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Effect of foliar application of macronutrients (N, P and K) on growth in different growth stages of green gram

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Abstract
The field experiment was carried out on "Effect of foliar application of macronutrients (N, P and K) on growth and yield of green gram." During *kharif* season of the year 2017-18 at the Research farm of College of Agriculture, Latur. The experiment was laid in randomized block design with three replications and variety BM 2003-2 as a test crop along with eight treatments viz., T_1 - Control, T_2 - RDF + Water Spray, T_3 - RDF + 19:19:19 @ 0.5 % 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 - T_3 + T_4, T_7 - T_4 + T_5 and T_8- T_3 + T_4 + T_5.
The results of field study indicated that, the growth, yield uptake and quality of green gram were significantly influenced by foliar application of macronutrients (N, P and K). The growth parameters viz., plant height, number of branches, number of leaves plant^{-1}, leaf area plant^{-1}, number of pod plant^{-1} and dry matter of greengram were significantly improved due to treatment T_8 (RDF + 19:19:19 @ 0.5 % at vegetative stage, RDF + 00:52:34 @ 1.0 % at flowering stage and RDF + 13:00:45 @ 1.0 % at grain filling stage). Whereas, yield contributing characters viz., seed yield, straw yield and biological yield as well as quality parameters such as protein content, protein yield and test weight of seed in green gram were also increased.

Keywords: Triclosan, TCS, determination, detection, sensor

Introduction
Green gram (*Vigna radiata* L. Wilczek) belongs to the family leguminoceae and sub family papilionaceae, is being grown as one of the principal crop since ages in our state as well as in the country. The annual world production area of green gram is about 5.5 million hectare and India is the primary green gram producer and contributes about 75% of the world's production. Green gram output accounts for about 10-12% of total pulse production in the country (Anonymous, 2016) [2]. It is highly nutritious pulse crop having nearly 24 to 25% protein in seed Foliar application is more beneficial 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 therefore, it is necessary to reduce the cost of fertilizers by using foliar application of nutrients to increase yield of legume crop. In Maharashtra there was regularly dry spell of 15 to 35 day during *kharif* season, which severely affect the growth and yield of green gram. It is evident from the literature that the foliar nutrition with nutrients helps in increasing drought resistant 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. It used wisely, it can more efficient and 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 improve 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 nutrient, heterogenic soil unsuitable for lower dosages and fixation, absorption reaction like in the case of potassium, Therefore attempts were made to know the effect of foliar application of macronutrients on growth and yield of green gram

Material and Methods

The experiment was conducted at Research Farm, College of Agriculture, Latur during kharif season 2017-2018.The topography of experimental field was uniform and leveled. The field experiment was carried out on "Effect of folior application of macronutrients (N, P and K) on growth and yield of green gram." during *kharif* season of the year 2017-18 at the Research farm of College of Agriculture, Latur. The experiment was laid in randomized block design with three replications and variety BM 2003-2 as a test crop along with eight treatments viz., T_1 - Control, T_2 - RDF + Water Spray, T_3 - RDF + 19:19:19 @ 0.5 % 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 - T_3 + T_4, T_7 - T_4 + T_5 and T_8- T_3 + T_4 + T_5.

Results and Discussion

The data regarding plant height was recorded at vegetative, flowering, pod development & maturity stage of crop are presented in table 1. It was evident from the results that the plant height was influenced due to foliar application of nutrients at critical growth stages of crop. The plant height was increased with advanced stages. The highest plant height was recorded with treatment T_8 at all the growth stages of green gram. It was significantly higher at vegetative (30.63), flowering (58.49), pod development (63.63), and harvest stage (64.05), followed by T_6. The treatment T_1recordedlowest plant height over the rest of the treatment at vegetative (20.49), flowering (39.84), pod development (47.24) and harvest stage (48.67) while treatment T_2, T_3,T_4 and T_5 were at par with each other in most of the in case of plant height of green gram. This increase of plant height might be due to foliar application of N, P and K which helped in acceleration of various metabolic processes in plants resulting greater apical growth Similar results were also recorded by Govindan and Thirumurugan (2000) [5] they reported that, the growth parameters *viz.*, LAI in green gram and height of plant were significantly higher with the foliar spray of KNO_3 (1%) or KCl (1%) and their combination. Ramesh and Thirumurugan (2001) [6] also stated that foliar applications of 2 per cent DAP and 1 per cent KCL along with Benzyl adenine 25ppm had significantly increased the plant height in soybean.

Table 1: Effect of foliar application of macronutrients on mean of plantheight at different growth stages of green gram

Treatments	Veget-ative Stage	Flowering Stage	Poddevelop-mentstage	At harvest
T_1: Control.	20.49	39.84	47.24	48.67
T_2: Water spray	22.77	42.25	50.30	54.08
T_3:19:19:19@0.5% at vegetative stage	23.82	48.54	53.06	56.25
T_4:00:52:34@1.0% at flowering stage	23.87	48.77	54.23	55.79
T_5:13:00:45@1.0% at grain filling stage	26.74	44.36	51.34	57.77
T_6: T_3 + T_4	27.34	53.56	58.95	59.63
T_7: T_4 + T_5	24.14	49.61	55.18	58.54
T_8: T_3 + T_4 + T_5	30.63	58.49	63.63	64.05
S.Em±	0.47	1.38	1.00	0.71
CD at 5%	1.44	4.20	3.03	2.17

Number of branches

Branching is an important character of crop, which bears the pods plant^{-1} and ultimately enhanced the yield of crop. The data regarding effect of foliar application of macronutrient (NPK) on number of branches at critical growth stages were presented in table 2.

It was evident from the result that the number of branches in green gram was influenced due to treatment of foliar application of macronutrient (NPK). The significantly highest numbers of branches plant^{-1} were observed with the treatment T_8 at all the growth stages of green gram. The treatment T_8 recorded significantly highest number of branches at vegetative (2.78), flowering (3.47), pod development (3.80) and harvest stages (3.18) than the rest of the treatments.

While significantly minimum numbers of branches plant^{-1} were observed in treatment T_1 at vegetative (1.70), flowering (2.17), pod development (2.50) and harvest stages (1.91). Among the treatment differences it was observed that the treatment T_4, T_6 and T_7 were at par with each other in case of mean number of branches plant^{-1} at vegetative stage and T_3, T_4, T_5, T_6, and T_7 were at par at par with each other at pod formation stage of green gram.

This increase in number of branches might be due to supply of N, P and K to green gram crop through foliar nutrition which may have accelerated metabolic process and resulted in to maximum branches. The decline of branches at harvest is might be because of mechanical damage during picking of pod and senescence of plant.

Similar findings were reported by Venkatesh and Basu (2011)[10], they reported that branching in chickpea enhanced significantly due to foliar spray of 2 % urea and the highest branches plant^{-1} (5.9) were recorded with 3 sprays of 2 % urea at 60, 75 and 90 DAS. Also, these results are in conformity with earlier findings of Kumar *et al*., (2008) [7] and Mamathashree *et al*., (2014) [11].

Kumar *et al.* (2008) [7] also reported that the plant height and number of branches plant^{-1} increased significantly with foliar spray of fertilizer whereas 2 per cent DAP spray recorded maximum number of branches at harvest.

Table 2: Mean number of branches plant^{-1}

Treatments	Mean number of branches plant^{-1}			
	Vegetative stage	Flowering stage	Poddevelopment stage	At harvest
T_1: Control	1.91	2.17	2.50	1.91
T_2: Water spray	1.87	2.28	3.03	2.25
T_3: 19:19:19@0.5% at vegetative stage	1.80	2.42	3.17	2.23
T_4: 00:52:34@1.0% at flowering stage	1.99	2.45	3.20	2.50
T_5: 13:00:45@1.0%at grain filling stage	1.87	2.92	3.12	2.39
T_6: T_3 + T_4	2.22	3.06	3.43	2.69

T_7: T_4 + T_5	2.01	2.63	3.32	2.79
T_8: T_3 + T_4 + T_5	2.78	3.45	3.80	3.10
S.Em±	0.10	0.18	0.10	0.12
CD at 5%	0.30	0.56	0.31	0.67

The data in table 3 related that the maximum number of root nodules plant^{-1} were recorded with treatment T_8 at all stages of growth in green gram. Significantly highest number of root nodules plant^{-1} were observed in T_8 (RDF + 19:19:19 @ 0.5% at vegetative stage + 00:52:34 @ 1.0 % at flowering stage + 13:00:45 @ 1.0 % at grain filling stage) treatment at vegetative (8.68), flowering (46.67) and pod development (28.41) than the rest of the treatment. However the treatment T_8 is at par with T_6 at flowering stage and with T_5, T_6 and T_7 at vegetative stage. The treatment T_1 (Control) is inferior over all the treatments and recorded lower number of root nodules plant^{-1} *i.e.* 5.24, 26.67 and 21.67 at vegetative, flowering and pod development stage Similarly results were recorded by Jayarani Reddy *et al*. (2004) [8] due to foliar spray of potassium nitrate on number of branches plant^{-1} of redgram.

Number of root nodules

The data regarding on number of root nodules plant^{-1} at different stage as influenced by foliar nutrition treatments are presented in table 3, Number of nodules plant^{-1} were significantly influenced by different treatments of foliar nutrition, in green gram of green gram respectively. Observations further showed that the number of root nodules plant^{-1} were increased up to flowering stage and declined thereafter. This may be due to degeneration of root nodules.

Similar results were also reported by conducted experiment on effect of bio fertilizers and foliar spray of urea on symbiotic traits, nitrogen uptake and productivity of chickpea and revealed that application of 20 kg N ha^{-1} + *Rhizobium* + PSB + PGPR + 2 per cent urea spray at flowering and 10 days thereafter recorded maximum nodule number and nodule dry weight and ultimately gives higher yield (1224 kg ha-^{1}).

Table 3: Effect of foliar application of macronutrients on number of root nodules in green gram

Treatments	Mean number of nodules plant^{-1}		
	Vegetative stage	Flowering stage	Pod development stage
T_1: Control	5.24	26.67	21.67
T_2: Water spray	5.94	30.34	22.67
T_3: 19:19:19@0.5% at vegetative stage	6.48	31.40	23.87
T_4: 00:52:34@1.0%at flowering stage	6.93	35.19	24.29
T_5: 13:00:45@1.0%at grain filling stage	7.29	36.67	23.00
T_6: T_3 + T_4	8.29	44.00	25.92
T_7: T_4 + T_5	7.53	42.33	24.66
T_8: T_3 + T_4 + T_5	8.68	46.67	28.41
S.Em±	0.46	1.32	0.54
CD at 5%	1.40	4.02	1.64

Conclusion

It can be concluded from the results that the green gram crop recorded positive response to foliar application of 0.5 per cent 19:19:19, 1 per cent 00:52:34 and 13:00:45 each at vegetative, flowering and grain filling stage, respectively along with RDF. The increased of plant height, number of leaves, number of branches, number of pod plant^{-1}, were resulted into significantly higher crop and grain at different growth stages were maximum with application of RDF + 19:19:19 @ 0.5% at vegetative stage, RDF + 00:52:34 @ 1.0% at flowering stage and RDF + 13:00:45 @1.0% at grain filling stage. Soil properties studied in post harvest soil were not affected due to various treatment except available k in soil. However the organic carbon content in soil was significantly increased due to treatment T_8 RDF + 19:19:19 @ 0.5% at vegetative stage, RDF + 00:52:34 @ 1.0% at flowering stage and RDF + 13:00:45 @1.0% at grain filling stage over rest of treatments.

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