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RESEARCH ARTICLE :

Influence of foliar nutrition on growth characters of black gram [*Vigna mungo* L.] under rainfed condition

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SUMMARY : Aim of research work is to study the effect of foliar nutrition on growth, yield, and quality of black gram (*Vigna mungo* L.). The field experiment was conducted in College of Agriculture, Latur farm during the *kharif* season 2016-2017 with black gram variety TAU-1 as test crop. The result reveled that foliar nutrition along with RDF had significant effect on growth parameter of black gram. Application of 19:19:19 @ 1.0% at vegetative stage, 00:52:34 @ 1.0% at flowering stage and 13:00:45 @1.0% at grain filling stage along with RDF recorded significantly higher plant height, number of branches, leaves, leaf area, root nodules and pods plant^{-1} of black gram. The application of 19:19:19 @ 1.0% at vegetative stage, 00:52:34 @ 1.0% at flowering stage and 13:00:45 @1.0% at grain filling stage along with RDF recorded highest plant height as 16.11, 30.73, 44.52, 45.25 cm and number of branches as 3.73, 6.20, 8.13, 8.33 at 30, 45, 60 DAS and harvest, respectively; leaves plant^{-1} 15.33, 22.67, 10.67 and leaf area plant^{-1} 334.33, 621.73 and 176.33 cm^2 at 30, 45, 60 DAS, respectively; root nodules plant^{-1} 20.33 (45DAS) and 34.20 (60 DAS) and pods plant^{-1} 12.27 (60 DAS) and 15.07 (harvest) over control.

KEY WORDS :
Black gram, Height, Leaf area, Branches, Root nodules, Pods

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BACKGROUND AND OBJECTIVES

Black gram [*Vigna mungo* (L.)] is popularly known as '*urad bean*'. It is one of the important pulse crop grown in India which belongs to family leguminoseae and genus *Vigna*. Black gram is reported as originated in India. Black gram cultivated since ancient times and is one of the most highly prized pulse crop in India. It has been introduced to other tropical areas mainly by Indian immigrants. Black gram is one of the most highly prized pulse crop, cultivated in almost all parts of India. It has inevitably marked itself as the most popular pulse and can be most appropriately referred to as the "king of the pulses" due to its mouth watering taste and numerous other nutritional qualities. Black gram is perfect combination of all nutrients, which includes protein (25-26 %), carbohydrate (60 %), fat (1.5 %), minerals, amino acids and vitamins. It stands next to soybean in its dietary protein content. It is rich in vitamin A, B_1, B_3 and has small amount of thiamine, riboflavin, niacin and vitamin C in it. It contains 78 % to 80 % nitrogen in the form of albumin and globulin. The dry seeds are good source of phosphorus. It also has very high calorie content. 100 gm of black gram has 347 calories. Therefore, black gram is the cheapest available source of protein for the poor and vegetarians. Foliar application of nutrients is best than soil application because less quantity of fertilizer is required for the foliar application as compare to soil application. The prices of fertilizers are increasing day by day and therefore, it is necessary to reduce the cost of fertilizers by using foliar application of fertilizer to increase yield of legume crops. During last three years, it was observed that in Maharashtra there was continuous dry spell of 15 to 35 days during kharif season. Which severely affect the growth and yield of kharif crops. It is evident from the literature that the foliar nutrition with N, P and K help in increasing drought resistance in plant and reduces the loss of water through evapotranspiration. Foliar feeding is a technique of a feeding nutrient to plant by applying liquid fertilizer (either in solution or suspension) directly to the crop canopy. If used wisely, it can more efficient, economical, environmental friendly, target oriented when used supplement soil fertilization now days, foliar feeding is widely adopted strategy in modern crop management where it is used to ensure higher or optimum crop performance by enhancing crop growth at certain growth stage, correcting the nutrient deficiency in crop and enhancing crop tolerance to adverse condition for crop growth. Foliar application overcome soil fertilization limitations soil unsuitable for fertilizer precipitation, antagonism between certain nutrients, heterogenic soil unsuitable for low dosages and fixation, absorption reaction like in the case of potassium. Therefore, attempts were made to know the effect of foliar nutrition on growth and yield of black gram. Accordingly the field experiments on "Studies on foliar nutrition in black gram [*Vigna mungo* (L.)] under rainfed condition." was conducted.

RESOURCES AND METHODS

The field experiment was conducted in College of Agriculture, Latur farm during the *kharif* season 2016-2017. This experiment was laid out in randomized block design with 3 replication and 8 treatments. The experimental soil was clayey in texture, slightly alkaline reaction, low in content of available nitrogen, medium in available phosphorous and high in available potassium. The experiment consist of 8 treatments *viz.*, T_1 - Control, T_2 - RDF + Water Spray, T_3 - RDF + 19:19:19 @ 1.0 % at vegetative stage, T_4 - RDF + 00:52:34 @ 1.0 % at flowering stage, T_5 - RDF + 13:00:45 @ 1.0 % at grain filling stage, T_6 - RDF + 19:19:19 @ 1.0 % at vegetative stage + 00:52:34 @ 1.0 % at flowering stage, T_7 - RDF + 00:52:34 @ 1.0 % at flowering stage + 13:00:45 @ 1.0 % at grain filling stage and T_8 - RDF + 19:19:19 @ 1.0 % at vegetative stage + 00:52:34 @ 1.0 % at flowering stage + 13:00:45 @ 1.0 % at grain filling stage. Recommended dose of fertilizer (25:50:00 kg ha^{-1}) *viz.*, nitrogen and phosphorus were applied in respective plots as per the recommendation by using the urea and SSP. Growth parameters like plant height, number of branches, leaves, leaf area, root nodules and pods $plant^{-1}$ were analyzed at various growth stage of black gram by selected five random plants per plot. Data recorded on growth parameter was subjected to analysis of variance (ANOVA, p d" 0.05) and means comparisons were done at Pd" 0.05. Percentages were computed using the least square means from respective ANOVA and tables and figures were drawn using MS excel 2007 program.

OBSERVATIONS AND ANALYSIS

Growth characters *viz.*, plant height, numbers of branches, number of leaves, leaf area $plant^{-1}$, number of nodules $plant^{-1}$, number of pods $plant^{-1}$ were recorded during the course of field experiment and the results obtained.

Plant height :

Effect of foliar nutrition on plant height presented in Table 1. It was evident from the results that the plant height was significantly affected due to foliar nutrition at different stages of the crop and it was increased with advanced stage. The taller plants were observed with treatment T_8 at all the growth stages of black gram (Fig. 2). The treatment T_8 recorded significantly higher plant height at 30 DAS (16.11 cm), 45 DAS (30.73 cm), 60 DAS (44.52 cm) and at harvest (45.25 cm) followed by T_6. While significantly lowest plant height was observed with treatment T_1 at all the critical growth stages of black gram *viz.*, 30 DAS (10.25 cm), 45 DAS (15.07 cm), 60 DAS (22.59 cm) and harvest stage (23.63 cm). Among the different treatments it was observed that the treatment T_3, T_4, and T_5 were at par with each other in case of

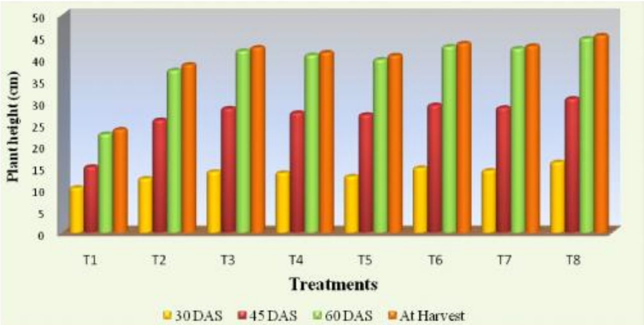

Fig. 1 : **Effect of foliar nutrition on plant height (cm) of black gram.**

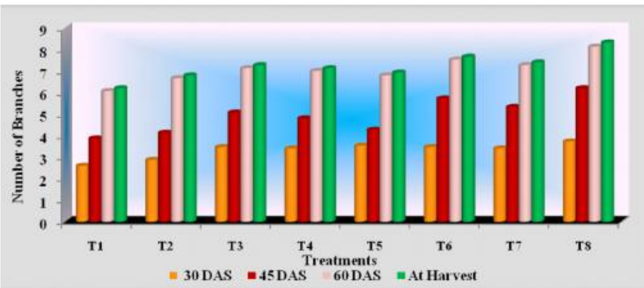

Fig. 2 : **Effect of foliar nutrition on number of branches plant-1 of black gram.**

plant height at all the growth stages of black gram. This increase of plant height might be due to foliar nutrition which helped in acceleration of various metabolic processes in plants resulting greater apical growth. Above result are in line with Godse *et al.* (2014). They observed that highest plant height (72.07 cm), was observed at harvest due to foliar spray of 1.5 per cent urea and DAP. Similar results were also recorded by Mamathashree *et al.* (2014) and Ramesh and Thirumurugan (2001).

Number of branches :

The data regarding effect of foliar nutrition on number of branches recorded at various growth stages from 30 DAS to harvest stage was significantly affected by different treatments and are presented in Table 2. It was evident from the result that the numbers of branches in black gram were significantly influenced due to foliar application of nutrients. The branches plant^{-1} were increased up to 60 DAS and thereafter, not increased considerably at harvest stage. The highest numbers of

Table 1: Effect of foliar nutrition on plant height (cm) of black gram

Treatments	Mean plant height (cm)			
	30 DAS	45 DAS	60 DAS	At harvest
T_1: Control	10.25	15.07	22.59	23.63
T_2: RDF + Water spray	12.35	25.81	37.23	38.55
T_3: RDF +19:19:19@1.0% at vegetative stage	13.92	28.49	41.70	42.47
T_4: RDF +00:52:34@1.0% at flowering stage	13.66	27.47	40.72	41.32
T_5: RDF +13:00:45@1.0% at grain filling stage	12.86	27.03	39.70	40.65
T_6: T_3 + T_4	14.79	29.22	42.70	43.43
T_7: T_4 + T_5	14.19	28.62	42.26	42.87
T_8: T_3 + T_4 + T_5	16.11	30.73	44.52	45.25
S.E.±	0.47	0.62	0.52	0.49
C.D. (P=0.05)	1.43	1.89	1.59	1.50

Table 2: Effect of foliar nutrition on mean number of branches plant^{-1} of black gram

Treatments	Mean number of branches plant^{-1}			
	30 DAS	45 DAS	60 DAS	At harvest
T_1: Control	2.60	3.87	6.07	6.20
T_2: RDF + Water spray	2.87	4.13	6.67	6.80
T_3: RDF + 19:19:19@1.0% at vegetative stage	3.47	5.07	7.13	7.27
T_4: RDF + 00:52:34@1.0% at flowering stage	3.40	4.80	7.00	7.13
T_5: RDF + 13:00:45@1.0% at grain filling stage	3.53	4.27	6.80	6.93
T_6: T_3 + T_4	3.47	5.73	7.53	7.67
T_7: T_4 + T_5	3.40	5.33	7.27	7.40
T_8: T_3 + T_4 + T_5	3.73	6.20	8.13	8.33
S.E.±	0.09	0.17	0.15	0.12
C.D. (P=0.05)	0.28	0.53	0.45	0.37

branches plant^{-1} were observed with the treatment T_8 (Fig. 3). The treatment T_8 recorded significantly higher number of branches at 30 DAS (3.73), 45 DAS (6.20), 60 DAS (8.13) and at harvest (8.33) than the rest of the treatments. While significantly minimum numbers of branches plant^{-1} were observed due to treatment T_1 at 30 DAS (2.60), 45 DAS (3.87), 60 DAS (6.07) and at harvest (6.20). It was observed that the treatments T_3, T_4 and T_5 as well as T_6 and T_7 were at par with each other in case of mean number of branches plant^{-1} at all the growth stages of black gram.

Mean leaf area plant^{-1} (cm^2) :

Data on mean leaf area (cm^2) plant^{-1} as influenced by different treatments are presented in Table 3. The leaf area plant^{-1} was increased at faster rate between 30 to 45 DAS and it was maximum at 45 DAS. Data presented in Table 4 revealed that the mean leaf area plant^{-1} was increased rapidly up to 45 DAS and then declined till 60 DAS and was absent at harvest due to drying of leaves and leaf senescence. Significant effect

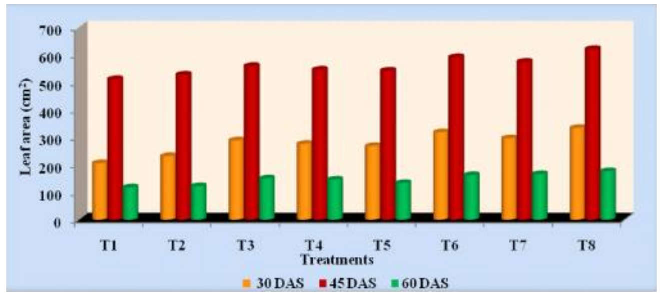

Fig. 3 : Effect of foliar nutrition on leaf area (cm^2) of black gram.

of foliar nutrition on black gram was observed in case of leaf area plant^{-1}.Significantly highest leaf area 334.33, 621.73 and 176.33 cm^2 at 30, 45 and 60 DAS, respectively was recorded by the treatment T_8. Whereas at 30, 45 and 60 DAS, the minimum leaf area 206.33, 512.42 and 117.67 cm^2, respectively was recorded by treatment T_1 (Control) which was found inferior over rest of all the treatments The leaf area depends on the number and size of leaves and hence the total leaf area is an important parameter for assessing the ability of plant to synthesis dry matter. The photosynthetic capability of

Table 3: Mean leaf area plant^{-1} (cm^2) as influenced by different foliar treatments at various growth stages of black gram

Treatments	Mean leaf area plant^{-1}		
	30 DAS	45 DAS	60 DAS
T_1: Control	206.33	512.42	117.67
T_2: RDF + Water spray	232.00	528.50	122.50
T_3: RDF + 19:19:19@1.0% at vegetative stage	288.75	560.33	150.33
T_4: RDF + 00:52:34@1.0% at flowering stage	276.50	546.75	146.41
T_5: RDF + 13:00:45@1.0% at grain filling stage	268.00	543.33	133.67
T_6: T_3 + T_4	318.27	592.43	162.42
T_7: T_4 + T_5	296.67	575.50	166.00
T_8: T_3 + T_4 + T_5	334.33	621.73	176.33
S.E.±	3.52	3.02	1.07
C.D. (P=0.05)	10.67	9.16	3.25

Table 4: Effect of foliar nutrition on number of nodules plant^{-1} in black gram

Treatments	Mean number of nodules plant^{-1}	
	45 DAS	60 DAS
T_1: Control	11.00	14.73
T_2: RDF + Water spray	13.57	16.47
T_3: RDF + 19:19:19@1.0% at vegetative stage	15.40	30.33
T_4: RDF + 00:52:34@1.0% at flowering stage	15.13	25.27
T_5: RDF + 13:00:45@1.0% at grain filling stage	14.33	20.47
T_6: T_3 + T_4	16.57	31.53
T_7: T_4 + T_5	15.33	26.73
T_8: T_3 + T_4 + T_5	20.33	34.20
S.E.±	0.34	0.66
C.D. (P=0.05)	1.03	2.01

plant is a function of leaf area development.Such of the results were also authenticated by Baghel and Yadav (1992) recorded that foliar spray of 19:19:19 at 2 % recorded significantly higher leaf area plant^{-1} (18.7 dm^2 plant^{-1}) compared to other water soluble fertilizers. Similar observation was also reported by Manivannan *et al.*, (2002).

Number of root nodules plant^{-1} :

Effect of foliar nutrition on number of root nodules plant^{-1} presented in Table 4. The maximum numbers of root nodules plant-1 were observed with treatment T_8 at all stages of crop growth in black gram. At 45 DAS and at 60 DAS significantly highest number of root nodules plant^{-1} were observed in T_8 (RDF + 19:19:19 @ 1.0 % at vegetative stage + 00:52:34 @ 1.0 % at flowering stage + 13:00:45 @ 1.0 % at grain filling stage) *viz.*, 20.33 and 34.20, respectively. However, treatment T_1 (Control) is inferior over all the treatments and recorded lower number of root nodules plant^{-1} *i.e.* 11.00 and 14.73 at 45 DAS and at 60 DAS, respectively. Periodical observations showed that the number of root nodules plant^{-1} were increased up to 60 DAS and declined thereafter. This may be due to degeneration of root nodules.

Number of pods plant^{-1} :

Effect of foliar nutrition on number of pods plant^{-1} in Table 5. It was evident from the result that, the number of pods plant^{-1} were significantly affected due to foliar application of nutrients. The treatment T_8 recorded significantly higher number of pod plant^{-1}, at 60 DAS (29.07) and harvest (34.07) than all other treatments**.** The minimum numbers of pods plant-1 were recorded with treatment T_1 at 60 DAS (12.27) and harvest stage (15.07) of black gram. The treatments T_2, T_4 and T_5 as well as T_6 and T_7 were at par with each other at 60 DAS, while T_4 and T_5 were at par at harvest stage. The reason for increasing the number of pods might be due to availability of nutrients through foliar application to the black gram crop which increased number of pods plant^{-1}. Similar results were also reported by Venkatesh and Basu (2011) for number of pods of chickpea. The results are also in conformity with those earlier reported by Kumar *et al.*, (2013) and Venkatesh *et al.*, (2012).

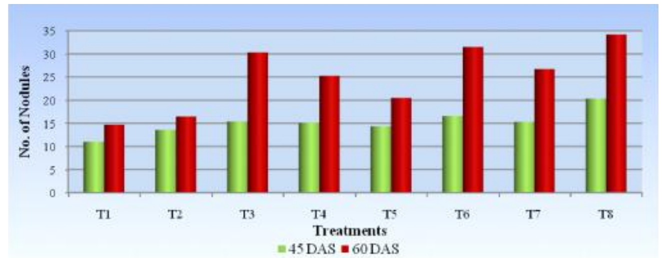

Fig. 4 : Effect of foliar nutrition on number of nodules plant^{-1} of black gram.

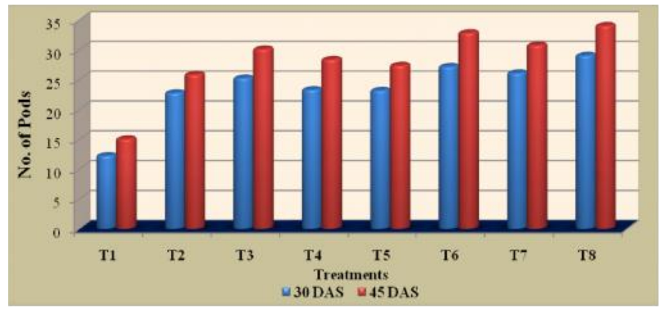

Fig. 5 : Effect of foliar nutrition on number of pods plant^{-1} of black gram.

Conclusion :

The beneficial effect of foliar nutrition on growth

Table 5: Effect of foliar nutrition on number of pods plant^{-1} in black gram

Treatments	Mean number of pods plant^{-1}	
	60 DAS	At Harvest
T_1: Control	12.27	15.07
T_2: RDF + Water spray	22.80	25.87
T_3: RDF + 19:19:19@1.0% at vegetative stage	25.27	30.13
T_4: RDF + 00:52:34@1.0% at flowering stage	23.33	28.40
T_5: RDF + 13:00:45@1.0% at grain filling stage	23.20	27.40
T_6: T_3 + T_4	27.20	32.87
T_7: T_4 + T_5	26.13	30.80
T_8: T_3 + T_4 + T_5	29.07	34.07
S.E.±	0.83	0.41
C.D. (P=0.05)	2.52	1.23

parameter of black gram was observed due to treatment T_8 (RDF + 19:19:19 @ 1.0% at vegetative stage + 00:52:34 @1.0% at flowering stage + 13:00:45 @ 1.0% at grain filling stage) at all critical growth stages of black gram. Among all treatments taller plants, higher number of branches, leaves plant^{-1} and number of pods plant^{-1} were observed with the treatment $T_{8.}$ Among the treatments, application of 19:19:19, 00:52:34 and 13:00:45 combination along with RDF showed superiority over all the treatments in all the respect which might be due to fact that there was positive and significant response among these three foliar nutrient combination as compared to individual or combined application of two nutrients along with RDF.

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