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STUDIES ON THE EFFECT OF FOLIAR APPLICATION OF ORGANIC AND INORGANIC NUTRIENTS ON THE PHENOTYPIC ENHANCEMENT OF BLACK GRAM *CV.* VAMBAN-6

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Abstract

Field experiments were conducted at Keezhmanakudi village, Bhuvanagiri taluk of Cuddalore district (TN) to study the effect of foliar application of nutrients on the phenotypic enhancement of black gram *cv.*VBN 6, during the summer and kharif seasons of 2017. The experiments were laid out in Randomized Block Design (RBD) with three replications. The growth and yield components of blackgram *viz*., plant height, leaf area index, dry matter production, number of pods plant^{-1}, pod length, number of seeds pod^{-1} and grain yield were favourably influenced by foliar application of 1 % pulse wonder spray on 25 DAS followed by 0.5 % 19:19:19 spray on 45 DAS (T_8). The control (T_1) recorded the lowest values with the above growth attributes. Among the treatments, foliar application of 1% pulse wonder spray on 25 DAS followed by 0.5 % 19:19:19 spray on 45 DAS (T_8) recorded the highest growth attributes viz., plant height, LAI, Nodule number and nodule biomass DMP, Absolute Growth Rate (AGR), Crop Growth Rate (CGR) and Leaf Area Duration (LAD) in both the seasons of crop period.
***Keywords*:** Foliar spray, DAP, Panchakavya, Pulse wonder, All 19.

Introduction

Black gram (*Vigna mungo* L. Hepper) ranked third on regarding economic significance among the pulses and contributes to 10 per cent in the country. Black gram is an indeterminate in habit of flowering and fruiting and there is a continuous competition for available assimilates between vegetative and reproductive sinks throughout the growth period. Since, the source is highly limited in pulses with lowered translocation of assimilates to the growing reproductive sinks. Apart from the genetic make-up, the physiological factors viz., insufficient partitioning of assimilates, poor pod setting due to flower abscission and lack of nutrients during critical stages of crop growth play a vital role on pulse production (Kalita *et al.,* 1994). The total area under pulses in Tamilnadu is around 3.65 lakh hectares with the production of 3.10 lakh tonnes and the average productivity of 851 kg per hectare (Tnstat, 2014). The per capita consumption of pulses in India is around 30-35 gm as against the recommendation of Indian Council of Medical Research (ICMR) at 45 gm and World Health Organisation (WHO) at 80 gm per day. But the level of productivity of these crops in India is far below the average productivity of the other countries. Farmers generally take up sowing with the basal application of nutrients as recommended and there is no regional recommendation of foliar nutrition during the crop growth period. Further, soil application of nutrients is often not enough to meet the growing crop demand particularly in short duration crop like black gram, as it is basically indeterminate in habit of flowering and fruiting, there is a continuous competition for available assimilates between vegetative and reproductive sinks throughout the growth period. In many cases, the aerial spray of nutrients is preferred and gives quicker and better results than the soil application (Jamal *et al.*, 2006). Foliar nutrients usually penetrate the leaf cuticle or stomata and enter the cells facilitating the easy entry of nutrients. Foliar application is credited with remarkably rapid absorption and nearly complete utilization of nutrients, elimination of leaching losses and fixation and helps in regulating the uptake of nutrient by plants (Manonmani and Srimathi, 2009). As fertilizers application is complicated to apply through top dressing or placement, foliar fertilization is best suited for rabi pulses (Rahman *et al.*, 2015). Apparently, in rice fallow situation, there is no possibility of basal application of fertilizer for pulses, since the pulses are sown before the harvest of the rice crop and fertilizer incorporation becomes impossible. Under these circumstances, foliar application of nutrients would be more appropriate, efficient and economical than the soil application (Balusamy and Meyyazhagan, 2000).

Hence, there is ample scope for enhancement of the production and productivity of black gram by proper agronomic practices. Several strategies like the use of good quality seeds, high yielding varieties, proper nutrient and irrigation management along with the adoption of innovative agro-technologies have to be initiated to boost its productivity level. One among them is the foliar application of organic and inorganic sources of nutrients for exploiting the genetic potential of the crop. Hence the present investigation was carried out to study the effect of foliar application through organic and inorganic nutrients on the phenotypic enhancement of black gram.

Materials and Methods

The field experiment was conducted at Keezhmanakudi village, Bhuvanagiri taluk of Cuddalore district to study the effect of foliar application through organic and inorganic nutrients on the phenotypic enhancement of black gram *cv*. VBN 6, during summer and kharif seasons of 2017. The soil of the experimental field was clay loam. The experiments were laid out in Randomized Block Design (RBD) with three replications. The promising black gram variety *cv*.VBN 6 was chosen for the study. The treatments consists of foliar spray of DAP @ 2 %, panchakavya @ 3%, pulse wonder @ 1%, 19:19:19 @ 0.5%. The panchakavya was prepared as per the standard procedure. The field experiment consisted of eleven treatments *viz*., T_1- Without foliar application (control), T_2- Foliar application of 1% pulse wonder spray on 25 and 45 DAS, T_3- Foliar application of 2 % DAP on 25 and 45 DAS, T_4- Foliar application of 3 % panchakavya on 25 and 45 DAS, T_5- Foliar application of 0.5 % 19:19:19 on 25 and 45 DAS, T_6- Foliar application of 1 % pulse wonder spray on 25 DAS followed by 2 % DAP on 45 DAS, T_7 - Foliar application of 1 % pulse wonder spray on 25 DAS followed by 3 % panchakavya on 45 DAS, T_8- Foliar application of 1 % pulse wonder spray on 25 DAS followed by 0.5 % 19:19:19 on 45 DAS, T_9- Foliar application of 2 % DAP on 25 DAS followed by 3 % panchakavya on 45 DAS, T_{10}- Foliar application of 2 % DAP on 25 DAS followed by 0.5 % 19:19:19 on 45 DAS, T_{11}- Foliar application of 3 % panchakavya on 25 DAS followed by 0.5% 19:19:19 on 45 DAS.

Crop management practices

The plots were prepared with the dimension of 5 m × 4 m and seeds of variety Vamban-6 were sown with a spacing of 30×10 cm. Irrigation was given uniformly and regularly to all plots as per the requirement to prevent the crop from water stress at any stage. The crop biometric observations such as plant height, LAI, Nodule number and nodule biomass were recorded at appropriate growth stages of the crop. DMP was worked out after keeping the sample in the oven at 80^o C for 48 hours. Absolute Growth Rate (AGR), Crop Growth Rate (CGR) and Leaf Area Duration (LAD) were calculated by adopting the procedure described by Radford (1967), Watson (1952) and Power (1967), respectively. The experimental data were statistically analysed as suggested by Gomez and Gomez (1976). For significant results, the critical difference was worked out at 5 per cent level.

Results and Discussion

Growth attributes

The result of the field experiment was conducted during summer and kharif seasons on 2017 (Table 1 and 2) indicated that foliar application of pulse wonder combines with 19:19:19 had significantly influenced growth attributes of black gram. Foliar application of macro and micronutrients applied at the proper time and stage resulted in better growth, development and metabolism of black gram. It also helped in increasing translocation of nutrients into the plant without any loss that contributes to better photosynthetic activity and ultimately reflected in a significant increase in plant height. Furthermore, the stimulating action of auxin as zinc is the promoter of auxin which softens the cell wall by increasing in its plasticity followed by hydrolysis of starch to sugars which lower the water potential of cell, resulting in the entry of water into the cell causing elongation (Meena *et al.*, 2012). Similar results were also observed by Ganapathy *et al.* (2008), Ravishankar *et al.* (2013), Mannan (2014) and Babu (2017). Higher LAI might be due to the positive influence of foliar spray of nutrients on cell division and cell elongation which facilitates better crop growth and development. Similar findings were reported by Mohmoud *et al.* (2006) and Cheghakhor *et al.* (2009).

Higher dry matter production is due to the application of nutrients significantly play a role in cell division, cell differentiation and development, translocation of photosynthates and growth regulators from source to sink. Besides, it's overall efficiency and utilization of nutrients and other resources and better interception of light paves more production of photosynthates during the crop period. The pronounced effect of foliar application of water-soluble fertilizers on DMP has also been reported by Pradeep and Elamathi (2007), Sathyamoorthi *et al.* (2008). Supplementation of adequate macro and micronutrients enhance the crop growth and development in source capacity *viz*., plant height, number of branches plant^{-1} and number of leaves plant^{-1}. These findings were confirmed with Singh *et al.* (2009), Pathak *et al.* (2012) and Ganga *et al.* (2014).

The foliar nutrition has significantly influenced on growth indices *viz.,* AGR, CGR and LAD at all growth stages (Table 2). Among the treatments, foliar spray of pulse wonder @ 1% with 19:19:19 (T_8) registered a maximum value of AGR (0.796 and 0.805 g day^{-1}) followed by pulse wonder with DAP 2% (T_6) (0.718 and 0.741 g day^{-1}) at 55 DAS-Harvest. A similar trend also noticed in other growth rate indices of black gram. Crop production is determined by CGR as a function of light interception by the leaf area of a crop and is influenced by leaf area index, photosynthetic rate and leaf angle. Interaction of phytohormones and nutrients on growth and development of crop plants cause positive responses on plant growth rate (Mir *et al.*, 2010). The higher leaf area duration had a positive influence on dry matter production by way of keeping the leaves remains green for a longer time which in turn participating in the photosynthetic activity for longer period. These results are corroborating the findings of Shashikumar *et al.* (2013) and Sritharan *et al.* (2015) in black gram. In addition to that, the foliar application influenced the root nodule number (26.43 and 29.4) and also nodule dry weight (268.5 and 285.6 mg plant^{-1}) respectively during both the seasons of crop period. This might be due to prominent supply of growth hormones and other nutrients to the growing tip of root establishment activity throughout the growth period. Similar results are quote out by Pineda *et al.* (1994).

Table 1: Effect of Foliar application of organic and inorganic nutrients on growth characters of black gram

Treatments	Summer season 2017						Kharif Season 2017					
	Plant height (cm)	LAI @ Flow	DMP (kg ha^{-1})	No. of branches plant^{-}	No. of Nodule plant^{-1}	Nodule biomass mg/plant	Plant height (cm)	LAI @ Flow	DMP (kg ha^{-1})	No. of branches plant^{-}	No. of Nodule plant^{-1}	Nodule biomass mg/plant
T_1	33.57	0.87	1847	4.38	8.71	36.82	35.4	1.01	1905.2	4.71	9.81	42.31
T_2	40.54	1.51	2653	5.63	12.90	106.5	42.2	1.58	2759.8	6.08	14.42	113.4
T_3	36.08	1.22	2475	5.02	11.18	69.32	37.3	1.27	2575.6	5.47	12.50	74.82
T_4	35.79	1.10	2382	4.86	10.20	55.40	37.0	1.14	2478.8	5.18	11.42	59.70
T_5	38.28	1.43	2598	5.44	11.81	96.10	39.6	1.49	2702.4	5.82	13.31	99.32
T_6	47.12	2.21	3132	6.71	23.91	224.7	48.7	2.31	3260.7	7.09	26.71	239.4
T_7	46.87	2.13	3097	6.58	20.32	189.7	47.5	2.20	3221.1	6.97	22.68	202.5
T_8	49.32	2.43	3256	7.12	26.43	268.5	52.3	2.57	3387.2	7.69	29.45	285.6
T_9	44.68	1.92	2968	6.19	19.81	168.2	45.7	1.94	3085.5	6.61	21.87	179.1
T_{10}	43.51	1.85	2882	6.11	17.46	143.7	45.2	1.91	2998.1	6.50	19.38	153.8
T_{11}	42.76	1.73	2796	6.07	15.10	123.0	44.3	1.78	2908.3	6.47	16.86	131.4
S.Em	**1.04**	**0.08**	**56.74**	**0.17**	**1.05**	**12.8**	**1.12**	**0.09**	**59.2**	**0.19**	**1.1**	**13.9**
CD(P=0.05)	**2.17**	**0.17**	**118.35**	**0.36**	**2.18**	**26.6**	**2.3**	**0.18**	**123.1**	**0.39**	**2.3**	**28.9**

Conclusion

To boost the productivity of black gram, it can be concluded and recommended that the foliar application of 1% pulse wonder spray on 25 DAS followed by 0.5 % 19:19:19 on 45 DAS (T_8) is found to be sustainable and most efficiently suitable nutrient management technology for maximizing the black gram productivity in a cost-effective approach and sustain the soil fertility.

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Table 2: Effect of Foliar application of organic and inorganic nutrients on AGR, CGR and LAD of black gram

Treatments	Summer season 2017						Kharif Season 2017					
	AGR @ 35-55 DAS	AGR @ 55-Har DAS	CGR @ 35-55 DAS	CGR @ 55-Har DAS	LAD @ 35-55 DAS	LAD @ 55-Har	AGR @ 35-55 DAS	AGR @ 55-Har DAS	CGR @ 35-55 DAS	CGR @ 55-Har DAS	LAD @ 35-55 DAS	LAD @ 55-Har
T_1	0.118	0.198	0.036	0.040	17.8	12.7	0.120	0.212	0.029	0.042	18.5	14.4
T_2	0.165	0.395	0.059	0.097	23.1	18.4	0.181	0.511	0.050	0.127	23.4	19.3
T_3	0.143	0.318	0.046	0.055	21.02	17.0	0.137	0.381	0.038	0.082	21.3	16.5
T_4	0.137	0.307	0.042	0.059	20.7	14.3	0.125	0.342	0.035	0.057	20.9	15.9
T_5	0.152	0.322	0.051	0.065	22.0	15.1	0.159	0.444	0.041	0.103	22.1	18.0
T_6	0.270	0.718	0.089	0.224	28.2	24.3	0.277	0.741	0.093	0.237	28.6	24.7
T_7	0.253	0.659	0.085	0.201	27.5	23.5	0.262	0.672	0.088	0.221	27.9	23.8
T_8	0.293	0.796	0.099	0.256	29.3	25.8	0.298	0.805	0.104	0.262	29.8	26.1
T_9	0.229	0.585	0.077	0.170	26.4	22.1	0.240	0.609	0.077	0.196	26.7	22.4
T_{10}	0.212	0.542	0.070	0.159	25.6	21.2	0.226	0.579	0.071	0.170	25.9	21.1
T_{11}	0.189	0.469	0.066	0.128	24.2	19.8	0.204	0.516	0.061	0.152	24.7	20.7
S.Em	**0.010**	**0.032**	**0.003**	**0.014**	**0.42**	**0.53**	**0.009**	**0.029**	**0.004**	**0.011**	**0.48**	**0.56**
CD(P=0.05)	**0.021**	**0.070**	**0.006**	**0.029**	**0.87**	**1.20**	**0.019**	**0.060**	**0.008**	**0.023**	**0.99**	**1.17**

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