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Short Communication

Effect of Application of Acidified Press Mud on Soil Properties, Nutrient Availability and Uptake by Khejri Trees in Arid Conditions

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In the arid areas of Bhiwani (Haryana), annual average rainfall is 350 mm only, and is concentrated mainly between July and September. Many times the rainfall occurs in one or two heavy spells. Most of the areas are rain-fed with no source of water for irrigation. There are sand dunes and soils have problems of *Kankar* layer and salt accumulation in the profile. Due to high temperatures and low cropping intensity, soils have very low organic carbon. The availability of nitrogen, phosphorus and micronutrients is also low. Presence of calcium carbonate further reduces availability of nutrients. The main crops during rainy season are pearl millet and clusterbean, which fail frequently due to low and erratic distribution of rainfall. Irrigation through tube wells is restricted as the ground waters are highly saline. Satyanarayana (1964) reported that *Prosopis cineraria* is one leguminous tree, which grows well against all odd climatic conditions and holds an increasingly important place in the economy of Indian desert. Singh and Lal (1969) and Sharma (2005) reported *Prosopis cineraria* improved the soil fertility leaf litter and also the soil maintained higher moisture beneath this tree. The animal population is very low in these areas and there is practically no source for addition of organic manures. Thus, there is a need to apply organic amendments like acidified press mud, a by-product from sugar industry. Large quantity of press mud is available and can be used in regions having calcareous soils. The press mud may decrease soil pH, dissolve some of the calcium carbonate and thus improve availability of nutrients in the soil.

An experiment was conducted on fields of Shri Ranbir Singh of village Dhani-Mau (Bhiwani). The surface soil samples (0-15 cm) were taken in 2001-03 and analyzed for physico-chemical properties. The soil was sandy loam in texture. The average soil pH, EC_2 and organic carbon (OC) were 8.37, 0.78 dS m^{-1} and 0.26%, respectively. In July, 2003 acidified press mud (APM) amendment was mixed in upper 15 cm soil in one meter square area around selected sixteen *Prosopis cineraria* trees of uniform growth. There were four treatments i.e. To = Control (no amendment), T_1= 5 kg APM/plant, T_2 = 10 kg APM/plant and T_3 = 15 kg APM/plant. Each treatment was replicated four times in the completely randomized block design. The final observations were taken sixteen months after application of APM or after two rainy seasons in November 2004. For chemical analysis, leaves of *Prosopis cineraria* were oven dried at 70°C, ground and passed through 16-mm sieve. HNO_3 and $HClO_4$ in a ratio of 3:1 were used to digest leaf samples. Na and K were analyzed using flame photometer and Ca, Mg and micronutrients by Atomic Absorption Spectrophotometer. Nitrogen and phosphorus were determined by Auto kjeldhal and vanado-molybdo-phosphroric-yellow color method, respectively. Soil samples were taken from 30 cm distance from the tree and 0-15 cm depths around *Prosopis cineraria*, where APM amendment was applied. Soil samples were air dried, ground in wooden pestle and mortar, passed through 16 mm sieve and stored for analysis. The soil pH, electrical conductivity, OC, available N, Olsen's P, and K, Ca+Mg, Na in soil saturation extracts and DTPA-extractable Zn, Mn, Fe and Cu were determined by standard procedures (Lindsay and Norvell, 1979).

Press mud having pH of 6.8 was brought from Karnal Co-operative Sugar Mills and APM of pH 4.0 was prepared by mixing low cost commercial grade sulphuric acid as described by Mehta (1998). The APM thus prepared and used had composition as given in Table 1.

Application of APM significantly lowered the soil pH of calcareous soils (Table 2). The reduction in pH was maximum in T_3. However, soil EC increased due to dissolved salts in the APM. OC, available nitrogen, available phosphorous

Table 1. Chemical composition of APM

pH (1:4)	4.00	Phosphorous	0.74%
EC (1:4)	9.00 dS m^{-1}	Potassium	0.34%
Organic carbon	24.23%	Fe	1021 ppm
Organic matter	41.67%	Zn	54 ppm
Total nitrogen	1.55%	Mn	124 ppm
Available nitrogen	0.07%	Cu	37 ppm
Moisture content = 12%			

significantly increased with the increasing levels of APM. Similar results leading to reduction in soil pH, increase in OC, available N and P were reported with the application of acidic materials. Singh *et al.* (1999) and Ibrahim *et al.* (1993) reported increased available P in soil due to press mud incorporation.

Potassium and Ca+Mg in soil saturation extract significantly increased, and Na content decreased with increasing APM doses (Table 2). The acidic nature of APM mobilizes the native Ca^{++}, which facilitates replacement of Na^{+} ions.

Increasing APM doses significantly increased the DTPA extractable micronutrients i.e. Zn, Fe and Mn (Table 3).

The application of APM significantly increased contents of N, P, K, Ca, Mg and Zn, Mn, Fe in the leaves of *P. cineraria* trees (Table 4). Thompe and More (1996) also reported that application of similar acidifying material like Press Mud Cake increased the uptake of N, P, K, by sunflower plant. These results are also in line with the results of Negm *et al.* (2002), who reported increased uptake of Ca and Mg) along with the micronutrients (Fe and Mn) by maize plant when FYM, which is acidic material was applied to calcareous soils. The Na concentration was more in control (T_0) and deceased at the higher doses (T_3) of APM treatment probably due to decrease in the exchangeable sodium as a result of APM application. Singh *et al.* (1999) also reported the low concentration of Na in leaves of pomegranate when acidic sulfinated cane filter cake amendment was used. Gupta *et al.* (1986) reported increased uptake of Zn by corn due to press mud cake application. APM application did not influence the uptake of Cu.

Table 2. Effect of application of APM of on soil properties and nutrients availability

APM doses treatment	pH (1:2)	EC (dS m^{-1})	OC (%)	Available N (kg ha^{-1})	Olson's P (ppm)	S.Ext. K (ppm)	S.Ext. Na (ppm)	S.Ext. Ca+Mg (me/l)
T_0	8.26	0.78	0.28	60.27	9.01	7.98	201.44	20.0
T_1	7.61	1.32	0.60	80.53	31.56	11.56	84.55	27.5
T_2	7.34	1.77	0.85	94.05	65.62	25.93	57.71	46.0
T_3	7.16	2.06	0.98	118.97	92.33	35.66	41.26	61.5
CD (P=0.05)	0.16	0.19	0.07	10.60	7.21	2.66	17.76	4.6

Table 3. Effect of application of APM on DTPA extractable micronutrients

APM doses	Micronutrient in ppm			
	Zn	Fe	Mn	Cu
T_0	0.70	2.91	10.64	0.65
T_1	1.44	3.85	16.92	1.39
T_2	2.90	4.44	25.12	2.98
T_3	3.15	5.19	40.27	1.67
CD (P=0.05)	0.26	0.46	3.52	1.77

Thus application of APM is useful in calcareous soils having impeded soils under rain-fed conditions for better growth of khejri (*Prosopis cineraria*) trees, and availability and uptake of nutrients.

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