRACT

Trials were carried out in plant and ratoon crops on the efficacy of a liquid fertilizer (agromax) on yield and its components in sugarcane under field conditions. Results obtained showed that yield was significantly higher in the agromax treated plots than yields from either the solid fertilizers used alone or in combination with agromax and the control plots. The agromax treated plots gave the highest yield (76.5 and 76.8 tonnes/ha) while the control plots gave the lowest, 26.2 and 22.9 tonnes/ha in both plant and ratoon crops, respectively. Differences were also obtained between treatments in yield components. Significant differences in sucrose and reducing sugars were found between treatments. However, no significant differences were obtained in respect of reducing sugars in the ratoon crop and fibre content. The practical implications of the findings for the sugarcane farmer are discussed.

INTRODUCTION

Liquid fertilizers have been prominently used to increase crop yield in most technologically advanced nations of the world and can easily be defined as concentrated solutions or suspensions containing the major elements NPK with or without micronutrients. They are applied to the soil or on foliage by means of aircrafts, fluid applicators or through irrigation water. The advantages of liquid fertilizers over the solid ones include cheaper production and hence cheaper products, less bulk and lower transportation cost, more efficient application and more incorporation of trace elements. It is also possible to mix them with herbicides and insecticides before application (Nnadi and Iwuafor, 1980).

In recent years, several commercial companies have been promoting the use of liquid fertilizers in Nigeria. Several of these liquid fertilizers have been sent to Agricultural Research Institutes for testing. They include Agromax soil conditioners, Agromax special fertilizers, Cellugest residue composter, Microlan fertilizers, Oxybac soil detoxicant, Aquamul soil conditioners, Azobac seed inoculants, Azomin and chelated micro-nutrients.

The purpose of this investigation, therefore, was to evaluate the efficacy of one of these liquid fertilizers (Agromax 17-5-5) on yield and its components in sugarcane under field conditions during the 1983/84 and 1984/85 cropping seasons.

MATERIALS AND METHODS

The sugarcane crop (var. Co1001) was planted on 4th April, 1983 on two soil series (pH 6.3, N 0.10%, organic matter 1.47% and cation exchange capacity 3.11 meq./100g. soil) (Smyth and Montgomery, 1962) on the experimental plots of the National Cereals Research Institute at Moor Plantation, Ibadan. Land preparation consisted of ploughing and harrowing and the trials were planted on flats. However, soil was mounded around the sugarcane stools during interrow cultivation.

The plot size was 6m x 6m with a 2m alleyway between plots. Sugarcane setts were planted continuously in rows spaced 1.5m apart. The experiment comprised of the following treatments laid out in a randomised block design with four replications :

1. Control.
2. Agromax at planting 2ml/m².
3. NPK only (at 125, 56, 56kg/ha from A/S, SSP and MP, respectively).
4. As in treatment 3 plus Agromax 1ml/m².
5. Agromax 1ml/m² plus NPK at 100, 50, 50kg/ha.

Agromax was applied at the rate of 20 litres/ha. In addition, foliar spray application of Agromax at 1, 0.5 and 0.5ml/m² in treatments 2, 4 and 5, respectively was made three times at 4-weekly intervals starting from 6 weeks of planting. The liquid fertilizers were applied by means of hand operated knapsack sprayers.

The composition of agromax includes NPK and other nutrient elements such as manganese, copper, zinc, calcium and magnesium. The exact amount of these elements in the product was not stated by the manufacturer. However, laboratory analysis carried out indicated that it contains the quantities of elements as follows :

Total N : 2.5%	Total Zn : 7.0 ppm
Total P : 2.5%	Total Fe : 168.2 ppm
Total K : 6.0%	Total Mn : 20.2 ppm
Total Ca : 18.0 ppm	Total Cu : 7.0 ppm
Total Mg : 19.0 ppm	

Germination count was recorded 21 days after planting while tiller counts were recorded 3, 6 and 9 months after planting. Three months after planting and at subsequent sampling dates (6 and 9 months), five cane stalks were randomly selected from each plot and cut at ground level. Each stalk was weighed and measured separately while the brix (total solids in expressed sap of sugarcane juice) was determined with a hand refractometer. The number of green leaves, internode number, weight of TVD (top visible dewlap) leaf, and cane height were also recorded.

Each set of five canes was ground in a Jeffcocutter grinder and 500g of the brei (ground cane) was used to analyse total and reducing sugars, sucrose and fibre % using the press method of cane analysis as described by Tanimoto (1964). The ratoon crop received similar treatments except that solid fertilizers were applied around that ratoon stubbles. Yield data were recorded in plant and ratoon crops twelve months after planting.

RESULTS AND DISCUSSION

Table 1 shows the effect of Agromax on yield and its components in plant and ratoon crops. There were significant differences between treatments in all the parameters measured. The highest internode number/stalk was from the Agromax only treatments while the control plots had the lowest value. However, there were no significant differences between the agromax only and NPK + Agromax treatments. For stalk number/ha, there were significant differences between treatments in the two crops. Apart from the control, these differences were not significant between the Agromax and other treatments in the plant crop. Similar trend was obtained for the number of green leaves per stalk. The weight of TVD (top visible dewlap) leaf also showed that the highest value was significantly higher than values obtained when Agromax was used in combination with solid fertilizers and the control treatment.

There were also significant differences between treatments in cane height. The tallest cane was that of the agromax only treatments (1.68 and 1.79m) while the shortest cane was from the control plots (0.58 and 0.51m) in both plant and ratoon crops respectively. Similar trend was obtained for cane weight, the highest value was that of the agromax only (1.66 and 1.72kg for plant and ratoon crops) treatment, while the control plots had the lowest values in the two crops.

There were also significant differences between treatments in yield. The highest values (76.5 and 76.8 tonnes/ha) were obtained in the two crops from the Agromax only plots which were about three times more than the control plots (26.2 and 22.9 tonnes/ha for both crops).

Table 1. Effect of liquid fertilizer (Agromax) on yield and its components

Treatment	Internode No / Stalk		Stalk No. 1000/ ha.		No of green leaves / Stalk		Wt. of TVD leaf (g.)		Cane height (m.)		Wt. / Cane (kg)		TCH	
	P	R	P	R	P	R	P	R	P	R	P	R	P	R
Control	8c*	7c	21.6b	22.8c	8b	6b	15.8c	13.7c	0.58c	0.51d	0.75c	0.50d	26.2d	22.9c
Agromax only	14a	15a	50.7a	54.5a	12a	13a	22.9a	23.1a	1.68a	1.79a	1.66a	1.72a	76.5a	76.8a
NPK only	10b	12a	45.8a	48.1a	11a	11a	21.6a	22.9a	1.58a	1.43b	1.58a	1.45b	66.9b	70.2b
NPK + Agromax	12a	10b	44.9a	47.2b	10a	10a	21.7a	19.8b	1.38b	1.20b	0.94b	0.92c	65.7b	65.8b
NPK ₁ + Agromax	10b	10b	45.6a	46.7b	10a	10a	19.4b	19.3b	1.25b	1.12c	0.98b	0.90c	45.4c	46.4d

NPK — Applied at the rate of 125, 56, 56 kg/ha as ammonium sulphate, single superphosphate and muriate of potash.

NPK₁ — 100, 50, 50 NPK as above.

Control — No Agromax, no NPK.

TCH — Tonnes cane/ha.

TVD — Top visible dewlap.

P — Plant crop.

R — Ratoon crop.

* — Statistical difference at 5% level. Means followed by a common letter are not significantly different at 5% level (Duncan Multiple Range Test).

As for the components of dry matter shown in Table 2, only sucrose and reducing sugars (in the plant crop) showed significant differences between treatments. The highest sucrose value was obtained from the Agromax only plots while the lowest was from the control plots. Conversely, the control plots had the highest reducing sugars content while the lowest was from the solid and liquid fertilizers treatments. There were however no significant differences between treatments in respect of reducing sugars in the ratoon crop and fibre contents.

Table 2. Effect of liquid fertilizer (Agromax) on components of dry matter.

Treatment	Sucrose % cane		Reducing Sugars		Fibre % cane	
	P	R	P	R	P	R
Control	11.5c	9.8d	1.84a	1.98	14.6	12.2
Agromax only	16.8a	15.9a	1.54a	1.67	13.0	12.0
NPK only	13.4b	14.8b	1.68a	1.72	14.2	12.2
NPK+Agromax	14.8b	12.8c	0.86b	0.92	13.8	12.8
NPK ₁ + Agromax	13.7b	11.9c	1.44a	1.21	10.6	10.7
			NS		NS	NS

Figures with same letter do not differ significantly at 5% level as per DNMR test.

The data presented showed that Agromax applied to the soil at the rate of 2ml/m² at planting and 1ml/m² as foliar spray 6 weeks after planting, three times at four weekly intervals during the crop gave the highest sucrose content in both plant and the ratoon crops. The yield from the Agromax treatments was about three times that of the control plots. It seems likely that its soil conditioning and growth regulatory roles made it superior to other treatments. The Agromax liquid fertilizers

contain some plant growth regulators such as gibberellins, maleic acid, indolebutyric and indolacetic acids. As a growth regulator, it is possible that the Agromax may affect cell elongation as shown by the differences in cane height and may also affect sugar storage. It may also carry out various other functions associated with growth and differentiation of the sugar storage cells. Such a relationship between cell volume, and sugar storage has been reported by Oworu *et al.* (1977).

The foliar application appeared to enhance good growth as evidenced by the number of leaves in the Agromax treated plots. This presumably may be related to the high sucrose content of canes from the Agromax treated plots. The high weight of TVD leaves in the Agromax treatments may be associated with high chlorophyll content in the leaves. This may also explain the high sucrose content of the agromax treated plots. It is possible that the level of chlorophyll may affect the rate of photosynthesis and hence sucrose storage. The reason for the depression in yield and other characters in the NPK + Agromax treatments is difficult to explain. However, it may be postulated that the addition of agromax to NPK may render the major elements immobile thus making them unavailable to the plants. Consequently, this may affect the yield and other characters in the NPK + Agromax treatments. This postulate needs further elucidation through field experimentation.

From this study, it is obvious that liquid fertilizers affects the yield and quality of sugarcane. However, liquid fertilizers and soil conditioners represent a new technology which may prove expensive for the average farmers to adopt. Since the liquid fertilizers are in concentrated forms and a lot of dilution is necessary before application, it might, where water is limiting, be difficult for the farmers to get enough water to cover a large acreage. Their use meanwhile should be limited to agricultural research organisations and highly mechanised farms where staff and equipments are readily available (Nnadi and Iwuafor, 1980). Yayock and Nnadi (1980) also suggested that a period of 10-15 years may be necessary to work out the effective rate of application of these chemicals, their effectiveness and economics under Nigerian conditions.

ACKNOWLEDGEMENT

I am grateful to Messrs. Mabawonku and Ezeobiakor for technical assistance and for the analysis of plant samples.

REFERENCES

- Nnadi, L. A. and Iwuafor, E.N.O. 1980. Preliminary Investigations on the use of liquid fertilizers in the savanna. Symposium on "Soil Research and Agromax System". Institute of Agricultural Research and Training, University of Ife, Moor Plantation, Ibadan, July 9, 1980.
- Oworu, O.O.; McDavid, C.R. and MacColl, D. 1977. The anatomy of the storage tissue of sugarcane in relation to sugar uptake. *Ann. Bot.*, **41** : 401-404.
- Smyth, A. J. and Montgomery, R. F. 1962. Soil and Land Use in Central South Western Nigeria, Ibadan Government Press.
- Tanimoto, T. 1964. Press method of sugarcane analysis. *Hawaiian Planters' Record*, **57** (2) : 133-150.
- Yayock, J. Y. and Nnadi, L. A. 1980. Introducing liquid fertilizers in Nigeria Philosophy and Approach. Symposium on "Soil Research and Agromax System". Institute of Agricultural Research and Training, University of Ife, Moor Plantation, Ibadan, July 9, 1980.