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Effect of biofertlizers and organic manure on soil microbial population during mung bean growth in Varanasi Inceptisols

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Abstract

To sustain higher level of soil fertility and productivity, integrated use of bio- fertilizers and chemical fertilizers along with organic amendments is advocated because added carbon substrate significantly increases the microbial biomass, leading to enrichment of soil fertility. All the inoculated treatments were significantly increased the total bacterial population over control at 40 DAS, 60DAS and post harvest soil. The highest bacterial population was obtained due to BRh. BM1 +CDM. Each of Bradyrhizobium+CDM or sludge significantly increased the fungal and actinomycetes population over the control (NI). Maximum actinomycetes population was obtained due to BRh. BM 1+ sludge. Each of Bradyrhizobium strains + PSM gave highly significant increase in PSM over the remaining treatments at all growth stages of moongbean crop. The soil microflora ranked in order of total bacteria > actinomicetes > fungi > PSB.

Introduction

Fertility of soil depends not only on its chemical composition, but also on the qualitative and quantitative nature of micro-organisms in habiting it. The useful micro organisms are those which attack the plant residues and release the plant food material in simpler forms for use by the crops.

For instance, through the composition of organic matter by micro-organisms nitrate, sulphate, phosphate and micronutrients are released from the organic matter which can be utilized for plant growth (FAI, 1986). The grater microbial biomass and its metabolites in the rhizosphere constitute the active fraction of soil organic matter and serve as an important source of nutrients. The optimum dose of N and P fertilizers increase the nodulation of green gram and microbial population in soil (Singh *et al.*1999) *viz.* fungi, bacteria and actinomycetes. In view of the above an attempt was made to study to the microbial population in soil at different growth stages of mung bean plant as influenced by two strains of Bradyrhizobium sp. *vigna* (MO5 and BM1) alone and in combination with Pseudomonas or cattle dung manures (CDM or digested sludge (DS).

Materials and methods

A field experiment was conducted during *Kharif* season at Agricultural Research Farm, Institute of Agricultural Sciences, B.H.U. Varanasi. The experimental soil had pH 7.7 to 7.8, EC 0.24 to 0.27 dSm^{-1}, organic carbon 0.54 to 0.55 %, Total N 0.043 to 0.045 % available N 236 to 239 kg/ha. The initial soil was analyses by standard method sited by Jakson (1973) and Tandon (1995). The experiment was laid out in randomized block design having nine treatments with thrice replication Uniform dose of nitrogen and phosphorus @10 kg and 20.09 kg/ha through urea and single super phosphate, respectively, was basically applied to soil. Molybdenum@ 20g/ha as sodium molybdete was applied

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with the sticker solution in case of seed inoculation. Cattle dung manure(CDM) and digested sludge(DS) @ 16 t and 5 t /ha respectively, were applied as treatments before sowing. Mungbean cv. HUM-1 was son @ 20 kg /ha in plots of 5 x 2 m^2. The seed were inoculated with respective cultures (*Bradyrhizobium* sp.(v*igna*) MO 5 and BM 1, *Pseudomonas striata* as PSM). Total bacterial, fungal, actnomycetes and phosphate solubilizing bacterial population in soil were determined at 40 DAS, 60 DAS and post harvest soil.

Results and discussions

The inoculation of mungbean with two *bradyrhizobium* strains alone and in combination with PSM or CDM or digested sludge significantly increased the total bacterial population over control at 40 and 60 DAS. Similar trend was observed in post harvest soils (Table-1) with the addition of carbon substrate (CDM or DS) there was highly significant increase in total bacterial population which might be due to the increased enzymatic activities. Manna et al. (1996) reported that in general there was increase in microbial growth and enzyme activities with the addition of carbon substrate and declined as the available carbon exhausted.

Among the inoculated treatments, each of *Bradyrhizobium* strains + CDM or DS significantly increased fungal population over the remaining treatment at all growth stages of mungbean crop (Table-1). This might be due to acidophilic nature of the fungi. There was increase in fungal population from initial stages to post harvested soil Variation in fungal population is also influenced by age of the plant (Lakshmi Kumari, 1961). All inoculated treatment showed significantly increased actinomycetes population over the control at all growth stages of the crop (table-2). Each of *Bradyrhizobium* strains + CDM Or DS showed highly significant increased actinomycetes population over remaining treatments at all stages of crop which might be due to addition of carbon substrate (Manna *et al*., 1996).

Rhizosphere population of individual crops differs at successive stages of plant growth and greatest numbers are usually noted at maximum vegetative growth and at fruiting (Krasil' nikov, 1934). Phosphate solubilizing bacterial (PSB) population showed similar trend as that of total bacterial in all cases. Highly significant increase was due to each of *Bradyrhizobium* + PSM (Table-2) over remaining treatments at all growth stages of mungbean crop. Increasing trend in microbial population was noticed after 30 DAS and after declined at harvest stage. Fertilizers and manures had a profound influence on the microbial population of the soil which in turn, affects the rate of assimilation of nutrients (John and Abraham, 1995).

Table-1: Effect of biofertilizers and organic manures on microbial population of soil at different stages of mung bean growth

Treatment combination	Bacterial population (X $l0^3$ cells g^{-1} soil)			Fungal population (x10^3 cells g^{-1} soil)		
	40 DAS	60 DAS	After harvest	40 DAS	60 DAS	After harvest
Tl No Inoculation (NI)	10.79	14.79	9.55	7.78	7.85	8.93
T2 *Bradyrhizobium* (M05)	17.92	22.66	10.32	7.08	7.30	7.90
T3 *Bradyrhizobium* BMI	16.94	21.65	11.37	7.55	7.90	7.14
T4 BRh M05 + PSM	21.85	24.66	12.03	7.64	7.27	7.45
T5 BRh BMI + PSM	19.28	23.72	12.00	7.15	7.85.	8.10
T6 BRh M05 + CDM	24.30	26.58	13.65	9.09	9.70	0.21
T7 BRh BMI + CDM	23.81	25.40	13.15	8.80	9.08	10.05
T8 BRh M05 + Sludge	26.18	26.26	13.10	9.10	9.48	10.54
T9 BRh BMI + Sludge	25.13	25.35	12.95	8.95	9.70	9.15
C.D. at 5%	0.79	2.84	1.72	1.21	1.32	1.21

BRh - *Bradyrhizobium strain* sp. *(vigna),* PSM : *Pseudomonas striata* (Phosphate Solubilising Microorganisms), CDM: Cattle dung manure

Table-2: Effect of Biofertilizers and organic manures on microbial population of soil at different stages of mung

Treatments combination	Actinomycetes population ($x10^5$ cells g^{-1} soil)			PSB population ($x10^3$ cells g^{-1} soil)		
	40 DAS	60 DAS	After harvest	40 DAS	60DAS	After harvesting
T1.No Inoculation (NI)	6.80	7.02	7.05	5.00	5.05	5.00
T2.Bradyrhizobium MOS	7.45	7.55	7.60	5.14	5.45	5.40
T3.Bradyrhizobium BMI	7.48	7.58	7.60	5.22	5.30	5.22
T4.BRh M05 + PSM	7.36	7.45	7.53	12.46	12.40	11.38
T5.BRh BMI + PSM	7.64	7.72	7.78	12.17	12.15	11.00
T6.BRh M05 + CDM	7.34	8.08	8.40	6.50	6.52	6.43
T7BRh BMI + CDM	8.15	8.20	8.42	6.20	6.26	6.05
T8.BRh M05 + Sludge	7.96	8.06	8.39	6.52	6.55	.6.38
T9.BRh BMI + Sludge	7.90	8.05	8.40	6.20	6.22	6.08
C.D.= at 5%	1.09	1.03	1.34	0.34	0.65	0.83

PSM : *Pseudomonas striata* (Phosphate Solubilising Microorganism) CDM : Cattle dung manure

Conclusion

Among the different treatment combination of Bradyrhizobium strains and organic sources with phosphate solubilizing microorganisms increased the significant population of bacteria, fungi, actinomycetes and PSB at 60 DAS. Both *Bradyrhizobium* strains along with PSM or CDM or DS gave more bacterial population. *Bradyrhizobium* alon with CDM increased the actinomycetes population while *Bradyrhizobium* + PSM increased phosphate solubilizing bacterial population. Soil microflora ranked in the order total bacteria> actinomycetes> fungi> PSB. Between the bradyrhizobial strains (MO 5 & BM 1) no remarkable difference was observed.

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