



RESPONSE OF NITROGEN AND IRRIGATION ON PRODUCTIVITY OF RABI BLACKGRAM (*VIGNA MUNGO* L. HEPPER)


P.Venkata Rao*¹, A.Subbarami Reddy², J.Sateesh Babu³ and M.V.Ramana⁴

¹⁻⁴ Regional Agricultural Research Station, ANGRAU, Lam-522034, Guntur, AP

ABSTRACT: The field experiment was conducted during *rabi* seasons of 2013 and 2014 at Regional Agricultural Research Station, Lam, Guntur in a randomized block design with three replications to study the effect of nitrogen and irrigation on growth and productivity of *rabi* blackgram (*vigna mungo* L. Hepper). The results revealed that there was no significant increase in grain yield of blackgram when N was applied without irrigation; whereas when N was applied with light irrigation at 25-30 DAS progressively increased the grain yield from 20 kg N/ha to 40 kg N/ha. Application of 40 kg N/ha (20 kg basal +20 kg at 25-30 DAS) along with light irrigation at 25-30 DAS proved superior to other treatments in increasing yield and yield attributes and net returns; however, it was on a par with the application of 30 kg N/ha (20 kg basal +10 kg at 25-30 DAS) along with light irrigation at 25-30 DAS.

Key words: blackgram, test weight, productivity, B: C ratio

*Corresponding author: Dr. P. Venkata Rao, Regional Agricultural Research Station, ANGRAU, Lam-522034, Guntur, AP, India Email: venkatraoptn@gmail.com

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INTRODUCTION

Majority of Indian population is vegetarian, pulses are cheap and best source of protein for Indian diet. It contains 20-25 per cent protein, which is more than two times of cereals. In India, presently farmers grow more than a dozen of pulses. Among them chickpea, pigeonpea, urdbean, mungbean, lentil, fieldpea and lathyrus are important. India is the largest producer and consumer of pulses in the world contributing around 25-28% of the total global production. The total pulse production is 17.15 million tonnes from 23.55 million ha area with a productivity of 728 kg/ha (Anonymous, 2015) is the only year majority of which falling under rainfed, resource poor and harsh environments frequently prone to drought and other abiotic stress conditions. Pulses are least preferred by farmers because of high risk and less remunerative than cereals; consequently, the production of the pulses is significantly low to meet the demand of pulses. The green plants can also be used as animal feed and its residues have the capacity to improve the physical, chemical and biological properties of soil thus increase the productivity of land. It can also fix atmospheric nitrogen through the symbiotic relationship between the host improves soil fertility.

Blackgram (*vigna mungo* L. Hepper) is one of the most important short duration grain legumes crop. It fits well in intensive crop rotations as a catch crop. This crop was cultivated on an area of about 3.24m ha with a production of 1.96 m t and productivity of 604 kg/ ha in our country during 2013-14 (Anonymous, 2015). In Andhra Pradesh, blackgram was grown on 3.10 lakh hectares area with production of 2.47 lakh tones and productivity of 797 kg/ha (Anonymous, 2015). Farmers grow this crop not as a principal crop but as a bonus crop, mixed with other crops on marginal lands and that too without manuring. By the introduction of numerous short duration varieties in blackgram it had been feasible to introduce blackgram in multiple cropping systems for increasing pulse production. Blackgram is a legume crop, it responds well to added nitrogen to overcome its lag phase and it influences nutrient uptake by promoting root growth and nodulation. Nitrogen enhances the uptake of other nutrients and increasing nitrogen content in the crop which increases protein content of blackgram.

Favourable responses to irrigation was observed especially, when irrigation is given at the time of flowering initiation resulting in higher yields in greengram (Miah and Carangal, 1981). Irrigation during flowering initiation stage helps for retention of flowers and pod development. Therefore, the present study was taken up to maximize the grain yield of blackgram with optimum dose of nitrogen and irrigation level.

MATERIALS AND METHODS

The research work was carried out for two years in 2013 to 2014 during *rabi* season at RARS, Lam, Guntur, India to find out the response of nitrogen and irrigation on growth and productivity of blackgram. The experimental site is located at 16° 18' N latitude, 80°29'E longitudes and an altitude of 33 m above mean sea level. The soil of the experimental site was clay loam in texture with soil pH 7.2 and electrical conductivity 0.22 dSm⁻¹. The soil was low in organic carbon content (0.51%) and available nitrogen (221 kg ha⁻¹), medium in available phosphorus (21.6 kg ha⁻¹) and available potassium (305 kg ha⁻¹). The trial comprised of seven treatments *viz.*, T₁: 20 kg N/ha (basal without irrigation), T₂: 20 kg N/ha (basal with light irrigation at 25-30 DAS), T₃: 30 kg N/ha (basal without irrigation), T₄: 30 kg N/ha (20 basal + 10 top dressing at 25 -30 DAS with light irrigation), T₅: 40 kg N/ha (basal without irrigation), T₆: 40 kg N/ha (20 basal + 20 top dressing at 25 -30 DAS with light irrigation) and T₇: Control (0 N and no irrigation). The blackgram variety used for the study was LBG752. The experiment was laid out in a RBD design and replicated thrice. Urea and Single Super Phosphate were used as source of nitrogen and phosphorus, respectively. Nitrogen was applied as per treatments in the form of urea and P₂O₅ as singlesuperphosphate @ 50 kg/ha applied as basal for all the treatments. Five plants from each treatments were selected randomly to record data on plant height at harvest, yield components *viz.*, branches plant⁻¹, pods plant⁻¹ and test weight (100 grain weight) was also recorded. All data were subjected to analysis of variance (ANOVA) as per standard procedures. Whenever 'F' ratio was found significant, critical difference (CD) value was calculated at p=0.05 to compare the treatment means. Gross returns and net returns were calculated after deducting the cost of cultivation of blackgram in the coastal districts of Krishna Agro-climatic zone of Andhra Pradesh Rs.25302/- and 27908/- per ha and average market price of seed Rs. 4000/- and Rs.5000/-, per quintal during the years 2013 and 2014 respectively.

RESULTS AND DISCUSSIONS

Effect on growth parameters

The plant height is an important morphological character that acts as potent indicator of availability of growth resources in its vicinity. The maximum plant height (39.2 cm and 50.2 cm) was recorded with the treatment T₆ (40 kg N/ha) followed by treatment T₄ (30 kg N/ha) with light irrigation at 25 DAS during both the years of the study. The lowest plant height (30.9 cm) was recorded in control plot (T₇). The plant height is directly proportional to the available nitrogen present in the soil. Nitrogen has direct effect on plant growth that's why the treatment having maximum doses of nitrogen in the maximum plant height. Moisture level also plays an important role in improvement of plant height. Irrigation at 25-30 DAS along with nitrogen supply at that stage might have resulted in synergistic effect for better plant growth and maximum plant height. Similar results also reported by Kulsum *et al.* (2007) in blackgram and Manoj *et al.* (2014) in summer greengram.

Effect on yield attributes and yield

Both irrigation and nitrogen levels significantly influenced the number of branches plant⁻¹ and number of pods plant⁻¹. Treatment T₆ with 40 kg nitrogen in two equal splits followed by light irrigation at 25-30 DAS gave significantly maximum number of branches plant⁻¹ (9.4 and 4.4) and number of pods plant⁻¹ (32.3 and 34.8) than that of other treatments without irrigation and control plot. The lowest number of branches plant⁻¹ (2.6) and number of pods plant⁻¹ (18.8) were recorded in control plot (Table 1). Adequate supply of nitrogen associated with sufficient moisture level in soil at 25-30 DAS which might have led to better utilisation of growth resources. The results are in agreement with the findings of Asaduzzaman *et al.* (2008) in mungbean.

During pod development stage the supply of sufficient nutrient and photo assimilates are essential for increasing pod length as well as seeds pod⁻¹. Seeds pod⁻¹ was significantly influenced by nitrogen levels (Table 1) followed by one light irrigation at 25-30 DAS over control. The maximum test weight (5.6g) was recorded in treatment T₆ (5.5 g and 5.7g, respectively in 2013 and 2014) having 40 kg N ha⁻¹ and one light irrigation at 25-30 DAS while, minimum was observed in control (4.9 g).

Seed size *i.e.* seed weight contributes greatly to seed yield and it varies with variation in N levels. Seed weight depends on protein synthesis in it and seed protein increases by nitrogen fertilization. Similar results have been observed by Biswas (2001) in field pea, Kulsum *et al.* (2007) in blackgram and Manoj *et al.* (2014) in summer greengram.

It was observed that all parameters affected by different levels of nitrogen, time of N application and irrigation. The seed yield per unit area is attributed to the number of pods plant⁻¹, number of seeds plant⁻¹ and test weight. All these yield attributing characters were significantly influenced by the level of N fertilizer as well as irrigation in blackgram. From the Table 1 it is clear that seed yield increased with increasing level of N from 0 to 40 kg ha⁻¹. The maximum seed yield (1113 kg/ha and 1148 kg/ha in 2013 and 2014, respectively) was realised through application of 40 kg N/ha with light irrigation at 25-30 DAS which was significantly superior over other levels of N (0, 20 and 30 kg/ha) without irrigation. However, it was statistically similar with application of 30 kg N/ha followed by light irrigation at 25-30 DAS (T₄). The significantly higher yield (17.4%) produced by the treatment T₄ (30 kg N/ha with light irrigation at 25-30 DAS) over T₃ (30 kg N/ha without irrigation) which might be due to the maximum production of crop characters and influenced by the plant to have good production of growth in early stages and that eventually raised and portioned to the reproductive organs. The irrigation also helped the plant for optimum seed development. These results are in agreement with the findings of Dhanjal *et al.* (2000) and Mozumder *et al.* (2003).

Table: 1 Growth, Yield and Economics of blackgram as influenced by different Treatments of N Levels and Irrigation

Treatments	Plant height at harvest (cm)		No. of branches/plant		Pods /plant		Seeds /pod		100 seed Weight (g)		Grain yield (kg/ha)		Gross returns (Rs)		Net returns (Rs.)		B:C Ratio	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
T ₁ -20kgN/ha	31.8	35.7	7.9	3.0	23.2	22.9	6.1	5.8	4.8	5.1	881	815	35240	40750	9691	12595	0.38	0.45
T ₂ -20kgN/ha+I	36.9	44.8	8.9	3.8	27.3	30.0	6.6	6.2	5.5	5.3	1021	976	40840	48800	12791	18145	0.46	0.59
T ₃ -30kgN/ha	33.5	38.1	8.5	3.2	25.0	25.9	6.6	6.1	4.9	5.3	948	867	37920	43350	12248	15072	0.48	0.53
T ₄ -30kgN/ha+I	38.4	49.9	9.1	4.2	29.0	33.6	6.8	6.6	5.5	5.4	1040	1093	41600	54650	13428	23872	0.48	0.78
T ₅ -40kgN/ha	34.3	40.3	8.6	3.3	26.0	26.3	6.8	6.5	5.3	5.6	985	918	39400	45900	13604	17498	0.53	0.62
T ₆ -40kgN/ha+I	39.2	50.2	9.4	4.4	32.3	34.8	7.0	6.5	5.5	5.7	1113	1148	44520	57400	16224	26498	0.57	0.86
T ₇ -0+0	-	30.9	-	2.6	-	18.8	-	6.1	-	4.9	-	687	-	34350	-	6442	-	0.23
Sem±	1.48	1.32	0.42	0.15	1.41	1.15	0.23	0.17	0.21	0.1	45.4	39.1	-	-	-	-	-	-
CD (5%)	3.1	3.90	0.9	0.40	3.0	3.40	0.5	0.5	0.44	0.3	137	116	-	-	-	-	-	-
CV (%)	5.9	6.40	6.9	8.40	7.3	8.30	4.9	5.5	5.6	3.8	9.1	8.4	-	-	-	-	-	-

Economics

The economic evaluation of the study presented in the table 2 revealed that though the maximum net returns (Rs.16224/- and Rs.26498/-) and benefit cost ratio (0.57 and 0.86) were obtained with application of 40 kg N/ha (20 kg ha⁻¹ as basal and 20 kg ha⁻¹ top dressing) with one light irrigation at 25-30 DAS but, which was statistically similar to that of T₅ with 30kg N /ha along with light irrigation during both the years of investigation. This might be due to higher number of branches /plant, pods/plant, test weight and seed yield recorded with this treatment. However, the lowest B: C ratio of 0.23 observed in control plot, nevertheless devoid of nitrogen fertilizer cost was due to lowest yield (687 kg/ha) and net returns (Rs.6442/-).

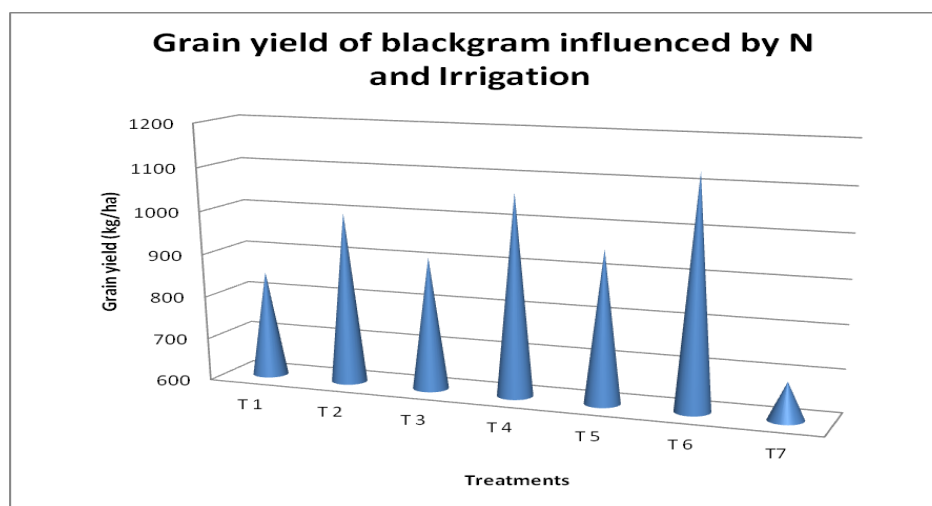


Fig-1: Grain yield of blackgram as influenced by nitrogen and irrigation

CONCLUSIONS

Based on the results obtained from the investigation it can be concluded that all the growth and yield parameters of blackgram increased significantly with application of nitrogen in two splits along with light irrigation at 25-30 DAS compared to that of application of nitrogen without irrigation. Application of 40 kg N /ha (20 kg basal +20 kg at 25-30 DAS) along with light irrigation at 25-30 DAS proved superior to other treatments in increasing yield and yield attributes and net returns; However, it was on a par with the application of 30 kg N/ha (20 kg basal +10 kg at 25-30 DAS) along with light irrigation at 25-30 DAS.

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