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Effect of Nitrogen, Phosphorus and Potassium on Growth, Yield and Nutrient Uptake by Blackgram (*Vigna mungo,* L.)

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Abstract

An investigation was carried out to assess the effect of N, P and K application on seed yield and nutrient uptake by blackgram during *kharif* seasons of 2004 and 2005. Three nutrients applied in combination did increase the seed yield significantly over control, however, N and K alone were at par with control. The highest seed yield was recorded with the application of 15 : 60 : 20 kg N : P_2O_5 : K_2O/ha. Application of 30 kg N/ha alone reduced the seed yield than 15 kg N/ha alone indicating inefficiency of higher N level to legume. The increase in seed yield seems to be due to the effect of P as revealed by the relative higher yields with the treatments having P than those without P or lower P treatments. The total uptake of nutrients by the blackgram was associated with higher biomass production.
Key words : Blackgram, Nitrogen, Phosphorus, Potassium, Yield.

Blackgram is the most important pulses of the *vigna* group. In Manipur, blackgram is grown under rainfed condition on marginal land and scarcely manured resulting in low yield. Farmers often fail to supply essential nutrients. Whatever is spent on fertilizer goes almost entirely nitrogen. Thus, the pulse crop production has become non-remunerative and has left a large gap between domestic requirement and actual production. Pulse crop productivity levels are usually low owing to various soil constraints such as heavy clayes and pH. Among measures for realizing higher yields, the use of chemical fertilizers is the quickest and most important. The present study therefore aims to identify the best combination of N, P and K for better growth and yield of blackgram.

Methods

The field study was conducted in the Research Farm, College of Agriculture, Central Agricultural University, Imphal during *kharif* seasons For consecutive two years. The clayey soil had an initial pH 5.3 and organic carbon 28.7 g/kg. The available N, P_2O_5 and K_2O were 405.44, 52.83 and 425.40 kg/ha, respectively. The treatments consisted of three levels of N (0, 15 and 30 kg/ha), three levels of P_2O_5 (0, 30 and 60 kg/ha) and two levels of K_2O (0 and 20 kg/ha). The experiment was laid out in randomized block design and treatments were replicated four times. Blackgram variety, T-9 was sown during second week of June in the furrow 30 × 30 cm apart. Growth and yield were recorded and analyzed according to the standard analysis of variance technique. The plant samples were analyzed for N P and K (1).

Results and Discussion

Plant Growth

The data reveal that there was a significant difference in all the yield attributes of blackgram due to various treatments (Table 1). The highest plant was found with the treatment combination of 30 : 60 : 20 kg N : P_2O_5 : K_2O/ha which was significantly superior to the other treatments except the treatments of T_{11} and T_{15} which was statistically at par. The number of branches per plant, numbers of pod per plant, number of seeds per pod and test weight were observed highest with the application of 15 : 60 : 20 kg N : P_2O_5 : K_2O/ha. The favorable effect on yield attributing characters might be due to its encouragement on vegetative growth causing higher photosynthesis and assimilation rate of the plant. Beyond 15 kg N/ha, yield attributing characters did not improve. This finding is in conformity with the findings of

Table 1. Growth parameters and yield components of blackgram as influenced by N, P and K levels (pooled mean).

Treatments (kg/ha)			Plant height (cm)	Number of branches/ plant at harvest	Number of pods/plant	Number of seeds/ pod	1000 seed weight (g)
N	P_2O_5	K_2O					
0	0	0 (T_0)	35.06	4.83	19.18	5.32	39.60
0	0	20 (T_1)	35.43	4.92	19.51	5.41	39.70
0	30	0 (T_2)	36.21	5.13	21.59	5.44	39.84
0	30	20 (T_3)	36.97	5.40	21.79	5.53	39.86
0	60	0 (T_4)	37.35	5.68	21.99	5.54	39.89
0	60	20 (T_5)	38.42	5.83	24.60	5.74	39.95
15	0	0 (T_6)	37.55	5.33	20.18	5.38	39.79
15	0	20 (T_7)	40.79	5.70	20.86	5.40	39.86
15	30	0 (T_8)	42.49	5.74	24.72	5.85	39.88
15	30	20 (T_9)	45.16	5.77	24.87	5.89	39.98
15	60	0 (T_{10})	45.06	5.88	25.26	6.10	40.02
15	60	20 (T_{11})	50.27	6.09	26.11	6.18	40.13
30	0	0 (T_{12})	49.24	5.32	20.74	5.44	39.81
30	0	20 (T_{13})	49.15	5.42	21.31	5.68	39.84
30	30	0 (T_{14})	48.21	5.96	22.05	5.87	39.91
30	30	20 (T_{15})	50.81	5.99	25.32	5.96	40.00
30	60	0 (T_{16})	48.55	6.02	25.37	6.07	40.09
30	60	20 (T_{17})	53.24	6.03	26.11	6.10	40.12
CD (P =0.05)			3.26	0.36	0.67	0.26	NS

Panwar et al. (2) and Venkateswarlu et al. (3).

Seed and Straw Yield

Seed and straw yield of blackgram was significantly influenced by different treatment combinations over the control (Table 2). The highest seed yield of black gram was obtained with the treatment combination of 15 : 60 : 20 kg N : P_2O_5 : K_2O/ha, while the

Table 2. Yield and N, P and K uptake by blackgram as influenced by N, P and K levels.

Treatments	Seed yield (q/ha)			Straw yield (q/ha)			Total uptake (kg/ha) (pooled mean)		
	N	P_2O_5	K_2O	2004	2005	Mean	2004	2005	Mean
T_0	10.10	11.12	10.61	16.67	16.75	16.71	70.06	7.96	19.54
T_1	10.74	11.35	11.05	16.83	18.14	17.49	72.93	8.33	20.45
T_2	12.26	13.14	12.70	18.96	19.04	19.00	84.00	9.57	23.67
T_3	12.66	13.37	13.02	21.04	19.94	20.49	91.10	10.71	25.89
T_4	13.10	14.15	13.63	21.48	21.70	21.59	94.10	11.14	26.91
T_5	13.44	14.55	14.00	21.92	22.85	22.39	97.90	11.90	27.79
T_6	11.97	12.83	12.40	16.94	17.33	17.14	77.44	8.98	21.52
T_7	12.54	13.22	12.88	19.45	20.00	19.73	86.47	10.32	24.63
T_8	13.40	14.57	13.99	21.79	21.70	21.75	96.40	11.63	27.48
T_9	14.03	14.96	14.50	23.92	24.12	24.02	106.08	13.00	32.17
T_{10}	14.87	15.43	15.15	23.60	24.05	23.83	107.82	13.22	31.58
T_{11}	16.01	16.92	16.47	29.00	28.25	28.63	126.79	16.39	38.00
T_{12}	11.71	12.96	12.34	18.50	19.22	18.86	80.66	9.19	22.71
T_{13}	12.87	13.38	13.13	21.38	22.00	21.69	92.95	10.89	26.54
T_{14}	13.88	14.82	14.35	22.18	23.47	22.83	100.39	12.30	29.35
T_{15}	14.50	16.33	15.42	25.92	26.70	26.31	112.89	15.14	34.23
T_{16}	15.28	15.93	15.61	25.33	26.30	25.82	113.68	14.57	33.71
T_{17}	16.00	16.85	16.43	29.17	28.91	29.04	127.12	16.62	38.11
CD (P=0.05)	1.82	1.64	1.80	3.92	3.23	3.41	9.43	0.33	2.79

highest straw yield was found with the application of 30 : 60 : 20 kg N : P_2O_5 : K_2O/ha. Similar result was also reported by Javad et al. (4). The application of 30 kg N/ha alone or in combinations with P and K resulted in seed yield reduction. This was possibly due to high level of combined N in the soil leading to narrow C : N ratio which prevented deformation of root hairs. This precludes the entry of bacteria resulting in no nodulation. The increasing levels of applied N increased the seed yield of blackgram up to 20 kg N/ha (5). Application of phosphorus at 30 and 60 kg P_2O_5/ha increased seed and straw yield significantly over control. This observation is in conformity with the findings of Shah et al. (6) and Sharoar et al. (7). There was no significant difference due to K application over control.

Nutrient Uptake

The total uptake of N, P and K (Table 2) at various treatment combinations ranged between 70.06–127.12, 7.96–16.62 and 19.54–38.11 kg/ha, respectively. The total N uptake was greatly influenced by the combination of N, P and K fertilization. The highest N uptake by black gram was recorded with treatment combination of 30 : 60 : 20 kg N : P_2O_5 : K_2O/ha. This is due to increased nitrogen concentration in seed and in straw resulting in the higher total N uptake by the plant. The highest total P and K uptake by the blackgram was also observed with the application of treatment combination 30 : 60 : 20 kg N : P_2O_5 : K_2O/ha which was statistically at par with the treatment combination of 15 : 60 : 20 kg N : P_2O_5 : K_2O/ha and significantly superior to the control. The total uptake of these nutrients by the plant is the combined effect of higher nutrient content in the plant and total biological yield. This finding is in agreement with that of Shah et al. (6).

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