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METHODS OF SOWING AND FOLIAR NUTRITION ON YIELD ENHANCEMENT IN BLACKGRAM

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Abstract

A field experiment was conducted at the Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar during January – April, 2017 to evaluate various methods of sowing and foliar nutrition on yield enhancement in blackgram. The results of the experiment showed that ridge sowing of blackgram in main plot registered significantly improved growth and yield attributes and yield. Among the foliar nutrition in the sub plots, 0.1% humic acid foliar spray on 25 and 45 DAS significantly increased the growth, yield components and grain yield of blackgram. Regarding the interactions, M_3S_2 -ridge sowing of blackgram along with 0.1% humic acid foliar spray on 25 and 45 DAS excelled all other treatments by recording higher growth and yield attributes and yield during the cropping period.

Key words *:* Ridge sowing, 0.1% humic acid foliar spray, growth attributes and yield.

Introduction

Blackgram (*Vigna mungo* L.Hepper) is a crop with excellent source of high quality protein and one of the most important pulse crops in India. Blackgram is the main source of deity protein (24%) also contains carbohydrate (67%), fiber (3.5%), fat (1.74%) and major protein with lysine in a vegetarian diet. The United Nations declared 2016 as "International Year of Pulses" (IYP) to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed at food security and nutrition (Mohanty and Satyasai, 2015). In Tamilnadu, blackgram is cultivated in 3.65 lakh hectares with the production of 3.10 lakh tonnes with average productivity of 851 kg ha^{-1} (Tnstat, 2014). The current level of production is well below the requirement, and future projected demand for 2022 also mounting 16.1 million tonnes, to meet the specified per capita requirement (Praduman Kumar *et al.,* 2009). The low yield is attributed to several reasons *viz.,* cultivated as rainfed crop, as intercrops in marginal lands, improper sowing methods, poor nutrition management practices, and low yield potential of varieties. Even though, sufficient moisture is made available to the sown crop by following the appropriate time of sowing, placement of seeds on the surface of soil in broadcasting is likely to cause poor germination which need to taken care of by following the proper method of sowing (Maruthupandi *et al*., 2016). In addition to that the lack of nutrients during the critical stages of crop growth leads to nutrient stress, which leads to poor yield and productivity of the crop. With this background, the present investigation was undertaken to find out suitable methods of sowing and foliar nutrition on improvement of yield in blackgram

Materials and Methods

A field experiment was conducted at Annamalai University, Experimental farm during January-April, 2017 for blackgram cultivation. Experiment was laid out in split plot design with three replications using variety VBN-5 as the test crop. The Experimental Farm is geographically situated at 11° 24' North Latitude and 79° 44' East Longitude and with an altitude of + 5.79 m above mean sea level. The Experimental Farm is characterized by tropical climate with a mean annual rainfall of 1500 mm. The soils of the experimental field was clay loam. The soil was low in available nitrogen, medium in available phosphorous and high in available potassium. The treatment includes, different methods of sowing *viz.,* M_1 - broadcasting, M_2 - line sowing, and M_3 - ridge sowing were compared in main plots and various foliar nutrition *viz.,* S_1 - Control, S_2 - 0.1 % humic acid foliar spray on 25 and 45 DAS, S_3 - 2 % DAP foliar spray on 25 and 45 DAS, S_4 - 3 % Panchakavya foliar spray on 25 and 45 DAS were compared in subplots. Cotton seeds were

sown in 5x4m plots with a spacing of 30 x 10cm. The variety was raised under optimum conditions of nutrient supply (25:50:25 kg NPK ha^{-1}) and plant protection measures in the field. The soil was clay in texture having pH 6.7, EC 0.34 ds/m, low in available N (246.50 $kgha^{-1}$) medium in available P (18.5 $kgha^{-1}$) and high in available K (280.75 $kgha^{-1}$). Observations on growth and yield attributes were taken on five randomly selected peg marked plants in periodical intervals. The mean values were used for statistical analysis as suggested by Panse and Sukatame (1978).

Results and Discussion

Growth attributes

All the growth attributes were significantly influenced by various sowing methods and foliar spraying of nutrients. The growth components *viz.,* plant height, leaf area index, number of branches $plant^{-1}$ and DMP were enhanced due to different sowing methods along with foliar spraying of nutrients (Table 1 and Table 2). The highest growth attributes was recorded in ridge sowing + foliar spray of 0.1% humic acid at 25 and 45 DAS (M_3S_2). Among the different sowing methods in the main plot, ridge sowing (M_3) significantly recorded the maximum growth attributes like plant height 55.85 cm, LAI of 4.65 at flowering stage, number of branches $plant^{-1}$ of 9.15, DMP of 3026.04 kg ha^{-1} at harvest stage of the crop. This might be due to better growing conditions after seed germination and less competitive effect between plants in ridge sowing. Higher values were recorded in LAI and number of branches $plant^{-1}$ might be due to crop sown in ridges which provides loose layer of soil which enhances better root grown, nutrient and water uptake and subsequently increased the LAI and other growth components. Similarly, improved light penetration in middle and bottom of the crop canopy in ridge sowing reflects in higher DMP. Similar results were also observed by Hill *et al.,* (2006) and Shashikumar *et al*., (2013).

Among the different foliar nutrition practices in the sub plot, the foliar spray of 0.1% humic acid at 25 and 45 DAS (S_2) was significantly superior over the other treatments and recorded the highest plant height of 57.73 cm, LAI of 5.05, number of branches $plant^{-1}$ of 9.90, DMP of 3131.26 kg ha^{-1} at harvest stage of the crop. This could be due to increased LAI, number of branches $plant^{-1}$, DMP might be due to the role of humic acid in increasing endogenous hormone as IAA stabilizing cell division and cell enlargement which in turn improves the plant growth. This result was in conformity with the reports of Bakry *et al*., (2015).

The treatment combinations of ridge sowing + foliar spray of 0.1% humic acid at 25 and 45 DAS (M_3S_2) significantly recorded the highest plant height of 59.84 cm, LAI of 5.48, number of branches $plant^{-1}$ of 10.65 and DMP of 3250.64 kg ha^{-1} at harvest stage of blackgram. This might be due to increased availability of nutrients due to ridge sowing method and 0.1% humic acid foliar nutrition which provided equal opportunity to the crop to grow and perpetuate. Also improvement in growth attributes could be improved in soil physical and chemical characteristics by reaction with soil minerals then improved water, air, soil characteristics and nutrient and mineral adsorption respectively. These findings were conformed with the earlier reports of Lone *et al.,* (2010) and Ananthi and Mallika Vanangamudi (2014).

Yield attributes and Yield

All the yield attributes and yield were significantly influenced by sowing methods and foliar spraying of nutrients. The yield attributes, grain yield and haulm yield were enhanced due to different sowing methods along with foliar spraying of nutrients table 3. Among the

Table 1: Methods of sowing and foliar nutrition of growth attributes of blackgram.

Plant height (cm) at Harvest stage					LAI at flowering stage				
Sub plot treatment	Main plot treatment				Sub plot treatment	Main plot treatment			
	M_1	M_2	M_3	Mean		M_1	M_2	M_3	Mean
S_1	46.25	48.60	52.30	49.05	S_1	3.02	3.32	3.96	3.43
S_2	55.20	58.15	59.84	57.73	S_2	4.52	5.15	5.48	5.05
S_3	54.19	55.02	56.62	55.27	S_3	4.20	4.46	4.85	4.50
S_4	51.20	53.44	54.64	53.09	S_4	3.64	4.10	4.32	4.02
Mean	51.71	53.80	55.85		Mean	3.84	4.25	4.65	
	Main	Sub	M × S	S × M		Main	Sub	M × S	S × M
SE_d	0.78	0.84	0.66	0.60	SE_d	0.14	0.21	0.13	0.11
CD (p=0.05)	1.64	1.78	1.40	1.28	CD (p=0.05)	0.31	0.45	0.28	0.23

M_1 - (Broad casting) , M_2 - (Line Sowing), M_3-- - (Ridge Sowing). S_1 - (Control) , S_2 - (0.1 % Humic acid foliar spray on 25 and 45 DAS), S_3 - (2 % DAP foliar spray on 25 and 45 DAS), S_4 - (3 % Panchakavya foliar spray on 25 and 45 DAS.

Table 2: Methods of sowing and foliar nutrition on growth attributes of blackgram.

Number of brances plant^{-1} at harvest stage					DMP (kg ha^{-1}) at harvest stage				
Sub plot treatment	Main plot treatment				Sub plot treatment	Main plot treatment			
	M_1	M_2	M_3	Mean		M_1	M_2	M_3	Mean
S_1	6.40	7.10	7.95	7.15	S_1	2665.20	2750.45	2860.65	2758.76
S_2	9.00	10.05	10.65	9.90	S_2	2984.95	3158.20	3250.64	3131.26
S_3	8.40	8.70	9.50	8.86	S_3	2905.50	2960.40	3072.10	2979.33
S_4	7.60	8.10	8.50	8.06	S_4	2839.60	2894.60	2920.80	2885.00
Mean	7.85	8.48	9.15		Mean	2848.81	2940.90	3026.04	
	Main	Sub	M × S	S × M		Main	Sub	M × S	S × M
SE_d	0.27	0.34	0.21	0.18	SE_d	39.30	43.97	39.57	36.61
CD(p=0.05)	0.58	0.72	0.46	0.37	CD (p=0.05)	82.58	92.40	83.15	76.93

M_1 - (Broad casting) , M_2 - (Line Sowing), M_3-- - (Ridge Sowing). S_1 - (Control) , S_2 - (0.1 % Humic acid foliar spray on 25 and 45 DAS), S_3 - (2 % DAP foliar spray on 25 and 45 DAS), S_4 - (3 % Panchakavya foliar spray on 25 and 45 DAS.

Table 3: Methods of sowing and foliar nutrition on yield of blackgram.

Grain yield (kg ha^{-1})					Haulm yield (kg ha^{-1})				
Sub plot treatment	Main plot treatment				Sub plot treatment	Main plot treatment			
	M_1	M_2	M_3	Mean		M_1	M_2	M_3	Mean
S_1	546.05	596.82	661.22	601.36	S_1	1540.64	1660.28	1810.96	1670.62
S_2	786.24	885.05	934.40	868.56	S_2	1943.04	2139.68	2248.32	2110.34
S_3	708.15	771.53	836.78	772.15	S_3	1872.92	1928.56	2041.20	1947.56
S_4	644.40	698.10	768.36	703.62	S_4	1760.76	1854.40	1887.08	1834.08
Mean	671.21	737.87	800.19		Mean	1779.34	1895.73	1996.89	
	Main	Sub	M × S	S × M		Main	Sub	M × S	S × M
SE_d	22.49	30.80	22.21	18.28	SE_d	45.95	48.71	45.00	41.98
CD (p=0.05)	47.26	64.72	46.68	38.41	CD (p=0.05)	96.54	102.35	94.56	88.21

M_1 - (Broad casting) , M_2 - (Line Sowing), M_3-- - (Ridge Sowing). S_1 - (Control) , S_2 - (0.1 % Humic acid foliar spray on 25 and 45 DAS), S_3 - (2 % DAP foliar spray on 25 and 45 DAS), S_4 - (3 % Panchakavya foliar spray on 25 and 45 DAS.

different sowing methods in the main plot, ridge sowing (M_3) significantly recorded the maximum yield attributes and grain yield of 800.19 kg ha^{-1} and haulm yield of 1996.89 kg ha^{-1}. The highest grain yield and haulm yield was obtained by the effective utilization of resources that increased the performance of crop. This result was conformity with the reports of Chaturvedi *et al*., (2015).

Among the different foliar nutrition practices in the sub plot, the treatment (S_2) recorded the highest yield attributes, grain yield of 868.56 kg ha$^{-1,}$ haulm yield of 2110.34 kg ha^{-1}. This might be due better translocation of assimilates to the sink which reflected in maximum values in yield components and other traces in humic acids could have resulted in higher post- flowering photosynthesis and assimilate apoplast and symplast movement of nutrients. This result was in conformity with the reports of Kalaichelvi *et al*., (2006).There was significant interaction between treatment combinations of ridge sowing + foliar spray of 0.1% humic acid at 25 and 45 DAS (M_3S_2) significantly recorded the highest grain yield of 934.40 kg ha^{-1} and highest haulm yield 2248.32 kg ha^{-1}. This might be due to increased synthesis of translocation from source to sink which in turn registered higher number of pods plant^{-1}, number of grains pod^{-1}, hundred grain.The cumulative and conjective application of nutrients to the crop might have enjoyed with sufficient nutrient condition for a longer period of time and the nutrient uptake there by allowing the plant to perpetuate with all the yield components and yield. This result was in conformity with the findings of Mishra *et al.,* (2012) and EL – Habbasha *et al*., (2012).

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