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Influence of Press Mud Application on Yield and Uptake of Nutrients by Finger Millet in Some Soils of Tamil Nadu.

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A pot experiment was carried out to study the influence of press mud application at 0, 10 and 20 tons per hectare using four soils representing black, red, alluvial and lateritic soils and finger millet (*ragi* Co 10) as test crop. The results showed progressively significant increase in grain yield with increasing levels of press mud in lateritic and red soils. whereas in the case of black and alluvial soils the yield increased significantly with application of 10 tons press mud perhectare and there was no further increase with the higher level of press mud. The uptake of nutrients N, P and K also showed significant increases with press mud application and this was more pronounced in the red and lateritic soils than in the black and alluvial soils. The soils were left generally with a higher or at least equal available nutrients status in the press mud tretments in spite of the higher yields as compared to the control.

Press mud an important by product of the sugar industry, contains considerable quantity of Calcium, organic matter and phosphorus along with nitrogen. potassium and minor nutrients in varying quantities. It has generally been used as soil conditioner and soil reclamation agent in the case of acid and alkali soils and also as phosphorus source for sugarcane fertilization. There are no reported studies on the effect of press mud on yields of cereal crops like finger millet. The present study was undertaken to study the influence of press mud treatment of soils on the growth, yield and uptake of nutrients by finger millet and to determine the optimum level of application in different soils.

MATERIAL AND METHODS

Four soils representing black, red, lateritic and alluvial soil groups collected from Coimbatore and Nilgiris were used for pot studies. The black and alluvial soils were alkaline in reaction with pH 8.2 and 8.3 whereas the lateritic and acid soils were acidic in reaction with pH 5.4 and 5.9 respectively. Press mud obtained from Sakthi Sugars, Appakudal, Erode, analysing 12.7% moisture and 3.16% N, 8.40% P_2O_5, 13.45% Cao, 0.90% K_2O and 17% organic carbon on dry weight basis was used for the study.

The experiment was laid out with the four soils, with the following 3 treatments viz. press mud at 0, 10 and 20 tons/ha replicated three times in a randomised block design. The fertilizer schedule recommended for finger millet viz. N, P, K at 90, 45, 45 kg/ha in the form of urea, super phosphate and muriate of potash, was given to all treatments; the nitrogen being given in two doses one at planting and one at 21 days after planting.

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Finger millet (*ragi* Co. 10) seeds were sown on 23-1-1978 and the seedlings transplanted on 9-2-78. The necessary plant protection measures were adopted. The height of plant and number of tillers were recorded. The earheads were harvested from 18-5-78 on wards and the straw was harvested on 22-5-78. The dry weights of grain and straw were recorded. The grain and straw samples were analysed for N, P and K contents and the uptake of nutrients calculated.

Soil samples collected after harvest of crop were analysed for available nutrients, carbondioxide evoluation. and microbial population.

The available nitrogen content of soil was estimated by the alkaline permanganate method (Subbiah and Asija, 1956) and the available phosphorus of soil by the method of olsen *et al.* (1954). The available potassium was estimated in the normal neutral ammonium extract of soil using Flame photometer. The soil reaction and electrical conductivity were determined in 1:2 soil-water suspension. The carbon-di-oxide evolution was determined as per the method described by Chesters *et al.* (1957). The populations of bacteria, fungi and actinomycetes were determined by the serial dilution and plate count method using soil extract agar, Rose Bengal agar and Kuster's agar medium respectively.

RESULTS AND DISCUSSION

The mean height of the crop was found to be significantly higher for the treatments 20 and 10 tons press mud/ha in the case of lateritic soil alone. Among the soils the height of the plant was significantly higher in red soil as compared to the other 3 soils. These results show the beneficial effect of press mud application on growth of the crop in the lateritic soil (Table 1).

The mean number of ear heads was significantly higher for the treatment of press mud 20 tons/ha as compared to 10 and o levels of press mud thus showing the beneficial effect of the higher level of press mud application in this regard.

Press mud level kg/ha	0	10	20	C. D. (P=0.05)
Mean number of earhead	4.3	5.3	6.8	1.33

The yield of grain was found to increase progressively with increasing level of press mud application in the case of red and lateritic soils. In the case of black and alluvial soils, the yield increased significantly for the treatment 10 tons press mud/ha application, but the increase obtained in the treatment 20 tons/ha level over the 10 tons/ha level of press mud did not attain the level of significance. The results showed a higher response to press mud application in the red and lateritic soils both of which were poor in calcium status and acid in reaction, the red soil also being poor in organic matter and nutrient contents as compared to the other soils. The highest yield obtained with 20 tons press mud/ha in red soil showed that press mud application could be most beneficial in soils that are acid in reaction and poor in organic

matter. In the case of lateritic soil also the yield increase was so spectacular as compared to the very poor yield obtained in the control treatment which received no press mud, thus showing the favourable effect of press mud application in these soils. The results also show the possibility of further enhancement of yield by higher levels of application of press mud.

In the case of the black and alluvial soils which are alkaline in reaction, the application of 10 tons press mud/ha was effective in increasing the grain yield over control, as there was no further significant increase over this by the application of 20 tons press mud/ha. Between the two soils the treatment was found to be more effective in black soil with the yield increase almost 5 times that of control as compared to an increase of 2 times the control yield in the case of the alluvial soil Higher yields of sugarcane by application of press mud / have been reported by Alexander (1972), Golden (1976) and Prasad (1976) for varying rates of application. Higher yields due to press mud application have also been reported in pineapple, peppers and sweet potato (Samuels and Landrau. 1955; Fernandez, 1962; Azzam, 1963 and Azzam and Samuels, 1964) and sugarbeet and wheat (Bogdonova *et al*. 1970.)

The straw yield also increased significantly with press mud application in all the four soils showing a similar trend as in the case of grain yield. Among the soils red soil gave the highest yield superior to the yield from the other three soils.

The uptake of nitrogen in grain increased significantly with press mud application in all the four soils studied. While the uptake of nitrogen progressively increased with level of press mud in the case of red and lateritic soils. the two levels of press mud were on a par in the case of black and alluvial soils (Table 2)

The phosphorus uptake by grain increased progressivley with increasing level of press mud tried irrespective of the soils, probably due to the higher availability of phosphorus in the treatments as compared to control.

The potassium uptake in grain increased progressively with press mud application in the red and lateritic soils. In the case of black soil, press mud application at 20 and 10 tons/ha increased the potassium uptake over control, whereas in the alluvial soil, press mud at 20 tons / ha increased potassium uptake in grain over 10 and 0 tons of press mud.

The uptake of nitrogen in straw progressively increased with increasing levels of press mud application in the lateritic soil whereas in the other three soils the application of 20 tons press mud/ha increased the nitrogen uptake over control. The phosphorus uptake in straw also progressively increased with press mud application in lateritic soil. The potassium uptake was higher in the treatment press mud 20 tons/ha as compared to control.

The increase in uptake of nutrients nitrogen, phosphorus and potassium in press mud treated soil over control may

be due to the increased availability of these nutrients and improved soil conditions including physical, chemical and biological properties of soil. 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) reported that when press mud was applied in quantities as high as 20 tons per ha on dry weight basis, no phosphate fertilizer was required for sugarcane. Prasad (1976) also reported higher N, P and K contents of sugarcane leaves in press mud treatments as compared to control besides an increase in sugar content of the cane resulting in increased production of cane sugar.

There was a significant positive correlation between yields of grain and straw ($r=0.830^{xxx}$). Similarly highly positive correlations were observed between nitrogen and phosphorus uptake in grain ($r=0961^{xxx}$) and straw ($r=0.858^{xxx}$), nitrogen and potassium uptake in grain ($r=0.937^{xxx}$) and straw ($r=0\ 826^{xxx}$) and phosphorus and potassium uptake in grain ($r=967^{xxx}$) and straw ($r=0.868^{xxx}$) thereby showing that these normal correlations which have been established by previous workers were not influenced by press mud application. Chandrasekaran (1967) observed similar correlations for uptake of nitrogen, phosphorus. potassium, calcium and magnesium by paddy crop at various stages. Similarly Ramaswami (1969) observed close correlations among N, P and K uptake values of paddy grain, straw and roots. The close correlations among the uptake values for nutrients would make it possible to predict with reasonable accuracy the uptake of one nutrient from a kowledge of the other. The close relatioships between uptake values in the present, study were observed in four soils and treatments, thereby showing the absence of soil and treatment effects on these relations.

The analysis of the post harvest soils showed that the available N content of soil was higher in press mud treatments than control in the case of alluvial and lateritic soils, while in black soil the treatment 20 tons press mud/ha had a higher available N than the lower level of press mud and control. In the case of red soil however the control plot had a slightly higher available N content than the treatments. The available phosphorus content was also higher in the treatments as compared to control particularly in the alluvial and black soils. The available K content varied only slightly among the treatments in the four soils.

The carbon-di-oxide evolution. which is an index of the biological activity of the soil was higher in press mud treatments as compared to control in the alluvial, black and lateritic soils. whereas in the red soil, the treatment press mud 20 tons/ha showed a slightly higher value than control. Similar variations were found in the population of bacteria, fungi and actinomycetes.

There is a slight reduction in pH of the press mud treated soil as com-

pared to control in the case of black soil (Table 4). Thus there seems to be an overall improvement of the soil properties which have been responsible for the higher yields in the treatments than control.

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TABLE-1 Influence of Press mud Application on Height of Crop, Earhead Number and Yield of Finger Millet Grain and Straw (Mean values of 3 replications).

Particulars	Treatment	Alluvial soil	Black soil	Lateritic soil	Red soil
Mean height in cm	T_1	49.8	47.6	37.7	54.8
	T_2	43.9	41.9	49.3	53.6
	T_3	45.7	45.0	53.0	53.9
	C. D. (P=0.05)=5.30				
Earhead number	T_1	4.7	5.3	3.0	4.0
	T_2	5.7	5.3	5.3	5.0
	T_3	6.3	7.0	7.0	6.7
Grain yield dry weight g/pot	T_1	2.57	0.90	0.10	0.09
	T_2	4.69	4.32	3.75	5.67
	T_3	6.68	5.78	7.89	9.30
	C. D. (P=0.05) for comparing yield x treatment=2.09				
Straw yield dry weight g/pot	T_1	8.60	7.40	5.29	9.24
	T_2	10.19	8.04	10.38	13.33
	T_3	12.79	10.16	13.73	15.15

T_1 – No press mud

T_2 = Press mud 10 tons/ha

T_3 – Press mud 20 tons/ha

TABLE 2 Influence of Press Mud Application on uptake of Nurtient by Finger Millet Grain and Strain (Mean values of 3 replications)

Particulars	Treatment	Alluvial soil	Block soil	Lateritic soil	Red soil
Nitrogen uptake in grain mg/pot	T_1	37.8	12.0	2.2	2.0
	T_2	62.2	45.4	60.3	59.5
	T_3	65.4	60.4	94.3	104.0
	C. D. (P=0.05)=27.37				
Phosphorus uptake in grain mg/ P/Pot	T_1	21.3	6.2	0.8	0.8
	T_2	36.3	31.3	29.1	38.8
	T_3	56.8	43.1	60.3	62.2
Potassium uptake in grain mg K/pot	T_1	10.9	4.5	0.9	0.8
	T_2	17.6	24.9	18.7	25.5
	T_3	30.0	33.0	37.5	44.2
	C. D. (P=0.05)=9.97				
Nitrogen uptake in straw mg N/pot	T_1	60.2	46.7	51.9	71.2
	T_2	78.4	56.3	76.4	74.6
	T_3	80.6	71.1	120.2	84.9
	C. D. (P=0.05)=20.06				
Phosphorus uptake in straw mg P/pot	T_1	69.9	59.3	43.0	56.6
	T_2	91.7	58.3	75.3	91.7
	T_3	89.5	86.4	106.4	98.5
	C. D. (P=0.05)=20.30				
Potassium uptake in straw mg K/Pot	T_1	107.5	90.7	87.3	138.6
	T_2	101.9	120.6	176.2	163.3
	T_3	182.2	152.4	195.8	185.6
	C. D. (P=0.05) = 37.07				

itic oil	Red soil
.2	2.0
3	59.5
3	104.0
	0.8
	38.8
	62.2
	0.8
	25.5
	44.2
	71,2
	74.6
	84.9
	56.6
	91.7
	98.5
	138.6
	163.3
	185.6

TABLE 3 *Initial analysis of soils used for the experiment*

Particulars	Alluvial soil	Black soil	Lateritic soil	Red soil
Available N (ppm)	142	115	174	113
Available P (ppm)	10	12	23	6
Available K (ppm)	420	390	190	170
Bacteria 10^5/g)	28.0	46.0	3.4	23.0
Fungi (10^3/g)	3.3	7.0	5.0	2.0
Actinomycetes (10^3/g)	2.2	1.0	4.0	5.5
pH	8.2	8.3	5.4	5.9

TABLE 4 Influence of Press Mud Application on Properties of soils Taken After Harvest of the Crop

Particulars	Treatment	Alluvial soil	Black soil	Lateritic soil	Rad soil
Available N (ppm)	T_1	117	95	197	117
	T_2	122	91	223	113
	T_3	144	112	222	116
Available P (ppm)	T_1	14	16	22	9
	T_2	35	18	47	8
	T_3	33	18	57	25
Available K (ppm)	T_1	400	450	220	250
	T_2	410	430	250	230
	T_3	430	470	240	300
Co_2 evolution mg/100 g of soil/day	T_1	2.88	2.53	5.48	3.37
	T_2	4.18	2.67	6.26	2.15
	T_3	4.04	4.60	6.27	3.57
Bacteria (10^5/g)	T_1	21.5	18.7	1.8	3.1
	T_2	30.2	23.3	6.6	3.6
	T_3	20.0	12.7	3.3	5.9
Fungi (10^3/g)	T_1	3.0	4.0	5.5	3.3
	T_2	4.0	13.9	32.0	8.9
	T_3	5.0	32.9	25.0	3.3
Actinomycetes (10^3/g)	T_1	9.5	8.0	10.9	31.1
	T_2	11.6	11.2	72.0	35.5
	T_3	14.0	17.3	51.7	58.9
pH	T_1	8.5	8.8	7.0	8.2
	T_2	8.5	8.5	7.2	8.0
	T_3	8.4	8.3	7.1	8.2