GAU Res. J. 1997. 22 (2) : 46-50

Effect of Nitrogen, Phosphorus and Sulphur on Yield and Chemical Composition of Blackgram (*Phaseolus mungo*)

S. K. Trivedi. Vijay Singh & C. P. Shinde*

Department of Soil Science, College of Agriculture, Gwalior- 474 002

ABSTRACT

A field experiment was conducted during the rainy seasons (*kharif*) of 1990 and 1991 on sandy loam soil to select the suitable levels of N, P and S for maximum production of Blackgram. Application of N, P_2O_5 and S significantly increased the grain and stover yields upto their maximum levels. Increase in seed yield of blackgram over control was 217, 273 and 109 kg ha^{-1} in mean yield at 30 kg N, 60 kg P_2O_5 and 60 kg S ha^{-1} respectively. The application of nitrogen in combination of sulphur significantly enhanced the yield. Significantly highest seed weight was recorded under the maximum limit of nutrient applications except in case of nitrogen where the difference between 15 and 30 kg N ha^{-1} was at par. Increasing levels of N, P_2O_5 and S significantly increased the total uptake of N, P and S. Further, continuous fertilizer application built up the fertility status of the soil. The maximum net return (Rs. 3893 ha^{-1}) and BCR (2.01) was gained under $N_{30}P_{60}S_{60}$ kg ha^{-1}.

(Received on 3rd Nov., 1995)

INTRODUCTION

The farmers of Northen Madhya Pradesh are adopting double cropping on their fields because of introduction of irrigation facilities. Sharma *et al.*, (1992) reported that adoption of blackgram - mustard crop sequence may help in increasing the cropping intensity under northern region of Madhya Pradesh where irrigation facilities exist. Being a pulse crop, blackgram builds up a mechanism of fixing atmospheric nitrogen into their root nodules. It provides about 40 kg N ha^{-1} to the succeeding crop (Patel *et al.*, 1981). The average yield of blackgram in Madhya Pradesh is much below (300 kg ha^{-1}) the national average. Efficient use of fertilizer help in enhancing the production and productivity of the crop. Therefore, it was considered important to find out proper combination of fertilizer nutrients like N, P and S to boost the productively of blackgram.

MATERIALS AND METHODS

A field experiment was conducted during 1990 at the research farm of Agriculture College, Gwalior (M.P.) which was continued for two years. The experiment was laid out in split plot design with three replications. The treatments consisted of combination of 3 levels, each of N (0, 15 and 30 kg ha^{-1}) and P_2O_5 (0, 30 and 60 kg ha^{-1}) in main plots and 2 levels of S (0 and 60 kg ha^{-1}) in sub plots. After harvesting of blackgram, mustard was grown during *rabi* with three levels, each of

*Present address : Department of Chemistry, SOS, Jiwaji University, Gwalior-474 002 (M.P.).

nitrogen and phosphorus and two levels of sulphur keeping the same randonmisation of treatments from 1 to 9 in both crops. The soil of experimental field was sandy loam having pH 7.8, organic carbon 0.37 per cent with available nitrogen 120 kg ha^{-1}, phosphorus 14.67 kg, potassium 225 kg ha^{-1} and sulphur as SO_4 6.69 ppm prior to the start of the trial. The rainfall of 867.3 and 439.2 mm was received in respective seasons. Jawahar Urd 2 was inoculated with rhizobium and sown 30 cm apart with a seed rate of 20 kg ha^{-1} on 5th August 1990 and 31st July 1991. Full dose of N, P_2O_5 and S according to treatment and a uniform dose of 25 kg K_2O ha^{-1} in the form of urea, triple super phosphate, pyrite and muriate of potash respectively were applied as basal. Estimation of N, P and S in seeds of blackgram was done by the procedures of Chopra and Kanwar (1980). Partial budgeting procedure was followed to workout the economics of the crop.

RESULTS AND DISCUSSION

Yield

Grain and stover yields of blackgram were significantly increased with each treatment in the dose of nitrogen upto 30 kg ha^{-1} (Table 1). Application of 15 and 30 kg N ha^{-1} increased the mean grain yield over control by 19.2 and 40.6 per cent, respectively. This might be due to proper N availability at an early growth stage which results in vigorous growth of the crop and adequate supply of photosynthetes for the formation of branches and seed development.

Significant increase in blackgram seed and stover yields (Table 1) were recorded with the application of phosphorus. Application of 60 kg P_2O_5 ha^{-1} gave the highest yield which was significantly more than other rates. The increase in seed and stover yield over control being 55.6 and 30.9 per cent respectively. The increase in grain yield may be due to vigorous growth which helped the plants in absorption of higher amount of nutrients from the soil.

Perusal of data of grain and stover yield (Table 1) indicated that addition of 60 kg S ha^{-1} significantly enhanced the grain as well as stover yield. The grain yield of blackgram increased by 20.4 per cent with the application of 60 kg S ha^{-1} over control. The increase in blackgram yield may be due to increase in availability of this nutrient as soils of experimental area were deficient in available sulphur content. Similar results were also observed by Singh *et al.*, (1992).

Grain weight

Highest 1000 grain weight of 38.90 g was recorded with 30 kg N ha^{-1} in mean value (Table 1). The N application @ 15 and 30 kg ha^{-1} caused significant increase in grain weight as compared to control but difference between two levels was not significant. This may be due to better built up of N in soil with regular use of N in blackgram.

Among different levels of phosphorus, application of 60 kg ha^{-1} resulted into highest significant test weight of 39.34 g (Table 1). The difference between 0 and 30 kg P_2O_5 ha^{-1} was also significant. The increase in test weight may be due to higher availability of nutrients through better root growth and metabolic role played by P in energy transfer system.

Addition of sulphur was also recorded to be effective at 60 kg ha^{-1} (Table 1). Increased sulphur supply might have favourably influenced the carbohydrate metabolism. This favourable effect led to an

TABLE 1

Effect of N, P and S on the yields, 1000 seed weight and total nutrient uptake of N, P and S by blackgram and soil fertility changes after harvest of crop. (Mean of two years)

Treatments (kg ha^{-1})	Yield (q ha^{-1})		1000 seed weight (g)	Total nutrient uptake (kg ha^{-1})			Soil fertility changes			
	Grain	Stover		N	P	S	O.C. (%)	Av. N. (kg ha^{-1})	Av. P. (kg ha^{-1})	Av. S. ppm
Nitrogen										
0	5.34	23.39	37.81	52.41	8.92	4.57	0.40	173	17.8	8.5
15	6.37	26.91	38.46	66.32	11.02	5.75	0.43	173	20.7	9.4
30	7.51	29.64	39.90	78.90	13.25	6.92	0.48	177	21.7	9.8
C. D. (P=0.05)	0.14	1.44	0.61	3.68	0.78	0.40	0.05	NS	NS	0.6
Phosphorus										
0	4.91	23.12	37.42	46.27	6.30	4.26	0.41	154	12.6	9.6
30	6.68	26.70	38.42	67.95	11.67	5.86	0.44	174	21.9	9.3
60	7.64	30.27	39.34	80.69	15.41	7.12	0.46	195	25.8	8.9
C. D. (P=0.05)	0.14	1.44	0.61	3.68	0.78	0.40	NS	4.8	3.8	NS
Sulphur										
0	5.81	25.84	38.10	60.12	10.19	4.65	0.42	169	19.5	5.4
60	7.00	27.54	38.69	75.57	12.06	6.85	0.45	180	20.6	8.0
C. D. (P=0.05)	0.10	1.28	0.42	3.36	0.70	0.32	NS	3.8	NS	0.6
				Initial soil status			0.34	120	14.6	6.7
Interactions (C. D. P=0.05)										
For N x P	0.25	NS	NS							
N x S	0.19	NS	NS							
P x S	NS	NS	NS							

NS : Not Significant.

increase in translocation of photosynthesis resulting into the formation of bold seed.

Nutrient uptake

It is evident from the data that total uptake of N, P and S was significantly affected due to application of nitrogen, phosphorus and sulphur (Table 1). It was noted that increasing levels of nitrogen, phosphorus and sulphur increased the total uptake of N, P and S. The maximum values was obtained at higher levels of these nutrients.

TABLE 2

Effect of different combinations of N, P and S levels on economics of blackgram production.

Treatments (kg ha^{-1})	*Yield (ha^{-1})*			*Total cost (Rs ha^{-1})*	*Gross return (Rs. ha^{-1})*	*Net return (Rs ha^{-1})*	*B.C.R.*
	1990	*1991*	*Mean*				
$N_0P_0S_0$ 1	1.11	6.59	3.85	2925	3080	115	1.06
$N_0P_0S_{60}$ 2	1.41	7.51	4.48	3283	3584	301	1.09
$N_0P_{30}S_0$ 3	1.44	8.34	4.89	3197	3912	715	1.22
$N_0P_{30}S_{60}$ 4	1.83	9.90	5.86	3479	4688	1209	1.33
$N_0P_{60}S_0$ 5	1.86	10.59	6.22	3397	4976	1579	1.46
$N_0P_{60}S_{60}$ 6	2.11	11.39	6.75	3679	5400	1721	1.46
$N_{15}P_0S_0$ 7	1.28	7.13	4.20	3031	3360	329	1.10
$N_{15}P_0S_{60}$ 8	2.50	8.00	5.25	3349	4200	851	1.25
$N_{15}P_{30}S_0$ 9	1.58	10.90	6.24	3267	4992	1721	1.52
$N_{15}P_{30}S_{60}$ 10	2.99	11.41	7.20	3545	5760	2215	1.62
$N_{15}P_{60}S_0$ 11	2.00	12.27	7.13	3467	5704	2237	1.64
$N_{15}P_{60}S_{60}$ 12	3.29	13.26	8.28	3749	6624	2875	1.76
$N_{30}P_0S_0$ 13	1.53	8.53	5.03	3101	4024	923	1.29
$N_{30}P_0S_{60}$ 14	3.66	9.73	6.69	3419	5352	1933	1.58
$N_{30}P_{30}S_0$ 15	1.72	12.27	6.99	3337	5592	2255	1.67
$N_{30}P_{30}S_{60}$ 16	3.99	13.65	8.82	3619	7056	3437	1.94
$N_{30}P_{60}S_0$ 17	2.02	13.52	7.84	3537	6272	2735	1.77
$N_{30}P_{60}S_{60}$ 18	4.38	14.90	9.64	3819	7712	3893	2.01

Note : (1) Cost of nutrient applied to the crop was worked out @ Rs. 4.05, P_2O_5 Rs. 6.69 and S Rs. 4.77 ha^{-1}.

(2) Sale price of grain produce of blackgram was Rs. 800/- q^{-1}.

(3) Economics was worked out on pooled data (1990 and 1991).

Soil fertility changes

The data (Table 1) on soil fertility status at harvest showed that application of nitrogen @ 30 kg ha^{-1} significantly improved the organic carbon and available sulphur content of soil as compared to control. Application of phosphorus @ 60 kg ha^{-1} markedly increased the available nitrogen and phosphorus content of the soil. While application of sulphur significantly improved the available nitrogen and sulphur content of the soil. The maximum value was obtained at highest dose i.e. 60 kg ha^{-1}. Data further revealed that after harvest of blackgram the organic carbon, available N, P and S content of soil improved due to application of fertilizers as compared to initial soil fertility status. This built up of soil fertility may be attributed to addition of biomass in the form of roots and plant residues due to backgram crop and manuring. Similar results were also reported by Ghosh (1987).

Economics

Economics of different treatments shows that highest net profit of Rs. 3893 ha^{-1} was obtained with the use of $N_{30}P_{60}S_{60}$ treatment followed by $N_{30}P_{30}S_{60}$ (Rs. 3437. ha^{-1}). The highest B.C.R. (2.01) was also recorded under $N_{30}P_{60}S_{60}$ treatment. The minimum net profit was recorded under control (Table 2). A heavy rainfall of 462.2 mm during the month of September 1990 caused a reduction on seed and straw yields of blackgram during first year.

REFERENCES

Chopra, S. L. and Kanwar, J. S. (1980). Analytical Agricultural Chemistry. Kalyani Publilishers Ludhiana, New Delhi.

Ghosh, A. B. (1987). Some aspect of stability and fertility and crop production. *Indian Soc. of Soil Sci.* **35** : 552-67.

Patel, P. G.; Singh, R. P. and Saraf, C. S. (1981). Proc. Natl. Symp. Indian Soc. Agron., New Challanges in Crop Production 22-36.

Singh, Surendra, Singh A. P. and Singh, B. (1992). Direct residual effect of pyrite on yield, protein content and S uptake by blackgram and lentil in entisol. *J. Indian Soc. Soil Sci.* **40** : 584-585.

Sharma, M. L.; Bhardwaj, G. S. and Chauhan, Y. S (1992). Studies on effective *kharif* crops for succeeding crop of raya (*Brassica juncea* Czen (L.) Coss) under irrigated conditions *J. Oilseed Res.* 9(2) : 234-236.