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Effect of Foliar Nutrition on Yield Attributes, Yield and Nutrient Uptake of Greengram (*Vigna radiata* L.) under Irrigated Conditions

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A B S T R A C T

A field experiment was conducted at Poompuhar Village, Sirkazhi Taluk of Mayiladuthurai District during February to April 2020 to study the effect of foliar nutrition on yield attribute, yield and nutrient uptake of greengram (*Vigna radiata* L.) under irrigated condition. The experiment was laid out in Randomized Block Design (RBD) with eight treatments and three replications. Among the different treatments, the foliar application of 2% vermiwash spray on 30 and 45 DAS (T_8) recorded significantly the higher yield attributes such as number of pods plant^{-1} (17.07), number of seeds pod^{-1} (6.94), test weight (4.03), number of effective nodules plant^{-1} (29.47) and seed yield (931 kg ha^{-1}), haulm yield (3008 kg ha^{-1}) and harvest index (23.6%) of irrigated greengram. This was followed by foliar application of 3% panchakavya on 30 and 45 DAS (T_5). The higher N (52.94 kg ha^{-1}), P_2O_5 (10.72 kg ha^{-1}) and K_2O (65.18 kg ha^{-1}) uptake by greengram was also registered with the foliar application of 2% vermiwash spray on 30 and 45 DAS (T_8). The lower yield attributes and seed yield (508 kg ha^{-1}), haulm yield (2133 kg ha^{-1}), harvest index (19.2 %) and N, P_2O_5 and K_2O uptake by greengram were obtained in control (T_1).

Key words: *Vigna radiata*, Foliar application, Vermiwash, Nutrition, Irrigation

Greengram (*Vigna radiata* L.) is one of the important pulse crops in India. It is a protein rich staple food which contains about 25 per cent protein, almost three times that of cereals. It is consumed in the form of split as well as whole pulse, which is an essential supplement of cereal-based diet and is an important ingredient in the average Indian diet. It is rich in leucine, phenylalanine, lysine, valine, isoleucine, etc. Greengram grains contain 22-28% protein, 60-65% carbohydrates, 1.0-1.5% fat, 3.5-4.5% fibre and 4.5-5.5% ash [1]. 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. The area under greengram in India is 30.48 lakh hectares with a production of 13.45 lakh tonnes and productivity of 441 kg ha^{-1} [2]. The total area under greengram in Tamil Nadu is 1.95 lakh hectares with the production of 0.89 lakh tonnes and productivity of 444 kg ha^{-1}. Though have multifarious advantages, productivity of greengram is declining year by year due to various reasons. The present average per capita consumption of pulses in India has decreased from 60 g in 1951 to 43 g day^{-1} in 2016, as against Indian Council of Medical Research (ICMR) recommendation of 65 g day^{-1} due to exploding population and low production [3]. So, there is a need for enhancing the productivity of this crop by adopting low-cost production technologies. Among them, nutrients play an important role in boosting the productivity of greengram. 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. Moreover, foliar feeding practice would be more useful in early maturing crops, which could be combined with regular plant protection programmes. If foliar nutrition is applied it reduces the cost of cultivation which in turn reduces the amount of fertilizer thereby reducing the loss and also economizing crop production. Foliar application is credited with the advantage of quick and efficient utilization of nutrients, elimination of losses through leaching and fixation and regulating the uptake of nutrient by plants. The organic sources like extracts of fish amino acid, humic acid, sea weed extract, panchakavya etc., are very effective on the pulses to increase the productivity of the crop.

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MATERIALS AND METHODS

The field experiment was conducted at Poompuhar Village, Sirkazhi Taluk of Mayiladuthurai District, Tamil Nadu during February - April 2020 to study the effect of foliar nutrition on growth and yield of irrigated greengram. The

experimental field was geographically situated at 11°8′ North Latitude and 79°50′ East Longitude at an altitude of +1 m above mean sea level. The farm is characterized by tropical climate with warm and hot summer months. The soil of the experimental field was sandy clay loam in texture. The soil was low in available nitrogen, high in available phosphorus and medium in available potassium. The promising greengram variety CO-8 was chosen for the study. The experiment was laid out in randomized block design (RBD) with three replications. The treatments comprised of T_1- Control, T_2- Foliar application of 2% DAP on 30 and 45 DAS, T_3- Foliar application of 3% fish amino acid on 30 and 45 DAS, T_4- Foliar application of 40 ppm humic acid on 30 and 45 DAS, T_5- Foliar application of 3% panchakavya on 30 and 45 DAS, T_6- Foliar application of 2% EM on 30 and 45 DAS, T_7- Foliar application of 10% seaweed extract on 30 and 45 DAS, T_8- Foliar application of 2% vermiwash on 30 and 45 DAS. The salient findings of field experiment are presented below. Observations on yield attributes were taken on five randomly selected peg marked plants at the time of harvest.

RESULTS AND DISCUSSION

Yield attributes and yield

The yield potential of greengram is determined by the resultant values of yield components which are greatly influenced by the growth parameters. Almost all yield attributing characters viz., number of pods plant^{-1}, number of seeds pod^{-1}, test weight, number of effective nodules plant^{-1}, and seed yield, haulm yield, harvest index of greengram were remarkably influenced by the different treatments of foliar application of nutrients. Among the treatments estimated, T_8 (Foliar application of 2% vermiwash on 30 and 45 DAS) significantly resulted in the higher number of pods plant^{-1} (17.07), number of seeds pod^{-1} (6.94), test weight (4.03), number of effective nodules plant^{-1} (29.47) and seed yield (931 kg ha^{-1}), haulm yield (3008 kg ha^{-1}) and harvest index (23.6%) of irrigated greengram compared with control.

Foliar spray of vermiwash in foliage at vegetative and flowering stages of the crop growth supplies more amounts of nutrients. This might cause more number of pods and its growth and efficient translocation of photosynthates and photosynthetic activity from source to sink relationships [4-6].

The seed yield was increased due to increase in number of pods plant^{-1} and seeds pod^{-1} and high nutrient uptake by the foliar application which contains plant growth hormones. The grain yield gets increased due to foliar application by which it could be attributed to reduction in flower droppings and increased in pod setting [7-9]. The foliar application might increase the growth parameters which resulted in higher haulm yield [10-11]. The presence of certain micro-nutrients as calcium, magnesium, manganese, copper, boron, iron, amino acids in vermiwash leads to an increase in the yield of the crop [12-14]. The treatment T_1 (Control) attained the lower yield attributes and yield because some physiological disorders due to insufficient nutrients might be the reason for yield reduction.

Table 1 Effect of foliar nutrition on yield attributes and yield of greengram (*vigna radiata* l.) under irrigated conditions

Treatments	No. of pods plant^{-1}	No. of seeds pod^{-1}	Test weight (g)	No. of effective root nodules plant^{-1}	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest index (%)
T_1: Control	11.31	4.11	3.93	20.49	508	2133	19.2
T_2: Foliar application of 2% DAP on 30 and 45 DAS	15.31	6.16	4.00	27.08	815	2790	22.6
T_3: Foliar application of 3% fish amino acid on 30 and 45 DAS	12.09	4.50	3.94	21.69	562	2252	19.9
T_4: Foliar application of 40 ppm humic acid on 30 and 45 DAS	14.53	5.77	3.98	25.89	753	2688	21.8
T_5: Foliar application of 3% panchakavya on 30 and 45 DAS	16.10	6.56	4.02	28.29	878	2901	23.2
T_6: Foliar application of 2% EM on 30 and 45 DAS	13.72	5.36	3.97	24.63	695	2542	21.4
T_7: Foliar application of 10% seaweed extract on 30 and 45 DAS	12.92	4.95	3.96	23.40	626	2405	20.6
T_8: Foliar application of 2% vermiwash on 30 and 45 DAS	17.07	6.94	4.03	29.47	931	3008	23.6
SEm±	0.24	0.12	0.03	0.31	17.00	31.85	0.12
CD (P=0.05)	0.76	0.37	NS	0.97	52.02	97.48	0.37

Table 2 Effect of foliar nutrition on nutrient uptake of greengram (*Vigna radiata* L.) under irrigated condition

Treatments	Nutrient uptake (kg ha^{-1})		
	N	P_2O_5	K_2O
T_1: Control	37.55	7.01	45.93
T_2: Foliar application of 2% DAP on 30 and 45 DAS	49.25	9.82	59.84
T_3: Foliar application of 3% fish amino acid on 30 and 45 DAS	41.60	7.69	48.95
T_4: Foliar application of 40 ppm humic acid on 30 and 45 DAS	47.40	9.37	57.17
T_5: Foliar application of 3% panchakavya on 30 and 45 DAS	51.12	10.29	62.53
T_6: Foliar application of 2% EM on 30 and 45 DAS	45.51	8.88	54.46
T_7: Foliar application of 10% seaweed extract on 30 and 45 DAS	43.61	8.36	51.73
T_8: Foliar application of 2% vermiwash on 30 and 45 DAS	52.94	10.72	65.18
SEm±	0.58	0.13	0.86
CD (P=0.05)	1.78	0.40	2.63

Nutrient uptake

The N, P_2O_5 and K_2O uptake was significantly influenced by the application of different foliar nutrient treatments in irrigated greengram. Among the treatments, T_8 - Foliar application of 2% vermiwash on 30 and 45 DAS recorded higher nitrogen (52.94 kg ha^{-1}), phosphorus (10.72 kg ha^{-1}) and potassium uptake (65.18 kg ha^{-1}) in irrigated greengram. The control (T_1) registered the lower nitrogen, phosphorus and potassium uptake. The higher uptake of nutrient was mainly due to absorption of nutrients under foliar application without any loss and higher activity of root nodules which would have fix the atmospheric nitrogen into the soil by which it increased the higher nutrient status in the soil [15]. Application of vermiwash improved the uptake of N, P, K and finally showed significant results [16].

CONCLUSION

Application of the different treatments of foliar nutrition (DAP, fish amino acid, humic acid, panchakavya, EM, seaweed extract and vermiwash) registered the maximum values of yield parameters, yield and nutrient uptake of irrigated greengram. Based on the results of the present investigation, it can be concluded that the foliar application of 2 % vermiwash spray on 30 and 45 DAS (T_8) holds promise as an agronomically sound and economically viable technology for maximizing the yield of irrigated greengram.

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