

Impact of Foliar Nutrition on Yield and Nutrient Uptake of Irrigated Greengram (*Vigna radiata*)

M. Arutkumaran¹, K. Suseendran², C.Kalaiyarasan³, M.V. Sriramachandrasekharan⁴, S.Jawahar⁵, R.Gobi⁶
^{1,2,3,5,6}Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar – 608 002, India

⁴Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalai Nagar – 608 002, India

Abstract - The field experiment was conducted at Ambagarathur village, Thirunallar Taluk, Karaikal District of Puducherry during the *kharif* season (June-September, 2021) for “Enhancing greengram crop architecture through intervention of foliar nutrition on growth and yield of irrigated greengram”. The experiment was laid out in Randomized Block Design (RBD) with thirteen treatments and three replications. The treatment schedule were as follows : T₁- RDF + water spray (control), T₂- RDF + foliar application of 2 % DAP and NAA 40ppm on 30 and 45 DAS, T₃- RDF + foliar application of 1 % potassium sulphate on 30 and 45 DAS, T₄- RDF + foliar application of 1 % TNAU Pulse wonder on 30 and 45 DAS, T₅- RDF + foliar application of 2 % poly feed on 30 and 45 DAS, T₆ - RDF + foliar application of 2 % DAP and NAA 40ppm + 3% seaweed extract on 30 and 45 DAS, T₇- RDF + foliar application of 1 % potassium sulphate + 3% seaweed extract on 30 and 45 DAS, T₈ - RDF + foliar application of 1 % TNAU Pulse wonder + 3% seaweed extract on 30 and 45 DAS, T₉ - RDF + foliar application of 2 % poly feed + 3% seaweed extract on 30 and 45 DAS, T₁₀ - RDF + foliar application of 2 % DAP and NAA 40ppm + 3% seaweed extract + 2 % humic acid and fulvic acid on 30 and 45 DAS, T₁₁ - RDF + foliar application of 1 % potassium sulphate + 3 % seaweed extract + 2 % humic acid and fulvic acid on 30 and 45 DAS, T₁₂ - RDF + foliar application of 1 % TNAU Pulse wonder + 3 % seaweed extract + 2 % humic acid and fulvic acid on 30 and 45 DAS, T₁₃ - RDF + foliar application of 2 % poly feed + 3 % seaweed extract + 2 % humic acid and fulvic acid on 30 and 45 DAS. Among the different treatments, application of RDF + foliar application of 1% TNAU Pulse wonder, 3% seaweed extract, 2% humic acid and fulvic acid on 30 and 45 DAS (T₁₂) recorded significantly higher yield attributes such as number of pods plant⁻¹(32.45), number of seeds pod⁻¹(9.00), test weight(3.69), yields(seed yield 1583 kg ha⁻¹ and haulm yield 3561 kg ha⁻¹), and harvest index (30.87). From the above results, it has been concluded

that the application of RDF + foliar application of 1% TNAU Pulse wonder, 3% seaweed extract, 2% humic acid, and fulvic acid on 30 and 45 DAS (T₁₂). The higher N (48.60 kg ha⁻¹), P (12.40 kg ha⁻¹) and K (62.30 kg ha⁻¹) uptake of greengram was also registered with the foliar application of RDF + foliar application of 1% TNAU Pulse wonder, 3% seaweed extract, 2% humic acid and fulvic acid on 30 and 45 DAS (T₁₂). The lower yield and nutrient uptake by greengram were observed under control (T₁)

Index Terms - Greengram, yield, nutrient uptake, foliar spray, TNAU Pulse wonder

INTRODUCTION

Greengram (*Vigna radiata* L.) is an important pulse crop in India. It is a warm weather crop and cultivated in all three-growing seasons in various parts of the country. Greengram belongs to the family leguminous and sub family papilionaceae. Greengram is supposed to be a native of India and central Asia. The area under greengram in India is 4.5 million hectares with a production of 2.5 million tonnes with a productivity of 548 kg ha⁻¹. The total area under greengram in Tamil Nadu is 1.95 lakh hectares with a production of 0.89 lakh tonnes and a productivity of 444 kg ha⁻¹ (India Stat, 2019). Greengram is a good source of high-quality protein. It contains about 25% protein, 1.3% fat, 3.5% minerals, 4.1% fiber, and 56.7% carbohydrate. The protein content of greengram is two to three times more than that of cereals (Panchal, 2015). The current level of production is well below the requirement and future projected demand for 2022 is also mounting at 16.1 million tonnes, to meet the specified per capita requirement. The productivity of greengram is low due to various constraints in

irrigated situations, such as biotic and abiotic factors. Also, the low yield is attributed to several reasons, like inadequate soil moisture during early stages, poor nutrient availability and management practices, and the low yield potential of varieties. In addition to that, the lack of nutrients during the critical stages of crop growth leads to nutrient stress, which leads to poor yield and productivity of the crop (Ramesh *et al.*, 2016). Foliar applications of nutrients and growth regulators during the pre-flowering and flowering stages were associated with decrease in the percentage of flowers dropped in the greengram and improved yield (Ganapathy *et al.*, 2008). Foliar nutrition is recognized as an important method of fertilisation since it usually penetrates the leaf cuticle or stomata and reaches the cells, allowing for simple and quick nutrient uptake. Its benefits include quick and effective nutrient usage, prevention of leaching losses, fixing, and increasing the yield and plant nutrient uptake of irrigated greengram (Manonmani and Srimathi, 2009). The influence of various nutrients and growth hormones includes DAP, NAA, Potassium sulphate, TNAU Pulse wonder, Seaweed extract, humic and fulvic acid as foliar spray on yield and nutrient uptake of irrigated greengram are reviewed in this paper.

MATERIALS AND METHODS

The field experiment was conducted in the farmer's field located in Ambagarathur Village, Thirunallar Taluk, Karaikal District of Puducherry during June – September 2021 for “Enhancing greengram crop architecture through intervention 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 + 4m above mean sea level. The texture of the experimental field soil was sandy clay loam with neutral pH, low nitrogen, and high phosphorus and potassium, respectively. The popular (Gg) variety VBN4 was chosen for the study. The experiment was laid out in a randomized block design with three replications and thirteen treatments. The treatment comprised of T₁- RDF + water spray (control), T₂- RDF + foliar application of 2 % DAP and NAA 40ppm on 30 and 45 DAS, T₃- RDF + foliar application of 1 % potassium sulphate on 30 and 45 DAS, T₄- RDF + foliar application of 1 % TNAU Pulse wonder on 30 and 45 DAS, T₅- RDF + foliar application of 2 %

polyfeed on 30 and 45 DAS, T₆ - RDF + foliar application of 2 % DAP and NAA 40ppm + 3% seaweed extract on 30 and 45 DAS, T₇- RDF + foliar application of 1 % potassium sulphate + 3% seaweed extract on 30 and 45 DAS, T₈ - RDF + foliar application of 1 % TNAU Pulse wonder + 3% seaweed extract on 30 and 45 DAS, T₉ - RDF + foliar application of 2 % poly feed + 3% seaweed extract on 30 and 45 DAS, T₁₀- RDF + foliar application of 2 % DAP and NAA 40ppm + 3% seaweed extract + 2 % humic acid and fulvic acid on 30 and 45 DAS, T₁₁ - RDF + foliar application of 1 % potassium sulphate + 3 % seaweed extract + 2 % humic acid and fulvic acid on 30 and 45 DAS, T₁₂- RDF + foliar application of 1 % TNAU Pulse wonder + 3 % seaweed extract + 2 % humic acid and fulvic acid on 30 and 45 DAS, T₁₃ - RDF + foliar application of 2 % poly feed + 3 % seaweed extract + 2 % humic acid and fulvic acid on 30 and 45 DAS. Observations on yield and nutrient uptake were taken at the time of harvesting stage.

RESULTS AND DISCUSSION

Yield attributes and Yield

Inorganic fertilizers such as N, P and K were applied to the soil along with foliar application of concentrated humic acid, fulvic acid, seaweed extract and TNAU Pulse wonder (T₁₂) and resulted in the yield attributing characters such as number of pods plant⁻¹(32.43) and number of seeds pod⁻¹(9.00) registering the higher values. This could be because the better nutritional environment provided to the crop has resulted in a faster rate of development, resulting in better proliferation and nutrient uptake. This helped in the better translocation of assimilates to the sink, resulting in a higher number of pods plant⁻¹ and seeds pod⁻¹. Similar results were obtained by Kaya *et al.* (2005) and Babu (2017).

Significant differences have been documented in seed yield and haulm yield as a result of foliar fertilization. The maximum seed yield(1583 kg ha⁻¹)and haulmyield (3561 kg ha⁻¹) is registered with the conjoint application of RDF along with foliar spray of TNAU Pulse wonder @ 1 %, seaweed extract @ 3 %, humic acid and fulvic acid @ 2 % Spray on 30 and 45 DAS (T₁₂) over the rest of the treatments. The consistent enhancement in varied yield attributes with the prescription of a recommended dose of NPK in combination with foliar application of beneficial

inputs like TNAU Pulse wonder, seaweed extract, humic and fulvic acid might have resulted in higher post-flowering photosynthesis and assimilate apoplast and symplast movement, ultimately contributing to the production of a higher seed yield. This was supported by the findings of Kaya *et al.* (2005), Babu (2017) and Krishnaveniet *al.* (2021). The higher haulm yield might because nutrients and growth regulators were used at the right time and stage which helped the plants get a steady supply of nutrients and substances that

help them grow, especially cytokinin, which could have increased the morpho-physiological parameters like plant height, number of branches, leaf area, and dry matter production and ultimately registered higher a haulm yield in the treatment T₁₂. The lower seed and haulm yields were recorded with no spray (control). The results are in agreement with the findings of Kuttimani and Velayutham (2011), Minakshiet *al.* (2018), Mohammad Aslam *et al.* (2019) and Kamaleshwaran and Karthiga, (2021).

Table1:Effect of foliar nutrition yield attributes and yield of irrigated greengram

Treatments		Number of pods plant ⁻¹	Number of seeds pod ⁻¹	Test weight (g)	Seed yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)	Harvest index (%)
T ₁	RDF + Water spray	14.91	3.46	3.59	683	1652	29.25
T ₂	RDF + DAP 2% + NAA 40ppm spray on 30 and 45 DAS	19.08	5.08	3.65	915	2231	29.08
T ₃	RDF + potassium sulphate 1% spray on 30 and 45 DAS	16.82	4.04	3.67	765	1909	28.60
T ₄	RDF + TNAU pulse wonder 1% spray on 30 and 45 DAS	20.15	5.35	3.64	975	2349	29.33
T ₅	RDF + poly feed 2% spray on 30 and 45 DAS	22.46	6.00	3.62	1106	2645	29.45
T ₆	RDF + DAP 2% + NAA 40ppm + sea weed extract 3% spray on 30 and 45 DAS	23.41	6.36	3.68	1161	2723	29.89
T ₇	RDF + potassium sulphate 1% +sea weed extract 3% spray on 30 and 45 DAS	17.18	4.19	3.69	836	1984	29.64
T ₈	RDF + TNAU pulse wonder 1% + sea weed extract 3% spray on 30 and 45 DAS	25.40	7.10	3.62	1278	2916	30.30
T ₉	RDF + poly feed 2% + sea weed extract 3% spray on 30 and 45 DAS	22.22	5.97	3.63	1096	2547	29.36
T ₁₀	RDF + DAP 2% + NAA 40ppm + sea weed extract 3%+ Humic acid and fulvic acid 2% spray on 30 and 45 DAS	28.56	7.80	3.64	1421	3173	30.93
T ₁₁	RDF +potassium sulphate 1% +sea weed extract 3%+ Humic acid and fulvic acid 2% spray on 30 and 45 DAS	26.52	7.24	3.70	1347	2995	31.02
T ₁₂	RDF + TNAU pulse wonder 1 % + sea weed extract 3% + Humic acid and fulvic acid 2% spray on 30 and 45 DAS	32.43	9.00	3.69	1583	3561	30.77
T ₁₃	RDF +poly feed 2 % + sea weed extract 3 % + Humic acid and fulvic acid 2% spray on 30 and 45 DAS	30.47	8.38	3.65	1503	3381	30.77
SEm±		0.52	0.15	0.15	20.30	20.30	0.15
CD (p=0.05)		1.88	0.55	NS	72.57	72.57	NS

Table2:Effect of foliar nutrition on nutrient uptake of irrigated greengram

Treatments		Nutrient uptake (kg ha ⁻¹)		
		N	P	K
T ₁	RDF + Water spray	33.54	7.79	49.85
T ₂	RDF + DAP 2% + NAA 40ppm spray on 30 and 45 DAS	37.76	9.25	52.78
T ₃	RDF + potassium sulphate 1% spray on 30 and 45 DAS	35.33	8.36	51.11
T ₄	RDF + TNAU pulse wonder 1% spray on 30 and 45 DAS	38.38	9.55	53.80
T ₅	RDF + poly feed 2% spray on 30 and 45 DAS	40.46	10.21	55.71
T ₆	RDF + DAP 2% + NAA 40ppm + sea weed extract 3% spray on 30 and 45 DAS	41.24	10.41	56.69
T ₇	RDF + potassium sulphate 1% +sea weed extract 3% spray on 30 and 45 DAS	36.01	8.71	51.48
T ₈	RDF + TNAU pulse wonder 1% + sea weed extract 3% spray on 30 and 45 DAS	42.89	10.82	57.96
T ₉	RDF + poly feed 2% + sea weed extract 3% spray on 30 and 45 DAS	40.07	10.02	54.99
T ₁₀	RDF + DAP 2% + NAA 40ppm + sea weed extract 3%+ Humic acid and fulvic acid 2% spray on 30 and 45 DAS	45.20	11.50	60.02
T ₁₁	RDF +potassium sulphate 1% +sea weed extract 3%+ Humic acid and fulvic acid 2% spray on 30 and 45 DAS	43.49	11.14	58.85
T ₁₂	RDF + TNAU pulse wonder 1 % + sea weed extract 3% + Humic acid and fulvic acid 2% spray on 30 and 45 DAS	48.60	12.40	62.30
T ₁₃	RDF +poly feed 2 % + sea weed extract 3 % + Humic acid and fulvic acid 2% spray on 30 and 45 DAS	46.92	11.97	61.17
SEm±		0.52	0.10	0.29
CD (p=0.05)		1.60	0.37	1.07

NUTRIENT UPTAKE

The nutrient uptake was significantly enhanced by the application of foliar nutrition. Among the treatments experimented, with the application of RDF + foliar application of TNAU Pulse wonder @ 1%, Seaweed extract @ 3%, humic acid and fulvic acid @ 2% spray on 30 and 45 DAS (T_{12}) recorded the highest nutrient uptake (N-48.60 kg ha⁻¹, P-12.40kg ha⁻¹, K- 62.30 kg ha⁻¹). The result indicated that the uptake of nutrients increased with the age of the crop and also suggest that uptake of nutrients governed by nutrient content and dry matter production of plant. Nutrient status is an important deciding factor in judging the total accumulation of dry matter production. Foliar application of Tnau pulse wonder, Sea weed extract, humic acid, and fulvic acid , in addition to the recommended dose of fertilizers , increase the supply of macro , micro and growth promoting substances , which might be the reaction for increasing uptake. Similar findings were quoted by Iswarya *et al.* (2019). Furthermore, the increased uptake of nutrients by the crop might also be due to the fact that humic and fulvic acid substances stimulate microbial activity in the soil and enhance nutrient uptake. As humic acid and fulvic acid acted as good sources of nitrogen, phosphorus and potassium, their addition increased the supply of native and added nutrients to the crop. The relative increase in nitrogen content in response to humic acid application might be due to its stimulatory effect, which might have increased the activity of microorganism capable of increasing urease enzyme activity and in turn, might have increased the availability of nutrients in soil, where its uptake by the crop was higher. This was supported by findings of Nandini and Math (2019).

CONCLUSION

The present investigation concluded that combined application of nutrients (TNAU Pulse wonder, seaweed extract, humic and fulvic acid) through foliar spray at vegetative (30 DAS) and flowering stage (45 DAS) along with recommended dose of fertilizers enhanced the number of pods plant⁻¹, number of seeds pod⁻¹, grain yield, haulm yield and nutrient uptake (N, P and K) of greengram under irrigated condition. For yield maximization in greengram, the farmers can

follow the combined application of nutrients as foliar spray at vegetative and flowering stages leading to sustainability and profitability.

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