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Growth and Yield of Sugarcane as influenced by Organic Manures

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ABSTRACT

The experiment was conducted at Rangpur Sugar Mills Farm (RSM) under the AEZ Level Barind Tract to study the influence of different organic manures with NPK fertilizers on sugarcane production. Germination percent, tillering, millable cane and sugar yield were increased due to application of cowdung, pressmud and mustard oil cake along with NPK fertilizers over NPK alone. Application of 0.5 t ha^{-1} mustard oil cake with NPK fertilizers showed the highest performance in both cropping seasons (58.3 t ha^{-1} and 89.1 t ha^{-1} respectively). Application of organic matter in the same soil in consecurive two years improved the yield and yield contributing partameters of sugarcane.

INTRODUCTION

The use of high analysis fertilizers for intensive cultivation of high yielding crop varieties causes deleterious effects on soil physical condition, lowers organic matter status and reduces the yield. Organic manures have been used for maintaining and improving the fertility and productivity of soil since time immemorial (Dhar, 1968). Sugarcane (*Saccharum officinarum* L) is a biennial crop with heavy nutritional requirement. Samuels and Landrau (1956) reported that any kind of organic manures has residual action on the soil. Organic manures are known to improve physical, chemical and biological properties of soils. Parthasarathy (1972) published that, if a field receives adequate or optimum quantities of organic matter through green manuring or application of farmyard manure, such fields rarely deteriorate in productivity of any crop. Because of their low nutrient content and slow acting nature, organic manures alone may not be able to meet up the high nutritional requirement of sugarcane crop and therefore, commercial fertilizers need to be suplemented. Keeping this view, effects of combined application of organic manures and commercial fertilizers on sugarcane production are investigated and reported.

MATERIALS AND METHODS

The experiment was conducted during two cropping seasons (1986-87 and 1988-89) at Rangpur Sugar Mills farm under the AEZ Level Barind Tract Soils. The initial physical and chemical status of soil was as follows:

Years	Texture	pH	Organic carbon (%)	Total Nitrogen (%)	Available P (ppm)	Exchangeable K meq/100g soil	Available S(ppm)
1986-87	Sandy Loam	4.5	0.51	0.034	15.0	0.09	6.0
1988-89	Sandy loam	5.0	0.53	0.039	16.0	0.11	13.0

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The experiment comprised the following treatment laid out in a randomized complete block design having unit plot size of $42m^2$ with three replications. Sugarcane variety Isd 16 was used as test crop.

T_0 = Without commercial fertilizers and organic manures. (control)
T_1 = 125 N + 37 P_2O_5 + 92 K_2O kg ha^{-1}
T_2 = T_1 + 10,000 kg cowdung (CD) ha^{-1}
T_3 = T_1 + 10,000 kg pressmud (PM) ha^{-1}
T_4 = T_1 + 500 kg Mustard Oil Cake (MOC) ha^{-1}
T_5 = T_1 + 300 kg MOC ha^{-1}
T_6 = T_1 + 10,000 kg PM ha^{-1} + 500 kg MOC ha^{-1}

Composition of organic manures:

Organic manures	Nutrient level (%)			
	N	P	K	S
Cowdung	1.5	0.08	0.09	0.45
Pressmud	2.6	0.05	0.15	0.55
Mustard oil cake	1.6	0.07	2.50	0.60

The organic manures of each treatment were applied and mixed properly in soils before planting. The entire amount of P from triple superphosphare (TSP), half of N and K from urea and muriate of potash (MP) respectively were applied at planting and the rest half of these fertilizers were applied at 120 d after planting as top dressing. Intercultural operations were done as and when required. Post harvest soil status was determined and presented in the Table 2. Soil texture was determined by hydrometer method, organic carbon was determined by wet oxidation method (Walkley and Black), pH by a glass electrode pH meter and total nitrogen by kjeldahl method. available P was determined by using 0.5M $NaHCO_3$ extraction procedure following colorimetric measurement by a spectrophotometer (Modified Olsen's method), exchangeable K was determined on 1M NH_4OAc extract using flame photometer. Available S was also determineds by turbidimetric method (Black, 1965).

RESULTS AND DISCUSSION

Results obtained from two years experiments are presented in the Table 1 and Figure 1. It appears from the results that treatment control (T_0) produces the lowest yield in all cases. Application of cowdung and pressmud along with NPK fertilizer had no significant effects over NPK fertilizers alone on any growth parameters although the yield was apparently increased. From the results (Table 1), it is clearly seen that treatment T_4 (500 kg ha^1 MOC) produced the highest benefit on the growth parameters studied except for TSH of 1986-87 crop, while the treatment T_5 (300 kg ha^1 MOC) recorded a depressing effect. Combined application of 500 kg ha^1 MOC and 10,000 kg PM ha^1 lowered yield of cane in both the years than single effect of 500 kg ha^1 MOC application. It is evident from Figure 1 that application of 500 kg MOC ha^1 along with NPK fertilizer produced the highest percent yield increase over NPK alone in both the years (30.8% & 15.1%). From the results of two years experiment it is seen that organic manures application on the same soil improves yield contributing parameters of

Table 1. Effects of different organic manures on yield and yield contributing factors of sugarcane.

Cropping year	Treatments	Germination %	Tillers (000 ha^{-1})	Millable cane (000 ha^{-1})	Yield of cane (TCH)	Yield of sugar (YSH
1986-87	T_0	24.5 c	52.3 c	35.5 c	32.0 b	2.9
	T_1	30.6 b	120.1 b	63.2 ab	44.6 ab	4.1
	T_2	32.4 ab	130.9 ab	68.7 a	53.8 a	5.3
	T_3	32.3 ab	131.8 ab	65.9 a	45.2 ab	4.4
	T_4	40.4 a	176.5 a	75.2 a	58.3 a	5.8
	T_5	35.6 ab	160.0 a	69.6 ab	50.1 a	8.9
	T_6	35.5 bc	170.5 a	70.9 a	52.5 a	5.2
1988-89	T_0	30.7 c	71.6 c	68.8 b	55.1 b	5.1
	T_1	34.3 bc	109.8 a	78.1 ab	77.4 ab	7.2
	T_2	40.8 ab	108.1 a	93.8 a	83.1 a	7.7
	T_3	40.1 ab	106.8 ab	86.1 ab	82.2 a	7.8
	T_4	44.5 a	115.7 a	96.7 a	89.1 a	8.8
	T_5	38.6 ab	109.7 a	83.6 ab	88.1 a	8.7
	T_6	35.6 bc	114.4 a	85.0 ab	86.3 a	8.1

Figures accompanied by same letters are not significantly different at 5% level of probability as per DNMR test.

Table 2. Physical and chemical properties of post harvest soils.

Cropping year	Treatments	Organic carbon (%)	pH	Total nitrogen (%)	Available p (ppm)	Exchan geable K(meq/100 gm soil)	Available S(ppm)
1986-87	T_0	0.49	5.0	0.038	17	0.12	4
	T_1	0.52	5.6	0.041	21	0.14	5
	T_2	0.51	5.7	0.043	20	0.14	5
	T_3	0.56	5.7	0.041	20	0.12	5
	T_4	0.52	5.3	0.043	19	0.16	4
	T_5	0.49	5.6	0.040	21	0.11	5
	T_6	0.54	5.7	0.045	19	0.12	5
1988-89	T_0	0.52	5.3	0.039	18	0.12	7
	T_1	0.52	5.4	0.038	17	0.13	6
	T_2	0.51	5.7	0.041	19	0.13	6
	T_3	0.50	6.1	0.042	19	0.11	5
	T_4	0.52	5.9	0.042	20	0.12	5
	T_5	0.56	5.9	0.043	20	0.13	6
	T_6	0.50	5.7	0.044	20	0.10	5

sugarcane on the following year. This could possibly be the fact that organic matter application might have contributed to the improvement of soil fertility resulting increase in yield in the second year. Patil and Kale (1983) also obtained higher cane and sugar yield from the successive crops using 400 kg ha^{-1} organic manures with two different

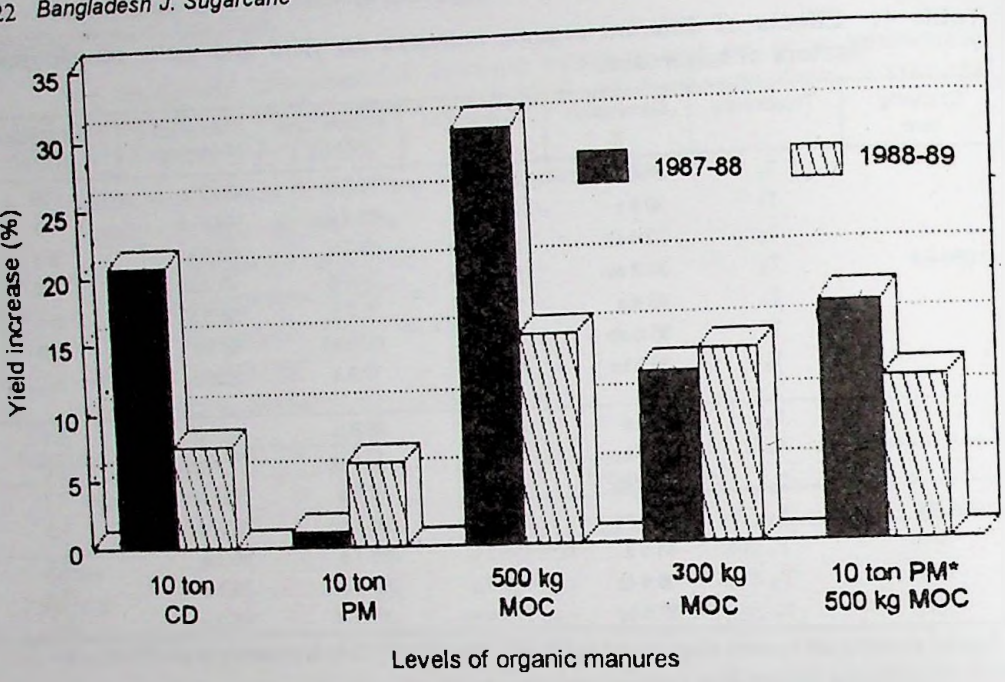

Figure 1. Yield increase (%) with different organic manures.

NPK rates. Increased cane and sugar yield due to application of filter pressmud were also reported by Golden (1975) in Louisiana but he reported adverse effect of pressmud on juice quality. Sarkar *et al.* (1983) obtained significant increase in cane yield due to application of 10,000 kg ha^{-1} pressmud in two splits. Post harvest soil analysis from the experimental plots showed a reduction in S content compared to its initial status indicating higher uptake of the element supplied through organic manuring (Table 2). It appears to be possible that soil having lower levels of sulphur must be supplimented by sulphur to obtain higher yield. The yield increase due to application of organic manure might also have contributed by other related factors like improvement of soil texture, higher water holding capacity and enhanced availability of plant food elements other than sulphur.

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