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Research Article

EFFECT OF POST BIO-METHANATED SPENT WASH AS A LIQUID MANURE ON SOIL PROPERTIES AND ON YIELD OF PEARL MILLET

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A B S T R A C T

Controlled land application of post biomethanated spent wash @ 75 000 L ha^{-1} as a liquid manure for pearl millet crop in Inceptisol was conducted to study effect on soil properties, nutrient uptake and on yield. The post bio-methanated spent wash a distillery effluent was neutral to slightly alkaline in reaction, contain high amounts of soluble salts , rich in plant nutrients and Low in BOD (6000 ppm) and COD (28,000 ppm).Land application recorded increased in bulk density, hydraulic conductivity and remarkable change in pH and EC of soil. The improvement in major nutrients, micronutrients and microbial population was noticed in soil after harvest of crop. Significantly increased in total uptake of N,P,K and yield over untreated plots.

INTRODUCTION

Distilleries are one of the most important agro-based industries in India producing ethyl alcohol from molasses. The effluent generated is discharged into the water resources therefore, a major source of soil, water and air pollution, which cause depletion of oxygen in the receiving waters. At present in Maharashtra, it could be estimated as 9367 million liters of total effluent generated from 65 distilleries that could produce 725 million liters of alcohol per annum. Management and safe disposal of enormous volume of spent wash generated with the production of alcohol is a challenge for the distilleries and to the Nation. The liquid which flows out of the methane generation plant is non toxic at low doses when treated with microbial inoculants and can be used as good organic liquid manure source. It is rich in plant nutrients along with enthusiastic load of microbial population which can be effectively used for recycling in agriculture (Devarajan et al. 1994), at low concentration may be beneficial in crop production.

MATERIALS AND METHODS

An investigation on farmer's field to study the effect on soil properties, nutrient uptake and yield of pearl millet was conducted during the year 2007-08. The experimental area comes in Tehsil. Newasa, Dist. Ahmednagar (MS). Twelve farmers from six villages were randomly selected.

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The post bio-methanated spent wash from Shri. Dnyaneshwar Sahakari Sakhar Karkhana Ltd., Dnyaneshwarnagar, Bhenda, distillery was spread uniformly @ 75,000 lit ha^{-1}, prior to cultural operations of land, and it was thoroughly mixed in soil before onset of monsoon. The pearl millet crop was sown during *kharif* season. The composite soil samples were collected from treated fields. The soil samples from adjacent fields were collected as control where there was no application. The pearl millet (cv. Shraddha) was grown to compare soil properties in treated as well as untreated plots.

RESULTS AND DISCUSSION

The post biomethanated spent wash was neutral in reaction with high concentration of soluble salts. The Nitrogen, Phosphorus and Potassium (1.03 per cent) were present in considerable quantity. Among the cations Ca^{2+}, Mg^{2+}, $Na^{+}$and anions like Cl^{-} and SO_4^{2-} were in appreciable quantity. The appreciable quantity of Fe (64 mg L^{-1}) was noticed .The low BOD (6000 mg L^{-1}) and COD (28000 mg L^{-1}), indicated that it possibly be applied in low concentration so as to reduce its ill effect on soil.

The chemical properties after one month of application, recorded significant improvement in bulk density by 5 Mg m^{-3} and hydraulic conductivity by 0.30 cm hr^{-1} over untreated fields. Significant increased in water retention at 33 kPa and 1500 kPa was observed. The soil pH of treated fields was significantly decreased by 0.46 and increased in electrical conductivity by 0.07 dSm^{-1}. Significantly increased in major nutrients *viz* N, P and K kg ha^{-1} was observed. The increased in micronutrients concentration was not significant. Significantly

higher microbial count was observed with respect to Bacteria and Fungi respectively, however significant decreased in count with respect to Actinomycetes.

Table 1 Characterization of post biomethanated spent wash

Parameters	Post biomethanted spent wash
Physical Properties	
Colour	Red yellow red, Munsell notation 10R 3/6
Odour	Unpleasant smell
Specific gravity (Mg m^{-3})	1.04
Chemical Properties	
pH	7.12
EC (dSm^{-1})	43.3
BOD (ppm)	6,000
COD (ppm)	28,000
Major nutrients	
Total N (%)	0.15
Total P (%)	0.028
Total K (%)	1.03
Cations (mg L^{-1})	
Ca^{2+}	3433
Mg^{2+}	2700
Na^{+}	2541
Anions (mg L^{-1})	
Cl^{-}	5333
SO_4^{--}	5342
Micronutrients (mg L^{-1})	
Fe	64
Mn	0.41
Cu	0.33
Zn	Trace

Table 2 Effect of Post biomethanted spent wash on soil fertility status after one month of application

Parameters	Untreated Field Mean	Treated field mean	t_{cal}
Physical Properties			
Bulk density (Mg m^{-3})	1.39	1.34	9.16*
Soil texture (%)			
Sand	29.16	26.19	N.S.
Silt	33.12	33.13	N.S.
Clay	39.53	39.60	N.S.
Water retention			
33 kPa	40.63	41.96	-7.18*
1500 kPa	25.52	26.44	-3.19*
Hydraulic conductivity (cm hr^{-1})	0.38	0.68	-6.88*
Chemical Properties			
pH	8.18	7.72	5.72*
EC (dSm^{-1})	0.16	0.23	-4.37*
Organic carbon (%)	0.52	0.57	N.S.
$CaCO_3$(%)	4.48	6.40	-8.34*
Major nutrients (kg ha^{-1})			
N	117.35	163.86	-13.62*
P	10.32	15.22	-7.23*
K	195.51	344.41	-8.48*
Micronutrients (mg L^{-1})			
Fe	5.83	5.97	N.S.
Mn	10.88	11.04	N.S.
Cu	0.52	0.54	N.S.
Zn	0.64	0.68	N.S.
B	0.53	0.76	-9.73*
Biological count			
Bacteria x 10^6 CFU g^{-1}	5.90	7.90	-6.66*
Fungi x 10^3 CFU g^{-1}	5.20	6.40	-3.17*
Actinomycetes x 10^4 CFU g^{-1}	7.50	5.90	4.71*

Table 3 Soil fertility status at harvest of pearl millet

Field Properties	Untreated Field Mean	Treated field mean	t_{cal}
Physical Properties			
Bulk density (Mg m^{-3})	1.34	1.30	-3.01*
Soil texture (%)			
Sand	26.28	26.15	N.S.
Silt	33.33	33.30	N.S.
Clay	39.17	39.24	N.S.
Water retention			
33 kPa	40.08	41.16	N.S.
1500 kPa	24.68	25.89	N.S.
Hydraulic conductivity (cm hr^{-1})	0.59	0.54	N.S.
Chemical Properties			
pH	8.18	8.03	-4.14*
EC (dSm^{-1})	0.19	0.26	-4.49*
Organic carbon (%)	0.75	0.87	N.S.
$CaCO_3$ (%)	6.02	7.77	-3.56*
Major nutrients (kg ha^{-1})			
N	106.60	110.56	N.S.
P	8.72	9.41	N.S.
K	243.75	317.51	-3.714*
Micronutrients (ppm)			
Fe	2.73	3.28	-3.17*
Mn	2.80	3.39	-3.78*
Cu	0.43	0.53	N.S.
Zn	0.36	0.51	-6.77*
B	0.44	0.65	-7.64*
Biological count			
Bacteria x 10^6 CFU g^{-1}	18.90	22.60	-4.49*
Fungi x 10^3 CFU g^{-1}	6.50	9.00	-4.38*
Actinomycetes x 10^4 CFU g^{-1}	8.10	4.90	9.78*

* = Significant at 5 % level of probability, N.S. = Non Significant

Table 4 Nutrient uptake at harvest of pearlmillet

Treatments	N (kg ha^{-1})			P (kg ha^{-1})			K (kg ha^{-1})		
	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
Control mean	30.05	19.17	49.23	4.94	5.49	10.36	11.03	77.52	88.57
Treated mean	34.61	21.38	56	5.77	6.08	11.82	12.50	80.64	93.16
t_{cal}	-9.57*	-3.46*	-14.03*	-5.28*	-3.47*	-5.28*	-5.28*	-3.45*	-5.78*

* = Significant at 5% level of probability

Table 5 Grain and straw yield of pearl millet as influenced by post biomethanated spent wash

Treatments	Mean Yield (q ha^{-1})	
	Grain	Straw
Untreated plot	22.73	48.87
Treated plot	25.13	50.72
t_{cal}	-7.11*	-6.25*

* = Significant at 5 % level of probability

Harvest of the crop

The post biomethanted spent wash recorded significant improvement in physical, chemical and biological properties at harvest of the pearl millet crop. The bulk density was significantly improved (1.30 Mg m^{-3}) over untreated (1.34 Mg m^{-3}) fields, however hydraulic conductivity, water retention and soil texture was not affected. Significant reduction in soil pH and increased in EC over control plots was observed. The organic carbon was increased by 0.12 per cent over control. Soils were calcareous in nature, with application of post biomethanated spent wash there was significant increasedin calcium carbonate by 1.75 per cent over untreated soil. The mean available N, P and K content were increased in treated plots as compared to untreated plots at harvest. The increased in N by 3.96 and P by 0.69 kg ha^{-1} over untreated fields respectively, however the results are not significant. The soil potassium was significantly increased by 73.76 kg ha^{-1} over untreated plots. Similar results were observed by Bhalerao *et al*. (2005) and Kaushik *et al*. (2005).

The DTPA extractable Fe,Zn and B were deficient in untreated plots while they were sufficient in treated plots. The mean

DTPA extractable Fe, Mn, Cu, Zn and B were found to be increased significantly over untreated plots except Cu (Devarajan *et al*. (1995). The application of post biomethanated spent wash led to increased in themean microbial population of bacteria (14.9 x 10^6 CFU g^{-1}) and fungi over untreated plots (6.50 x 10^3 CFU g^{-1}) while actinomycetes population was reduced from 8.10 to 4.9 x 10^4 CFU g^{-1}might be due to neutral to slightly alkaline condition as observed by Mallika *et al*. (2003).

Yield and Nutrient uptake

The grain and straw yield of pearl millet was 25.13 and 50.52 q ha^{-1} respectively. Theresult indicated that significantly higher grain (10 percent) (t_{cal} = -7.111*) and straw (4 percent) (t_{cal}= -6.247*) yield was observed over control. Total uptake of N, P and K in grain and strawwas significantly increased by treated plot was 6.77, 1.46 and 4.59 kg ha^{-1} over control respectively.

The increased in yield and uptake was due to post bio-methanated spent wash which was rich source of various nutrient elements might have improved microbial population, which may have released nutrients in soil and helped to maintain the soil fertility. Several researchers have also reported the beneficial effect of post bio-methanated spent wash on serial crops (Pathak *et al*. 1999, Singh *et al*, 2002, Hati *et al*. 2003, Bhalerao *et al*, 2005 and Hati *et al*. 2007).

References

1. Bhalerao, V.P., Jadhav, M.B. and Bhoi, P.G. (2005). Effect of distillery's biomethanted effluent on yield, quality of *adsali* sugarcane and soil properties. *Co-op. Sug., 36 (8): 653-659.*
2. Devrajan, L. and Oblisami, G. (1995). Effect of distillery effluent on soil properties, yield and quality of sugarcane. *Madras Agric. J. 82(5): 397-399.*
3. Devrajan, L., Rajannan, G., Ramanathan, G. and Oblisami, G. (1994). Performance of field crops under distillery effluent irrigation. *Kissan World, 48-49.*
4. Hati, K.M., Biswas, A.K., Bandyopadhaya, K., Mishra, A.K.(2003). Effect of post methanation effluent on soil physical properties under a soybean-wheat system in a vertisol. *J. Pl. Nutrition and Soil Sci. 166(3): 345-347.*
5. Hati, K.M., Biswasa, A.K., Bandyopadhyaya, K.K. and Misra, A.K. (2007). Soil properties and crop yields on a vertisol in India with application of distillery effluent. *Soil and Tillage Res. J. 92(1-2). 60-68.*
6. Kaushik, A., Nisha, R., Jasjeeta, K. and Kaushik, C.P. 2005. Impact of long and short term irrigation of a sodic soil with distillery effluent in combination with bio-amendments. *Bioresoruce Tech., 96(17): 1860-1866.*
7. Mallika, K., Prabhakaran, J. and Lakshmanan, A. (2003). Influence of distillery spent wash application on the microbial population dynamics and enzyme activity of maize soil. *Madras Agric. J. 90(10-12): 589-595.*
8. Manohar Rao, (1983). Production of methane gas from stillage on commercial scale in India. *Indian Sug., 32(12): 873-880.*
9. Pathak, H., Joshi, H.C., Chaudhary, A., Chaudhary, R., Kalra, N., Dwivedi, M.K. (1999). Soil amendment with distillery effluent for wheat and rice cultivation. *J. Water, Air and Soil Pollu. 113(1-4): 133-140.*
10. Patil, G.D., Pingat, S.M. and Yelwande, A.J. (2000). Effect of spent wash levels on soil fertility, uptake, quality and yield of fodder maize. *J. Mah. Agric. Univ. 25(1-3): 168-170.*
11. Uppal, J. (2004). Water utilization and effluent treatments in the Indian alcohol industry- an overview. *Indo-EU workshop on Promoting Efficient Water Use in Agro-based industries, New Delhi, 15-16:India.*

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