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Influence of phosphorus, vermicompost and PSB on yield attributes, seed yield and quality of black gram

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ABSTRACT : A field experiment was conducted to study the effect of phosphorus, vermicompost and PSB inoculation on growth, yield and quality of black gram during *Kharif* 2011 on the farm of Agronomy department, at college of Agriculture, Latur. The maximum value of yield attributes, seed yield and protein content of black gram was obtained with the application of 75 kg P_2O_5 ha^{-1}. A significant increase in seed yield was recorded with the application of vermicompost @ 2.5 tonne ha^{-1} combined with PSB inoculation. The higher protein content was recorded with the higher level of phosphorus and combined treatment of vermicompost and PSB inoculation.

Key Words : Phosphorus, Vermicompost, PSB

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Blackgram (*Vigna mungo* L.) is one of the important pulse crops grown in India. Pulses are the cheapest source of quality protein for human being. Black gram is also grown as a cover crop as well as catch crop due to short duration. The role of legume is in improving soil fertility by fixing atmospheric nitrogen in soil. The importance of phosphorus application to black gram crop has been recognised since long (Patil and Jadhav, 1994). Application of phosphorus plays an important role in growth, development and maturity of crop. Phosphorus helps to increase grain yield, seed quality, regulate the photosynthesis, governs physico-bio chemical process and also in development of roots and nodulation. Therefore, application of phosphorus is must incentive coupled with increased use of phosphorus with organic manure (Vermicompost) and bio fertilizers PSB. To compensate the short supply and price hike of chemical fertilizers, use of indigenous sourses like vermicompost has to be encouraged as it supplies essential plant nutrients and improves physical, chemical and biological conditions of the soil, soil microbial activities, soil structure, water holding capacity and thereby increase the fertility and productivity of soil. Vermicompost is a potential source due to the presence of available plant nutrients, growth enhancing substances like nitrogen fixing, phosphorus solubilising and cellulose decomposing organism. Many investigators reported that crop utilizes only 15- 20 per cent of the applied phosphorus and rest is retained in the form which is not readily available to the crop. The PSB like *Pseudomonas* and *Bacillus* also enhance the availability of phosphorus to plant by converting insoluble phosphorus from the soil into soluble form. Hence, the present investigation was undertaken to study the effects of judicious use of inorganic phosphorus, organic vermicompost, and biofertilizer PSB on yield attributes, seed yield and quality of black gram.

RESEARCH PROCEDURE

The present field experiment was conducted during *Kharif* 2012-13 at the Experimental Farm, Agronomy Section, College of Agriculture, Latur (Maharashtra).The soil of the experimental site was clayey in texture, low in available nitrogen (193.5 kg ha^{-1}), medium in available phosphorus (11.82 kg ha^{-1}), and high in potash (433.78 kg ha^{-1}).The soil was slightly alkaline in reaction (8.27 pH). The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications.The treatments comprised of three levels of phosphorus *viz.*, P_1: 25 kg P_2O_5 ha^{-1}, P_2: 50 kg P_2O_5 ha^{-1}, P_3: 75 kg

P_2O_5 ha^{-1}and the treatments of vermicompost and PSB *viz.* V_1: Vermicompost @ 2.5 tone ha^{-1}, V_2: PSB inoculation @ 250 g/10 kg seed and V_3: Vermicompost and PSB inoculation. The gross and net plot size was 5.4m x 4.2m and 4.8m x 3.0m, respectively. The precipitation received during crop growth season was 526.1mm and distributed over 34 rainy days during the course of experimentation. The sowing of black gram seed (BDU-1) was done on 1st july 2012 by dibbling two seeds per hill at a distance of 30 x10 cm at about 2.5 cm depth. The complete dose of phosphorus and nitrogen as per treatments was drilled at the time of sowing uniformly in the plot. Application of vermicompost and PSB seed inoculation was done as per treatments before sowing.

RESEARCH ANALYSIS AND REASONING

The results obtained from the present investigation have been presented under following heads:

Yield attributes:

Effect of phosphorus levels:

Data in Table 1 revealed that yield attributes *viz.*, dry matter plant^{-1}, no. of pods plant^{-1}, pod yield (g) plant^{-1}, seed yield (g) plant^{-1} and test weight (g) were significantly influenced by the different levels of phosphorus. Maximum dry matter production plant^{-1}, no. of pods plant^{-1}, pod yield (g) plant^{-1}, seed yield (g) plant^{-1} and test weight (g) were observed with the application of 75 kg P_2O_5ha^{-1}but was found to be at par with 50 kg P_2O_5 ha^{-1}. This might be due to the higher dose of phosphorus resulted in producing large productive parts (Sarkar and Banik, 1991; Rathore *et al.,* 2010).

Effect levels of vermicompost and PSB inoculation:

The maximum dry matter plant^{-1}, number of pods plant^{-1}, pod yield (g) plant^{-1}, seed yield (g) plant^{-1} and test weight (g) was recorded when vermicompost 2.5 tonnes ha^{-1} incorporated with the PSB seed inoculation. But was found at par with PSB seed inoculation. Alone vermicompost application was not found significantly beneficial. Higher values in respect of yield attributes may be due to efficient photosynthesis and produces high carbohydrate (Rajkhowa *et al.,* 2000).

Seed and biological yield:

Effect of phosphorus levels:

The results indicated that various phosphorus levels significantly affected the seed, straw and biological yield (kg ha^{-1}) of black gram (Table 2). The higher harvest index was observed with the higher levels of phosphorus. It may be due to vigorous start to plant and strengthen straw by the higher dose of phosphorus application (Singh and Sharma, 2001).

Effect of vermicompost and PSB inoculation:

Application of vermicompost 2.5 tonnes ha^{-1} along with seed inoculation of PSB enhanced the seed, straw and biological yield of black gram. PSB inoculation with vermicompost application and alone PSB seed inoculation were at par with each other and found significantly superior over

Table 1: Dry matter plant^{-1}, no. of pods plant^{-1}, pod yield (g) plant^{-1}, seed yield (g) plant^{-1} and test weight (g) as influenced by various treatments

Treatments	Dry matter plant^{-1}	No. of pods plant^{-1}	Pod yield (g) plant^{-1}	Seed yield (g) plant^{-1}	Test wt. (g)
Levels of phosphorus (P)					
P_1 - 25 kg P_2O_5ha^{-1}	20.27	17.88	4.93	3.57	45.74
P_2 - 50 kg P_2O_5 ha^{-1}	22.18	19.80	5.53	4.48	47.47
P_3 - 75 kg P_2O_5 ha^{-1}	22.73	20.40	6.21	5.10	48.39
S.E. +	0.53	0.57	0.19	0.15	1.24
C.D. (P=0.05)	1.58	1.70	0.57	0.45	NS
Vermicompost and PSB (V)					
V_1 – Vermicompost @ 2.5 tonnes ha^{-1}	20.20	17.57	4.94	3.81	46.10
V_2 - PSB inoculation @ 250g ha^{-1}	22.14	19.56	5.57	4.46	47.07
V_3-Vermicompost and PSB inoculation	22.83	20.96	6.61	4.89	48.43
S.E. $\pm$	0.53	0.57	0.19	0.15	1.24
C.D. (P=0.05)	1.58	1.70	0.57	0.45	NS
Interactions (P x V)					
S.E. +	0.91	0.98	0.33	0.27	2.14
C.D. (P=0.05)	N.S	NS	NS	NS	NS
General mean	21.72	19.36	5.56	4.38	47.20

NS= Non-significant

vermicompost application alone.

Quality attributes:

Effect of phosphorus levels:

Data in Table 3 revealed that the higher protein content in black gram seed was recorded with the application of 75 kg P_2O_5 ha^{-1} but did not differ significantly whereas significantly higher protein yield was obtained with75 kg P_2O_5 ha^{-1} was at par with 50 kg P_2O_5 ha^{-1} (Shukla and Dixit, 1996).

Effect of vermicompost and PSB inoculation:

The seed protein content was not significantly influenced by the application of vermicompost and PSB inoculation. Where as protein yield was significantly affected. The higher protein content and protein yield was obtained with the combined application of vermicompost and PSB inoculation.

Table 2: Mean seed yield, straw yield, biological yield (kg ha^{-1}), harvest index (%) as influenced by various treatments

Treatments	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
Levels of phosphorus (P)				
P_1 - 25 kg P_2O_5ha^{-1}	1014	1610	2624	38.64
P_2 - 50 kg P_2O_5 ha^{-1}	1264	1720	2984	42.35
P_3 - 75 kg P_2O_5 ha^{-1}	1319	1718	3037	43.43
S.E. +	40	64	114	-
C.D. (P=0.05)	120	NS	342	-
Vermicompost and PSB (V)				
V_1 – Vermicompost @ 2.5 tonnes ha^{-1}	1055	1574	2690	39.22
V_2 - PSB inoculation @ 250g ha^{-1}	1229	1755	2984	41.18
V_3Vermicompost and PSB inoculation	1305	1727	3034	43.01
S.E. $\pm$	40	64	114	-
C.D. (P=0.05)	120	192	342	-
Interactions (P x V)				
S.E. +	69	111	198	35.07
C.D. (P=0.05)	NS	NS	NS	NS
General mean	1194	1679	2883	41.41

NS=Non-significant

Table 3: Seed yield (kg ha^{-1}), protein content (%) and protein yield (kg ha^{-1}) as influenced by different treatments

Treatments	Seed yield (kg ha^{-1})	Protein content (%)	Protein yield (kg ha^{-1})
Levels of phosphorus (P)			
P_1 - 25 kg P_2O_5ha^{-1}	1014	22.80	231
P_2 - 50 kg P_2O_5 ha^{-1}	1264	23.06	291
P_3 - 75 kg P_2O_5 ha^{-1}	1319	23.39	309
S.E. +	40	0.48	9.02
C.D. (P=0.05)	120	NS	27.77
Vermicompost and PSB (V)			
V_1 - Vermicompost @ 2.5 tonnes ha^{-1}	1055	22.67	239
V_2 - PSB inoculation @ 250g ha^{-1}	1229	23.11	284
V_3-Vermicompost and PSB inoculation	1305	23.47	306
S.E. $\pm$	40	0.48	9.02
C.D. at 5%	120	NS	27.77
Interactions (P x V)			
S.E. +	69	0.82	0.023
C.D. at 5%	NS	NS	NS
General mean	1194	23.08	276

NS=Non-significant

(Vasanti and Subramanian, 2004).

Interaction (P x V):

Interaction effect of fertilizer levels and vermicompost alone and with PSB did not show any significant effect on yield and quality attributes.

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