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Effect of Land Configuration and Nutrient Management Methods on Growth and Yield of Blackgram (*Vigna mungo*)

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ABSTRACT

Background: Pulse require less water than other crops. It plays a significant role in combating soil erosion and degradation. Pulses are the main sources of dietary protein in the vegetarian diet in our country. They preserve soil fertility by biological nitrogen fixation in the soil, as well as being a rich source of protein and thus play a vital role in sustainable agriculture. In Tamil Nadu, the Cauvery Delta Zone (CDZ) has a total land area of 1.45 million ha which is equivalent to 11% of the state area and this zone is the potential zone for pulse cultivation. The cultivation of blackgram faces many problems like water logging and inadequate aeration, which affect the growth and yield in flatbed conditionsadversely. Further the major causes of poor productivity and soil fertility are imbalanced application of nutrients. Hence there is a need to evaluate the appropriate land configuration and nutrient management methods.

Methods: The field experiment was performed at Soil and Water Management Research Institute, Thanjavur, Tamil Nadu, during the summer seasons of 2018 and 2019 in split plot design with four replications. In main plot three land configuration methods *viz.,* broadcasting seeds and forming ridges (30 cm width), broad bed (100 cm width), flatbed and in sub plot three nutrient management methods *viz*., control (S_1), recommended dose of fertilizer (RDF) (S_2), RDF+biofertilizers (S_3) in a plot size of 40 m^2. In all the land configuration methods 30 cm row spacing is adopted. Line sowing is followed in broad bed (M_2) and flat bed method (M_3). In broadcasting seeds and forming ridges (M_1) the seeds will be broadcasted after land preparation and ridges (30 cm) will be formed with ridge former. Uniform seed rate is adopted in all the methods.

Result: Sowing of blackgram in broad beds along with 100% RDF + biofertilizers was found to be superior over flat bed and broadcasting seeds and forming ridges by producing higher grain yield and B:C ratio and achieved the higher productivity and profitability.

Key words: Blackgram, Broad bed, Flat bed, Grain yield, Nutrient management.

INTRODUCTION

Pulses are the very vital component of the food and economy of the Indian subcontinent. The country is the largest producer and consumer of pulses. The area under pulses in India is 25 million hectare, production is 16.47 million tones and productivity is 652 kg ha^{-1} (Agricultural Statistics at a Glance, 2016). Among the pulses, black gram and green gram contribute to 10% and 7% of the total pulses production of the country, respectively.

Though India accounts to 25% of the world's pulse production, the country is also the largest importer of pulses. The import in 2016 was 5.7 million tonnes of pulses. Theper-capita availability of pulses in India is only 43 g day^{-1} amid high production and imports, compared to the ICMR recommendation of 65 g day^{-1}.

Blackgram being a summer crop in the Cauvery Delta zone in about 2.0 lakh hectare cultivated either as rice fallow or irrigated crop after rice harvest in the rice fields. No special land preparation is being done, although beds and channels are being practiced in certain regions. Further being a secondary crop no significant research work has been taken up especially in land management system. Now the delta farmers started cultivating blackgram either as rice fallow or as irrigated crop in kuruvai and summer season. Under this circumstances farming community faces some difficulties in drainage and also for irrigation during summer. In delta districts, heavy down pouring in short spell and even lengthy dry spell is prevalent. This research was then undertaken to figure out the effective methods of land configuration and nutrient conservation.

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MATERIALS AND METHODS

The field experiment was conducted during summer seasons of 2018 and 2019 at Soil and Water Management Research Institute, Thanjavur which is located at 10°45′ North latitude and 79° East longitude with an elevation of 50 meters above mean sea level. Themean maximum and minimum temperature vary from 38.9°C in May to 29.4°C in December

and from 27.1°C in May to 20.8°C in January respectively. The experimental soil was classified as sandy loam. At the initiation of the experiment soil had pH 6.3 and available N, P and K was 232, 29 and 140 kg/ha respectively. The experiment was laid out in spilt plot design with four replications. The treatments comprised of three land configuration methods in main plot (Broad casting and forming ridges, broad bed and flat bed) and three nutrient management (Control, 100% RDF, 100% RDF+ Biofertilizers). The recommended doses of fertilizers (RDF) for blackgram were 25:50:25 of N, P_2O_5, K_2O respectively. The entire quantity of NPK was applied at the time of sowing. Both seed treatment (20 g/kg of seed) and soil application of (2 kg/ha) bio-fertilizers rhizobium and phosphobacterium was done as per the treatments. Blackgram ADT 5 was sown in rows at 30 cm apart with a seed rate of 25 kg/ha during summer season of 2018 and 2019. The crop was grown as per recommended package of practices. Observations on various growth and yield attributes were recorded. The B:C ratio was worked out at the prevailing market prices of the inputs and outputs. Statistical analysis was carried out as per the procedure given by Gomez and Gomez (1984) for split plot design.

RESULTS AND DISCUSSION

Growth parameters

Growth parameters such as plant height and number of branches per plant were significantly affected by the land configuration and nutrient management. Higher plant height and number of branches/plant was recorded under broad bed (51 cm, 6.5) as compared to flat bed (48 cm, 5.5) and broadcasting seeds and forming ridges (46.7 cm, 3.5) respectively. It might be due to better availability of nutrients to crops in broad bed as evident from the beneficial effects on the crop growth. The results were in conformity with the findings of Tomar *et al.* (2016). Among the nutrient management practices, 100% RDF + bio fertilizer (rhizobium + phosphobacteria) produced taller plants and more number of branches /plant (49.9 cm, 6.5) which was significantly higher than the rest of the treatments. Lower plant height (23.5 cm) with minimum number of branches/plant (3.0) was recorded in control plot which was significantly lower than other treatments (Table 1). The overall improvement in the growth and yield of blackgram in broad bed with the addition of both inorganic fertilizers and biofertilizers could attributed to their major role in several physiological and biochemical process, *viz*., root development, photosynthesis and biological N fixation process. These findings are supported by Tomar *et al.* (2016).

Yield and yield attributes

Grain yield of blackgram varied significantly due to different land configuration and nutrient management methods. Highest grain yield of 1006 kg/ha was recorded under broad bed methodwhich was significantly superior over flat bed (832 kg/ha) and broadcasting seeds and forming ridges

Table 1: Influence of land configuration and nutrient management on growth and yield of blackgram (Mean of two years).

Treatments	Plant population (no/m^2)	Plant height (cm)	No. of branches/plant	No. of pods/plant	No. of seeds/pod	Test weight (g)	Grain yield (kg/ha)	Haulm yield (kg/ha)	HI	WUE (kg/ha mm)
Main plot										
M1	36	46.8	3.5	20.3	4.2	3.5	816	1751	0.32	2.33
M2	32	51.0	6.5	30.9	5.5	3.6	1006	1854	0.35	2.87
M3	32	48.2	5.5	24.1	5.2	3.5	832	1693	0.33	2.08
SEd	-	0.7	0.1	0.5	0.2	0.05	9.2	50.8	-	0.13
CD (P=0.05)	NS	2.4	0.4	1.6	0.5	NS	22.5	102.7	-	0.33
Sub plot										
S1	30	23.5	3.0	20.9	4.5	3.5	445	1258	0.26	1.27
S2	33	49.9	6.5	29.9	5.7	3.5	1059	1891	0.36	2.87
S3	32	52.5	7.2	32.3	5.9	3.6	1149	1984	0.37	3.28
SEd	-	0.5	0.2	0.6	0.2	0.10	11.1	60.5	-	0.16
CD (P=0.05)	NS	1.5	0.5	1.7	0.7	NS	23.3	110.1	-	0.56

Table 2: Economics of different treatments (Mean of two years).

Treatments	Cost of cultivation (Rs./ha)	Gross income (Rs./ha)	Net income (Rs./ha)	B:C ratio
Main plot				
M1	18920	53014	34094	2.80
M2	22500	65387	42887	2.91
M3	21900	54048	32148	2.47
Sub plot				
S1	17200	28922	11722	1.68
S2	22750	65397	43647	2.87
S3	24000	74682	50682	3.11

(816 kg/ha). The highest grain yield under broad bed was mainly due to higher growth and yield attributes. Similar trend was also recorded in haulm yield in which broad bed (1854 kg/ha) recorded significantly higher over the rest of the treatments flat bed (1751 kg/ha) and broadcasting seeds and forming ridges (1693 kg/ha). Harvest index also followed the same trend, Higher HI of 0.35 was recorded in broad bed and RDF + biofertilizer (0.37) due to higher biological yield (Table 1). The highest grain and haulm yield of blackgram in broad bed is due to favourable soil and moisture conditions, the plant accumulates and translocate of photosynthates from source to the sink more efficiently which in turn increased all the growth and yield attributes. Similar results were also reported by Jadhav *et al* (2008).

Application of 100% RDF + biofertilizers recorded the highest grain (1149 kg/ha) and haulm (1984 kg/ha) yields. This was followed by 100% RDF with a grain (1059 kg/ha) and haulm (1891 kg/ha). The control plot without the application of fertilizers recorded significantly lower yield (445 kg/ha). Similar results was reported by Singh (2017).

Water use efficiency

Among the land configuration methods broad bed recorded highest WUE of 2.87 kg/ha mm followed by broadcasting seeds and forming ridges (2.33 kg/ha mm) and flat bed (2.08 kg/ha mm). Application of recommended dose of fertilizer along with biofertilizers recorded higher WUE of 3.28 kg/ha mm followed by recommended dose of fertilizers alone (2.87 kg/ha mm). This may be due to higher grain yield and less water consumption. Control plot recorded lowest water use efficiency due to lesser yield.

Economics

Higher cost of cultivation (22500 Rs./ha), gross return (65387 Rs./ha), net return (42887 Rs./ha) and benefit cost ratio (2.91) was recorded under broad bed method. Lower cost of cultivation (18920 Rs./ha), gross return (53014 Rs./ha), net return (34094 Rs./ha) and benefit cost ratio (2.80) was observed in broadcasting seeds and forming ridges. Flat bed method recorded cost of cultivation (21900 Rs./ha), gross return (54048 Rs./ha), net return (32148 Rs./ha) and benefit cost ratio (2.47). Similar result was reported by Pal *et al.* (2015). Among the nutrient management, higher cost of cultivation (24000 Rs./ha), gross return (74682 Rs./ha), net return (50682 Rs./ha) and benefit cost ratio (3.11) was recorded under 100% RDF + biofertilizers. The minimum value of cost of cultivation (17200 Rs./ha), gross return (28922 Rs./ha), net return (11722 Rs./ha) and benefit cost ratio (1.68) was recorded under control, which may be attributed to low yield of the crop (Table 2).

CONCLUSION

It may be concluded that sowing of blackgram in broad beds along with 100% RDF + biofertilizers was found to be superior over flat bed and broadcasting seeds and forming ridges by producing higher grain yield and B:C ratio and achieved the higher productivity and profitability.

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