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# A novel crop-stand establishment technique for Blackgram (*Vigna mungo* (L.) Hepper) under Rice-pulse cropping system in delta regions

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### Abstract

Blackgram (*Vigna mungo* (L.) Hepper) is one of the most important and extensively grown pulse crops around the world. The present practice of farmers has been sowing the blackgram seeds, preferably 7-10 days, prior to harvest of rice under rice-pulse cropping system in delta regions. It ensures zero tillage and also utilization of residual soil moisture to hasten germination of blackgram seeds. The major constraint here is plant population maintenance and low productivity of the pulse crop. The objective of the experiment was to find out suitable stand establishment method for cultivating blackgram, after harvest of rice crop, in stubbles under rice-pulse cropping system and also to fix seed rate to get optimum yield. Accordingly, the field experiment was conducted at central farm of Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during 2019 – 2020 with different crop-stand establishment techniques and performance of blackgram assessed in terms of growth and yield. A perusal of the results on growth and yield of blackgram indicated that the grain yield ranged from 364.58 kg to 713.54 per ha of land. The maximum yield was registered in the treatment T7: Broadcasting (37.5kg/ha) followed by tiller (9 Tyne) ploughing with a yield of 713.54 kg/ha and was significantly different from other treatments. A similar trend was also observed with haulm yield.

**Keywords:** Blackgram, tiller plough, ridger, grain yield, haulm yield, root nodule

### Introduction

The cultivation of a food legume, preferably a short duration crop, according to the water availability is a common practice among delta rice farmers of Southern India especially in states like Tamil Nadu, Karnataka and Andhra Pradesh. The cultivation of such crop generally coincides with the summer season (January last to May). This is a system approach known as Rice-Pulse cropping system for effective and efficient utilization of land. The popular food legumes also called as pulses, are blackgram, green gram, chickpea, field pea *etc* and, these pulse crops have enormous potential in scaling up both productivity and resource use efficiency especially residual soil moisture and nutrients. It ensures crop diversification to facilitate improvement in physico-chemical and biological properties of the cultivating field, and breaking the monotony of monocropping and monoculture i.e. of single crop and same variety of that crop for long years in the same field. Blackgram (*Vigna mungo*) is one of the most important and extensively grown pulse crops around the world. The importance of the crop is associated with the high protein content and other essential minerals. Its seed contains 22.5% protein, 9.4% moisture, 2.05% fat, 6.95% fiber and 343.5 kcal/100g energy <sup>[1]</sup>. The present practice of farmers has been sowing the blackgram seeds, preferably 7-10 days, prior to harvest of rice. It ensures zero tillage and also utilization of residual soil moisture to hasten germination of blackgram seeds.

The major constraint here is plant population maintenance and low productivity of the pulse crop. With this backdrop, a novel crop establishment technique has been evaluated in rice-blackgram cropping system through scientific interventions like close cutting of rice stubbles; farm mechanization, enhanced seed rate and foliar nutrition have been experimented. Among the agronomic practices for crop production optimum plant population is an important for obtaining higher productivity <sup>[5]</sup>. The significance of using optimum plant spacing has been recognized by several researches.

The objective of the experiment was to find out suitable stand establishment method for cultivating blackgram, after harvest of rice crop, in stubbles under rice-pulse cropping system and also fix seed rate to get optimum yield.

## Materials and Methods

### i) Location

The field experiment was conducted at central farm of Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during 2019 – 2020. The farm is geographically located at, 9°54'N latitude and 78°54'E longitude at an elevation of 147 m above mean sea level. The field is located in the southern agro climatic zone of the Tamil Nadu. The normal weather conditions of the location are; mean annual rainfall of 864mm received in 47 rainy days and of which, 39.8 per cent was received during South West Monsoon (June-September), 42.0 per cent during North East Monsoon (October-December), 2.0 per cent during Winter (January-February) and 16.2 per cent during Summer (March-May), daily mean maximum and minimum temperatures were 33.36, 32.64 and 23.94, 24.15°C during *kharif* season (June-September) and *rabi* season (October-December) respectively and the daily mean pan evaporation was 4.02 mm and 4.13 mm with relative humidity of 74 and 79 per cent during both the seasons. The soil of the experimental field was well drained sandy clay loam in texture.

### ii) crop and variety

The test crop is blackgram (*Vigna mungo* L.), a food legume. The variety used for experimentation is VBN 8 and the varietal characters are; 65-75 days duration with a maximum potential yield capacity of 900 kg/ha. The special characters include non-shattering and synchronous maturity; Resistant to Yellow Mosaic Virus and leaf crinkle diseases; Protein content –21.9%; Arabinose–7.5%

### iii) Experimentation and objective

The objective of the study is to find out the influence of land preparation technique and seed rate on crop stand establishment and yield in Blackgram (*Vigna mungo* L.). A factorial experiment in the base of Randomized Block Design with 9 treatments and 3 replications. The treatments are T1: Broadcasting with normal seed rate, T2: Line sowing with normal spacing 30x10cm, T3: Broadcasting (25kg/ha) followed by tiller (9 Tyne) ploughing, T4: Broadcasting

(25kg/ha) followed by ridge forming at 45cm with ridger, T5: Broadcasting (25kg/ha) followed by ridge forming at 60cm with ridger T6: Broadcasting at enhanced seed rate (37.5kg/ha), T7: Broadcasting (37.5kg/ha) followed by tiller (9 tynes) ploughing, T8: Broadcasting (37.5kg/ha) followed by ridge forming at 45cm with ridger, T9: Broadcasting (37.5kg/ha) followed by ridge forming at 60cm with ridger. The sowing was raised during February – May, 2020.

A manual removal of weeds was done during 20<sup>th</sup> day of sowing. For nutrition, a fertilizer dose of 25:50:0 NPK Kg ha<sup>-1</sup> was given as basal. The N, P and K fertilizers were applied in the form of urea (contains 46% N) (54.3 kg ha<sup>-1</sup>), single super phosphate (contains 16% P<sub>2</sub>O<sub>5</sub>) (312.5 kg ha<sup>-1</sup>) and potash (contains 60% K) (41.6 kg ha<sup>-1</sup>). Twice foliar nutrition of Di-ammonium phosphate (DAP) 2% sprays was given at first appearance of flowering and 15 days after.

### iv) Biometrics and statistical analysis

The experiment was set up in a Randomized Block Design and the data recorded on growth and yield of the crop were subjected to ANOVA<sup>4</sup> and inference drawn for the results are discussed.

## Results and Discussion

The statistically analysed data recorded are presented in tables. It indicated the influence of different crop stand establishment technique on the performance of blackgram and is indicated through various growth and yield parameters. The biometric observations were recorded on above ground biomass like plant height, number of leaves and below ground biomass namely root length and root nodule number. The results revealed that the values for below ground biomass parameters were higher in treatment T7: Broadcasting (37.5kg/ha) followed by tiller (9 Tyne) ploughing. That is more number of root nodules (18.33) were produced in this treatment besides it also produced longest roots (16.73cm). While higher values for root characteristics were recorded in the same treatment, T7: Broadcasting (37.5kg/ha) followed by tiller (9 Tyne) ploughing. Nodulation is a characteristic feature of legume crops; it needs to be promoted through agronomic and soil management practices to enhance the biological nitrogen fixation which can be used by the subsequent crop. And hence the root nodule counts were recorded.

**Table 1:** Effect of land configuration methods on growth of Blackgram.

Treatments	Plant height at 30 DAS (cm)	No. of leaves	No. of root nodules	Root length (cm)
T1: Broadcasting with normal seed rate	19.67ab	12.67	12.33	13.77
T2: Line sowing with normal spacing 30x10cm	21.87ab	14.56	9.00	14.03
T3: Broadcasting (25kg/ha) followed by tiller (9 tynes) ploughing	19.26bc	14.67	12.00	16.53
T4: Broadcasting (25kg/ha) followed by ridge forming at 45cm with ridger	21.35bc	12.88	10.67	10.13
T5: Broadcasting (25kg/ha) followed by ridge forming at 60cm with ridger	20.89bc	13.44	14.67	16.07
T6: Broadcasting at enhanced seed rate (37.5kg/ha),	19.13bc	12.33	12.67	15.43
T7: Broadcasting (37.5kg/ha) followed by tiller (9 tynes) ploughing	20.65a	13.56	18.33	16.73
T8: Broadcasting (37.5kg/ha) followed by ridge forming at 45cm with ridger	22.21abc	13.00	5.67	16.40
T9: Broadcasting (37.5kg/ha) followed by ridge forming at 60cm with ridger	22.65abc	13.89	13.33	18.13
S.E.(d)	2.271	2.761	11.42	7.030
C.D.	1.071	NS	NS	NS

\*Alphabets a,b,c indicate DMRT values and the numbers followed by similar alphabets are not statistically different from each other.

Longer roots coupled with more number of root nodules is a key factor that influence the anchorage of the plant besides it facilitates better soil foraging for nutrients and moisture

below ground. Further adoption of tillage with tractor drawn tiller (9 Tyne) had loosened the top soil up to 30cm, which facilitated better aeration in the soil and moisture retention.

These two factors of soil aeration and soil moisture ensured higher below ground biomass characters in this treatment. However, as regards the above ground biomass taller plants were observed in treatments T8 and T9 with the enhanced

seed rate. It confirms the concept of crowded and thickly populated crop tends to grow taller because of competition for light and space. The Light is the triggering factor and in search of Sun light, plants grow taller.

**Table 2:** Effect of land configuration methods on yield and yield attribute in blackgram.

Treatments	Grain yield (kg/ha)	Haulm yield (kg/ha)
T1: Broadcasting with normal seed rate	583.33ab*	1291.67
T2: Line sowing with normal spacing 30x10cm	567.70ab	1250.00
T3: Broadcasting (25kg/ha) followed by tiller (9 Tyne) ploughing	468.75bc	1104.17
T4: Broadcasting (25kg/ha) followed by ridge forming at 45cm with ridger	364.58c	968.75
T5: Broadcasting (25kg/ha) followed by ridge forming at 60cm with ridger	468.75bc	1104.17
T6: Broadcasting at enhanced seed rate (37.5kg/ha),	437.50abc	1041.66
T7: Broadcasting (37.5kg/ha) followed by tiller (9 Tyne) ploughing	713.54a	1427.08
T8: Broadcasting (37.5kg/ha) followed by ridge forming at 45cm with ridger	447.92bc	1140.63
T9: Broadcasting (37.5kg/ha) followed by ridge forming at 60cm with ridger	468.75bc	1168.33
S.E.(d)	182.39	286.7606
C.D.	86.04	NS

\*Alphabets a,b,c indicate DMRT values and the numbers followed by similar alphabets are not statistically different from each other.

It was recognized that under the rice fallow condition, blackgram cv. ADT 3 recorded higher values for all growth and yield parameters and registered the highest grain yield (810 kg/ha). The results indicated that the suitability of the blackgram genotypes under rice fallow condition<sup>3</sup>.

A perusal of data on yield of blackgram presented in table (2) indicated that the grain yield ranged from 364.58 kg to 713.54 per ha of land. The maximum yield was registered in the treatment T7: Broadcasting (37.5kg/ha) followed by tiller (9 Tyne) ploughing with a yield of 713.54 kg/ha and was significantly different from other treatments. The next best treatment was T1: Broadcasting with normal seed rate with a yield of 583.3 kg/ha, however it was on a par with T2. Other treatments did not show any significant statistically and the yield recorded were on a par. A similar trend was observed with haulm yield also as the treatment T7: Broadcasting (37.5kg/ha) followed by tiller (9 Tyne) ploughing with a yield of 1427.08 kg/ha. However the haulm yield data did not show a significant difference between treatments.

The better performance of treatment T7: Broadcasting (37.5kg/ha) followed by tiller (9 Tyne) ploughing in terms of higher output and yield may be due to the production of more number of nodules in this treatment and also longer roots, as evidenced from this study, which facilitated better soil foraging and absorption of nutrients and moisture which has been utilized for production of sink. The study also revealed that increase seed rate and broadcasting method of sowing is ideal for such conditions.

It has been reported that in respect of rice fallow crops, different methods of sowing/planting adapted to rice did not exert any Influence on succeeding crop yield. Higher level of fertilizers had an impact on yield of all sequential crops raised in rice fallows. Among the sequential crops, soybean performed better than others. Blackgram was the next best<sup>2</sup>

From the study it may be concluded that for cultivating blackgram under rice-pulse cropping system and rice fallow conditions, broadcasting of 37.5 kg of blackgram seeds in rice stubbles, after harvest of rice and practicing tiller (9 Tyne) ploughing 1or 2 days after sowing is the novel and ideal method to ensure better crop stand and also higher grain yield.

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