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Effect of Poultry Manure and PSB Culture in Conjunction with Different Levels of Phosphorus on Physico-Chemical Properties of Soil of Black Gram (*Vigna mungo* L.)

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A B S T R A C T

The experiment was conducted during *kharif* (July-October) season 2016 on crop research farm of Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Allahabad. By order to evaluate the effect of different treatment of poultry manure and PSB culture with levels of phosphorus. The Soil parameters viz. bulk density (Mg m^{-3}), particle density (Mg m^{-3}), Pore space (%) and water holding capacity (%), pH, EC (dSm^{-1}), organic carbon (%), available nitrogen (kg ha^{-1}), phosphorus (kg ha^{-1}) and potassium (kg ha^{-1}). All parameters of soil properties are found significant accept Pore space (%). Physical properties viz., Bulk density (Mg m^{-3}), Particle density (Mg m^{-3}), and Water holding capacity (%) was recorded as 1.30, 2.85, 52.94, 64.69. chemical properties viz., pH, EC, organic carbon (%), available nitrogen (kg ha^{-1}), available phosphorus (kg ha^{-1}) and potassium (kg ha^{-1}) was recorded as 7.19, 0.19, 0.79, 263.01, 23.89, 132.57 respectively in the treatment was significantly higher as compared to other treatment combination. Bulk density (Mg m^{-3}), particle density (Mg m^{-3}) Pore space (%), water holding capacity (%), organic carbon (%), available nitrogen (kg ha^{-1}), and potassium (kg ha^{-1}) T_8 (P 100% + poultry manure) and pH, EC (dSm^{-1}) and available phosphorus (kg ha^{-1}) T_9 [P 100% + PSB culture] was found to be the best, for improvement of the physico-chemical properties of soil.

Introduction

Black gram (*Vigna mungo L.*) is one of the most important pulse crop grown in India. Black gram contributes 13% in total pulse area and 10% in total pulses production of India. Black gram seeds are highly nutritious containing higher amount of protein (24-26%) and are reported to be rich in potassium, phosphorus and calcium with good amount of sodium. It is also reported to be rich in vitamin A, B_1, B_3 besides nutritionally rich protein, important minerals and vitamin (Selvakumar *et al.*, 2012).

Proper fertilization is essential to improve the productivity of black gram. It can meet nitrogen requirements by symbiotic fixation of atmospheric nitrogen. The nutrients which need attention are phosphorus and sulphur (Mir *et al.*, 2013). Levels of phosphorus are the most important factors affecting the yield of black gram (Madan Ananda Jagannath *et al.*, 2014) Phosphate solubilizing microorganism used for treatment of seed or soil. They are organic products containing living cells of different types of

microorganisms, which have the ability to convert nutritionally important element from unavailable to available form through biological process. The PSB like *Pseudomonas* and *Bacillus* also enhance the availability of phosphorus to plant by converting insoluble phosphorus from the soil into soluble form (Swati kadam *et al.*, 2014).

Soil fertility cannot be maintained with the application of inorganic fertilizer alone. No single source can meet the increasing nutrient demands for agriculture, to achieve sustainability in production, there is a need to integrate both organic and inorganic source of nutrients (Punitha Premanantharajan and Komathy Prapagar, 2013). For maintaining soil fertility poultry manure occupied a place as it is rich in nutrient then the other manures (Mohamad Ananullah *et al.*, 2007).

Application of poultry manure increases soil organic matter content, total-N, available-P, exchangeable cations (Ca, Mg and K), CEC and percent base saturation (Adeleye, 2007).

Materials and Methods

The experiment was conducted during *Kharif* season 2016 on crop research farm of Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Allahabad. The area is situated on the south of Allahabad on the right side of the river Yamuna on the South of Rewa road at a distance of about 6 km from Allahabad city. It is situated at 25024’23" N latitude, 81050’38" E longitude and at the altitude of 98 meter above the sea level (MSL).

The treatment consists of poultry manure and PSB Culture with different levels of Phosphorus. T_1 [P 0% + uninoculated (control)], T2 [P 0% + poultry manure], T_3 [P 0% + PSB culture], T_4 [P 50% + un inoculated], T_5 [P 50% + poultry manure]. T_6 [P 50% + PSB culture], T7 [P 100% + uninoculated], T_8 [P 100% + poultry manure], T_9 [P 100% + PSB culture]. The trial was laid out in a randomized block design with three replications; plot size was 2 x 2 m for crop seed rate is 20 kg ha^{-1} (*Vigna mungo* L). Applies the recommended dose of nitrogen, potassium, poultry manure and PSB culture and phosphorus in different levels with source of urea, MOP, and SSP respectively, Basal dose of fertilizer was applied and poultry manure applies in respective plots according to treatment and PSB culture applies as seed treatment according to treatment.

All the agronomic practices were carried out uniformly to raise the crop. Soil samples were collected from the soil 0-15 cm depth, air dried kept in an oven at 105ºC for 48 hrs for drying, pass through 2 mm sieve, soils were analysis by using standard procedures as described for bulk density (Mg m^{-3}), particle density (Mg m^{-3}), Pore space (%) and Water holding capacity (%) (Muthuaval *et al.*, 1992), pH 1:2 (s/w) (Jackson, 1958), EC (dSm^{-1}) (Wilcox, 1950), organic carbon (%) (Walkley, 1947), available Nitrogen kg ha^{-1} (Sobbiah and Asija, 1956), phosphorus kg ha^{-1} (Olsen *et al.*, 1954) and potassium kg ha^{-1} (Tooth and Princr, 1949).

Results and Discussion

All parameters found significant accept Pore space (%). Physical properties viz., bulk density (Mg m^{-3}), particle density (Mg m^{-3}), and Water holding capacity (%) was recorded as 1.30, 2.85, 52.94, 64.69 and chemical properties viz., pH, EC, organic carbon (%), available nitrogen (kg ha^{-1}), available phosphorus (kg ha^{-1}) and potassium (kg ha^{-1}), was recorded as 7.19, 0.19, 0.79, 263.01, 23.89, 132.57 respectively in the treatment was significantly higher as compared to other treatment combination.

Microbial inoculation not only increased the nutritional assimilation (total N, P and K) of plants, but also improved soil properties. In this study, soil was tested before sowing and after harvest of black gram crop for residual NPK content.

Available P content increased significantly in inoculated soil then uninoculated content. It may be due to reason that as the phosphorus solubilizers increased the availability thereby improved phosphorus concentration in soil (Raut *et al.*, 2000).

Available N content significantly increased may be due to fact that legumes contribute to the total pool of nitrogen in the soil as observed by Ahmad *et al.*, (2001).

Table.1 Effect of poultry manure and PSB culture with different levels of phosphorus on physical properties of soil before sowing and after harvest of black gram crop

Treatment	Bulk density (Mg m^{-3})	Particle density (Mg m^{-3})	Pore space (%)	Water holding capacity (%)
Before sowing → **After harvest ↓**	**1.23**	**2.87**	**48.33**	**54.89**
T_1	1.30	2.22	51.96	59.11
T_2	1.17	2.41	52.08	62.24
T_3	1.29	2.41	49.01	58.56
T_4	1.25	2.22	52.94	58.52
T_5	1.17	2.62	49.03	62.27
T_6	1.22	2.41	50.00	57.68
T_7	1.22	2.73	44.97	61.07
T_8	1.15	2.85	45.69	64.49
T_9	1.21	2.50	49.02	61.32
S. Em (±)	**0.03**	**0.11**	**2.67**	**1.08**
C. D. at 5%	**0.06**	**0.24**	**5.67**	**2.29**

Table.2 Effect of poultry manure and PSB culture with different levels of phosphorus on Chemical properties of soil before sowing and after harvest of black gram crop

Treatment	pH (1:2)	EC (dSm^{-1})	O.C (%)	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})
Before sowing → **After harvest ↓**	**7.33**	**0.24**	**0.48**	**216.91**	**12.63**	**120.54**
T_1	7.13	0.14	0.56	214.81	13.26	118.55
T_2	7.04	0.14	0.61	232.62	14.63	126.10
T_3	7.05	0.14	0.51	208.52	16.69	120.71
T_4	7.15	0.14	0.64	222.14	13.60	122.33
T_5	7.06	0.16	0.72	251.49	17.72	131.32
T_6	7.15	0.16	0.55	221.09	20.80	125.02
T_7	7.13	0.18	0.68	216.91	14.63	130.28
T_8	7.02	0.15	0.69	263.01	20.46	132.57
T_9	7.19	0.19	0.72	236.82	23.89	128.79
S. Em (±)	**0.02**	**0.01**	**0.00**	**7.66**	**1.93**	**3.07**
C. D. at 5%	**0.04**	**0.02**	**0.03**	**16.23**	**4.09**	**6.50**

Fig.1 Effect of poultry manure and PSB culture with different levels of phosphorus on bulk density, particle density, percent pore space and water holding capacity of soil after harvest of black gram crop

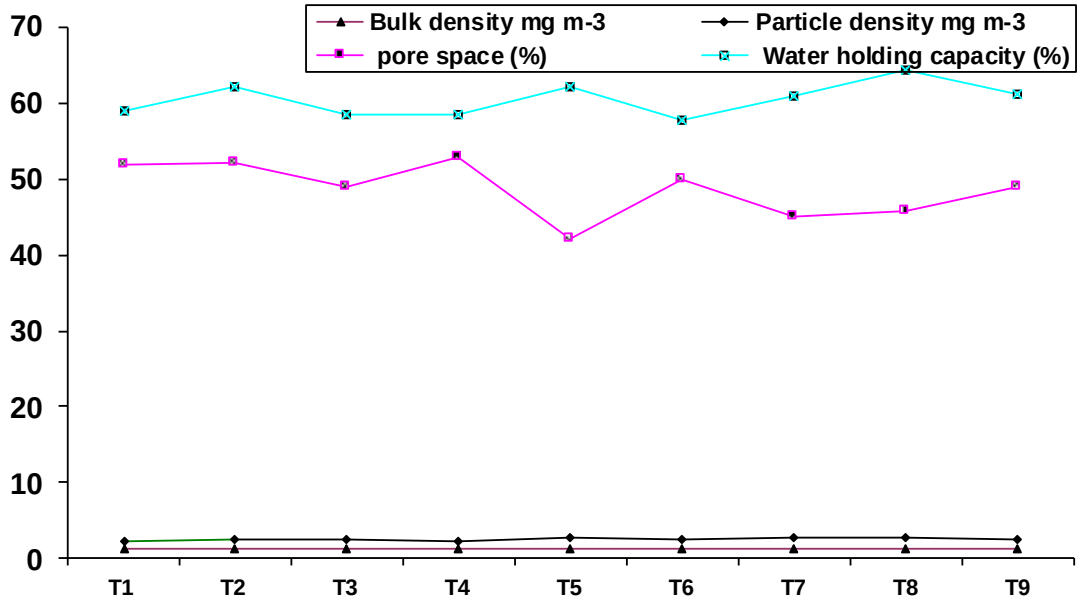


Fig.2 Effect of poultry manure and PSB culture with different levels of phosphorus on pH, EC, and organic carbon of soil after harvest of black gram crop

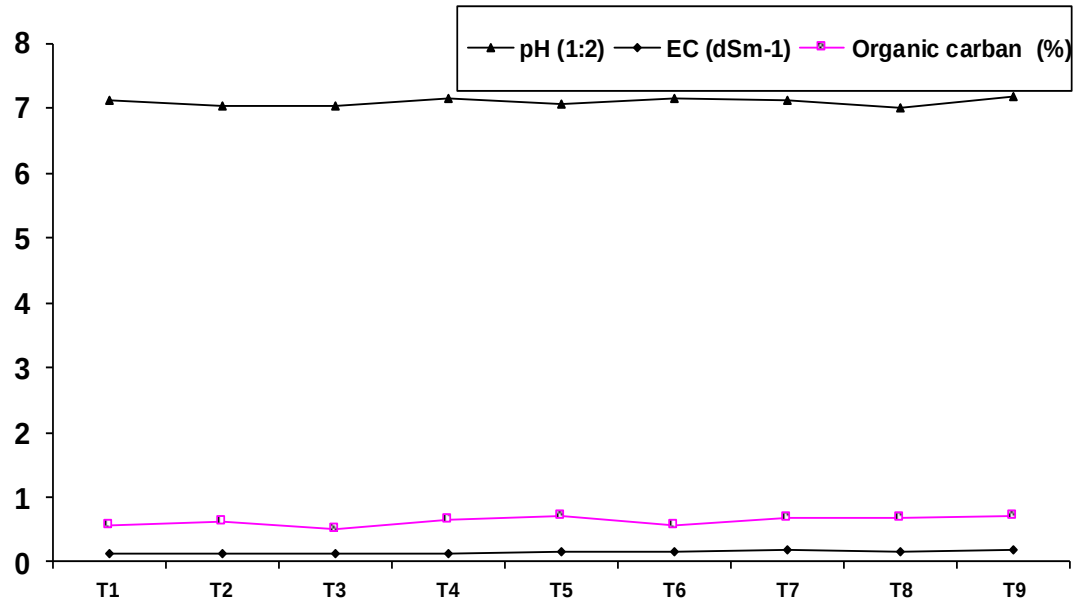
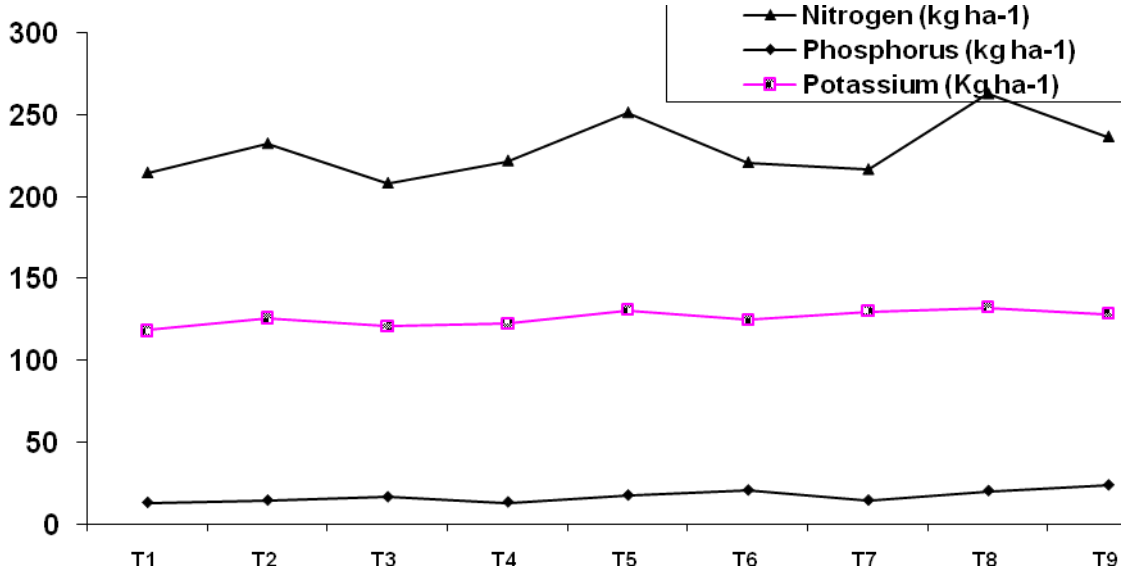


Fig.3 Effect of poultry manure and PSB culture with different levels of phosphorus on NPK in soil after harvest of black gram crop



Poultry manure additions up to 50 t ha^{-1} improved soil organic matter total N and available P as well as improved soil physical properties as indicated by reduction in soil bulk density and increased in soil moisture content (Ewulo *et al.*, 2008).

The results in given tables 1 and 2 indicate some of the important parameter on physico-chemical properties of soil on black gram crop different treatment of poultry manure and PSB culture with levels of phosphorus.

It may be concluded from trial that the different level of phosphorus with PSB culture in the experiment. Bulk density (Mg m^{-3}), particle density (Mg m^{-3}) Pore space (%), water holding capacity (%), organic carbon (%), available nitrogen (kg ha^{-1}) and potassium (kg ha^{-1}) T_8 (P 100% + poultry manure) and pH, EC (dSm^{-1}) and available phosphorus (kg ha^{-1}) T_9 (P 100% + PSB culture) was found to be the best for improvement of the physico-chemical properties of soil (Figs. 1-3).

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