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Research Article

Effect of Phosphorous Levels and Varieties on Growth, Yield and Qualitiy of Black Gram (*Vigna mungo* L.)

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ABSTRACT

Field experiment was conducted at the Student instructional Farm, Department of Agronomy, AKS University, Satna, (M.P.) during the kharif season of 2019-20 to study the effect of phosphorus levels and varieties on growth, yield parameters, yield and economics of black gram. The experiment was laid out in randomized block design with four phosphorus levels viz., control (no fertilizer), 40, 50 and 60 kg P_2O_5 /ha and three black gram varieties were tested are V_1- PU-31, V_2- PRATAP-1 and V_3- IPU-2-43. Application of 60 kg P_2O_5 /ha registered significantly higher grain yield (4.65 kg/ha), yield attributing characters, harvest index, net returns (Rs. 14474.00/ha) and B: C ratio (1.77:1) of black gram compared to control, 20 & 40 kg P_2O_5 /ha. Cv. IPU- 2-43 produced significantly higher grai n yield (4.40 q/ha), yield attributing parameters, harvest index, net returns (Rs. 13407.00/ha) and B: C ratio (1.73:1) compared to other varieties. Result showed that black gram variety IPU- 2-43 sown with the application of 60 kg P_2O_5/ha recorded the maximum and significantly higher values of these parameters.

Keywords: *Black gram, Phosphorus level, Grain yield, Varieties, Harvest index.*

INTRODUCTION

Black gram (*Vigna mungo* L.) is one of the important *kharif* pulse crop. It is commonly grown in summer and rainy seasons in northern India. It is a protein rich (25 per cent) staple food containing almost three times that of cereals. India is the largest producer as well as consumer of black gram. It produces about 15 to 19 lakh tones black gram annually from about 35 lakh ha of area, with an average productivity of 500 kg/ha (Ministry of Agriculture, GOI 2014-15).

There exists a vast gap between potential productivity and actual productivity of black gram being realized at present. Apart from other agronomical management practices, imbalanced plant nutrition is the major constraint to higher productivity of the crop. Proper fertilization is essential to improve the productivity of black gram. It can meet its nitrogen requirements by symbiotic fixation of atmospheric nitrogen.

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The nutrients which need attention are phosphorus fertilization. Black gram being a leguminous crop, requires adequate amount of phosphorus as well as apart from other nutrients these are directly involved in growth and development of plant.

Phosphorus is an integral component of virtually all the biochemical compounds that make plant life possible. Its response is known in presently available black gram varieties. Nitrogen as well as phosphorus (Singh et al., 2008) is essential for normal growth and development of black gram. Phosphorus application to black gram increases plant growth, yield attributes and grain yield. Phosphorus promotes early root formation and the formation of lateral, fibrous and healthy roots which is very important for nodule formation and to fix atmospheric nitrogen. Different varieties of black gram have varying nutrient demand and climate adaptability. Therefore, selection of appropriate adoptable variety requires immediate and large efforts in the direction of an improved varieties for a particular tract and its distribution.

MATERIALS AND METHODS

A field experiment was conducted at the Student instructional Farm, Department of Agronomy, AKS University, Satna, (M.P.) during the kharif season of 2019-20. The experiment was laid out in randomized block design in factorial concept with four phosphorus levels viz., control (no fertilizer), 40, 50 and 60 kg P_2O_5 /ha and three black gram varieties were tested are V_1- PU-31, V_2- PRATAP-1 and V_3- IPU-2-43. The recommended dose of N 20 kg/ha through urea and 60 Kg K_2O /ha through MOP was applied at the time of sowing. The phosphorus was applied as per treatments through single super phosphate. The experimental plot size was 5.0 m 3.5 m. The crop was sown on July, 20th 2019. The line to line spacing was kept 30 cm using seed rate of 20 kg/ha. A distance of 10 cm was maintained between plant to plant in rows. Hand weeding was done at 25 days after sowing. The observations on five randomly selected plants from each treatment were recorded at maturity. The crop was harvested on 10th October, 2019.

RESULTS AND DISCUSSION

Varying levels of phosphorus significantly influenced the plant height (49.69 cm), number of branches per plant (8.56), number of pods per plant (16.41), number of seeds/pod (8.85) and 1000- seed weight (36.80 g) over control (Table- 1). There occurred significant increase with each increase in treatment (P_3) phosphorus levels up to 60 kg P_2O_5/ha. The results are in conformity with those of Yadav et al. (2007). The positive effect of phosphorus application on number of pods per plant might be due to better enzymatic activities which controlled flowering and pod formation. Application of varying levels of phosphorus significantly improved the seed yield of black gram over control (Table- 1). Application of 60 kg P_2O_5 /ha fetched net returns of Rs. 14474.00/ha with the same B: C ratio of 1.77:1 (Table- 2). The higher seed yield with higher phosphorus rates was attributable to better nodulation and efficient functioning of nodule bacteria for fixation of N to be utilized by plants during grain development stage in the synthesis of protein as reflected in N uptake which in turn led to increase in seed yield. Similar findings were observed by Singh et al. (2011) and Das (2017). The grain yield is known to have positive association with these characters. However, higher levels of phosphorus i.e. 60 kg P_2O_5 /ha were at par with respect to nutrient uptake. The increase in yield and yield attributes with increased phosphorus application rates was perhaps due to efficient and effective role of N fixing bacteria. These results are in accordance with the findings of Duhan (2014).

Black gram variety IPU- 2-43 registered highest plant height (48.11 cm), number of branches per plant (7.44), number of pods per plant (15.44), number of seeds/pod (8.14) and 1000- seed weight (34.62 g) compared to PU-31 and Pratap- 1 (Table- 1). Similar type of variations in yield attributing parameters of various genotypes has been reported by Kumar

et al. (2007). This may be due to its better growth and yield attributing characters to cv. PU- 31 and Pratap- 1. The superiority of cv. IPU- 2-43 was owing to its better source to sink supply than in other varieties. The higher net returns of Rs. 13407.00/ha (Table- 2) was obtained with variety IPU- 2-43. The benefit cost ratio was also higher with variety IPU- 2-43 (1.73:1) compared with others. The higher net return and benefit cost ratio were the resultant of higher yield recorded in the former variety and hence all economic constituents vary among different varieties. Similar findings have also been reported by Rajput and Rajput (2017). Variable response of black gram varieties in respect of growth and yield was also reported by Ganeshamurthy et al. (2007).

Table 1: Effect of Different Levels of Phosphorus and Varieties on Growth and Yield of Black Gram

Treatment	Plant height (cm)	Number of branches per plant	Number of pods per plant	Number of seeds per pod	1000- seed weight (g)	Grain yield per hectare (q/ha)	Straw yield per hectare (kg/ha)
	Effect of phosphorus levels						
P_0	44.64	5.59	13.80	6.85	30.95	3.96	2147.09
P_1	46.04	6.48	14.42	7.56	32.33	4.12	2182.71
P_2	48.18	7.52	15.39	8.11	34.51	4.38	2236.72
P_3	49.69	8.56	16.41	8.85	36.80	4.65	2275.17
S. Em±	0.09	0.08	0.10	0.08	0.18	0.02	4.27
C.D.(P=0.05)	0.27	0.25	0.31	0.23	0.53	0.07	12.61
	Effect of varieties						
V_1	46.09	6.67	14.71	7.53	32.98	4.20	2183.70
V_2	47.22	7.00	14.87	7.86	33.34	4.24	2212.57
V_3	48.11	7.44	15.44	8.14	34.62	4.40	2235.00
S. Em±	0.07	0.07	0.09	0.07	0.15	0.02	3.70
C.D.(P=0.05)	0.21	0.21	0.27	0.20	0.46	0.06	10.92
	Interaction effect between phosphorus and varieties						
P_0V_1	44.21	5.22	13.64	6.55	30.55	3.91	2136.07
P_0V_2	45.47	6.00	14.22	7.22	31.90	4.07	2168.01
P_0V_3	46.87	7.22	14.77	7.89	33.12	4.22	2203.49
P_1V_1	47.81	8.22	16.19	8.45	36.34	4.60	2227.22
P_1V_2	44.35	5.56	13.66	6.89	30.64	3.93	2139.92
P_1V_3	46.07	6.45	14.34	7.55	32.16	4.10	2183.25
P_2V_1	48.27	7.44	15.08	8.11	33.77	4.29	2238.89
P_2V_2	50.20	8.56	16.42	8.89	36.79	4.65	2288.21
P_2V_3	45.35	6.00	14.11	7.11	31.66	4.05	2165.27
P_3V_1	46.60	7.00	14.69	7.89	32.95	4.20	2196.87
P_3V_3	51.07	8.89	16.63	9.22	37.26	4.70	2310.08
S. Em±	0.14	0.14	0.18	0.14	0.31	0.04	7.40
C.D.(P=0.05)	0.42	NS	0.53	NS	0.91	0.12	21.85

Table 2: Effect of Different Levels of Phosphorus and Varieties on Economics of Black Gram

Treatment	Net monetary return (Rs/ha)	B: C ratio
	Effect of phosphorus levels	
P_0	11676.00	1.67
P_1	11704.00	1.64
P_2	13078.00	1.70
P_3	14474.00	1.77
S. Em±	127.699	0.007
C.D.(P=0.05)	376.945	0.020
	Effect of varieties	
V_1	12270.00	1.67
V_2	12522.00	1.69
V_3	13407.00	1.73
S. Em±	110.591	0.006
C.D.(P=0.05)	326.44	0.017
	Interaction effect between phosphorus and varieties	
P_0V_1	11432.00	1.65
P_0V_2	11427.00	1.62
P_0V_3	12112.00	1.65
P_1V_1	14108.00	1.75
P_1V_2	11444.00	1.66
P_1V_3	11573.00	1.63
P_2V_1	12583.00	1.68
P_2V_2	14489.00	1.77
P_2V_3	12151.00	1.70
P_3V_1	12112.00	1.66
P_3V_2	14540.00	1.78
P_3V_3	14824.00	1.78
S. Em±	221.81	0.011
C.D.(P=0.05)	652.888	0.034

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CONCLUSION

Based upon this experiment it is concluded that application of higher level of phosphorus at the rate of 60 kg/ ha with the black gram variety on IPU- 2-43 recorded the maximum growth and grain yield of black gram.

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