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EFFECT OF LEVELS AND SOURCES OF PHOSPHORUS AND PSB ON GROWTH AND YIELD OF BLACK GRAM (*VIGNA MUNGO* L. HEPPER)

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ABSTRACT

In two years study on the response of black gram (*Vigna mungo* L. Hepper) Cv JU 2, the optimum level of phosphorus through different sources was determined with or without application of PSB [Phosphorus solubilizing bacteria]. Significantly highest seed yield of 651 kg/ha was recorded due to application of 40 Kg P_2O_5/ha through DAP with PSB. The increase in seed yield was attributed mainly due to increase in nodulation, plant height, branches per plant, leaves per plant and pods per plant. A net return of Rs. 2624/- per hectare was also recorded highest in this treatment. It is therefore, recommended for general adoption in medium black soils of Madhya Pradesh.

INTRODUCTION

Black gram (*Vigna mungo* L. Hepper) is the most important rainy season pulse crop of Madhya Pradesh that is grown in about 554 thousand hectare with an average productivity of 361 kg/ ha. The introduction of pulse-based intensive cropping system in the recent years, the majority of black soils in the state needs phosphorus supply from out sources for getting good yield of these crops. The problem of available phosphorus in the soil become more severe than in the past due to growing of pulse after pulses regularly. Application of mineral phosphorus fertilizer is also not much encouraging due to its rapid fixation. It is a proven fact that about 85-90 % of applied phosphorus through fertilizer get fixed in the soil and only 10-15% of its become available to the crop. Large deposits of rock phosphate in India still remained unused as a fertilizer as it is low grade and insoluble phosphorus content. Based on these circumstances emphasis has been given to use phosphorus solubilizing bio-fertilizer which have been found useful in enhancing phosphorus availablity to plant through solubilization, converting low grade rock phosphate as fertilizer and increasing the seed yield (Bhattacharya and Jain, 2000). Keeping this in view, an investigation was carried out to study the effect of levels and sources of phosphorus and PSB on growth and yield of black gram in Madhya Pradesh.

MATERIAL AND METHODS

An experiment was conducted to determine the optimum level of phosphorus through different sources with or without application of PSB at AICRP on MULLaRP, JNKVV. RAK College of Agriculture, Sehore (M.P.) during rainy seasons of 2002-03 and 2003-04 under normal agronomical practices. The soil was clay loam with pH 7.5, 236 kg available nitrogen, 19.5 kg available phosphorus and 465kg/ha available potassium. The treatments comprised two levels of phosphorus (20 and 40 kg P_2O_5/ ha) applied through two sources of phosphorus i.e. rock phosphate and di-ammonium phosphate alone and also in combination with PSB. One absolute control and one PSB inoculation alone treatments were also included for comparison. The experiment was laid out in a randomized black design with 3 replications. Black gram variety JU 2 was sown on July 18, 2002 in first year and July 01, 2003 in second year at a row spacing of 30cm. Uniform dose of 20 kg nitrogen, potash and sulphur per hectare were applied common to all the plots at the time of sowing. The rainfall received during the crop season was 464.2 mm and 1103 mm during 2002-03 and 2003-04,

respectively. Two sets of five plants were randomly selected from each treatment for recording observations. The observations on number and dry weight of root nodules were recorded after 45 days of sowing from first set of selected plants. Whereas, branches per plant, leaves per plant and pods per plant were recorded at maturity from second set of selected plants. Inner eight rows were harvested and threshed to record seed yield per plot, which was converted into yield per hectare.

RESULTS AND DISCUSSION

Number and dry weight of root nodules : The number and dry weight of root nodules (31.8 nodules/ plant and 33.0 mg dry weight/ plant, respectively) were found maximum due to application of 40 kg P_2O_5/ ha through DAP + PSB. Seed inoculation with PSB alone produces significant number and dry weight of root nodules per plant *viz.* 33.5 nodules and 19.0 mg nodules dry weight, respectively as compared to control (25.1 nodules and 13.0 mg nodule dry weight, respectively). These results were in agreement with the findings of Jaggi and Sharma (1992), Tomar *et al.* (1993), Rajput (1994) and Tiwari and Pandey (2002).

Crop growth : The levels and sources of phosphorus with and without PSB exerted significant influence on growth parameters. However, rock phosphate alone showed least effect on growth parameter. Application of 40 kg P_2O_5/ ha through DAP+ PSB recorded maximum plant height (26.1 cm), branches per plant (4.6), leaves per plant (6.6), and pods per plant (30.7). The effect of seed inoculation with PSB was found significant on growth parameters as compared to control. Among the sources of phosphorus, DAP performed better than rock phosphate. Similarly, PSB inoculation proved better than no inoculation (Table -1). Prabhaker and Saraf (1991), Tomar *et al.* (1994) Mathan *et al.* (1996), Singh and Sharma (2001) have also reported more or less similar results in black gram.

Grain yield : A perusal of data (Table 2) revealed that the levels and sources of phosphorus alone and its combined application with PSB caused significant increase in the seed yield of black gram variety JU 2. Amongst various treatments, 40 kg P_2O_5/ ha applied through DAP with PSB inoculation resulted in the significantly highest seed yield (651 kg/ ha). This increase in

Table 1. Effect of levels and sources of phosphorus and PSB on the growth and yield attributes of black gram (Mean of 2002-03 to 2003-04)

S.No.	Treatments	No. of root Nodules per plant at 45 DAS	Dry wt. of root nodules per plant at 45 DAS	Plant height (cm)	Branches/ plant	Leaves/ plant	Pods/ plant
T1	Absolute control	25.1	13.0	19.0	3.3	4.1	20.8
T2	20 kg P_2O_5/ ha through RP	28.8	15.5	20.4	3.5	5.1	22.6
T3	20 kg P_2O_5/ ha through DAP	30.0	17.0	22.8	3.8	5.5	24.4
T4	40 kg P_2O_5/ ha through RP	29.0	15.0	20.6	3.4	5.3	23.0
T5	40 kg P_2O_5/ ha through DAP	32.4	19.5	23.9	4.2	6.0	28.1
T6	PSB	30.3	19.0	22.0	3.7	5.1	24.0
T7	T_2+PSB	31.2	18.5	22.4	4.0	5.6	24.8
T8	T_3+PSB	31.5	27.0	24.8	4.3	5.9	27.5
T9	T_4+PSB	31.9	24.0	23.2	4.2	6.0	26.3
T10	T_5+PSB	31.8	33.0	26.1	4.6	6.6	30.7
	SEm±	0.88	0.93	0.66	0.14	0.22	0.73
	CD at 5 %	2.05	2.23	1.81	0.39	0.60	2.07

Table 2. Effect of levels and sources of phosphorus and PSB on the seed yield and net return of black gram

S.No.	Treatments	Seed Yield kg/ ha			Yield increase over control		Additional cost of treatment (Rs. ha)	Additional return (Rs./ha)	Net Return (Rs./ha)
		2002-03	2003-04	Mean	Kg/ ha	%			
T1	Absolute control	417	450	434	-	-	-	-	-
T2	20 kg P_2O_5/ ha through RP	431	478	455	21	4.8	116	315	199
T3	20 kg P_2O_5/ ha through DAP	454	497	476	42	9.7	291	630	339
T4	40 kg P_2O_5/ ha through RP	440	510	475	41	9.4	232	615	383
T5	40 kg P_2O_5/ ha through DAP	523	584	554	104	27.6	581	1560	979
T6	PSB	458	528	493	59	9.9	50	885	835
T7	T_2 + PSB	478	541	510	76	17.5	166	1140	974
T8	T_3 + PSB	518	610	564	30	30.0	341	1950	1609
T9	T_4 + PSB	505	617	561	127	29.3	282	1905	1623
T10	T_5 + PSB	565	736	651	217	50.0	631	3255	2624
	SEm±	20	28.7	24.35					
	CD at 5 %	67	67.6	67.3					

seed yield was higher by 50 per cent (217 kg/ ha) over absolute control. The second best treatment was 20 kg P_2O_5/ ha through DAP + PSB. It is thus clear from the results that rock phosphate was less effective as compared to DAP as a source of phosphorus. However, when this source of P was used with PSB inoculation, the seed yield increased significantly over its application at same level without PSB. Hence, PSB inoculation increased the efficiency of this insoluble source of P. The response of DAP was better than RP with PSB and without PSB inoculation. The trends of the results were in conformity with those reported by Jaggi and Sharma (1992), Tomar *et al.*, (1994), Mathan *et al.* (1996), Reddy and Swami (2000), Singh and Sharma (2001).

Net Return : Applications of 40 kg P_2O_5/ ha through DAP along with PSB inoculation resulted in highest seed yield as well as net return per hectare. The higher level of phosphorus through DAP with PSB inoculation brought about the highest net return up to Rs. 2624/ ha (Table 2).

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