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EFFECT OF PHOSPHATE SOLUBILIZERS AND FYM ON MICROBIAL POPULATION OF SOYBEAN FIELD [*GLYCINE MAX* (L.) MERRILL]

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ABSTRACT
Soybean [*Glycine max* (L.) Merrill] is an all famous oil seed as well as pulse crop which contains 40-44 % protein, 20 % oil and many other nutrients. A field experiment was conducted to know the effect of phosphate solubilizing bacteria and fungi and FYM on microbial population of soybean field during *Kharif* season 2009-10. Among treatments, *Aspergillus awamori and Bacillus polymixa* were used as seed treatment @ 20 g/kg seed and phosphorus levels were given through SSP (50 and 25 % P_2O_5) and FYM levels (5 and 2.5 t/ha) as applied into the soil. Seed treatment with *A. awamori* increased fungal (25.25 and 29.06 cfu x 10^3/g) and actinomycetes population (23.44 and 26.19 cfu x 10^8/g) while *B. polymixa* increased phosphate solubilizing bacterial counts (21.37 and 23.31 cfu x 10^6/g) significantly at 30 and 60 DAS, respectively. Application of FYM (5 t/ha) had significantly increased the fungi (22.21 and 27.25 cfu x 10^3/g), actinomycetes (20.37 and 23.77 cfu x 10^8/g), bacterial (30.55 and 36.02 cfu x 10^6/g) and PSB population (18.42 and 21.30 cfu x 10^6/g) in the soybean field at 30 and 60 DAS, respectively. Thus, it can be concluded that the application of *Aspergillus awamori* (20 g/kg seed) and FYM (5 t/ha) are better to increase microbial population as well as yield attributes of soybean in the field.

INTRODUCTION

Farmers are facing severe problem on availability of chemical fertilizers for soybean production. Growers generally use chemical fertilizers to increase soybean production. However, it gives hazardous effect as soil and water pollution. Biofertilizer (*Rhizobium*, PSB) and FYM (organic manure) compared with chemical fertilizers are an attractive and environmental safety method of soybean production as it helps to minimize the use of chemical fertilizer and proved environmental safe and ecological sustainable. Phosphorus is an essential major nutrient for the development of plants as it stimulates early development and promotes healthy growth of seedlings. It also enhances the formation of nodules and nitrogen fixation in legumes. Many scientists used various selected strains of phosphate solubilizers which increase the dry matter, grain yield and 'P' uptake (Ahmad and Jha, 1982), PSB increased grain yield and nodulation (Chandra *et al*., 1995). Application of fertilizer nutrients along with FYM, use of nitrogen fixers, phosphate solubilizers and VAM increased grain and straw yield (Saini *et al*., 2005). Sarawgi *et al*. (2012) reported that seed treatment with biofertilizers had their significant effect on microbial population in conjunction with P application in soybean field. The main objective of this study was to assess the effect of bio-fertilizers and FYM on microbial population for promoting better growth of soybean.

MATERIALS AND METHODS

A field experiment was conducted at experimental farm of Department of Plant Pathology, College of Agriculture, Nagpur during *kharif* season 2009-10. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with four replications. Among the treatments, the carrier based inoculants of *Aspergillus awamori* and *Bacillus polymixa* obtained from Plant Pathology Section, College of Agriculture, Nagpur were used as seed treatment @ 20 g/kg seed and phosphorus levels through SSP (50 and 25 % P2O5) and FYM (5 and 2.5 t/ha at 10 days before sowing) as applied into the soil. A common dose of 30 kg N/ha was applied in all the plots. The soybean cultivar JS-335 was drilled at geometry of 30 x 5 cm. Prior drilling, the seeds were treated with *Aspergillus awamori* and *Bacillus polymixa* @ 20 gm/kg seed. For population count, an isolation of fungi, bacteria, PSB, and actinomycetes were made from rhizospheric soils following serial dilution plate method of Vincent (1970) at the time of 30, 60 and 90 DAS, respectively.

The selected Potato Dextrose Agar medium was used for isolation of fungi, nutrient agar medium for bacterial isolation, Pikovaskaya's medium for PSB isolation and Kenknight medium used for actinomycetes. In each plate, 20 ml medium was poured and rotated with hands for even distribution of suspension and allowed to settle down. The plates were incubated at room temperature 28 ± 2ºC. After four days of incubation, the total numbers of colonies were counted and calculated the number of microorganism per ml of original suspension as follows:

$$\text{Organism in 1 g of samples} = \frac{\text{No. of colonies}}{\text{Amount of diluted suspension x dilution factor}}$$

Table 1: Effect of phosphate solubilizers and FYM on microbial population in soybean field

Treatments	Fungal population (cfu x 10^3/ gm)			Bacterial population (cfu x 10^6/ gm)			PSB population (cfu x 10^6/ gm)			Actinomycetes population (cfu x 10^8/ gm)		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
FYM levels												
5 t/ha	22.21	27.25	24.85	30.55	36.02	33.47	18.42	21.30	17.72	20.37	23.77	20.35
2.5 t/ha	18.10	22.30	21.04	27.72	32.87	29.5	14.82	18.20	14.80	18.02	19.77	17.90
S.Em+	0.13	0.08	0.08	0.05	0.18	0.09	0.07	0.10	0.09	0.10	0.10	0.06
CD (P=0.05)	0.39	0.25	0.25	0.15	0.52	0.27	0.21	0.29	0.26	0.29	0.30	0.19
PSB												
A. awamori	25.25	29.06	26.93	30.00	36.13	33.00	18.18	21.18	17.31	23.44	26.19	23.25
B. polymixa	21.87	27.38	25.56	31.31	39.31	34.63	21.37	23.31	19.00	20.81	25.31	22.06
50% P_2O_5/ha	19.15	24.75	22.62	28.93	34.00	31.37	16.25	19.81	16.37	18.81	21.44	17.63
25% P_2O_5/ha	18.06	22.75	20.88	28.63	32.25	30.18	14.87	18.50	15.75	16.93	18.38	16.88
Control	16.43	19.93	18.73	26.81	30.56	29.13	12.43	15.94	12.88	16.00	17.56	15.81
S.Em+	0.97	0.62	0.63	0.38	1.29	0.67	0.51	0.70	0.65	0.72	0.75	0.47
CD (P=0.05)	2.82	1.81	1.83	1.10	3.74	1.95	1.49	2.05	1.89	2.09	2.18	1.38
Interaction												
S.Em+	1.37	0.88	0.89	0.53	1.82	0.95	0.73	1.00	0.92	1.02	1.09	0.67
CD (P=0.05)	-	-	-	-	-	-	-	-	-	-	-	-

RESULTS AND DISCUSSION

Effect of phosphate solubilizers

It is cleared from the data (Table 1) that there were significant differences on fungal, bacteria, PSB and actinomycetes population at all the intervals. Maximum population of fungi (29.06 cfu x 10^3/g) and actinomycetes (26.19 cfu x 10^8/g) were attained at 60 DAS by treating the seeds with *Aspergillus awamori* and found significantly superior over all the treatments which were followed *Bacillus polymixa* (27.38 cfu x 10^6/g and 25.31 cfu x 10^8/g, respectively). The increase in fungal population from 30 to 60 DAS may be due to growth promoting substances secreted during crop growth period. At 90 DAS, there was a decrement in counts in all the treatments. Similar results were obtained by Gupta *et al*. (1992). Present results are also in accordance with the findings of Saini *et al*. (2005) where microbial biomass, C, N and P contents in the rhizosphere soil of soybean were maximum from 30-60 DAS and decreased from 60 DAS or harvest after applying fertilizer nutrients along with FYM, use of nitrogen fixers, phosphate solubilizers and VAM. Babana and Antoun (2006) reported that phosphate solubilizing fungal isolates of *Aspergillus awamori* Nakazawa C_1 and *Penicillium chrysogenum* Thom C_{13} increased microbial population and root dry matter yield. Sarawgi *et al*. (2012) reported that seed treatment with biofertilizers had their significant effect on microbial population in conjunction with P application in soybean field. Significant differences were also observed on bacterial and PSB population at all the intervals. Maximum population of bacteria (39.31 cfu x 10^6/g) and PSB (23.31cfu x 10^6/g) were attained by seed inoculation with *B. polymixa* at 60 DAS and it was found significantly superior over all the treatments and was followed by seed treatment with *A. awamori* (36.13 cfu x 10^6/g and 21.18 cfu x 10^6/g, respectively). At 60 DAS, there was increased population counts in bacterial and PSB treatments and decreased at 90 days in all the treatments (Table 1). These results are in agreement with Kundu and Gaur (1980), Saini *et al*. (2005) and Qureshi *et al*. (2005).

Effect of FYM

The data (Table 1) showed that the application of FYM 5 t/ha had significantly increased the fungi, actinomycetes, bacterial and PSB population in soybean field up to 60 DAS. Maximum population of fungi (27.25 cfu x 10^3/gm), actinomycetes (23.77 cfu x 10^8/gm), bacterial (36.02 cfu x 10^6/gm) and PSB (21.30 cfu x 10^6/gm) was recorded by application of 5 t/ha FYM as compared to 2.5 t/ha. At 60 DAS, there was an increased viable count in all the treatments which are in agreement with Kundu and Gaur (1980), Gupta *et al*. (1992), Qureshi *et al*. (2005), Saini *et al*. (2005) and Chaturvedi *et al*. (2010). This may be due to fact that there might have been more amount of degradation of organic matter in soil which resulted in increased microbial populations (Table 1) while at 90 DAS, it was decreased in all the treatments. The decrease in population may be due to proceeding of crop to maturity stage.

REFERENCES

Ahmad, N. and Jha, K. K. 1982. Effect of phosphate solubilizers on

the dry matter and grain yield and 'P' uptake by soybean. *J. Indian Soc. Soil Sci.* **30:** 105-106.

Babana, A. H. and Antoun, H. 2006. Biological system for improving the availability of Tilemsi phosphate rock for wheat (*Triticum aestivum* L.) cultivated in Mali. *Nutrient Cycling in Agroecosystems*. **76 (2-3):** 285-295.

Chandra, K., Mukherjee, P. K., Karmakar, J. B. and Sharma, B. K. 1995. Effect of phosphate solubilizing bacteria on rhizobial symbiosis in soybean at rainfed conditions of Manipur. *Environment and Ecology*. **13(2):** 436-438.

Chaturvedi, Sumit, Chandel, A. S., Dhyani, V. C. and Singh, A. P. 2010. Productivity, profitability and quality of soybean (*Glycine max*) and residual soil fertility as influenced by integrated nutrient management. *Indian J. Agro*. **55(2):**

Gupta, S. B., Vyas, M. K. and Patil, S. K. 1992. Effect of phosphorus solubilizing bacteria and thiram at different levels of phosphorus on soybean and soil micro flora. *J. Indian Soc. Soil Sci.* **40:** 854-856.

Kundu, B. S. and Gaur, A. C. 1980. Establishment of nitrogen-fixing and phosphate solubilizing bacteria in rhizosphere and their effect on yield and nutrient uptake of wheat Crop. *Plant and Soil*. **57:** 223-230.

Qureshi, A. A., Narayanasamy, G., Chhonkar, P. K. and Balasundaram, V. R. 2005. Direct and residual effect of phosphate rocks in presence of phosphate solubilizers and FYM on the available P, organic carbon and viable counts of phosphate solubilizers in soil after soybean, mustard and wheat crops. *J. Indian Soc. Soil Sci.* **53(1):** 97-100.

Saini, V. K., Bhandari, S. C., Sharma, S. K. and Tarafdar, J. C. 2005. Assessment of microbial biomass under integrated nutrient management in soybean-winter maize cropping sequence. *J. Indian Soc. of Soil Sci.* **53(3):** 346-351.

Sarawgi, S. K., Chitale Shrikant, Tiwarp, A. and Bhoi, S. 2012. Effect of phosphorus application along with PSB, *Rhizobium* and VAM on P fractionation and productivity of Soybean (*Glycine max*). *Indian J. Agron.* **57(1):** 55-60.

Vincent, J. M. 1970. A manual for the practical study of the root nodule bacterial, IBP Hand Book No. 15, Blackwell, *Scientific Publication, Oxford.*