African Journal of General Agriculture
Vol. 4, No. 1, March 31, 2008
Printed in Nigeria

1595-6984/2008 $12.00 + 0.00

http://www.asopah.org

AJGA 2007067/4108

Effects of organic and inorganic fertilizers on sugarcane production

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(Received August 2, 2007)

ABSTRACT: Field trials were conducted in 1998 and 1999 wet seasons at the upland sugarcane experimental farm, Badeggi (9°45^{I}N, 06°07^{I}E) in the Southern Guinea Savana of Nigeria to evaluate the sustainability of organic fertiliser on chewing sugarcane (var. Bida Local) production. From the results in both years, organic fertiser cow-dung 10ton/ha, inorganic fertiliser 120N-60P_2O_5-90k_2O, cow-pea var. L.25 soybean TGX579 and *Sesbania rostrata* were able to sustain sugarcane growth and yield throughout its life cycle. Sugarcane growth and yield (ton/ha) obtained from plots treated with organic and inorganic fertilisers and also plots incorporated with life legumes were significantly greater than the sole cane where no fertiliser was applied. Though the plots that received the standard rate in - organic fertiliser (120N-60P_2O_5-90k_2O kg/ha) gave better sugarcane growth and yield over the plots treated with life legumes (Cowpea, Soybean and Sesbania). However, the best sugarcane growth and yield (ton/ha) were obtained from the plots incorporated with cow-dung at 10 ton/ha and also supplemented with in-organic fertiliser at 120N-60P_2O_5-90$k_2O$kg/ha.

Key Words:- Cowdung, Legumes, Fertiliser, Chewing sugarcane.

Introduction

In sandy soils, especially in upland ecologies loss of mineral nutrients, water and herbicides through leaching is very high thereby making the soil unproductive. The application of organic manure is needed not only to replenish lost nutrients but also to improve the physical, chemical and biological properties of such ecologies which will enhance the performance of soil applied inputs (Vanlauwe *et al* 2001).

In Africa, soil structure and fertility is maintained or enhanced by the use of animal manure, compost, farm wastes and green manure (Vanlauwe *et al* 2001). Soils in which legumes and Farm Yard Manure (FYM) are either grown or incorporated contain enough suitable phosphoric, acid, potash and lime (Rao and Sharma 1981). Cow-dung helps in improving soil structure, soil aeration and therefore improves the activities of soil micro-organisms (Agboola, 1975 and FAO, 1999).

About 300 to 400kg/ha of total nitrogen is contained in single legume though only between 10 to 60kg/ha is made to crops (Agboola, 1975, MacCalla, 1974). Singh (1963) reported a beneficial effect on sugarcane from an incorporated legumes in North India, and also Agboola (1975) showed that at Samaru, Nigeria, the incorporated groundnut and cowpea increased yield of maize.

Even prior to the introduction of mineral fertiliser, about 80 years in Nigeria, manure, compost and farm yard manure were particularly the only source of nutrient to crop (Yanan *et al* 1997).
It is therefore, imperative that sound soil and crop management practice that is environmentally friendly is to be adopted to improve soil fertility for the purpose to sustain sugarcane production.

Materials and Methods

Field trials were carried at the upland sugarcane experimental field of the National Cereals Research Institute, Farm, Badeggi (9°45^{I}N, 06°07^{I}E) in the Southern Guinea Savanna ecological zone of Nigeria in 1998 and 1999 wet seasons. The soil at the site of the trial have been classified as ultisol and sandy loam in texture with a bulk density of 1.45gm^{-3} and have an average rainfall, temperature and relative humidity of 112mm, 230° - 33°C and 85 - 87% respectively.
Bida Local (variety of chewing cane) was intercropped with three legume species cowpea (var. L.25), Soybean (TGX 579) and *Sesbania rostrata*. Treatment also included cane treated with inorganic fertiliser at 120N-60P_2O_5-90k_2O kg/ha, cane treated with cowdung alone at 10ton/ha, and also supplemented with inorganic fertiliser at rate of 120N-60P_2O_5-90k_2O kg/ha, and sole chewing sugarcane no fertiliser was applied.

Each treatment was accommodated in 30m^2(6 x 5m) gross plot area containing six rows of chewing sugarcane and 18m^2(6 x 3m) net plot following a randomised complete block design in three replicates.
The legumes were incorporated into the soil when they were 6 weeks old. The cowdung was incorporated into the soil 2 weeks before planting of the cane. While inorganic fertiliser was applied split at planting (basal application) and during earthing up.
Soil samples were collected using soil auger from soil depth of 0 - 25cm before planting, at 6WAP and at harvest, for nitrogen analysis. The source of NPK inorganic fertiliser was from straight fertiliser single element bag of Urea (N), Single Supper Phosphate (P) and Muriate of Potash (K).
Data collected include percent germination at 1MAP, crop vigour score, stalk length (cm), number of green leaves/stalk, tiller number/plot at 6 and 10MAP (at harvest) while the cane yield (ton/ha) was taken at harvest. Data collected were compared using Duncan's Multiple Range Test (DMRT) where F values were significant.

Results and Discussion

There was no significant difference among the treatments intercropped with cane and solecane for all the growth parameters measured at 1MAP in both 1998 and 1999 (Table 2). In relative terms, cane planted in plots treated with inorganic fertiliser alone, and also plots treated with both cowdung and inorganic fertiliser, however, produced the highest values for plant height and percent germination in both years. This may be attributed to the early supply of nitrogen and phosphorus by cowdung and inorganic fertiliser used for root development and sprouting by the cane (Rao and Sharma 1982).

At 6 and 10MAP in both years (5 and 9 months after legume incorporated) cane incorporated with legumes significantly recorded higher crop vigour scores, stalk length and chewable number/plot than the sole cane (Table 3). Among the cowdung, inorganic fertiliser and legumes in 1998 and 1999, cane treated with cowdung alone and also inorganic fertiliser alone significantly produced better canes interms of length, vigour, chewable number/plot and cane yield (ton/ha). However, cane treated with cowdung and supplemented with inorganic fertiliser at rate of 120N-60P_2O_5-90k_2O kg/ha recorded best stalk length, crop vigour score, chewable number/plot than cane treated with inorganic fertiliser alone in both years (Table 3). This may be attributed to the ability of cowdung in improving the soil structure and aeration thereby reducing leaching of inorganic fertiliser applied consequently leading to the increase in yield (Agboola, 1975 and Daliparthy *et al*, 1994).

Table2: Effect of Legume crops and organic fertiliser on sugarcane growth at 1MAP (before legume incorporation) in 1998 and 1999.

Treatments	**% Geremination**		**Crop Score**	**Vigour**	**Plant Height (cm)**		**Number of Green Leaves/Stalk**	
	1998	1999	1998	1999	1998	1999	1998	1999
Chewing sugarcane+cowpea (var.L.25)	664.3	65.5	7.0	8.0	70.3	85.1	7.1	8.0
Chewing sugarcane+seabania rostrata	66.3	67.1	7.7	8.3	72.5	82.3	7.2	8.1
Cane+soybean TGX 579	65.3	66.4	7.5	8.6	70.1	85.1	7.3	8.1
Chewing sugarcane+120N-60P_2O_5-90k_2O kg/ha	67.0	69.6	8.0	8.9	80.7	89.1	8.8	9.0
Chewing sugarcane+Cowdung (10ton/ha)	68.5	69.3	8.0	8.9	80.9	89.8	8.9	9.1
Chewing sugarcane+ cowdung+ (120N-60P_2O_5-90k_2O kg/ha)	98	100	8.0	8.9	80.9	90.9	9.3	9.7
Solecane	66.8	68.9	7.5	8.0	80.0	80.0	7.3	7.9
LSD 0.5	NS	NS	NS	NS	NS	NS	NS	NS

Plot size = 5mx6m = 30m^2, MAP = Months After Planting, Vigour Rating (1-10) where 1 = retarded, weak growth and 10 = Rubust, Active growth

Table3: Effect of organic fertiliser on sugarcane growth at 6 and yield at 10 MAP (4½ and 8½ months after legume incorporation) in 1998 and 1999.

	Crop Vigour Score				Stalk Length (cm)				Number of Chewable stalk/plot				Yield (ton/ha)	
Treatments	6 MAP		10 MAP		6 MAP		10 MAP		6 MAP		10 MAP		10 MAP	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Chewing sugarcane+cowpea (var.L.25)	8.6	8.8	7.0	7.1	170.0	171.0	241.0	243.0	95	94	95	97	49.5	56.1
Chewing sugarcane+seabania rostrata	8.3	8.4	7.1	7.3	170.0	171.3	242.1	243.0	92	93	93	95	46.2	56.4
Cane+soybean TGX 579	8.3	8.6	7.0	7.1	171.0	173.0	243.1	244.5	92	93	94	97	50.3	57.1
Chewing sugarcane+120N-60P_2O_5-90k_2O kg/ha	9.9	10.0	9.9	10.0	193.3	194.3	263.1	267.1	126	128	130	140	60.3	63.0
Chewing sugarcane+Cowdung (10ton/ha)	7.0	7.0	8.8	8.0	175.5	176.7	268.1	269.1	95	96	97	97.8	45	50
Chewing sugarcane+ cowdung (120N-60P_2O_5-90k_2O kg/ha)	10	10	10	10	210	230	273.1	281.3	160	162	163	170	81.2	83.1
Solecane	5.0	4.9	4.1	3.8	111.8	110.9	191.0	189.0	66	65	59	62	21.2	20.0
LSD 0.5	0.57	0.61	0.49	0.53	20.3	24.3	21.1	23.3	25.3	21.1	20.4	10.3	112	12.3

Plot size = 5mx6m = 30m^2, MAP = Months After Planting, Vigour Rating (1-10) where 1 = retarded, weak growth and 10 = Rubust, Active growth

Conclusion

From these results, all the three sources of fertilisers legumes, cowdung and inorganic fertilisers have positive influence on cane. However, the best was observed in plots treated with cowdung 10ton/ha supplemented with inorganic fertiliser at rate of 120N-60P_2O_5-90k_2O kg/ha. Therefore, the use of cowdung should be highly encouraged for sugarcane farmers to adopt, but should be supplemented with the inorganic fertiliser as cowdung alone cannot sustain sugarcane production for optimal yield.

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