

IMPROVEMENT OF SUGARCANE PRODUCTION IN TANNERY EFFLUENT POLLUTED SOILS

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ABSTRACT

Four sugarcane varieties (Co 740, CoC 771, CoC 85061 and G 85335) were evaluated in a soil polluted by tannery effluents under different management practices. Among the four varieties, CoC 771 recorded the highest cane yield of 124.92 t/ha and sugar yield of 13.61 t/ha with the application of 25 t/ha of coir pith. Coir pith mulching, trash mulching and pressmud application were found superior over the application of amendments like gypsum and pyrites.

KEY WORDS: Sugarcane, Tannery effluent, Pollution

Tannery industry consumes large quantities of chemicals and water in leather processing. The effluent from tanneries contains varying quantities of suspended and dissolved salts, especially chlorides, carbonates, bicarbonates and sulphates of sodium and magnesium (Varadharajan *et al.*, 1970), in addition to substantial amount of chromium (1000 to 2000 ppm) (Sastry and Prasad, 1980). The waste water also has very high BOD (1450 to 4100 ppm) (Kothandaraman *et al.*, 1972). Thousands of hectares of land in Vellore district is affected by tannery effluents. Sugarcane were one of the major crops grown in this tract. Cane yield and quality are considerably reduced due to the pollution of soil and irrigation water by tannery effluents (George, 1982). Consequently sugarcane cultivation has become uneconomical and farmers have switched over to tolerant, but less remunerative crops like ragi, maize and coconut. A field experiment was therefore conducted to select sugarcane varieties suitable for tannery effluent polluted soils and the management practices by using amendments.

MATERIAL AND METHODS

A field experiment was conducted during 1989-90 at Tharvazhi village in the Ambur Co-operative Sugar mill area of Vellore district in a tannery effluent affected field. The experiment was conducted in split plot design with three replications. Four sugarcane varieties (Co 740, CoC 771, CoC 85061 and G 85335) were included as main plot treatments and six management practices as listed below formed the sub-plot treatments:

- T₀ - Control
- T₁ - Gypsum at 2.5 t/ha incorporated just before planting
- T₂ - Pyrites at 1.0 t/ha incorporated just before planting
- T₃ - Coir pith mulching at 25 t/ha along the ridges and furrows two days after planting
- T₄ - Trash mulching at 15 t/ha two days after planting
- T₅ - Pressmud at 37.5 t/ha incorporated just before planting

The soil (Udic Rhodustalfs) of the experimental field was sandy loam in texture with a pH of 8.5 and EC of 0.65 dSm⁻¹. It was low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium. The irrigation water used was of poor quality with EC ranging from 4.29 dSm⁻¹ (July '89) to 6.56 dSm⁻¹ (March '89). The SAR value varied from 3.03 to 6.50.

RESULTS AND DISCUSSION

i) GROWTH OF SUGARCANE

Growth characters such as germination per cent, tiller production and shoot population did not differ significantly among the four cane varieties tested (Table 1). Among the management practices tested, application of pressmud recorded better growth compared to other treatments and the increase over control was 43.7, 42.1 and 43.0 per cent respectively for germination, tiller

Table 1. Growth characters and yield components

Treatment	Germination per cent	Number of tiller (1000/ha)	Shoot population (1000/ha)	Cane girth (cm)	Cane length (cm)	Number of internodes	Number of millable canes	Single weight (kg)
A. Varieties (Main plot)								
Co 740	55.0	109.50	92	2.49	110.6	19	90	0.895
CoC 771	60.9	118.17	103	2.71	132.8	17	99	0.920
CoC 85061	58.5	104.33	89	2.68	117.1	16	85	0.912
G 85335	58.4	113.06	98	2.65	129.0	18	93	0.886
SE ₃ 3.09	9.37	7.7	0.03	5.86	0.7	6.0	0.058	
CD (P=0.05)	NS	NS	NS	0.08	14.35	1.6	NS	NS
B. Management practices (Sub plot)								
T ₀ - Control	48.7	92.92	79	2.44	99.3	15	77	0.764
T ₁ - Gypsum (2.5 t/ha)	51.8	98.67	85	2.52	115.9	17	86	0.878
T ₂ - Pyrites (1.0 t/ha)	51.5	99.75	85	2.63	111.2	16	81	0.840
T ₃ - Coir pith (25 t/ha)	54.0	121.33	103	2.78	138.3	19	101	1.040
T ₄ - Trash mulch (15 t/ha)	53.2	122.92	106	2.69	138.7	18	101	0.964
T ₅ - Pressmud (37.5 t/ha)	70.0	132.08	113	2.79	131.0	19	103	0.931
SE ₅ 2.42	5.15	4.2	0.05	7.04	0.7	2.8	0.038	
CD (P = 0.05)	5.32	11.28	9.2	0.11	15.51	1.51	6.0	0.083

production and shoot population. Application of coir pith and trash mulch also improved these parameters to about 30 per cent over control.

Pressmud contain 3.5 percent P_2O_5 , 10.59 per cent CaO and 21.0 per cent organic carbon on dry weight basis. In addition to better nutrition, pressmud also improves soil physical properties, especially water retention (Prasad, 1974). This beneficial soil environment would have resulted in better cane growth with pressmud application.

ii) YIELD COMPONENTS

Yield components such as cane girth, cane length and number of internodes differed significantly among the four cane varieties tried. They were also significantly improved over control by the different management practices. However, number of millable canes and single cane weight were influenced by the management practices only.

Among the four varieties, CoC 771 recorded the highest cane girth and cane length, while the number of internodes was maximum in Co 740.

All the management practices except gypsum application significantly increased the cane girth, with coir pith application recording the maximum girth of 2.78 cm. Trash mulching recorded the highest cane length of 138.7 cm, closely followed by coir pith application (138.3 cm). Both these treatments were found to be significantly superior to control and application of pyrites or gypsum. All the management practices substantially improved the number of internodes, number of millable canes and single cane weight over control. In general, application of coir pith, trash mulch and pressmud were found to be superior to gypsum and pyrite application. This could be attributed to the improvement in soil physical properties like structure, porosity and water holding capacity resulting in better growth

Table 2. Effect on juice quality

Treatment	Brix (%)	Sucrose (%)	Purity (%)	CCS (%)
A. Varieties (Main plot)				
Co 740	19.73	16.41	83.18	11.03
CoC 771	19.69	16.24	82.48	10.79
CoC 85061	19.61	16.37	83.47	11.01
G 85335	19.92	16.29	81.76	10.78
SE _d 0.38	0.34	0.61	0.25	
CD (P = 0.05)	NS	NS	NS	NS
B. Management practices (Sub plot)				
T ₀ - Control	19.12	15.54	80.77	10.20
T ₁ - Gypsum (2.54 t/ha)	19.37	16.06	82.90	10.76
T ₂ - Pyrites (1.0 t/ha)	19.70	16.13	81.90	10.65
T ₃ - Coirpith (25.0 t/ha)	19.70	16.56	84.06	11.17
T ₄ - Trash mulch (15.0 t/ha)	20.21	17.02	84.26	11.52
T ₅ - Pressmud (37.5 t/ha)	20.32	16.76	84.45	11.11
SE _d 0.32	0.37	1.20	0.33	
CD (P=0.05)	0.69	0.81	NS	0.72

(Parameswaran, 1985). In addition, organic manuring would have also resulted in reduced salt hazard in the root zone due to higher moisture storage and enhanced permeability as suggested by George (1982). Patil *et al.* (1983) noticed improvement in number canes due to pressmud application.

The variety x management practices interaction was significant on the number of millable canes and single cane weight. Variety CoC 771 recorded the highest number of millable canes of 11,14,000/ha with the application of pressmud and the highest single cane weight of 1.33 kg with coir pith application.

iii) JUICE QUALITY

The effect of management practices and varieties on juice quality is summarised in Table 2. Quality attributes like brix, sucrose, purity and CCS per cent were not significantly different among the four varieties studied. The mean sucrose content ranged from 16.24 per cent in CoC 771 to 16.41 per cent in Co 740, whereas CCS per cent ranged from 10.78 (G 85335) to 11.03 (Co 740). On the other hand juice quality characters were favourably influenced by the management practices compared to control. Pressmud application recorded the

highest juice brix of 20.32% followed closely by trash mulching (20.21%). Trash mulching recorded the highest juice sucrose content (17.02) per cent and CCS 11.52) per cent. Coir pith, trash and pressmud were on par for juice sucrose and CCS per cent. Increase in juice sucrose and CCS per cent due to pressmud application was also reported by Bawaskar *et al.* (1980). The interaction effect was not significant on juice quality. Favourable physical environment and reduced salt hazard might have resulted in better juice quality with the application of trash mulch, coir pith and pressmud.

iv) CANE AND SUGAR YIELD

The effect of different treatments on cane and sugar yield is furnished in Table 3. Both cane and sugar yields were significantly influenced by the varieties, management practices and their interaction. Among the varieties, CoC 771 recorded the highest cane yield of 91.81 t/ha and sugar yield of 10.01 t/ha. The increase in cane yield was 14.2, 16.9 and 10.8 per cent respectively over Co 740, CoC 85061 and G 85335. The improvement in sugar yield ranged from 11.2 to 14.9 per cent over the other varieties.

All the management practices increased the cane as well as sugar yield over control. Among

Table 3. Cane and sugar yield

Management practice	Cane yield (t/ha)					Sugar yield (t/ha)				
	Co 740	CoC 771	CoC 85061	G 85335	Mean	Co 740	CoC 771	CoC 85061	G 85335	Mean
T ₀ - Control	56.77	58.46	56.19	62.45	58.47	5.80	5.99	5.69	6.33	5.95
T ₁ - Gypsum (2.54 t/ha)	75.21	77.88	72.07	68.60	73.44	8.57	8.22	7.83	7.10	7.93
T ₂ - Pyrites (1.0 t/ha)	67.73	69.19	68.59	64.93	67.61	7.38	7.00	7.76	6.67	7.20
T ₃ - Coirpith (25.0 t/ha)	109.68	124.92	96.16	101.37	108.03	12.48	13.61	10.91	11.15	12.04
T ₄ - Trash mulch (15 t/ha)	83.84	110.66	94.12	99.97	97.15	9.75	13.23	10.60	11.25	11.21
T ₅ - Pressmud (37.5 t/ha)	89.28	109.77	84.25	99.85	95.79	9.51	12.03	9.47	11.48	10.62
Mean	80.42	91.81	78.56	82.86	-	8.92	10.01	8.71	9.00	-

	SE _d	CD (P=0.05)	SE _d	CD (P=0.05)
Varieties	1.10	2.69	0.21	0.51
Mgt. practices	2.25	4.95	0.34	0.75
Varieties x Mgt.practices	4.25	9.43	0.66	1.47
Management practices x varieties	4.50	9.90	0.69	1.51

them, application of coir pith was found to be significantly superior to all others followed by trash mulching. Coir pith application at 25 t/ha increased the cane yield by 84.8% over the control and more than doubled the sugar yield. The increase in cane yield with coir pith application over other management practices varied from 59.8% (pyrite application) to 11.2% (trash mulching). Yang and Chang (1976) reported that organic amendments increased the sugar yield besides showing significant improvement in soil properties.

Variety X management practice interaction had a positive significant effect on both cane and sugar yield. The variety CoC 771 with coir pith application recorded the highest cane yield of 124.92 t/ha and was significantly superior to all other treatment combinations. With reference to sugar yield, CoC 771 with coir pith application (13.61 t/ha) as well as trash mulching (13.23 t/ha) were observed to be the best. The better performance of CoC 771 among the four varieties was due to the enhanced yield attributes like cane girth, cane length and number of millable canes and thus could be attributed to the genetic nature. Trash mulch and

pressmud were more effective in higher cane production compared to pyrite and gypsum. Favourable effect of organic manures on improved soil physical properties, increased nutrient availability and reduced salt hazard would have facilitated better crop growth and higher yield. The beneficial effect of coir pith on soil physical and chemical properties was reported by Ramaswami and Sree Ramulu (1983) and Parameswaran (1985). Singaram (1994) suggested coir pith as an effective amendment for tannery effluent polluted soils for achieving highest productivity.

In conclusion, for better sugarcane growth and yield in tannery effluent affected soils, the variety CoC 771 with coir pith application at 25 t/ha may be recommended. In areas where coir pith is not available, trash mulching at 15 t/ha or application of pressmud at 37.5 t/ha is the other alternative.

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RESPONSE OF RICE TO VARIOUS LEVELS OF ZINC AND IRON WITH AND WITHOUT FYM IN BLACK CALCAREOUS SOIL

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ABSTRACT

A pot culture experiment was conducted to study the response of rice to various levels of Zn and Fe with and without FYM in black calcareous soil of Palghar (Thane). Application of Zn at 5 ppm and Fe at 10 ppm with NPK and FYM significantly increased the grain and straw yield of rice over recommended dose of NPK alone. The uptake of N, P and K by grain and straw also increased due to application of Zn at 5 ppm with NPK and FYM and application of Fe at 10 ppm with NPK and FYM as compared to NPK alone. The uptake of Fe significantly increased due to application of Fe with and without FYM as compared to NPK alone. However, Zn application did not show significant effect on Fe uptake. While the uptake of Zn significantly increased due to application of both the levels i.e., 5 ppm of Zn with NPK and FYM as compared to NPK alone. However, Fe application did not increase the Zn uptake indicating an antagonistic relationship between these two elements.

KEY WORDS: Yield of rice, Calcareous soil, Zinc, Iron uptake

Micronutrients have assumed an increasing importance in crop production. Under present day intensive agriculture, introduction of high yielding crop varieties, increased use of chemically pure fertilisers, increased cropping intensity and restricted recycling of organic wastes or farm wastes resulted into widespread deficiencies of

micronutrients. At many places, the normal yield of crops are not achieved despite judicious application of NPK fertilisers. This occurred mainly due to micronutrient deficiencies (Katyal and Agarwal, 1982). Zinc and iron are required by the plants for their normal growth and development.