

Effect of press mud Application on the yield and Nutrient uptake by bhendi in soils of Tamil Nadu

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A pot culture experiment was carried out on four soils representing black, red, lateritic and alluvial soils of Tamil Nadu amended with press mud at 0, 10 and 20 tons/ha and bhendi was grown as test crop. The yield of bhendi fruits recorded a significant increase with press mud application at both the levels (10 and 20 tons/ha) over control in all the four soils, the comparative increase in yield over control being the highest in red soil. The higher level of press mud (20 tons/ha) tried did not prove superior to the lower level (10 tons/ha). The yield of dry matter and uptake of nutrients N, P, K and Ca also followed the same trend, recording a significant increase due to press mud treatments over control.

Press mud, one of the important by-products obtained from the sugar industry has been used as soil conditioner, manure or ameliorant for soil improvement purposes for the past many years. It contains large proportions of organic matter and calcium, along with considerable amounts of nitrogen and phosphorus and also some micronutrients. In sandy soils it can improve the moisture and nutrient retention properties, while in heavy clays it can assist in soil aeration and permeability mainly on account of its organic matter and calcium contents. It can also influence the number of microbes in the rhizosphere in favour of beneficial rather than harmful organisms (Alexander, 1972). Press mud had been used for effecting reclamation of saline, alkali and saline-alkali soils. It has also been found effective in reclamation of acid soils when added on the basis of its calcium content. A number of workers have found that it could substitute for single

or triple superphosphate in sugarcane fertilization programmes (Patil *et al.*, 1978). Increased yields of tomatoes, sugar beet, peppers, sweet potato and pine apple due to press mud application have also been reported.

This paper gives an account of a study carried out to investigate the influence of press mud application on the yield and nutrient uptake of bhendi raised in four different soils of Tamil Nadu.

MATERIAL AND METHODS

Four surface soils representing black, red alluvial and lateritic soils collected from Coimbatore and Nilgiri districts were used for pot culture studies. The soils were clayey in texture with the clay content ranging from 38.5 percent in lateritic soil to 50.0 percent in red soil. The available phosphorus was medium in red, black

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and alluvial soils and high in lateritic soil. The available nitrogen ranged from low in red soil to medium in lateritic soil, while the available potassium ranged from medium in red soil to high in black and alluvial soils. The available calcium was low in lateritic and red soils and high in alluvial and black soils. The pH of the soil was alkaline in alluvial and black soils (8.2 and 8.3) and acidic in red and lateritic soils (5.9 and 5.4). The red and black soil were poor in organic carbon status while the alluvial soil was medium and lateritic soil high in this constituent. Press mud obtained from Sakthi Sugars, Appakudal, Periyar district, and analysing 3.16% N, 8.40% P_2O_5 , 13.45% CaO, 0.90% K_2O and 17.0% organic carbon on dry weight basis and 12.7% moisture was used for the study.

The experiment was laid out with four soils with three treatments, viz. press mud at 0, 10 and 20 tons per hectare replicated two times in a completely randomised block design. The fertilizer schedule as per standard recommendation (NPK: 20, 50, 30 kg/ha) was adopted for all the treatments.

Level of press mud T/ha	0	10	20	C.D. (P=0.05)
Mean weight of fruits (g/pot)	5.96	6.52	7.77	1.43

The yield of fruits (fresh weight) increased significantly with press mud application.

Level of Press mud T/ha	0	10	20	C.D. (P=0.05)
Mean yield of fruits g/pot	23.4	38.5	42.1	6.99

Among the soils lateritic soil recorded the highest yield which was superior to alluvial, black and red soils.

Soil	Alluvial	Black	Lateritic	Red	C. D. (P=0.05)
Mean yield of fruits (g)	3.45	27.7	52.2	24.4	8.07

Seeds of the test crop bhendi *Abelmoschus esculentus* (Moench) variety Pusa Sawani were sown in pots. The crop was raised under green house conditions adopting all necessary plant protection measures. The fruits were harvested as and when mature and their fresh weights recorded. The plants were finally harvested and their dry weights recorded.

The fruits and plants were separately dried, sampled and analysed for N, P, K and Ca contents and the uptake of these nutrients was calculated. The soil samples collected at harvest were analysed for their available nutrient status and carbondioxide evolution.

RESULTS AND DISCUSSION

The data of mean length and weight of bhendi fruits, yield of fruits and dry weight of stalk are given in Table I. The mean fruit length did not differ significantly for treatments or soils. The mean fruit weight increased significantly for the treatment 20 tons press mud per hectare as compared to no press mud application.

The yield of dry matter (stalk) differed significantly for treatments, soils and their interaction. Press mud at 20 tons/ha recorded the highest yield on a par with press mud at 10 tons/ha and superior to control.

Level of press mud T/ha	0	10	20	C. D. (P=0.05)
Mean yield of dry matter (g/pot)	5.2	7.4	8.1	1.28

Among the soils lateritic soil recorded the highest yield superior to the other soils.

Soil	Alluvial	Black	Lateritic	Red	C.D. (P=0.05)
Mean dry matter yield g/pot	7.1	5.6	9.7	5.2	1.48

Among the soils the red soil appeared to benefit the most from press mud application on with an increase in yield amounting to three times that of control. This may probably be due to the inherent low nutrient status of the red soil as compared to the other soils studied Alexander (1972) and Prasad (1976) reported higher yields of sugarcane due to press mud application. Samuels and Landrau (1955), Fernandez

(1962) and Azzam (1963) reported increased yields of pine apple, peppers and sweet potato due to press mud application.

The uptake of nutrients by bhendi fruits are shown in Table II. The nitrogen uptake varied significantly for treatments as well as soils. Press mud application at both the levels increased the uptake of nitrogen by fruit significantly over control.

Level of press mud T/ha	0	10	20	C. D. (P=0.05)
Mean N uptake by fruits mg/pot	48.6	78.5	90.8	19.89

Among the soils lateritic soil recorded the highest uptake of nitrogen by fruits superior to the other soils.

Soil	Alluvial	Black	Lateritic	Red	C.D. (P=0.05)
Mean N uptake by fruits mg/pot	77.6	56.3	106.3	50.3	22.97

The uptake of phosphorus and potassium by fruits also showed a similar trend, Press mud application at both the levels increased the P and K uptake over that of control.

Level of press mud kg/ha	0	10	20	C.D.(P=0.05)
Mean P uptake by fruits mg/pot	6.8	14.9	17.2	3.28
Mean K uptake by fruits mg/pot	37.1	70.3	80.1	16.74

Among the soils, lateritic soil resulted in the highest uptake of P and K by fruits.

Soil	Alluvial	Black	Lateritic	Red	C. D. (P=0.05)
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Mean uptake of P by fruits (mg/pot)	14.3	11.4	17.8	8.4	3.78
Mean uptake of K by fruits (mg/pot)	75.7	50.5	82.3	41.6	19.33

The uptake of calcium by fruits differed significantly for treatments, soils and their interaction. In the lateritic soil, the treatment press mud 10 tons/ha was superior to press mud 20 tons/ha and control, while in red soil, the treatment 20 tons/ha press mud was superior to tons/ha level and control. In black and alluvial soils, the two levels were on a par and superior to control.

The uptake of nutrients by stalk

showed similar trends as in the case of fruits.

The total uptake of nutrients by fruits and stalk are given in Table III. The total uptake of nitrogen differed significantly for soils and treatments. The two levels of press mud were superior to control and among the soils lateritic soil was superior to the alluvial black and red soils.

Level of press mud T/ha	0	10	20	C.D. (P=0.05)	
Mean total N uptake mg/pot	99.7	144.4	165.4	24.53	
Soil	Alluvial	Black	Lateritic	Red	C.D. (P=0.05)
Mean total N uptake mg/pot	151.8	109.4	194.3	90.7	28.33

The total uptake of phosphorus differed significantly for treatments, soils and their interaction. In the black and lateritic soils the three treatments 0, 10 and 20 tons press mud/hectare were significantly different from each other and showed a progressive increase

in P uptake with increasing level of press mud. In the of alluvial soil 10 tons press mud was superior to the 20 tons level and control, In the red soil 20 and 10 tons levels of press mud were on a par and superior to control.

The total uptake of potassium by fruits and stalk was significantly higher for press mud treatments as compared to control.

Level of press mud T/ha	0	10	20	C.D. (P=0.05)	
Mean total K uptake mg/pot	87.8	138.5	155.4	21.61	

Among the soils the lateritic and alluvial soils were on par superior to black and red soils.

Soil	Alluvial	Black	Lateritic	Red	C.D. (P=0.05)
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Mean total K

uptake (mg/pot)	153.2	117.0	158.0	80.6	24.96
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The total calcium uptake by fruits and stalk differed significantly for treatments, soils and their interaction. While there was increase in calcium uptake due to treatments in alluvial soil, in black soil 20 tons press mud level was superior to no press mud but on par with 10 tons level. In the lateritic soil 10 tons level of press mud was superior to 20 tons level and control, while in red soil the 20 tons level was superior to 10 tons level and control.

The analysis of soil samples taken at harvest of the crop are given in Table IV. The available nutrient status of the soil was found either to increase or to be atleast equal to that of control, inspite of the increased yield obtained. The CO₂ evolution was higher, particularly in the 20 tons press mud treatment as compared to no press mud. Prasad (1976) also reported increased extractable P, K, Ca and Mg of soil and increased availability to sugarcane crop due to press mud application.

The results clearly indicate the beneficial influence of press mud application on the yield and uptake of nutrients by bhendi crop, the lower level of 10 tons/ha being adequate. The higher uptake of nutrients from lateritic soil as compared to the other soils corresponded to the trend in crop yield and may be due to the higher available nitrogen content of the lateritic soil and also other soil conditions being more favourable for the crop. The alluvial soil was next to the lateritic soil and was

followed by the black and red soils. The general increase in N, P, K and Ca uptake in the case of press mud treatments as compared to no press mud is presumably due to the increased availability of these nutrients induced by press mud. Chinloy *et al* (1953), Karim *et al* (1974) and Patil *et al* (1978) have reported that the phosphorus of press mud was equivalent to that of single or triple superphosphate. Prasad (1976) also reported higher N, P and K contents of sugarcane leaves in press mud treated soil as compared to control besides increase in sugar content of the cane.

The authors are grateful to the Tamil Nadu Agricultural University for permission accorded to publish the data which formed a part of the first author's thesis work. They acknowledge with thanks the help rendered by M/s. Sakthi Sugars, Appakudal in providing the press mud used for the study.

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Table 1 Influence of Press Mud Application on the Length and Weight of Bhendi Fruits and Yield of Fruits and Stalks (Mean of 2 replications)

Particulars	Treatment	Alluvial soil	Black soil	Lateritic soil	Red soil
Mean length of fruit in cm	1	9.2	10.1	9.5	10.6
	2	8.5	8.0	11.0	8.7
	3	10.8	7.1	10.0	10.0
Mean weight of fruit fresh weight in g	1	5.61	5.53	6.65	6.08
	2	6.17	5.21	8.83	5.86
	3	8.15	8.51	7.06	7.36
Fresh weight of fruits: g/pot	1	22.8	20.5	39.7	10.7
	2	38.5	28.7	57.7	29.8
	3	42.3	38.9	59.3	33.1
Dry weight of stalk: g/pot	1	7.32	4.80	5.19	3.63
	2	8.78	4.70	10.64	5.38
	3	5.17	7.28	13.17	6.75

C.D. (P=0.05) = 2.57

Treatments: 1. No. press mud. 2. Press mud 10 tons/ha. 3. Press mud 20 tons/ha

Table II Influence of Press Mud Application on the Nutrient Uptake by Bhendi Fruits
(Mean of 2 replications)

Particulars	Treat- ment	Alluvial soil	Black soil	Lateritic soil	Red soil
Nitrogen uptake by fruits: mg N/pot	1	41.7	41.9	91.7	19.2
	2	96.8	61.8	99.2	56.3
	3	94.3	65.1	128.2	75.5
Phosphorus uptake by fruits: mg P/pot	1	7.4	6.9	10.4	2.5
	2	18.6	13.0	19.2	8.8
	3	16.9	14.2	23.8	14.0
Potassium uptake by fruits: mg K/pot	1	39.3	32.9	61.0	15.4
	2	97.0	55.0	84.1	45.3
	3	91.0	63.7	101.8	64.1
Calcium uptake by fruits: mg Ca/pot	1	19.1	17.9	45.2	10.2
	2	63.2	53.3	106.2	33.5
	3	34.7	48.5	67.8	71.9

C.D. (P=0.05) = 25.88

Table III Influence of Press Mud Application on Total Uptake of Nutrients by Bhendi Crop
(Mean of 2 replications)

Particulars	Treat- ment	Alluvial soil	Black soil	Lateritic soil	Red soil
Nitrogen uptake: mg N/pot	1	134.0	78.9	158.9	47.2
	2	176.5	107.8	196.0	97.6
	3	144.9	141.5	248.0	127.5
Phosphorus uptake: mg P/pot	1	24.3	16.0	18.2	6.5
	2	40.6	27.0	39.4	16.8
	3	29.8	39.7	56.7	23.4
Potassium uptake: mg K/pot	1	112.5	86.9	106.4	45.3
	2	195.5	107.7	163.9	86.8
	3	151.7	166.4	203.8	109.0
Calcium uptake: mg Ca/pot	1	209.8	162.0	190.6	112.5
	2	263.5	203.5	489.5	119.0
	3	169.0	281.5	305.5	287.5

C.D. (P=0.05) = 8.31

C. D. (P=0.05) = 83.74

Table IV Influence of Press Mud Application on the Soil Properties At Harvest of Bhandl Crop.

Particulars	Treatment	Alluvial soil	Black soil	Lateritic soil	Red soil
Available N (ppm)	1	102	93	198	117
	2	107	126	135	118
	3	126	111	150	129
	1	12	27	17	8
	2	27	24	25	15
	3	29	64	22	28
Available K (ppm)	1	420	490	280	250
	2	420	600	330	250
	3	450	450	350	280
Available Ca (ppm)	1	4200	4600	3100	2600
	2	4100	4900	3400	2600
	3	4300	4700	3500	2800
Co ₂ evolution mg/100g soil/day	1	2.86	2.90	4.71	2.45
	2	3.47	2.95	4.70	2.45
	3	3.24	3.00	5.48	3.72