

Impact of Land Configuration, Seed Rate and Fertilizer Doses on Growth and Yield of Blackgram [*Vigna mungo* (L.) Hepper]

S. Krishnaprabu

Faculty of Agriculture, Department of Agronomy, Annamalai University, Annamalainagar, Tamil Nadu, India

ABSTRACT: Field experiment was conducted at Experimental Farm, Annamalai University during summer season 2011. Raised bed sown crop produced significantly superior growth characters, yield attributing traits, seed and straw yields as compare to flat bed sown crop. 20 kg seed/ha recorded significantly higher grain and straw yield, while all growth characters (except plant height) and all yield attributing traits were higher with 10 kg seed/ha. Application of 100% RDF (20 kg N + 60 kg P₂O₅ + 20 kg K₂O + 20 kg S/ha) produced significantly higher growth characters, yield attributing traits (number of clusters and pods per plant) and seed and straw yield over 50% RDF. However, application of 75% RDF recorded significantly higher seed and straw yield than 50% RDF. The other yield attributes like pod length, seeds per pod and seed index remained unaffected due to fertilizer doses.

KEYWORDS: Land configuration, Seed rate, Fertilizer doses, Yield attributes, Blackgram.

I. INTRODUCTION

Blackgram (*Vigna mungo* L. Hepper) is one of the most important pulse crops of rainfed areas, grown throughout the country. The production share of blackgram in total pulses production of Tamilnadu is 12 per cent area and 5 per cent production. The area of black gram in Tamilnadu is 492 thousand hectare and production 174 tonnes with productivity of 354 kg/ha. (Anonymous, 2007). Pulse crops are sensitive to excess moisture and terminal drought. As 88% of the area under pulses is rainfed, efficient water management is crucial for successful production. Raised bed planting technique can be used for efficient water management and higher yield in pulses. Pramanik and Singh (2006) reported that urdbean planted on raised bed during kharif season recorded significantly better growth than planted on flat beds. They further concluded that raised bed planting significantly increased branching, nodulation and root growth. The seed rate was the most important factor to maintain optimum plant population of cultivation of blackgram. It has been observed that the yield of blackgram is greatly affected by seed rate. Therefore, it is necessary to find out optimum seed rate to increase yield of blackgram. Seed rate becomes very important specially when the plant compete with each other for yield governing factors like moisture, light and plant nutrients. In this condition proper seed rate avoids advantages in any crop for production programme therefore, the knowledge of proper seed rate is most essential. Black gram has been universally accepted as responsive crop to the application of nitrogen, phosphorus and potash. It requires less amount of nitrogen as it is synthesized by nodulation process; phosphorus is required in large quantity by this crop. Phosphorus contributes directly to both the yield and quality of the black gram. Potash influences root growth, number and weight of root nodules per plant and quality of grains.

II. MATERIALS AND METHODS

The present investigation was conducted at Experimental Farm, Annamalai University during summer season 2011. The experiment was aimed to find out optimum seed rate and economic dose of fertilizer under raised bed and flat bed planting system. The soil of the experimental area was clay loam in texture, slightly alkaline (pH 7.7), medium in available nitrogen (257 kg/ha), low in available phosphorus (5.6 kg/ha) and high in available potassium (410 kg/ha). The experiment consisted of eighteen treatment combinations laid in split-plot design replicated three times. The main

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

plot treatments consisted of the combination of two bed configurations viz., raised bed and flat bed and three seed rates viz., 10, 15 and 20 kg/ha (made raised bed with the help of raiser). The sub plot treatments were three fertilizer doses viz., 100% recommended dose of fertilizer (RDF) (20 kg N + 60 kg P₂O₅ + 20 kg K₂O + 20 kg S/ha), 75% RDF and 50% RDF. The crop was sown on 04th July, 2007 and variety used was JU-3. The seed as well as fertilizer were applied as per treatment in each plot. Before sowing the seed were treated with Thiram + carbendazim @ 3 g/kg seed and rhizobium + PSB @ 5 g/kg seeds each. The different doses of fertilizer as per the treatment were applied in the form of DAP, single super phosphate and murate of potash, respectively as basal dose at the time of sowing. Five plants were taken randomly from each treatment and all growth and yield observations were recorded from them. The data recorded on growth and yield parameters and yield were analyzed as per ANOVA for split-plot design.

III. RESULTS AND DISCUSSION

Growth parameters

Growth parameters viz., number of branches per plant, dry weight per plant were significantly influenced by land configuration (Table-1). Similar results of higher growth parameters in raised bed as well as modified land configuration over flat bed method were also reported by Shivkumar and Mishra (2001). The growth parameters (except plant height) were significantly decreased with increasing rates of seeds and these growth parameters were significantly superior to 10 kg seed/ha over higher rates of seed (Table-1). The increase in height of plant may be due to higher seed rate. When higher seed rate is used, plant gets better environment opportunities to be grown vertically due to inter plant competition. Superiority of lower seed rate over higher seed rates in terms of growth parameters have also been reported by Singh *et al.* (2004). Application of 100 % RDF produced significantly higher all growth parameters over 75% and 50% RDF (Table-1). The overall improvement in the growth of black gram with the addition of fertilizers could be ascribed to their pivotal role in several physiological and biochemical processes, viz., root development, photosynthesis, energy transfer reaction and symbiotic biological N fixation process. These observations are in line with the findings of Vaishya and Tomar (2007).

Table 1. Growth attributes of black gram as influenced by land configuration, seed rates and fertilizer doses

| S. No. | Treatments | Plant height cm. | No. of Branches /plant | No. of leaves /plant | Dry wt./plant (g) | No. of Root nodules/ plant |
|------------------------------|----------------|------------------|------------------------|----------------------|-------------------|----------------------------|
| A. Land configuration | | | | | | |
| 1. | B1: Raised bed | 37.65 | 8.28 | 20.03 | 8.18 | 35.50 |
| 2. | B2: Flat Bed | 36.40 | 7.74 | 19.60 | 7.86 | 34.73 |
| | S.E. (m)± | 0.52 | 0.17 | 0.22 | 0.085 | 0.34 |
| | C.D. (at 5%) | NS | 0.53 | NS | 0.268 | NS |
| B. Seed rates | | | | | | |
| 1 | S1: 10 kg/ha | 35.08 | 8.66 | 20.52 | 8.66 | 36.79 |
| 2 | S2: 15 kg/ha | 37.47 | 8.00 | 19.76 | 8.07 | 35.37 |
| 3. | S3: 20 kg/ha | 38.52 | 7.38 | 19.18 | 7.33 | 33.19 |
| | S.E. (m)± | 0.64 | 0.21 | 0.27 | 0.104 | 0.42 |
| | C.D. (at 5%) | 2.02 | 0.65 | 0.86 | 0.328 | 1.33 |
| C. Fertilizer doses | | | | | | |
| 1. | F1: 100% RDF | 37.96 | 8.52 | 20.48 | 8.70 | 36.23 |
| 2. | F2: 75% RDF | 37.04 | 8.09 | 19.78 | 8.07 | 34.93 |
| 3. | F3: 50% RDF | 36.08 | 7.42 | 19.20 | 7.29 | 34.18 |
| | S.E. (m)± | 0.42 | 0.18 | 0.29 | 0.128 | 0.43 |
| | C.D. (at 5%) | 1.21 | 0.54 | 0.86 | 0.373 | 1.26 |

RDF – 20 kg N + 60 kg P₂O₅ + 20 kg K₂O + 20 kg S/ha.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

Yield attributes

Raised bed sowing significantly enhanced the number of clusters and pods per plant over flat bed sown crop (Table-2). This might be due to the fact that increase in number of leaves had to increased photosynthesis so there by more food was prepared by plants, leading to more number of clusters and pods per plant. Superiority of altered land configuration over flat bed method were also reported by Shivkumar and Mishra (2001) All the yield attributing characters except pod length significantly increased with decreasing rates of seed. Crop sown with 10 kg seed/ha produced significantly more clusters, pods, seeds and seed index as compared to the crop sown with 15 and 20 kg seed/ha (Table-2). The improvement in yield attributes at lower seed rate could be attributed to a relatively less competition for light, nutrients and moisture enabling the plants to develop better than their plants in higher seed rate. The yield attributing characters i.e., number of clusters per plant and number of pods per plant, increased significantly with increasing fertilizer doses and recorded the maximum value of at 100% RDF. However, the differences between any two adjoining levels of fertilizer in respect of both of these yield attributing characters were found non-significant. The improvement in yield components might have resulted from favorable influence of fertilizers on the growth attributes efficient and greater partitioning of metabolites and adequate translocation of photosynthates and nutrients to developing reproductive structures. These results confirm the findings of Vaishya and Tomar (2007) and Srivastava and Srivastava (2005).

Yield

Raised bed sowing significantly increased the seed and straw yields over flat bed sowing (Table-2). The higher growth, better yield attributes in altered land configuration might have contributed for the higher yields in this treatment. Similar results of higher yields in altered land configuration over flat bed method were also reported by Lawand *et al.* (1993). The seed and straw yield of the blackgram was significantly influenced by seed rates (Table-2). Increasing seed rates from 10 to 20 kg/ha significantly increased the seed and straw yield. As a result, the maximum seed yield of blackgram was registered with 20 kg seed/ha (Table-2). The improvement in yield parameters with lower seed rate was, however, not reflected on total yields because the increase in per plant productivity could not compensate for the increased plant population in higher seed rates. The increases in seed rate due to higher seed yield have also been reported by Kumar and Sharma (2007). Seed as well as straw yield of blackgram was significantly influenced by fertilizer doses. Crop fertilized with 100% RDF (20 kg N + 60 kg P₂O₅ + 20 kg K₂O + 20 kg S/ha) produced significantly higher seed yield over 50% RDF (Table-2). However, the differences between any two consecutive levels of fertilizers in respect of seed yield were found non-significant. Similar trend was also found in straw yield except the significant difference between both lower doses *i.e.* 50% and 75% RDF (Table-2). The increased yield of blackgram by application of fertilizers was largely a function of improved growth and consequent increase in yield-attributing characters. These results were in conformity with those of Singh and Singh *et al.* (2007). Harvest index remained unaffected due to fertilizer dose (Table-2) as well as land configuration. Whereas, the harvest index values decreased with the increasing rates of seed, which might be due to low rate of increase in seed yield compared to the straw yield.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

Table 2. Yield attributes, seed and straw yield of blackgram as influenced by land configuration, seed rates and fertilizer doses

| S. No. | Treatments | Clusters / plant | Pods / plant | Pods length (cm) | Seeds / pod | Seed index (g) | Seed yield (kg/ha) | Straw yield (kg/ha) | Harvest index (%) |
|------------------------------|----------------|---------------------|-----------------|---------------------|----------------|-------------------|-----------------------|------------------------|----------------------|
| A. Land configuration | | | | | | | | | |
| 1. | B1: Raised bed | 11.88 | 36.29 | 3.89 | 6.20 | 6.30 | 1254.63 | 8997.09 | 12.33 |
| 2. | B2: Flat Bed | 10.36 | 33.27 | 3.81 | 5.89 | 6.10 | 1127.57 | 8117.70 | 12.32 |
| | S.E. (m)± | 0.21 | 0.66 | 0.09 | 0.12 | 0.11 | 12.18 | 101.07 | 0.14 |
| | C.D. (at 5%) | 0.65 | 2.07 | NS | NS | NS | 38.39 | 318.48 | NS |
| B. Seed rates | | | | | | | | | |
| 1. | S1: 10 kg/ha | 12.18 | 38.41 | 4.07 | 6.60 | 6.54 | 0945.99 | 6333.69 | 13.06 |
| 2. | S2: 15 kg/ha | 11.23 | 35.26 | 3.80 | 6.09 | 6.19 | 1196.24 | 8594.62 | 12.24 |
| 3. | S3: 20 kg/ha | 09.94 | 30.67 | 3.69 | 5.46 | 5.86 | 1431.07 | 10744.86 | 11.68 |
| | S.E. (m)± | 0.25 | 0.80 | 0.11 | 0.14 | 0.16 | 14.92 | 123.79 | 0.176 |
| | C.D. (at 5%) | 0.79 | 2.53 | NS | 0.45 | 0.43 | 47.01 | 390.05 | 0.555 |
| C. Fertilizer doses | | | | | | | | | |
| 1. | F1: 100% RDF | 11.52 | 36.33 | 3.88 | 6.22 | 6.28 | 1225.05 | 8850.57 | 12.22 |
| 2. | F2: 75% RDF | 11.13 | 34.78 | 3.88 | 6.03 | 6.19 | 1194.44 | 8650.82 | 12.25 |
| 3. | F3: 50% RDF | 10.70 | 33.23 | 3.80 | 5.90 | 6.12 | 1153.81 | 8170.78 | 12.52 |
| | S.E. (m)± | 0.20 | 0.75 | 0.06 | 0.11 | 0.09 | 19.10 | 116.23 | 0.235 |
| | C.D. (at 5%) | 0.58 | 2.18 | NS | NS | NS | 55.76 | 339.25 | NS |

Interactions effects

The interaction between land configuration and seed rate was found significant only for seed yield (Table -3). The interaction land configuration and fertilizer dose was not significant for all growth parameters, yield attributing traits and seed and straw yields. The interaction between seed rate and fertilizer dose as well as between land configuration, seed rate and fertilizer dose was not significant for any measurable character.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

Table 3. Effect of seed rates under raised and flat bed systems on seed and straw yield and harvest index of blackgram

| Land configuration | Seed rates | | |
|--------------------|---------------------|---------------------|-------------------|
| | S1 | S2 | S3 |
| | Seed yield (kg/ha) | | |
| B1 | 1002.06 | 1293.72 | 1468.11 |
| B2 | 889.92 | 1098.77 | 1394.03 |
| | Straw yield (kg/ha) | | |
| B1 | 6868.31 | 9166.15 | 10956.79 |
| B2 | 5799.07 | 8021.09 | 10532.92 |
| | Harvest index (%) | | |
| B1 | 12.80 | 12.37 | 11.82 |
| B2 | 13.06 | 12.24 | 11.68 |
| | Seed yield (kg/ha) | Straw yield (kg/ha) | Harvest index (%) |
| S.E. (m)± | 21.10 | 175.07 | 0.25 |
| C.D. (at 5%) | 66.49 | NS | NS |

REFERENCES

- Anonymous (2007), Annual report of AICRP on Mulla RP, Indian Institute of Pulses Research, Kanpur, (U.P.) pp. 53.
- Kumar, A. and Sharma B.B. (2007). Effect of row spacing and seed rate on root growth, nodulation and yield of blackgram (*Phaseolus mungo*). *Indian J. Agric. Sci.* 59: 728-729.
- Lawand, B.T., Rajput S.C. and Patil V.K. (2008). Effect of planting methods on growth and yield of cowpea. *Madras Agril. J.* 80 : 407-408.
- Pramanik, S.C. and Singh N.B. (2006). Raised bed planting improves productivity of pulses. *Chickpea Newsletter*, January 2006.
- Singh, Bhopal and C.M. Singh (2005). Response of urdbean to NPK application on field under rainfed condition. *Indian J. Pulse Res.* 2 : 137-139.
- Shivkumar, B.G. and Mishra B.N. (2001). Effect of land configuration, nutrient and stover management on growth and yield of wheat under limited water supply. *Annals of Agric. Res.* 22 : 462-467.
- Singh, S., Yadav D.S. and Singh S.K. (2004). Root growth and yield of summer black gram (*Vigna mungo* L. Hepper) as affected by row spacing and seed rate. *Narendra Deva J. Agric. Res.* 7: 199-201.
- Srivastava, G.P. and Srivastava V.C. (2005). Contribution of production factors in growth, yield and economics of blackgram (*Phaseolus mungo*). *Indian J. Agron.* 40 (1): 64-66.
- Vaishya, U.K. and Tomar S.S. (2007). Performance of urdbean to nitrogen and phosphorus. *Field Crop Abstr.* 36 (4): 310.