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ROLE OF PHOSPHATE SOLUBILIZING MICROORGANISM (PSM-2) IN COMBINATION WITH ORGANIC MANURE IN SOYBEAN NODULATION AND SEED YIELD GROWN WITH DIFFERENT DOSE OF 'P' UNDER RAINFED CONDITIONS OF CENTRAL INDIA

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ABSTRACT

Field experiment were conducted in chromustert soil (vertisol) for four years in Kharif season of 1999, 2000, 2001 and 2002 at Research Farm of R.A.K. College of Agriculture, Sehore (M.P.). The findings revealed that the inoculation of Soybean seed with PSM-2 alongwith incorporation of FYM @ 1 t/ha + SSP 60 kg P_2O_5/ha (T_5) produced the significant higher nodulation viz. number of nodule/plant (NN/plant), nodule dry weight (NDW/plant), shoot dry weight (SDW/plant), seed index (weight of 100 grams seeds) and seed yield over T_1 and control. This treatment also remained superior over rest of the treatments and fetched the highest 38.56 more seed yield as that of rest of the treatments. This indicates the superiority of phosphate solubilizing micro organism (PSM 2) in enhancing the availability of phosphorous alongwith other essential nutrients in the soil leading to higher nodulation and seed yield of Soybean in Central India.

Key words: Organic manure, Soybean, seed yield, rainfed conditions.

Phosphorus is an important nutrient element next to nitrogen for plant growth. The 'P' supplied into the soil through chemical fertilizers gets fixed in the soil. The most of the soil 'P' remained in unavailable form and hardly about 1-2% of it is incorporated into the above ground part of the plants (Tilak, 1998). Next to chemical sources 'P' is supplied through organic sources such as decomposed plant and animal material which are slow release of 'P' in the soil for plant growth. Phosphorus solubilizing microorganism (PSM) include various bacterial, fungal and actinomycetes forms which help to convert insoluble inorganic phosphate (already existing in the soil in huge amount) into simple and soluble forms for plant growth (Tilak, 1998). Therefore, to curtail down the use of chemical 'P' fertilizer for economic viability of the farmers communities and sustaining the arable soil health and productivity of Soybean in Central India, the present investigation in chromuster soil (vertical) was undertaken for four consecutive years.

Field experiments were conducted in randomized block design with three replication during Khariff seasons of 1999, 2000, 2001 and 2002 at Research Farm of Rafi Ahmed Kidwai College of Agriculture, Sehore (M.P.) with Soybean variety JS 335. The basal application of recommended nitrogen and potash @ 20 kg each through urea and muriate of potash respectively was uniformly given to all the plots. In all, there were 09 (nine) treatments with and without PSM-2 in combination of organic manure (FYM) and different doses of 'P' applied at the time of sowing of crops in all the four years. The soil in the experimental soil was low in available nitrogen (192 kg/ha), phosphorus (11.20 kg/ha) and high in available potassium (410 kg/ha) and low in organic carbon (3.14 g/kg soil). The electrical conductivity was normal (0.30 dos/m) and pH was neutral (7.4).

The FYM 1t/ha alongwith the different doses of 'P' was applied in furrows at the time of sowing and inoculation of Soybean seeds was done with PSM 2 seed treatment @ 10 gms/kg seed. Observations of different parameters were recorded at 50% flowering stage and physiological maturity stage of the crop. Chemical analysis of different parameters was done as per standard methods.

Table - 1: Effect of phosphate solubilizing microorganism in combination with organic manure in Soybean grown with different doses of phosphorus under rainfed conditions (Average of 4 years data 1999-2000)

S. No.	Treatment	At 50% flowering stages NN/Plant (mg)	NDW/Plant (g)	SDW/Plant (g)	Seed index (g)	Seed yield (kg/ha)	Increase over control (%)
1.	FYM @ 1 t/ha + SSP 60 P_2O_5 kg/ha	72.43	134.10	4.86	9.35	1402.78	36.22
2.	FYM @ 1 t/ha + SSP 45 kg P_2O_5 /ha	59.52	124.99	4.74	9.28	1313.89	25.85
3.	FYM @ 1 t/ha + SSP 45 kg P_2O_5 /ha	60.87	115.08	4.48	9.20	1252.85	16.50
4.	FYM 1 t/ha	53.84	95.09	3.96	8.79	1216.78	13.31
5.	T_1 + PSM -2	99.90	152.61	5.75	9.46	1418.17	38.50
6.	T_2 + PSM -2	79.20	143.49	5.46	9.38	1405.39	36.99
7.	T_3 + PSM -2	72.02	127.84	5.18	9.25	1373.03	30.72
8.	T_4 + PSM -2	62.89	108.53	4.30	8.92	1268.17	20.22
9.	Control	50.70	74.96	3.86	8.45	1088.89	
	S. Em. ±	3.44	4.73	0.32	0.18	52.08	
	CD at 5%	10.30	14.15	0.95	0.55	156.84	

The result acquired on number of nodule/plant, nodule dry weight/plant, shoot dry weight, seed index and seed yield (Table -1) indicates that they were boosted up significantly with the application of FYM @ 1t/ha + 60 kg P_2O_5 (SSP) + PSM-2 (T_5) over control and T_1. This treatment (T_5) remained superior to rest of the treatments exerting 38.50% increase in the seed yield over control. Such increase in symbiotic traits viz. NN/plant, NDW/plant, SDW/plant and seed index could be ascribed due to the fair availability of phosphorus and other nutrients in the soil needed for plant growth owing to the enhanced microbial activities leading to the higher mineralization rate which, inturn, might have accelerated the nutrient uptake by growing plants resulted in higher seed yield of Soybean in Central India in medium black clay loam soil. The increase in the grain yield of different leguminous and cereal crops due to the application of phosphate solubilizing microorganism has also been reported by Gour (1985). Furthermore, the findings are in close confirmity with those reported by Annapurna (2001) and Singh & Jain (2005).

Conclusion

The application of FYM 1t/ha + Phosphorus @ 60 kg P_2O_5/ha + PSM 2 may be the tool to sustained the physical, biological and chemical health of the soil leading to higher productivity of Soybean under rainfed conditions of Central India in chromusterd (medium black clay loam) soil.

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