Internat. J. agric. Sci. Vol.3 No.1 January 2007 : 179-180

Effect of nitrogen levels and rhizobium application methods on yield attributes, yield and economics of black gram (*Vigna mungo* L.)

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ABSTRACT
A field experiment was conducted during kharif season of 2005, at crop research form, Department of Agronomy, Allahabad Agricultural Institute – Deemed University, Allahabad, with Blackgram (*Vigna mungo L*.) var. PU-19. The treatments comprised of four levels of nitrogen (10, 20, 30 and 40 kg ha^{-1}) and three methods of application of Rhizobium (Uninoculated, soil application and seed treatment) in factorial randomized block design (4x3), with 12 treatment combinations, each replicated three times. Among the treatments, application of nitrogen @ 20 kg ha^{-1} and seed treatment with Rhizobium significantly increased the plant height, number of leaves, dry weight of plant, number of nodules, number of pods, number of grains per pod, test weight, grain yield and stover yield. This treatment combination was found superior to all other treatments in respect of growth, nodulation, yield, economic returns and benefit cost ratio.

Key words : Nitrogen, Rhizobium, Blackgram, Yield.

INTRODUCTION

Contribution of pulses to Indian agriculture and daily life has been tremendous besides being one of the important constituents of our diet, Black gram is the third important pulses crop in India. Covering on area of 2.56 million hectares. With the share of 12 per cent for the total acreage, but constitutes only 8 per cent of the total pulse production of the country. This is due to the fact that average productivity of Blackgram is as low as 467 kg/ha in India while the average productivity of other legumes were 778/ ha. The cause for such low yield are due to some of physiological, biochemical as well as certain inherent factors associated with the crop apart from the genetic constitution. The physiological factors such as inefficient partitioning of assimilates, poor pod setting, excessive flower abscission and lack of nutrients during the critical stages of crop growth were found to be some of the yield barriers of Black gram (Alberta and Bower, 1983).

Nutrients plays a privotal role in increasing the seed yield in pulses. Nitrogen and Rhizobium application was found to be as good as soil application (Subramanian and Palaniappan, 1981). Mitra *et al*. (1988). Opioned that nitrogen is the major limiting factor for yield in Blackgram. Keeping on the above points in view, the study was conducted to develop a suitable combination of Nitrogen and rhizobium for improving the yield of the black gram.

MATERIALS AND METHODS

A field experiment was carried during Kharif 2005 season, in the department of Agronomy, Allahabad Agricultural Institute –Deemed University, Allahabad using variety PU-19. The treatments comprised of T_1 Nitrogen 10 $kgha^{-1}$ +uninoculated, T_2-Nitrogen 10 $kgha^{-1}$ + rhizobium soil application, T_3-Nitrogen 10 $kgha^{-1}$ + Rhizobium seed treatment, T_4-Nitrogen 20 $kgha^{-1}$ + uninoculated, T_5-Nitrogen 20 $kgha^{-1}$ +Rhizobium soil application, T_6-Nitrogen 20 $kgha^{-1}$ + Rhizobium seed treatment , T_7-Nitrogen 30 $kgha^{-1}$ + uninoculated, T_8-Nitrogen 30 $kgha^{-1}$ + Rhizobium soil application T_9-Nitrogen 30 $kgha^{-1}$ + Rhizobium seed treatment, T_{10}-Nitrogen 40 $kgha^{-1}$ +Uninoculated, T_{11}-Nitrogen 40 $kgha^{-1}$ +Rhizobium soil application, T_{12}-Nitrogen 40 $kgha^{-1}$+Rhizobium seed treatment. The soil of experimental site was sandy loam with a pH. 7.8, organic carbon 0.4, low in available nitrogen (212 kg/ha) medium in available phosphoures (16 kg/ha) and potassium (246.2 kg/ha) The experiment was laid out in factorial randomized block design with 3 replication. PU-19 Blackgram was sown at a spacing of 30 cmx 10cm. The treatments were imposed as per schedule. The recommended inorganic fertilizer of 50 kg/ha P and 20 kg/ha. K were applied to all the plots. Plant height, number of braches/plant, number of nodules/ plant and dry weight/plant, were recorded at different interval. The number of pod per plant was counted from five plants and mean arrived.

RESULTS AND DISCUSSION

Yield attributes and yield:

The maximum number of pods (32.33) were recorded with T_6 (Nitrogen 20 $kgha^{-1}$ + Rhizobium seed treatment) followed by T_5 (Nitrogen 20 $kgha^{-1}$ + Rhizobium soil application). T_6 recorded significant increase in pods/plant, which was significantly superior to other treatments and statistically at par with T_5 and T_4, respectively. The maximum number of seeds/pod was recorded with T_6 followed by T_5. Which is significantly superior to all the treatments. The higher value of test weight was found in T_6 followed by T_5. Similar results were recorded by Singh and Shriwastava (1991).

Plant dry weight and no of nodules /plant:

T_6 produced more number of nodules/plant followed by T_5, However higher plant dry weight was observed in T_6 followed by T_5 and T_4, respectively. Nitrogen and Rhizobium application increased the no. of nodules/plant and dry matter production. This result corroborated with Raju and Verma (1993) and Mand and Chahal (1987).

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Table : 1 Effect of nitrogen levels and rhizobium application methods on yield attributes, yield and benefit cost ratio.

Treatment	Plant dry weight (g)	No. of nodules/ plant	No. of pods /plant	No. of seeds /pod	Test weight (g)	Seed yield (q/ha)	Haulm yield (q/ha)	Cost of Cultivation (Rs./ha)	Total return (Rs/ha)	Net return (Rs/ha)	Benefit cost ratio
T_1-Nitrogen 10 kgha^{-1} + Uninoculated	10.77	32.13	24.00	7.07	41.53	11.00	31.17	11296	25758	14462	2.28
T_2-Nitrogen 10kgha^{-1} + Rhizobium soil application	11.50	32.40	25.60	7.07	41.87	11.00	32.50	11356	25825	14469	2.27
T_3 –Nitrogen 10kgha^{-1} + Rhizobium seed treatment	11.83	32.40	27.20	7.13	42.47	11.00	32.50	11314	25825	14511	2.28
T_4-Nitrogen 20 kgha^{-1} +Uninoculated	14.23	33.13	31.27	7.27	43.67	12.00	35.00	11416	28150	16734	2.47
T_5-Nitrogen 20 kgha^{-1} + Rhizobium soil application	14.27	33.13	31.33	7.33	43.67	12.23	35.63	11476	28695	17219	2.50
T_6-Nitrogen 20 kgha^{-1} + Rhizobium seed treatment	15.00	33.20	32.33	7.53	43.80	12.50	36.33	11434	29317	17883	2.56
T_7 - Nitrogen 30 kgha^{-1} + Uninoculated	12.73	32.67	29.3	7.20	43.20	11.50	34.17	11536	27008	15472	2.34
T_8-Nitrogen 30 kgha^{-1} + Rhizobium soil application	13.50	32.87	30.67	7.20	43.50	11.50	34.33	11596	27017	15421	2.33
T_9- Nitrogen 30 kgha^{-1} + Rhozbium seed treatment	13.67	33.00	31.07	7.27	43.57	11.67	34.50	11554	27392	15835	2.37
T_{10}- Nitrogen 40 kg/ha^{-1} +Uninocutated	12.10	32.67	27.73	7.20	42.80	11.17	32.83	11656	26208	14552	2.25
T_{11}- Nitrogen 40 kgha^{-1} +Rhizobium soil application	12.10	32.60	28.93	7.20	42.87	11.17	33.37	11716	26235	14519	2.24
T_{12}-Nitrogen 40 kgha^{-1} +Rhozobium seed treatment	12.67	32.67	29.07	7.20	43.20	11.50	33.83	11674	26992	15318	2.31
S.Ed(±)	0.15	0.05	0.25	0.03	0.10	0.07	0.20				
CD (P=0.05)	0.31	0.11	0.51	0.06	0.20	0.14	0.41				

Grain and Haulm yield:

The maximum grain yield was recorded in T_6 (12.50 q/ha.) followed by T_5 (12.23 q/ha.) which was significantly superior to other treatments. The percentage increase in grain yield and haulm yield with T_6 over T_1 was 13.63 and 16.55, respectively. Nitrogen and rhizobium application had registered higher grain yield. The causes for the increasing yield are due to increase in dry matter production and efficient assimilate translocation to the developing sink leading to increased pods and resulted in higher grain yield. The results are supported by the findings of Daterao *et al* (1994).

Benefit cost ratio:

Cost of cultivation, total return and Benefit cost ratio was registered in the T_6 (2.56) followed by T_5 (2.50). The highest benefit cost ratio was registered in the T_6 (2.56) followed by T_5 (2.50). Thus it is concluded that Nitrogen application @20 kg N/ha. with rhizobium seed treatment had significantly improved the seed yield of blackgram. The increase in yield was due to the increase in the yield attributes by the nitrogen and rhizobium application.

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Received : June, 2006; Accepted : October, 2006