Indian J. Agron. **40** (3) : 469–473 (September 1995)

Effect of pressmud and fertilizer on yield and quality of plant and ratoon sugarcane (*Saccharum officinarum*) in flood-prone areas

O. P. SINGH G. SINGH, B. B. SINGH AND M. S. SHARMA

Crop Research Station, Narendra Deva University of Agriculture and Technology, Ghaghraghat, Uttar Pradesh 271 901

Received: July 1994

ABSTRACT

A field experiment was conducted during 1988–90 and 1989–91 to study the effect of fertilizer and pressmud on yield and quality of plant and ratoon sugarcane (*Saccharum officinarum* L.). Pressmud alone or in combination with nitrogen improved the cane yield and quality of plant and ratoon crops. Pressmud @ 30 tonnes/ha + 120 kg N/ha increased the ratoon yield by 32% over recommended dose of 150 kg N/ha + 60 kg P_2O_5/ha + 50 kg K_2O/ha. However, total cane production was 5.5% higher with pressmud @ 30 tonnes/ha + 120 kg N/ha compared with 150 kg N/ha + 60 kg P_2O_5/ha + 50 kg K_2O/ha. Sucrose and sugar contents (%) of plant cane were higher in the control plot; however, pressmud @ 30 tonnes/ha + 120 kg N/ha recorded the highest sucrose and sugar content (%) in ratoon crop. The total production of commercial cane sugar was 13.1% higher in pressmud @ 30 tonnes/ha + 120 kg N/ha compared with 150 kg N/ha + 60 kg P_2O_5/ha + 30 kg K_2O/ha. The highest net profit and benefit : cost ratio were Rs 6,0636/ha and 17.6 respectively under pressmud @ 30 tonnes/ha + 120 kg N/ha.

Sugarcane (*Saccharum officinarum* L.) produces heavy tonnage and removes large amount of plant nutrients from soil. Considerable quantity of nutrients or inorganic fertilizer is lost through leaching, volatilization and run-off during flooding. Thus under such conditions a suitable combination of organic and inorganic sources, and split application of nitrogen may increase fertilizer-use efficiency and finally cane yield (Kumar and Mishra, 1992). Pressmud is a rich source of organic carbon (35–37%) and supplies 1.0–1.5% N, 2.5–3.5% P_2O_5 and 0.5–0.8% K_2O. Besides a good source of secondary and micro-nutrients (Kale, 1981), pressmud contains cane wax 8–15% and its slow decomposition may benefit the ratoons. Therfore an experiment was conducted to study effects of pressmud and fertilizer alone or in combination on plant and ratoon crops of sugarcane in flood-prone conditions.

MATERIALS AND METHODS

The field experiment was conducted during the spring cropping season of 1988–90 (plant) and 1989–91 (ratoon) at Ghaghraghat. There were 10 treatments, viz. T_1, control; T_2, pressmud @ 30 tonnes/ha; T_3, pressmud @ 30 tonnes/ha + 60 kg N/ha (full nitrogen at sowing); T_4, pressmud @ 30 tonnes/ha + 120 kg N/ha (full N at sowing); T_5, pressmud @ 30 tonnes/ha + 60 kg N/ha (full N top-dressed at first irrigation); T_6, pressmud @ 30 tonnes/ha + 120 kg N/ha (full N top-dressed at first irrigation); T_7, pressmud @ 30 tonnes/ha + 60 kg N/ha (half N at sowing + half N top-dressed at first irrigation); T_8, pressmud @ 30

tonnes/ha + 120 kg N/ha (half N top-dressed at first irrigation + half N top-dressed at second irrigation); T_9, 150 kg N + 60 kg P_2O_5 + 50 kg K_2O/ha (half N + full P and K at sowing + one-fourth N top-dressed at first irrigation + one-fourth N top-dresed at second irrigation recommended dose); and T_{10}, 75 kg N + 30 kg P_2O_5 + 25 kg K_2O/ha (half N + full P and K at sowing + one-fourth N top-dressed at first irrigation + one-fourth N top-dressed at second irrigation). These were tested in randomized block design in 3 replications. Carbonated pressmud of 68% moisture was uniformly broadcast and mixed 15 days before cane planting. Urea, single uperphosphate and muriate of potash were the source of N, P and K respectively.

The soil was sandy-loam with pH 8.1, organic carbon 0.30%, P_2O_5 22.4 kg/ha and available K_2O 291.2 kg/ha. Sugarcane 'CoS 8118' was planted at 75 cm row apart with 6 tonnes/ha cane seed. Three-budded setts treated with Emisan @ 100 litres water/ha were planted in the second fortnight of February. First irrigation was given at 45 days after planting and subsequent at 30-day interval. Earthing-up was done in the last week of June.

Tillers and millable canes were counted before flood and December respectively; and cane length, girth, weight and yield were recorded at harvest. Juice was analysed for total soluble solids and sucrose content (%). Sugar recovery was calculated as per the formula of Spencer and Meade (1964). Commercial cane sugar was calculated multiplying sugar recovery (%) by cane yield and divided by 100.

RESULTS AND DISCUSSION

Yield attributes

Tillers/ha, millable canes/ha, length, weight and girth of cane were significantly affected due to various pressmud and fertilizer treatments in both plant and ratoon crops (Table 1). Application of pressmud @ 30 tonnes/ha increased the tillers/ha, millable canes/ha, cane length, weight, and girth significantly campared with the control in plant and ratoon crops. Sugarcane receiving 150 kg N + 60 kg P_2O_5 + 50 kg K_2O/ha recorded significantly better yield attributes than other treatments in plant crop. However, pressmud @ 30 tonnes/ha + 120 kg N/ha was significantly superior in yield attributes of ratoon crop and increased millable canes by 48.0%, cane length by 52.3%, cane weight by 59.3% and cane girth by 11.8% over the control. Yadhuvanshi *et al.* (1990) and Yadhuvanshi and Yadav (1992) reported similar results. However, inorganic source 150 kg N + 60 kg P_2O_5 + 60 K_2O/ha increased the millable canes by 56.1%, cane length by 57.1%, cane weight by 63.3% and cane girth by 16.9% over the control in plant cane.

Cane yield

Cane yield of plant and ratoons crops increased significantly with pressmud @ 30 tonnes/ha over the control. Similarly, pressmud + fertilizer treatments (average of T_3–T_8) increased the yield of plant cane by 75.2% and of ratoon cane by 82.3% over the control. However, pressmud @ 30 tonnes/ha + 120 kg N/ha resulted in 93.5% higher cane yield than 83.0% with 150 kg N + 60 kg P_2O_5 + 60 kg K_2O/ha over the control (Table 2). This indicates that pressmud application either alone or in combination with fertilizers was more effective for ratoon crop compared with inorganic source. Kanwar *et al.* (1987), Yadhuvanshi *et al.* (1990) and Yadhuvanshi and Yadav (1992) also reported beneficial effect of pressmud application.

Application of 150 kg N + 60 kg P_2O_5 + 50 kg K_2O/ha recorded significantly higher

Table 1. Yield attributes of plant and ratoon crops of sugarcane as affected by pressmud and fertilizer treatments (pooled data of 2 years)

Treatment	Tillers ('000/ha)		Millable canes ('000/ha)		Cane length (cm)		Cane weight (g)		Cane girth (cm)	
	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
T_1	99.5	44.8	75.3	34.2	178	124	526	368	5.9	4.1
T_2	129.2	64.6	92.6	50.7	213	170	613	429	6.2	4.3
T_3	134.3	67.2	97.9	53.8	223	183	568	461	6.3	4.4
T_4	139.6	69.8	103.2	56.7	227	194	742	519	6.4	4.5
T_5	135.2	70.3	99.0	54.4	233	188	726	508	6.3	4.4
T_6	145.2	79.8	105.7	60.1	261	214	774	542	6.6	4.6
T_7	136.7	71.0	99.7	50.8	240	194	737	516	6.4	4.5
T_8	151.0	89.5	111.5	7.69	272	223	838	767	6.6	5.3
T_9	159.2	74.8	117.6	58.6	280	165	859	502	6.9	4.3
T_{10}	137.3	59.0	82.7	33.1	243	150	757	545	6.4	4.2
CD (P = 0.05)	4.4	2.8	5.0	6.0	21	11	8	10	0.1	0.2

Details of treatments are given in text

Table 2. Sucrose (%), sugar (%), commercial cane sugar (tonnes/ha), yield and economic gain as affected by pressmud and fertilizer application (pooled data of 2 years)

Treatment	Sucrose (%)		Sugar (%)		Commercial cane sugar(tonnes/ha)		Cane yield (tonnes/ha)			Input (Rs/ha)	Economic grain (Rs/ha)			Over control	Benefit : cost ratio
	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Total		Plant	Ratoon	Total		
T_1	15.85	15.92	10.6	10.7	4.20	2.92	39.7	24.3	67.0		19,056	13,104	32,160		
T_2	15.65	15.96	10.5	10.6	6.17	3.83	58.8	37.3	93.0	900	28,224	14,976	43,200	11,096	12.32
T_3	15.60	15.91	10.5	10.6	6.65	4.30	63.3	40.6	103.9	1,260	29,124	19,488	48,612	16,452	13.05
T_4	15.65	15.96	10.5	10.5	7.22	4.58	68.8	43.7	112.5	1,620	31,404	20,976	52,380	20,220	12.48
T_5	15.60	15.91	10.3	10.5	6.79	4.37	66.0	44.7	107.7	1,260	30,420	20,016	50,436	18,276	14.50
T_6	15.65	15.96	10.4	10.6	7.36	4.82	70.8	45.5	116.3	1,620	32,364	21,840	54,204	22,044	13.60
T_7	15.45	15.75	10.3	10.5	7.29	4.57	69.5	43.6	113.1	1,260	32,100	20,928	53,028	20,868	16.56
T_8	15.65	16.12	10.5	10.8	8.29	5.47	79.0	50.7	129.7	1,620	36,300	24,336	60,636	28,476	17.57
T_9	15.15	15.45	9.9	9.9	8.36	3.80	84.5	38.4	122.9	1,900	38,660	18,432	57,092	24,932	13.12
T_{10}	15.20	15.35	10.0	9.8	6.25	2.45	62.5	25.0	87.5	950	29,050	12,000	41,050	8,890	9.35
CD (P = 0.05)	NS	0.12	0.1	0.2	0.12	0.52	3.5	3.1	3.3						

Details of treatments are given in text

cane yield (84.5 tonnes/ha) of plant crop compared with all the treatments. The poor availability of nutrients due to slow decomposition of pressmud in plant crop caused significant reduction in yield attributes and yield under pressmud + fertilizer treatments (Tables 1, 2). However, pressmud @ 30 tonnes/ha + 120 kg N/ha gave significantly higher yield of plant cane than the other pressmud + fertilizer treatments. Thus, 2 or 3 splits of N proved more effective than to basal or top-dressing of N at 1 time. As the soil requires adequate nutrients for initial establishment, tillering, millable cane and yield attributes, and thus resulted in higher cane yield under 150 kg N + 60 kg P_2O_5 + 50 kg K_2O/ha.

Plant crop receiving pressmud @ 30 tonnes/ha + 120 kg N/ha gave 32 and 5.5 % more ratoon cane yield and total cane production (plant + ratoon) respectively over 150 kg N + 60 kg P_2O_5 + 50 kg K_2O/ha. This indicated greater effect of combined application of pressmud + fertilizer in ratoon crop compared than inorganic source because of prolonged availability of nutrients due to complete decompostion of pressmud for ratoon crop.

Quality

Application of pressmud @ 30 tonne/ha significantly improved sugar commercial cane sugar (% and tonnes/ha) over the control; however, pressmud @ 30 tonnes/ha + 120 kg N/ha resulted significantly better sucrose (%) and sugar (%) compared with the recommended dose of fertilizer (Table 2). Commercial cane sugar was significantly higher with pressmud @ 30 tonne/sha + 120 kg/ha than the other treatments. These results are in conformity with those of Singh *et al.* (1986) and Kanwar and Kapur (1987), who reported improvement in Juice quality owing to pressmud application in ratoon crop.

Economics

Inorganic source 150 kg N + 60 kg P_2O_5 + 50 kg K_2O/ha showed higher net return (Rs 38,660/ha) in plant cane but pressmud @ 30 tonnes/ha + 120 kg N/ha gave higher return (Rs 23,336/ha) in ratoon crop. However, total net return and benefit : cost ratio were higher by 6.2% and 33.9% respectively under pressmud @ 30 tonnes/ha + 120 kg N/ha than those under recommended dose of fertilizer. The lowest benefit : cost ratio of 9.35 was recorded under 75 kg N + 30 kg P_2O_5 + 25 kg K_2O/ha.

REFERENCES

Kale, S. P. 1981. 'Processing and utilization for pressmud cake as a source of enrich manure'. Ph.D. Thesis, Indian Agricultural Research Institute, New Delhi, (Unpublished).

Kanwar, R. S. and Kapur, J 1987. Direct and residual effects of sulfitation pressmud cakes on the yield, quality and nutrient of sugarcane (*Saccharum officinarum*). *Indian Sugar Crops Journal* **13** (4) : 1–5.

Kanwar, R. S., Singh, N. and Kapur, J. 1987. Effect of sulphitation and carbonation pressmud cakes on the yield and qualtiy of Sugarcane. *Indian Sugar Crops Journal* **13** (2 & 3) : 17–20.

Kumar, V. and Mishra, D. 1992. Manurial value of pressmud cake (Ganna-khoi). *Indian Farmers Digest* **25** (11) : 33–34.

Singh, K. D. N., Prasad, C. R. and Singh, Y. P. 1986. Comprative study of pyrite and suphitation pressmud on soil properties, yield and quality of sugarcane in calcareous saline sodic soil of Bihar. *Journal of Indian Society of Soil Science* **34** : 152–154.

Spencer, B. P. and Meade, G. P. 1964. *Cane Sugar-Handbook*, edition 2, pp. 433–37 John Wiley & Sons.

Yadhuvanshi, N. P. S. and Yadav, D. V. 1992. Effect of direct, residual and cumulative application of pressmud with nitrogen on soil properties and on yield and quality of sugarcane. *Indian Journal of Sugarcane Technology* **7** (1) : 33–39.

Yadhuvanshi, N. P. S., Yadav, D. V. and Singh, T. 1990. Effect of sulphitation pressmud and nitroen fertilizer on biomass, nitrogen economy and plant composition in sugarcane and on soil chemical properties. *Journal of Agricultural Science*, Cambridge **114** (3) : 259–263.