International Journal of Engineering and Science Invention
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org ||Volume 5 Issue 12|| December 2016 || PP. 84-87

Effect of Application of Acidified Press Mud on Soil Properties, Nutrients Availability and Nutrients Uptake by Prosopis Cinerria in Arid Conditions.

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ABSTRACT:
To Study the effect of application of Acidified Press Mud (APM) amendment on soil properties, nutrients availability and nutrients uptake by Prosopis cineraria trees in arid conditions, an experiment was conducted on the farmer's field of Bhiwani district of Haryana. Acidified Press Mud (pH=4.0) organic amendment was applied and mixed in upper 15 cm. soil in one meter square area around the already exiting 8-10 years old selected sixteen Prosopis Cineraria trees of uniform growth during July 2003. Treatments were: T_0=Control (No amendment/plant), T_1=5Kg APM/plant, T_2=10Kg APM/plant and T_3=15Kg APM/plant. Each treatment was replicated four times in the completely randomized block design. To observe the effect of nutrient uptake in different treatments, leaf samples were taken in November, 2004 after sixteen month application of APM. Results showed that the mean concentration of N, P, K, Ca, Mg, and Zn, Mn, Fe in Prosopis Cineraria leaves were significantly increased with increasing doses of APM except sodium. Soil samples 0-15cm. depth were also taken from around the Prosopis cineraria trees in November 2004 to Results showed that the Soil pH decreased significantly with increasing doses of APM, beings minimum with T_3 treatment. Application of APM significantly increased soil O.C., available N, available P, and K, Ca+Mg in soil saturation extract and micronutrients i.e. Zn, Fe and Mn significantly increased with increasing doses of APM.
(***Key words:*** *calcareous, kankar, impeded, Acidified Press Mud, Prosopis Cineraria)*

I. INTRODUCTION:

In the arid areas of Bhiwani (Haryana), where the rainfall is 350 mm per annum only. The rainfall is mainly concentrated between July and September and many times the rainfall occurs in one or two heavy spells. Most of the areas are rain-fed having no source of water for irrigation. There are sandy 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 very low. Presence of calcium carbonate further reduces availability of plant nutrients. The main crops during rainy season are pearl millet and Cyamopsis tetragonoloba, which fail very frequently due to uneven 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 increased soil fertility by adding leaves and pods and also soil maintained higher moisture regimes under this tree. There is a need for planting of multipurpose forest trees like P. cineraria. The animal population is very low in these areas and there is practically no source for addition of organic manures in these areas. Under such situations, there is a need to use organic amendments like acidified press mud a byproduct from sugar industry. Large quantity of press mud is available can be converted into acidified press mud and used in regions having calcareous soils which may decrease soil pH, dissolve some of the calcium carbonate and thus improve availability of nutrients in the soil.

II. MATERIALS AND METHODS:

A field experiment was conducted on fields of Sh. Ranbir Singh of village Dhani-Mau (Bhiwani). The surface soil samples (0-15cm) were taken in 2001-03 and analyzed for physico-chemical properties. The soil was sandy loam in texture. The average soil pH, EC, and organic carbon were 8.37, 0.78 dS/m and 0.26%, respectively. In July, 2003 acidified press mud amendment was applied and mixed in upper 15 em. 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/plant), T_1= 5Kg APM/plant, T_2= 10Kg APM/plant and (T_3) = 15Kg APM/plant. Each treatment replicated four times in the completely randomized block design. The results are discussed based upon the final observations taken in Nov. 2004 after sixteen month application of APM or after two rainy seasons. For chemical analysis, leaves of Prosopis cineraria tree were oven dried at 70°C, ground and

passed through 16-mm sieve. HNO3 and HCIO, at 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 colour method, respectively. Soil samples were taken from the 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 16mm sieve and stored for analysis. The soil pH, Electricalconductivity, organic carbon, 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. M.L. and Norvell, W.A 1979).

CHEMICAL COMPOSITION OF ACIDIFIED PRESS MUD (APM):

Press mud having pH of 6.8 was brought from Karnal Co-operative sugar mills and Acidified Press Mud (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

Table: 1 CHEMICAL COMPOSITION OF APM.

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

III. RESULTS AND DISCUSSION

Effect of application of APM on soil properties and nutrients availability: The results are discussed based upon the final observations taken in Nov. 2004 after sixteen month application of APM. Results showed that application of APM resulted in significant lowering of soil pH of calcareous soils significantly by the acidified press mud (table-2). The reduction in pH was maximum at T3 level of amendment. application. Cifuentes & Lindemann (1993) studied that application of elemental-S to calcareous soil lowered the soil pH. However increased EC of soil was observed due to dissolved salts in the APM. Organic carbon, available nitrogen, available phosphorous significantly increased with the increasing levels of APM application. Similar results leading to reduction in soil pH, increase in O.C, available N & P were reported with the application of acidic materials. Singh et al (1999) and Ibrahim, et al (1993) reported that application of Press Mud increased available P in soil.

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

APM doses Treatment	pH (1:2)	E.C. (dS/m)	O.C. %	Available N (Kg/h)	Olson's P (ppm)	S.Ext. K (ppm)	S.Ext. Na (ppm)	S.Ext. Ca+Mg (me/l)
To	8.26	0.78	0.28	60.27	9.01	7.98	201.44	20.0
T1	7.61	1.32	0.60	80.53	31.56	11.56	84.55	27.5
T2	7.34	1.77	0.85	94.05	65.62	25.93	57.71	46.0
T3	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

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

DTPA extractable Zn, Fe, Mn and Cu:

Application of APM doses increased significantly the DTPA extractable micronutrients i.e. Zn, Fe and Mn (table-3). Sutaria, et al (1992) found that application of sulphuric acid in calcareous soils cu increased up to fifty percentage of acid titrable.

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

APM doses Treatment	Mean value in ppm			
	Zn	Fe	Mn	Cu
To	0.70	2.91	10.64	0.65
T1	1.44	3.85	16.92	1.39
T2	2.90	4.44	25.12	2.98
T3	3.15	5.19	40.27	1.67
CD (p=0.05)	0.26	0.46	3.52	1.77

CHEMICAL COMPOSITION OF LEAVES OF PROSOPIS CINERARIA:

The results showed that application of APM significantly increased uptake of N, P, K, Ca, Mg and Zn. Mn, Fe by the leaves of P.Cineraria (table-4). Thompe and More, (1996) also reported that use of similar acidifying material like Press Mud Cake increased 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 secondary nutrients (Ca & Mg) along with the micronutrients (Fe & Mn) by Maize plant when FYM which is acidic material was applied to calcareous soils. The leaf analysis revealed that Na concentration was more in control treatment (T_0) and low concentration in 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 that increased uptake of Zn content in corn plant where press mud cake was applied. Effect of APM application was non significant in the uptake of Cu at all the three levels of APM application.

Table: 4 Effect of application of APM treatments on various nutrients content of leaves of PROSOPIS CINERARIA.

APM doses Treatment	% Nutrients						mg kg^{-1}			
	N	P	K	Ca	Mg	Na	Zn	Fe	Mn	Cu
To	2.30	0.18	0.97	0.74	0.04	0.037	15.70	42.38	18.30	7.35
T1	2.80	0.24	1.07	0.85	0.09	0.029	19.72	49.14	27.90	9.36
T2	3.10	0.27	1.18	1.04	0.13	0.024	22.52	53.32	35.98	11.85
T3	3.40	0.32	1.31	1.28	0.17	0.019	32.43	68.46	59.58	7.83
CD (p=0.05)	0.22	0.03	0.09	0.12	0.013	0.004	3.06	5.45	5.55	10.57

Above studies have thus revealed that application of APM is useful to calcareous soils having impeded soils under rain-fed conditions for better growth of Khejri (Prosopis cineraria) trees, soil nutrient availability and uptake of both major and micro nutrients.

ACKNOWLEDGEMENT:

The authors are highly thankful to the Indian Council of Agricultural Research, New Delhi, Director, CAZRI, Jodhpur and Director, CSSRI, Karnal for providing the financial support and facilities to carry out these studies under the NATP project.

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