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Effect of Phosphorus, Vermicompost and PSB on Seed Yield, Yield Attributes and Economics of Blackgram (*Vigna Mungo* L.)

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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 research showed that the application of 75 kg P2O5ha-1 recorded highest seed yield (1194 kg ha-1) and yield attributes as well as high economic returns but it was found at par with 50 kg P2O5ha-1. The higher B: C ratio (1.58) was recorded at 50 kg P2O5ha-1. Therefore, it is recommended to apply 50 kg phosphorus ha-1 to black gram crop. The superior development and yield parameters were recorded by the combine application of vermicompost and PSB inoculation. It was also found superior in respect of gross monetary return but higher net monetary return (18377 kg ha-1) and B: C ratio (1.74) was obtained by the application of PSB inoculation. Hence it is recommended to apply PSB inoculation to black gram.

Keywords*: Phosphorus levels, Vermicompost, PSB, Seed yield, Economics, Black gram*

1. Introduction

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 is also grown as a cover crop as well as catch crop due to short duration. The role legume 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, govern 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. Vermicompost alone or in combination with fertilizer improve the N, P and K status of soil. Its application realized highest number (24.33) of nodules / plant (Rajkhowa, *et al*. 2003). Many investigators reported that crop utilizes only 15- 20 % 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.

2. Materials and Method

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 p^{H}). The experiment was laid out in Factorial Randomised Block Design (FRBD) with three replications. The treatments were

comprised of three levels of phosphorus *viz*, namely 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 gms/10 kg seed and V_3: Vermicompost and PSB inoculation. The gross and net plot size was 5.4mx4.2m and 4.8mx3.0m 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.

3. Results and Discussion

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

3.1. Yield Attributes

3.1.1. 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_5$$ha^{-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, Rathor *et al* 2010)

3.1.2. Effect Levels of Vermicompost and PSB Inoculation

The maximum dry matter $plant^{-1}$, no. 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)

3.2. Seed and Biological Yield

3.2.1. 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. The significantly protein of 75 kg P_2O_5 ha^{-1} which was found to be at par with 50 kg P_2O_5 ha^{-1} and significantly superior over 25 kg P_2O_5 ha^{-1} (Table 2). The higher harvest index and test weight 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)

3.2.2. Effect of Vermicompost and PSB Inoculation

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

3.3. Economics

3.3.1. Effect of Phosphorus Levels

The data in Table 3 revealed that the application of 75 kg P_2O_5 ha^{-1} gave highest gross monetary returns (Rs.46165 ha^{-1}), net monetary returns (Rs.16923 ha^{-1}) followed by the application of 50 kg P_2O_5 ha^{-1} and 25 kg P_2O_5 ha^{-1} . This may be due higher economic yield and higher gross monetary return received due to application of 75 kg P_2O_5 ha^{-1}.

The data on benefit: cost ratio it was seen that the application of 50 kg P_2O_5 ha^{-1} gave higher on benefit: cost ratio (1.58) than application of 75 kg P_2O_5 ha^{-1}. It may be due to higher GMR and lower cost of cultivation resulted in higher B: C ratio.

3.3.2. Effect of Vermicompost and PSB Inoculation

The data on gross monetary returns it was revealed that the combine application of vermicompost with PSB inoculation was received highest gross monetary returns (Rs.45675 ha^{-1}).Significantly lowest GMR (Rs.35925 ha^{-1}) was obtained due to alone application of vermicompost whereas GMR (Rs. 43015 ha^{-1}) due to PSB inoculation was found comparable with combined application of vermicompost and PSB. The lowest GMR obtained by the application of vermicompost might be due to slow release of nutrients resulted in low seed yield ultimately received less GMR. The higher GMR was obtained by the combined application of vermicompost and PSB inoculation. It may be due to PSB in combination with vermicompost made more availability of phosphorus. Ultimately economic yield as well as GMR increased.

Higher net monetary return was obtained due to the PSB inoculation treatment. PSB inoculation is a low cost technology and requires low cost of cultivation as compare to vermicompost treatment. Its may be resulted in to higher monitory return.

The data on benefit: cost ratio it was seen that the inoculation of PSB treatment gave higher benefit: cost ratio (1.74) this might be due to low cost of PSB bio fertilizer as compared to the vermicompost manure.

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
SE $\pm$	0.53	0.57	0.19	0.15	1.24
CD at 5%	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
SE $\pm$	0.53	0.57	0.19	0.15	1.24
CD at 5%	1.58	1.70	0.57	0.45	NS
Interactions (P x V)					
SE $\pm$	0.91	0.98	0.33	0.27	2.14
CD at 5%	N.S	NS	NS	NS	NS
General Mean	21.72	19.36	5.56	4.38	47.20

Table 1: Dry matter plant^{-1}, No. of pods plant^{-1}, Pod yield (g) plant^{-1} And seed yield (g) plant^{-1}, Test weight (g) as influenced by various treatments

Treatments	Seed Yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)	Test wt. (g)
Levels of phosphorus (P)					
P_1 - 25 kg P_2O_5ha^{-1}	1014	1610	2624	38.64	45.74
P_2 - 50 kg P_2O_5 ha^{-1}	1264	1720	2984	42.35	47.47
P_3 - 75 kg P_2O_5 ha^{-1}	1319	1718	3037	43.43	48.39
SE $\pm$	40	64	114	-	1.24

CD at 5%	120	NS	342	-	NS
Vermicompost and PSB (V)					
V_1 - Vermicompost @ 2.5 tonnes ha^{-1}	1055	1574	2690	39.22	46.10
V_2 - PSB inoculation @ 250g ha^{-1}	1229	1755	2984	41.18	47.07
V_3Vermicompost and PSB inoculation	1305	1727	3034	43.01	48.43
SE ±	40	64	114	-	1.24
CD at 5%	120	192	342	-	NS
Interactions (P x V)					
SE ±	69	111	198	35.07	2.14
CD at 5%	NS	NS	NS	NS	NS
General Mean	1194	1679	2883	41.41	47.20

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

Treatments	**Seed yield (kg ha^{-1})**	**Gross monetary returns (Rs ha^{-1})**	**Cost of cultivation (Rs ha^{-1}`)**	**Net monetary returns (Rs ha^{-1})**	**B:C ratio**
Levels of phosphorus (P)					
P_1 - 25 kg $P_2O_5ha^{-1}$	1014	35490	26667	8823	1.38
P_2 - 50 kg P_2O_5 ha^{-1}	1264	44240	27955	16285	1.58
P_3 - 75 kg P_2O_5 ha^{-1}	1319	46165	29242	16923	1.57
SE ±	40	1400	-	1400	-
CD at 5%	120	4200	-	4200	-
Vermicompost and PSB (V)					
V_1 - Vermicompost @ 2.5 tonnes ha^{-1}	1055	35925	29588	6337	1.21
V_2 - PSB inoculation @ 250g ha^{-1}	1229	43015	24638	18377	1.74
V_3-Vermicompost and PSB inoculation	1305	45675	29638	16037	1.54
SE ±	40	1400	-	1400	-
CD at 5%	120	4200	-	4200	-
Interactions (P x V)					
SE ±	69	2415	-	2415	-
CD at 5%	N.S.	N.S.	-	N.S.	-
General Mean	1194	41790	27955	13835	1.51

Table 3: Gross monetary returns (Rs ha^{-1}), Net monetary returns (Rs ha^{-1}), and cost of cultivation (Rs ha^{-1}) And Benefit: Cost (B: C) ratio as influenced by different treatments

4. References

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