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Effect of Foliar Nutrition on the Growth and Productivity of Greengram (*Vigna radiata* L)

Keywords: *CGR and LAI, Foliar nutrition,Productivity and Vigna radiata*.

Greengram (*Vigna radiata* L.) is one of the important pulse crop in India. It is a protein rich staple food which contains about 25 per cent protein, almost three times that of cereals. Rich in leucine, phenyl alanine, lysine, valine, isoleucine et. In addition to being an important source of human food and animal feed, plays an important role in sustaining soil fertility by improving soil physical properties and fixing atmospheric nitrogen. It is a drought resistant crop, suitable for dryland farming and predominantly used as an intercrop with other crops. Though it has multifarious advantages, productivity of greengram is declining year by year due to various reasons. India is producing 14.8 mt of pulse from an area of 23.6m.ha and particularly the productivity of greengram is 500kg/ha (ICAR outlook 2020-21). The reasons for low yield of greengram are the slow rate of dry matter accumulation during the pre-flowering phase, poor pod setting, onset of leaf senescence during the period of pod development and low partitioning efficiency of assimilates to grain along with inadequate nutrient supply were identified as the main physiological constraints for yield. Foliar feeding practice would be more useful in early maturing short duration crops, where the soil applied fertilizer may not become fully available before maturity of crop. It has been well established that most of the plant nutrients are absorbed through the leaves and absorption would be remarkably rapid and nearly complete. As fertilizers application is complicated to apply through top dressing or placement, foliar fertilization is best suited for rabi pulses (Rahman *et al.*, 2015). Foliar application of nutrients using water soluble fertilizer is one of the possible ways to enhance the productivity of pulses like greengram. Foliar nutrients usually penetrate the leaf cuticle or stomata and enter the cells facilitating 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 (Somla Naik *et al.*, 2018).

However scare literature was available for greengram foliar spray nutrients as individual and in combination. Hence, looking into importance of foliar spray of nutrients in enhancing crop productivity of various field crops, a field experiment was conducted with the objective of studying the greengram productivity enhancement through foliar spray of nutrients.

The field experiment on greengram productivity enhancement through foliar spray of nutrients was conducted during three consecutive seasons of *Kharif* 2017, 2018 and 2019 at Agricultural Research Station, ANGR Agricultural University, Darsi, Prakasam District of AP. The soil of the experimental site was red sandy clay. The greengram variety GGG-1 was sown with spacing of 30 cm X 10 cm. The recommended nutrient levels of 20 kg N and 50 Kg P_2O_5 per ha were applied to all the plots with a plot size of 12 sq.m (4m x 3m). Seven treatments were laid out in randomised block design with three replications. The treatments consisted of the control *i.e.,* No spray (T1), water spray (T2), foliar spray of KNO_3 (0.5%) (T3), 19:19:19 (0.5%)

(T4), Urea (1%) (T5), DAP (1%) (T6) and Borax (0.1%) (T7). Foliar sprays were done in respective treatments at flower initiation. The data on growth parameters, yield and yield attributes were taken for statistical analysis (Rangasamy, 1995). The spray solutions of KNO_3 and 19:19:19 were prepared by dissolving each of 5 g in one litre of water each to get their respective 0.5% concentration. Similarly spray solutions of urea and DAP were prepared by dissolving 10 g each of urea and DAP in one litre of water each to get 1% concentration. DAP granules were dissolved in small quantity of water and allowed to settle overnight and the supernatant solution was taken for spraying after dilution with remaining quantity of water**.** Borax solution is prepared by dissolving 1 g of borax in one litre of water to get 0.1% concentration.

The data were pooled for three years, which indicated that there was a significant difference among treatments for days to 50% flowering, total dry matter (TDM), Crop growth rate (CGR), Leaf area index (LAI) and yield & yield components in Greengram but there was no significance difference in plant height and number of branches per plant. The KNO_3 @0.5% treated plants came earlier days to 50% flowering (28.7 days) when compared to no treatment (31.5 days). Nutrient status is an important and deciding factor in judging the total dry matter accumulation in plants. The foliar spray of nutrients enhances the nutrient uptake by increasing the total dry matter production. The dry matter production was higher with the foliar application of 19.19.19. @ 0.5% (49.7 g/plant) which is on par with KNO_3 @0.5% treated plants (47.9 g/plant). The plants treated with 19.19.19 recorded maximum pods per plant (26.1), number of seeds per pod (6.8) which is on par with KNO_3 @0.5% treated plants. According to Jayabal *et al.* (1999), it might be due to efficient translocation of foliage applied nutrients at critical stages of crops into the developing pods, which generated much filled and more number of pods. This result was in close proximity with the work of Kuttimani and Velayutham (2011). CGR and LAI are maximum at 60 DAS and later on decreasing trend was observed. The KNO_3 treated plants obtained maximum CGR (6.48 g/m^2/day) and LAI (1.72) in all intervals and it is at par with 19.19.19 treated plants (Table 2). The higher leaf area index might be due to the foliar application of potassium *via* KNO_3 enhancing the accumulation and translocation of nutrients.

Effect on seed yield

Apart from having maximum test weight (4.1 g), foliar spray of KNO_3 (746.8 kg.ha^{-1}) recorded significantly higher grain yield of greengram as compared to other treatments. However, it was at par with foliar spray of 19:19:19 (685.8 Kg ha^{-1}). The significant increase in yield with these treatments is mainly attributed to significant improvement in number of pods per plant and test weight. The significant increase in yield with KNO_3 treated plants is mainly attributed to significant improvement in number of pods per plant and test weight. These results were in agreement with the work of Shyamrao *et al.*, 2016 in greengram. Priyanka *et al.*, (2016) reported similar findings with clusterbean crop. Potassium nitrate may be considered the best option because, it provides potassium which influences the efficient water uptake, root growth, maintenance of turgour, transpiration and stomatal behavior. These findings are in a good line with those findings obtained in blackgram and greengram (Britto John and Girija, 2007) and in bengalgram (Saravanan and Panerselvam , 2014). The findings in the present study are in conformity with Sridhar *et.al.*, 2020. The lowest grain yield was obtained in without foliar spray (absolute control) (584.7 kg ha^{-1}) (Table 1).

Table 1. Effect of foliar nutrition on physiological efficiency of greengram

Treatment	50% flowering	PH (cm)	branches / pl	TDM (g/pl)	pods/pl	Seeds /pod	100 Sd wt (g)	Seed Yld (kg/ha)
T1:No. spray	31.5	28.7	3.87	40.8	19.4	5.4	2.9	584.7
T2: Water spray	32.4	31.3	4.12	42.7	21.7	6.2	3.1	620.1
T3: KNO_3 0.5%	28.7	32.9	4.19	47.9	25.8	6.4	4.1	746.8
T4: 19:19:19 0.5%	30.7	32.7	4.82	49.7	26.1	6.8	3.5	685.8
T5: Urea 1%	34.8	31.9	4.33	44.3	21.1	5.8	3.4	663.4
T6: DAP 1%	32.9	32.1	4.27	45.8	20.7	6.1	3.7	671.9
T7: Borax 0.1%	31.8	31.9	4.71	44.1	21.1	6.6	3.2	649.7
Mean	32.26	31.64	4.33	44.47	22.14	6.19	3.44	660.34
Sem	1.21	0.61	1.90	2.70	2.60	2.50	1.18	1.70
CD	2.31	NS	NS	2.20	10.80	7.60	2.59	68.20
CV	5.54	5.40	8.50	9.40	14.30	12.40	6.27	10.40

Table 2. CGR and LAI of Greengram affected by various treatments

Treatment	CGR (g/sq.m/day)				LAI		
	20-40 DAS	40-60 DAS	60-80 DAS	80 DAS - harvest	40 DAS	60 DAS	80DAS
T1:No. spray	2.97	5.28	5.28	4.96	0.74	1.24	1.08
T2: Water spray	3.27	5.31	5.22	4.28	0.81	1.30	1.10
T3: KNO_3 0.5%	4.19	6.48	5.83	5.11	0.93	1.72	1.24
T4: 19:19:19 0.5%	3.81	6.18	4.39	4.11	0.87	1.38	1.17
T5: Urea 1%	3.32	5.64	4.72	4.27	0.79	1.27	1.12
T6: DAP 1%	3.20	3.89	3.18	3.61	0.86	1.19	1.05
T7: Borax 0.1%	2.29	4.99	4.27	3.17	0.84	1.20	1.07
Mean	3.57	5.61	4.61	4.11	0.83	1.33	1.12
SEm	0.15	0.49	0.37	0.34	0.21	1.13	2.11
CD	1.27	1.68	1.22	1.12	1.37	1.69	1.94
CV	9.34	16.82	14.68	14.29	9.53	10.62	9.27

CONCLUSION

From the above results, it had been concluded that Foliar application of KNO_3 @0.5% and 19:19:19 @ 0.5% at flowering stage recorded significantly higher seed yield and yield parameters of greengram. Moreover, this study gives the option to the farmers i.e. foliar spray of KNO_3 @0.5% and 19:19:19 @ 0.5% at flowering stage would be adopted

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Dept. of Crop Physiology, Agricultural codllege, Bapatla, A. P.

G Vijaya Kumar,
L Rajesh Chowdary,
S Rama Devi,
G Subba Rao,
M Guru Prasad and
V Sri Devi.

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