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Original Research Article

AVAILABILITY OF PHOSPHORUS IN SOIL UNDER THE INFLUENCE OF ORGANIC MANURES

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Abstract: An incubation experiment was conducted with the same set of three soils with five different organics (green manure, farmyard manure, vermicompost, pressmud and poultry manure) to find out the release pattern of P. the soil samples were analysed for available P once in 15 days up to 75 days. The experimental soil was sandy clay loam in texture which comprised of 74.01% sand, 4.35% silt and clay 21.30%. It was neutral in reaction (pH 7.3), non saline in nature with electrical conductivity of 0.21 dSm^{-1} and cation exchange capacity of 15.7 cmol (p+) kg^{-1}. The soil samples were analysed for available P once in 15 days up to 75 days.The results of the experiment revealed that with progress of incubation time (0, 15, 30, 45, 60 and 75 days) an increase in the concentration of available P was observed in all the treatments applied. However, addition of green manure (T_2) exhibited a significant increase in the concentration of available P at all days of sampling with the mean values ranged from 0.43 to 0.56 ppm. The treatment T_2 was followed by T_3 (Farmyard manure), T_4 (Vermicompost), T_5 (Pressmud), T_6 (Poultry manure) and T_1 (Control) regarding the release of phosphorus. The lowest value was found with control where no manure was applied.

Key words: *Organics, Phosphorus, Incubation, Release pattern*

Introduction: Organic manures are plant and animal wastes that are used as sources of plant nutrients. They release nutrients after their decomposition. On decomposition the organic manures are releasing certain organic and inorganic acids which are able to solubilise the native and applied nutrients from soil, particularly phosphorus. Regarding phosphorus is one of the major nutrient ranks second after Nitrogen needed for root growth and development of cell molecules such as ADP, ATP, Nucleic acids, Phospholoipids, Phosphoproteins etc. In India, soils are universally showing deficiency of Phosphorus due to fixation and leaching. Around 80% of the applied phosphorus is being fixed in soils; hardly 20 % is available to the growing plants. In this critical situation, the crops cannot perform well in the field condition and also results in huge fertilizer loss to the farmers.

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Keeping these points in mind, the present investigation was taken up.

Materials and methods: An incubation experiment was conducted to find out the influence of organic manures on release of P soils. The experimental soil was sandy clay loam in texture which comprised of 74.01% sand, 4.35% silt and clay 21.30%. It was neutral in reaction (pH 7.3), non saline in nature with electrical conductivity of 0.21 dSm^{-1} and cation exchange capacity of 15.7 cmol (p+) kg^{-1}. The organics included were, green manure (10.0 t ha^{-1}), farmyard manure (12.5 t ha^{-1}), vermicompost (0.5 t ha^{-1}) pressmud (5 t ha^{-1}), and poultry manure (2.0 t ha^{-1}). The organic manure treated soils were incubated for a period of 75 days. The soil samples were analysed for available P once in 15 days up to 75 days. The treatments included were T_1 (Control), T_2 (Green manure), T_3 (Farmyard manure), T_4 (Vermicompost), T_5 (Pressmud) and T_6 (Poultry manure). The amount of soil added for theis experiment is 150 g/Cup. The design of the experiment is CRD with four replications. Before added in the incubation experiment, the manures were analysed for nutritional status by using standard procedures.

Results and discussion: The organic manures *viz*., green manure (*Sesbania aculeata*), farmyard manure, vermicompost, pressmud and poultry manure were used in the incubation experiment. The data presented in Table 1, indicated that the nutrient composition of these organic manures were 3.51, 0.37 and 4.80 per cent N, P and K respectively in green manure, 0.53, 0.35 and 0.90 per cent N, P and K respectively in farmyard manure, 0.90, 0.22 and 1.50 per cent N, P and K respectively in vermicompost, 2.5, 0.18, 0.5 per cent N, P and K respectively in pressmud and 4.00, 0.17 and 2.1 per cent N, P and K respectively in poultry manure.

The P releases as affected by different organic manures are presented in Table 2. Data indicated that the release of P was significantly affected by different organic manures. With progress of incubation time (0, 15, 30, 45, 60 and 75 days) an increase in the concentration of available P was observed in all the treatments applied. However, addition of green manure (T_2) exhibited a significant increase in the concentration of available P at all days of sampling with the mean values ranged from 0.43 to 0.56 ppm. The treatment T_2 was followed by T_3, T_4, T_5, T_6 and T_1 regarding the release of phosphorus. The lowest value was found with control where no manure was applied. Among the different sources, addition of green manure (T_2) in normal and saline soil exhibited a significant increase in the concentration of available P at all days of sampling over other organics included. It might be due to the reason that the green manure was incorporated into the soil could further increase the P availability during decomposition by releasing CO_2, which forms H_2CO_3 in the soil solution in normal and saline soils. The concentration of organic acids that might have effectively reduced P sorption to the soil and increased the P availability. Similar trend of results were reported by Carrie Laboski and John Lamb (2003). This is also because that green manure might have helped in increasing the available phosphorus which attributed to production of acids like H_2SO_4, H_2SO_3, and H_2CO_3 responsible for lowering the soil pH and enhanced the availability of phosphorus (Jagtap *et al*., 2006) in soil.

Conclusion: Among the different organic manures used, green manure performed better in release of P in soil, which was followed by farmyard manure, vermicompost, pressmud, and poultry manure based on the different time intervals of incubation. Compared to other organic manures, decomposition of green manures is speed up in neutral soils, so that it enhances the release of nutrient particularly phosphorus in soil. The release of organic and inorganic acids has the potentiality to solubilize the applied and native phosphorus in soils.

References

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Table 1. Nutrient composition of different organic manures used in Incubation Experiment

Nutrients (%)	Green manure (*Sesbania aculeata*)	Farmyard manure	Vermicompost	Pressmud	Poultry manure
N	3.51	0.53	0.90	2.50	4.00
P	0.37	0.35	0.22	0.18	0.17
K	4.80	0.44	1.50	0.50	2.10

Table 2. Phosphorus release pattern (ppm) from different organic manures in soil

Treatments	Normal soil							
	Days of incubation							
	0	**15**	**30**	**45**	**60**	**75**	**60**	**75**
T_1- Control	0.09	0.10	0.10	0.10	0.11	0.11	0.09	0.09
T_2- Green manure	0.43	0.46	0.49	0.53	0.55	0.56	0.43	0.45
T_3- Farmyard manure	0.40	0.44	0.47	0.51	0.54	0.54	0.44	0.47
T_4 - Vermicompost	0.34	0.38	0.40	0.42	0.45	0.47	0.37	0.38
T_5 - Pressmud	0.28	0.32	0.33	0.36	0.38	0.40	0.31	0.32
T_6 – Poultry manure	0.21	0.24	0.27	0.29	0.31	0.32	0.25	0.25
SEd	0.024	0.025	0.023	0.028	0.0031	0.035	0.02	0.03
CD (p= 0.05)	0.048	0.051	0.047	0.056	0.063	0.071	0.05	0.05