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Effect of levels of post biomethanated spent wash (PBSW) on physical and chemical properties of soil at harvest of soybean [*Glycine max* (L.) Merrill]

ASHWINI C. CHANDEL*, C.R. PALWE[1] AND H.P. PARDESHI[1]
Department of Soil Science and Agricultural Chemistry, Mahatma Phule Krishi Vidyapeeth, Rahuri, AHMEDNAGAR (M.S.) INDIA

ABSTRACT

An experiment was conducted on inceptisol soil at Rahuri (M.S.) concluded that the application of post biomethanated spent wash 60 m^3 PBSW ha^{-1} + RDF was beneficial for achieving higher yield of soybean along with improvement in soil physical and chemical properties at harvest without any adverse effect on the soil quality during first year of study.

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Key words : PBSW, Physical and chemical properties, Soybean

INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] is an important pulse as well as oilseed crop. Nutritionally, soybean is excellent source of protein and oil. It contains 38 to 43 % protein, 18 to 20 % oil, 26 % carbohydrates, 4 % minerals and 2 % phospholipids. Among the oilseed crops, soybean has occupied third place in the edible oil scenario of India, next to groundnut, rapeseed and mustard.

In India, the area under soybean was 8.88 million ha, with production and productivity of 9.99 Mt and 1124 kg ha^{-1}, respectively. In Maharashtra area under soybean was 2.66 million ha production and productivity of 3.97 Mt and 1492 kg ha^{-1}, respectively (Anonymous, 2008).

Alcohol is one of the major revenue earning enterprises for the government. The fermented molasses is distilled and alcohol is obtained. The liquid left after distillation of fermented molasses is known as spent wash.

In India, Alcohol is mostly produced from sugarcane molasses. The molasses are fermented with the yeast (*Saccharomyces cerevisiae*).The fermented wash is distilled and alcohol is obtained. The liquid left after distillation of alcohol is generally known as spent wash, vinase, distillery effluent, under slopes.

The amount of spent wash produced is quite staggering causing environmental pollution and disposal problem. However, some recent studies indicate its potential for crop production as a source of nutrient. The idea of methane generation from spent wash came forward generated with a view to use huge organic load present in spent wash. The effluent left after the methane gas generation is known as post biomethanated effluent or primary treated effluent.

The post biomethanated spent wash is nearly neutral in reaction (pH 7.51), contain high concentration of soluble salts (EC 41.6 dSm^{-1}) with low BOD (5400 mg L^{-1}) and COD (24680 mg L^{-1}) and good amounts of N, P and K. Therefore, post biomethanated spent wash could be utilized as a liquid manure and should not have adverse effects on availability of soil nutrients as well as on physico-chemical properties of soil. Due to addition of high amounts of potassium through spent wash, the potassium dynamics could be altered and may change the forms of soil potassium fixation and release of potassium is expected.

MATERIALS AND METHODS

The field experiment with soybean was conducted at Post Graduate Institute Research Farm, Department of Soil Science and Agricultural Chemistry, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmadnagar (M.S.) during *Kharif* season of 2009. The soil of the experimental site belonged to order Inceptisol. The field experiment was laid out in Randomized Block Design with eight treatments and three replications. The treatments comparised of control, RDF (Recommended dose of fertilizer) only, post biomethanated spent wash @ 20, 40, 60, 80, 100 and 120 m^3 ha^{-1} + RDF. The quantity of N, P and K supplied through the post biomethanated spent wash was adjusted while applying the quantity of N, P and K through recommended dose of fertilizers.

* **Author for correspondence.**
[1]Rajiv Gandhi Agricultural College, PARBHANI (M.S.) INDIA

The gross and net plot size were 3.60 x 4.50 and 3.00 x 3.90 m^2, respectively. The soybean variety JS-335 was used for sowing with seed rate of 75 kg ha^{-1}. The manures and fertilizers were applied as per the treatments. The nitrogen and phosphorus were applied through urea and single super phosphate, respectively.

The Post biomethanated spent wash was obtained from the distillery of The Kopergaon Sahakari Sakar Karkhana Ltd., (Distillery Division), Gautamnagar, Post. Kolpewadi, Teshil. Kopergaon, Dist. Ahmednagar, Maharashtra State. The fresh quantity of post biomethanated spent wash as per treatments was applied to the surface of soil 30 days before sowing of soybean.

Soil samples were collected at 0 to 20 cm depth after harvesting of crop. The samples were dried in shade, ground and sieved through 2 mm sieve and were used for analysis of various physical and chemical parameters.The statistical analysis of the data was carried out by using standard statistical method of analysis given by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The results of the present study along with relevant discussion have been presented as under:

Effect on physical properties of soil:

The highest bulk density (1.37 mg m^3) was observed in control treatment, however, treatment 120 m^3 PBSW ha^{-1} + RDF showed comparatively lowest bulk density 1.30 mg m^3 (Table 1). The decrease in bulk density might be due to direct addition of organic matter in soil might be ascribed to increase in organic carbon status and porosity of the soil.The decrease in bulk density due to PBSW was also reported by Hati *et al.* (2003).

The hydraulic conductivity of treated soil was found to be increased over control and was significantly increased with increasing levels of post biomethanated spent wash at after harvest of the crop (Table 1). The treatment 120 m^3 ha^{-1} level of PBSW + RDF showed highest hydraulic conductivity (0.22 cm ha^{-1}) over rest of the treatments while it was low at control (0.13 cm hr^{-1}). The treatment 80 m^3 PBSW ha^{-1} + RDF and 100 m^3 PBSW ha^{-1} + RDF *i.e.* application of post biomethanated spent wash @ 60 m^3 and 80 m^3 ha^{-1} level, respectively recorded 0.18 cm hr^{-1} which was at par with each other, while further increased in application increased the hydraulic conductivity at 100 m^3 PBSW ha^{-1} + RDF (0.19 cm hr^{-1}) and 120 m^3 PBSW ha^{-1} + RDF (0.22 cm hr^{-1}) level, respectively. The improvement in hydraulic conductivity might be due to higher organic load and presence of soluble salts in PBSW. Similar results were also reported by Hati *et al.* (2003).

Table 1 : Effect of levels of post biomethanated spent wash (PBSW) on soil bulk density and hydraulic conductivity at harvest of soybean

Treatments	Bulk density ($Mg\ m^{-3}$)	Hydraulic conductivity ($cm\ hr^{-1}$)
T_1 : Control	1.37	0.13
T_2 : RDF	1.35	0.14
T_3 : 20 m^3 PBSW ha^{-1} + RDF	1.33	0.15
T_4 : 40 m^3 PBSW ha^{-1} + RDF	1.32	0.16
T_5 : 60 m^3 PBSW ha^{-1} + RDF	1.32	0.18
T_6 : 80 m^3 PBSW ha^{-1} + RDF	1.31	0.18
T_7 : 100 m^3 PBSW ha^{-1} + RDF	1.31	0.19
T_8 : 120 m^3 PBSW ha^{-1} + RDF	1.30	0.22
C.D. (P=0.05)	0.013	0.013

PBSW : Post biomethanated spent wash.
RDF : Recommended dose of fertilizer

Effect on chemical properties of soil:

The pH of the soil at harvest was slightly decreased due to application of PBSW as compared with control and RDF (Table 2).The significant decrease with increasing levels of PBSW was observed. The decrease in soil pH could be attributed to lowest pH at treatment T_8 (120 m^3 ha^{-1} + RDF). This treatment showed significantly lowest value of pH 7.91 over all the treatments except 100 m^3 ha^{-1}+ RDF.

Significant decrease in soil pH at harvest of soybean was observed in 20 m^3 ha^{-1} and 40 m^3 ha^{-1} level (8.02) and increase in application over and above 40 m^3 ha^{-1} level recorded significant decrease in soil pH. The levels *viz.*, 40, 60 and 80 m^3 ha^{-1} levels were at par with each other, while 80 m^3 ha^{-1} level was at par with 100 m^3 ha^{-1} level and 100 m^3 ha^{-1} level was at par with 120 m^3 ha^{-1} level. The increase in post biomethanated spent wash application resulted notable decrease in soil pH at harvest may be attributed to release of organic acids during decomposition of dissolved organic matter, directly added through post biomethanated spent wash. The decrease in soil pH due to application of PBSW was also reported by Ranjun (2007).

The electrical conductivity of treated soil was significantly increased with increasing level of PBSW over control and RDF (Table 2). Application of 120 m^3 PBSW ha^{-1} + RDF showed highest electrical conductivity 0.46 dSm^{-1} at harvest of crop. The treatment T_5 (60 m^3 PBSW ha^{-1} + RDF) recorded significant increase in electrical conductivity (0.43 dSm^{-1}) over its lower levels and control

Table 2 : Effect of levels of post biomethanated spent wash on pH, EC, organic carbon, calcium carbonate and available sulphur at harvest of soybean

Treatments	pH	EC (dSm^{-1})	Organic carbon (%)	Calcium carbonate (%)	Available sulphur (ppm)
T_1 : Control	8.22	0.40	0.47	5.30	18.10
T_2 : RDF	8.13	0.40	0.47	6.03	18.71
T_3 : 20 m^3 PBSW ha^{-1} + RDF	8.06	0.40	0.52	6.08	19.50
T_4 : 40 m^3 PBSW ha^{-1} + RDF	8.02	0.41	0.56	6.40	21.15
T_5 : 60 m^3 PBSW ha^{-1} + RDF	7.98	0.43	0.62	6.80	22.94
T_6 : 80 m^3 PBSW ha^{-1} + RDF	7.97	0.44	0.67	7.10	23.89
T_7 : 100 m^3 PBSW ha^{-1} + RDF	7.93	0.45	0.74	7.46	25.28
T_8 : 120 m^3 PBSW ha^{-1} + RDF	7.91	0.46	0.80	7.83	27.91
C.D. (P=0.05)	0.042	0.023	0.085	0.436	1.44

while it was at par with increasing levels *i.e.* T_6 of application and T_7.Treatment No.T_8 (120 m^3 PBSW ha^{-1} + RDF) recorded highest electrical conductivity of soil due to PBSW is attributed to the salt load present in it. Similar finding was also reported by Hati *et al.* (2003).

The organic carbon content of soil was significantly increased due to application of PBSW over control and RDF (Table 2). The highest increase was observed at highest 120 m^3 ha^{-1} PBSW + RDF level of application while control and RDF recorded the least (0.47 %). Application of PBSW + RDF recorded non significant increase in organic carbon. However each higher level was at par with its lower level.

The organic carbon status of soil under PBSW application was significantly higher over RDF indicating favourable effect of PBSW in increasing the organic carbon content of soil. The significantly higher organic carbon at harvest of crop indicating the beneficial effect of PBSW to improve the soil quality. This is also reflected in the improvement of physical properties of soil *i.e.* hydraulic conductivity which is mainly improved due to addition of PBSW resulting into build up of organic carbon status of soil. Addition of organic matter through effluent and better crop growth might have increased the root biomass which could be the reason for maintaining the organic carbon content of soil at harvest of crop. Similar result was also reported by Kaushik *et al.* (2005).

The calcium carbonate content of soil showed significant increase with application of PBSW (Table 2) over control and RDF. Application of RDF alone and in combination with PBSW resulted increase in calcium carbonate in soil. Highest calcium carbonate (7.83 %) was recorded at 120 m^3 ha^{-1} level of PBSW while the least calcium carbonate (6.03 %) at RDF over control. Each increasing level of PBSW over and above RDF was recorded non significant increase in calcium carbonate and was at par with its lower level of application. The slight increase in free calcium carbonate content was observed due to application of higher levels of PBSW indicating favorable condition for calcification process in soil.

It was observed that available sulphur recorded significant increase with application of post biomethanated spent wash over control (Table 2). Sulphur status of soils increased from 18.10 ppm (control) to 27.91 ppm (120 m^3 PBSW ha^{-1} + RDF). The significant increase in available sulphur was recorded at 60 m^3 ha^{-1} level, however, increase in application above 60 m^3 ha^{-1} recorded increase in available sulphur. The treatment T_8 (120 m^3 PBSW ha^{-1} + RDF) was significantly superior over T_7 (100 m^3 PBSW ha^{-1} + RDF) while treatment T_7 was at par with treatment T_6 (80 m^3 PBSW ha^{-1} + RDF) and treatment T_6 was at par with treatment T_5 (60 m^3 PBSW ha^{-1} + RDF). The increase in available sulphur in soil due application of single super phosphate and PBSW contain sulphur in high amount might have increased available sulphur in soil.

REFERENCES

Anonymous (2008). *Agricultural research data book 2008.* ICAR publication, New Delhi. pp.206.

Hati, K.M., Biwas, A.K., Bandyopadhaya, K. and Mishra, A.K. (2003). Effect of post methanation effluent on soil physical properties under a soybean-wheat system in a vertisol. *J. Pl. Nutrition & Soil Sci.*, **166** (3): 345-347.

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. *Bioresource Tech.*, **96** (17): 1860-1866.

Panse, V. and Sukhatme, P.K. (1985). *Statistical methods for agricultural workers*. ICAR, New Delhi.

Ranjun, A.R. (2007). Soil quality as influenced by post biomethanated spent wash application to maize in Inceptisol. M.Sc. (Ag.)Thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri, M.S. (India).

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