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Study of Different Organic Manures on Soil Microbial Activity, Growth and Yield Parameters of Greengram (*Vigna radiata* L.)

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The essence of practicing organic farming lies in the use of naturally available resources like organic wastes, in conjunction with natural processes like decomposition biological nitrogen fixation and resistance to achieve the needs of crop production. Applying organic manures for growth of the crop, which inturn improves the organic matter status of soil. Organic manures not only helps to supply the nutrients but also acts as a food for micro organisms and encourage the multiplication of their population, which inturn improves the mineralization of nutrients in soil and thus, fertility and productivity of the soil is improved for that we undertaken the investigate to know the effect of different organic manures on soil microbial activity and growth and yield of green gram (*Vigna radiata* L.) under green house condition conducted at Department of Agricultural Microbiology, UAS, GKVK, Bangalore. There were seven treatments and three replications in a CRD design. The abundance of different microorganisms such as Bacteria, Fungi, Actinomycetes, PO_4-solubilizing microorganisms and *Rhizobium* were found to be significantly highest in the treatment having the FYM (25%) + Vermicompost (25%) + Glyrecidia (25%) + Pongamia (25%) and least was found to be in control. Plant parameters like plant height, number of branch per plant, number of leaves per plant, dry matter production and yield by the plant were studied and these were found to be significantly higher due to application RDF (100%) and least was found in the control.

Key words: Organic manures, Microorganisms, *Vigna radiata*, *Rhizobium*, Greengram.

Increasing conscious about conservation of environment, health hazards associated with agro chemicals and consumer's preference to safe and hazard free food are the major factors for growing interest in organic agriculture. The main theme of organic farming is to attain sustainable agriculture production without deterioration of natural resources and to produce better quality of agricultural produce. Hi-tech modern agriculture which largely dependent on fertilizers and chemicals started from mid 1960's was responsible for bridging the gap between the demand and supply of food for the raising population. During the late 1980's, the soil system appeared to show signs of exhaustion and decline in the overall productivity per unit area of most of the crops. Despite use of modern technologies, the yields did not show the same upward trend and it continued even today itself.

Organic manures in agriculture add much needed organic and mineral matter. Organic systems rely on management of organic matter to enhance the soil fertility and productivity. Organic matter has an over whelming effect on almost all soil properties. Organic matter a most precious component is also considered as store house of many nutrients. For mineralisation of organic matter, soil fauna and microorganisms are indispensible. Soil harbours a dynamic microbial population, arthropods and others (soil biota).

Greengram is the third most important pulse crop of India, next to chickpea and pigeonpea. It has been cultivated in India**,** which is one of the

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largest producing countries in the world since ancient times. Greengram is a protein rich staple food. It contains about 25 per cent protein, which is almost three times that of cereals. Greengram being a leguminous crop, it improves the soil fertility by fixing atmospheric nitrogen in the soil. India is producing 14 lakh tonnes of grain from an area of 34.4 lakh hectares with the productivity of 407 kg per hectare. In Karnataka, it is cultivated in an area of about 5.28 lakh hectares with the production of 1.08 lakh tonnes and productivity of 205 kg per hectare (Anon., 2012).

MATERIALS AND METHODS

Treatments details: T_1 Control, T_2 RDF (100%), T_3 FYM (100 %), T_4 Vermicompost (100 %), T_5 Glyrecidia (100 %), T_6 Pongamia (100 %) and T_7 FYM (25%) + Vermicompost (25%) + Glyrecidia (25%) + Pongamia (25%). Note: RDF (Rec. NPK-25:50:00 Kg/ha), Rec. FYM- 10 t/ha, Rec. FYM: 10 t/ha, Rec. Vermicompost: 2.5 t/ha, Rec. Glyrecidia: 20 t/ha and Rec. Pongamia: 20 t/ha and each treatments were replicated three times, greengram crop were used for the pot experiment (Variety BGS-9) and the data recorded on various soil microbial, greengram growth and yield parameters were subjected to Fisher's method of analysis of variance and interpretation of data as given by Gomez and Gomez (1984). The level of significance used in 'F' test and't' test was P = 0.01. Enumeration of microbial populations, soil samples collected from study site (pot) were used for enumeration of common soil microorganisms like bacteria, fungi, actinomycetes and different physiological groups such as *Rhizobium*, Phosphorus Solubilizing Microorganism (PSM) by following serial dilution agar plate method. Greengram plants were randomly selected from each treatment during different growth stages (25 and 50 DAS) for recording various observations on growth and yield parameters.

RESULTS AND DISCUSSION

Microbial population in study site

Bacterial population (cfu × 10^7 g^{-1} of dry soil), at 25 DAS, combined application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) recorded significantly higher bacterial population as compared to rest of the treatments. The next best treatments were vermicompost (100 %), FYM (100%) and RDF (100%). Significantly lower number of bacterial colonies was recorded with control. Similar trend was also noticed at 50 DAS.

Fungal population (cfu X 10^4 g^{-1} of dry soil), at 25 DAS, combined application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) recorded significantly higher fungal population as compared to rest of the treatments. Significantly lower number of fungal colonies was recorded with control which inturn was on par with rest of the treatments except vermicompost (100 %), FYM (100%) and RDF (100%) and *glyrecidia.* At 50 DAS, significantly higher fungal population was recorded with combined application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) as compared to all other treatments except vermicompost. Significantly lower number of fungal colonies was recorded with control which inturn was on par with rest of the treatments except FYM and RDF.

Actinomycetes population (cfu X 10^3 g^{-1} of dry soil), at 25 DAS, among various treatments, application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) recorded significantly higher actinomycetes population as compared to rest of the treatments. Significantly lower number of actinomycetes colonies was recorded with control which inturn was on par with rest of the treatments except vermicompost (100 %), FYM (100%) and RDF (100%) and *glyrecidia.* At 50 DAS, significantly higher actinomycetes population was recorded with combined application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) as compared to all other treatments except vermicompost and FYM. Significantly lower number of actinomycetes colonies was recorded with control which inturn was on par with rest of the treatments except RDF, *glyrecidia* and pongamia.

PSM (cfu X 10^3 g^{-1} of dry soil), At 25 DAS, combined application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) recorded significantly higher phosphate solubilising microbial population as compared to rest of the treatments except vermicompost (100%). Significantly lower number

Table 1. Bacteria, Fungi, Actinomycetes, PSM and *Rhizobium* population at different growth stages of greengram as influenced by nutrient management practices through organics in greengram under pot conduction

Treatments	Bacteria (CFU X 10^7/g of dry soil)		Fungi (CFU X 10^4/g of dry soil)		Actinomycetes (CFU X 10^3/g of dry soil)		PSM (CFU X 10^3/g of dry soil)		*Rhizobium* (CFU X 10^3/g of dry soil)	
	25 DAS	50 DAS	25 DAS	50 DAS	25 DAS	50 DAS	25 DAS	50 DAS	25 DAS	50 DAS
Control	20.67	43.33	13.00	27.33	19.67	30.00	21.67	31.33	26.67	44.67
RDF	30.33	70.33	20.33	33.00	26.67	43.00	31.33	41.67	46.67	70.67
FYM (100 %)	31.33	72.67	21.00	34.67	27.33	44.33	32.33	43.33	48.67	67.00
Vermicompost (100 %)	34.00	74.33	25.00	38.67	29.67	45.33	34.67	45.33	50.67	72.33
Glyrecidia (100 %)	27.67	63.33	17.67	31.33	24.67	35.00	23.67	38.33	35.33	63.33
Pongamia (100 %)	27.00	61.00	15.00	31.00	23.67	34.67	23.33	37.67	33.33	59.67
FYM (25%) + Vermicompost (25%) + Glyrecidia (25%) + Pongamia (25%)	37.00	76.67	28.67	43.67	35.33	47.33	36.33	49.33	53.67	76.67
S.Em	0.84	1.02	1.20	1.54	1.71	1.26	1.15	1.70	1.14	2.60
CD	2.49	3.05	3.56	4.65	5.14	3.75	3.48	5.06	3.48	7.90

Note: Values are mean of three replications

Table 2. Plant height, Number of branches, Number of leaves and Dry matter production at different growth stages of greengram as influenced by nutrient management practices through organics in greengram under pot conduction

Treatments	Plant height (cm)		Number of branch per plant	Number of leaves per plant		Dry matter production (g/plant)		Yield (kg/ha)
	25 DAS	50 DAS	50 DAS	25 DAS	50 DAS	25 DAS	50 DAS	
Control	9.33	23.33	1.67	2.00	3.67	0.97	4.33	315
RDF	22.33	48.33	4.67	5.67	8.33	1.77	11.33	1035
FYM (100 %)	13.67	38.33	3.33	3.33	7.33	1.05	7.00	613
Vermicompost (100 %)	15.67	41.33	4.00	4.33	7.67	1.07	7.67	718
Glyrecidia (100 %)	12.67	35.33	3.33	3.00	6.33	1.02	6.67	433
Pongamia (100 %)	10.67	33.00	3.33	2.67	6.00	1.01	5.67	468
FYM (25%) + Vermicompost (25%) + Glyrecidia (25%) + Pongamia (25%)	17.67	43.67	4.33	5.33	8.00	1.60	9.00	829
S.Em	0.71	0.96	0.43	0.49	0.50	0.10	0.66	8.92
CD	2.12	2.91	1.29	1.50	1.50	0.31	1.98	37.55

Note: Values are mean of three replications

of phosphate solubilising microbial population was recorded with control which inturn was on par with rest of the treatments except FYM (100%) and RDF (100%). At 50 DAS, significantly higher phosphate solubilising microbial population was recorded with combined application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) as compared to all other treatments except vermicompost. Significantly lower number of phosphate solubilising microbial population was recorded with control.

Rhizobium population were at 25 DAS of greengram, among various treatments, application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) recorded significantly higher N fixing microbial population as compared to rest of the treatments except vermicompost (100%). Significantly lower number of N fixing microbial population was recorded with control. At 50 DAS, significantly higher N fixing microbial population was recorded with combined application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) as compared to all other treatments except vermicompost (100%) and RDF (100%). Significantly lower number of N fixing microbial population was recorded with control. The rest of the treatments are on par with each other. In the present study, significant improvement in the population of soil micro-organisms *viz*., bacteria, fungi, actinomycetes, *Rhizobium* and P solubilizers was noticed at different stages of greengram (25 and 50 DAS). This could be attributed to presence of flush of easily metabolizable compounds at the beginning and the crop was also under active growth phase releasing higher amounts of root exudates, supporting numerous and diverse microflora. The significant increase in microbial population was observed with the addition of organic manures in combination with green leaf manure like Glyrecidia and pongmia. Application of FYM (25 %) + vermicompost (25 %) + Glyrecidia (25 %) + pongmia (25 %) recorded significantly higher bacteria, fungi, actinomycetes, *Rhizobium* and PSM population as compared to rest of the treatments. Lower microbial population was noticed in control (Table 1). Because it did not cause significant changes in the soil microbial population. These results are in line with the findings of Sreenivasa (2007), Deshpande *et al.* (2010) and Dhok and Ghodpage (2011) who reported higher soil microbial population with addition of combined application of organics as compared alone and control.

Plant growth parameters

Plant height of greengram at 25 DAS, significantly higher plant height was recorded with application of RDF (22.33 cm) as compared to all other treatments. Significantly lower plant height was recorded with control (9.33 cm) which inturn was on par with rest of the treatments except FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) (17.67 cm), vermicompost (100%) (15.67 cm) FYM (100%) (13.67 cm) and *glyrecidia* (100%) (12.67 cm). At 50 DAS, treatment with application of RDF (100%) recorded significantly higher plant height (32.70 cm) as compared to all other treatments. The next best treatments were combined application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) (43.67 cm) and vermicompost (100%) alone (41.33 cm). Significantly lower plant height was recorded with control (23.33 cm) which inturn was on par with rest of the treatments.

Number of branches per plant of greengram at 50 DAS, treatment with application of RDF (100%) recorded significantly higher number of branches per plant (4.67) and was on par with combined application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) (4.33) and vermicompost (100%) (4.0). Significantly lower number of branches per plant was recorded with control (1.67 cm) which inturn was on par with the treatments supplemented with FYM (100%), pongamia (100%) and *glyrecidia* (100%) (3.33). Number of leaves of greengram plant at 25 DAS, significantly higher number of leaves per plant was recorded with application of RDF (5.67) as compared to all other treatments except FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) (5.33). significantly lower number of leaves per plant was recorded with control (2.0) which inturn was on par with rest of the treatments. At 50 DAS, application of RDF(100%) recorded significantly higher number of leaves per plant (8.33) over all other treatments except the treatments received with combined application of FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) (8.0), vermicompost (100%) (7.67) and FYM (100%) (7.33). significantly lower number

of leaves per plant was recorded with control (3.67) which inturn was on par with rest of the treatments.

Dry matter production per plant of greengram at 25 DAS, significantly higher dry matter production per plant was recorded with application of RDF (100%) (1.77 g plant^{-1}) as compared to all other treatments except FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) (1.46 g plant^{-1}), significantly lower dry matter production per plant was recorded with control (0.97 g plant^{-1}) which inturn was on par with rest of the treatments. At 50 DAS, application of RDF (100%) recorded significantly higher dry matter production per plant (8.33) over all other treatments. Significantly lower dry matter production per plant was recorded with control (4.33 g plant^{-1}) which inturn was on par with rest of the treatments except FYM (25%) + vermicompost (25%) + *glyrecidia* (25%) + pongamia (25%) (9.0 g plant^{-1}), vermicompost (100%) (7.67 g plant^{-1}), FYM (100%) (7.0 g plant^{-1}) and *Glyrecidia* (100%) (6.67 g plant^{-1}). Greengram plant was significantly higher grain yield was recorded with application of RDF (1035 kg/ha) as compared to all other treatments. Significantly lower grain yield was recorded with control (315 kg/ha),

The present investigation was shown the plant height, number of branch, number of leaves, dry matter production and yield increased with the increase in the age of the plant. Plant yield increase due to the inorganic fertilizer application because inorganic fertilizer is easily taken up by the plant and organic manures will take the more time to decomposition by the bacteria or other microbes. Plant growth and yield of greengram was significantly higher with application of RDF at all the growth stages of greengram, whereas, significantly lower plant growth and yield was recorded with no application organic manure that's control over RDF (Table 2). Several workers have also reported increase in crop growth and yields with combined application of organic manures (Thomas Abraham and Lal, 2003; Gholve *et al*., 2005; Zalate and Padmani, 2009 and Patil *et al*., 2012).

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