



ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating (2025): 4.97
IJAFA 2025; 7(11): 277-280
www.agriculturaljournals.com
Received: 14-10-2025
Accepted: 17-11-2025

Rushikesh J Salunkhe
M.Sc Research Scholar,
Department of Agronomy,
Post Graduate Institute,
MPKV Rahuri, Maharashtra,
India

Nitin S Ugale
Junior Agronomist, AICRP on
Integrated Farming System,
MPKV Rahuri, Maharashtra,
India

Niteen J Danawale
Professor, Department of
Agronomy, Post Graduate
Institute, MPKV Rahuri,
Maharashtra, India

Mahesh R Patil
Head, Department of
Statistics, Post Graduate
Institute, MPKV Rahuri,
Maharashtra, India

Iqbal R Bagwan
Junior Soil Scientist, AICRP
on Integrated Farming
System, MPKV Rahuri,
Maharashtra, India

Kaustubh R Kadam
M.Sc Research Scholar,
Department of Agricultural
Extension Education, Post
Graduate Institute, MPKV
Rahuri, Maharashtra, India

Corresponding Author:
Rushikesh J Salunkhe
M.Sc Research Scholar,
Department of Agronomy,
Post Graduate Institute,
MPKV Rahuri, Maharashtra,
India

Enhanced Growth and Yield of Summer Green Gram (*Vigna radiata* L.) through Foliar Application of Potassium Sources in Semi-Arid Tropics

Rushikesh J Salunkhe, Nitin S Ugale, Niteen J Danawale, Mahesh R Patil, Iqbal R Bagwan and Kaustubh R Kadam

DOI: <https://www.doi.org/10.33545/2664844X.2025.v7.i11d.970>

Abstract

A field experiment was conducted at the AICRP on Integrated Farming System, Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, during summer 2024-25, to assess the influence of foliar application of distinct potassium sources and concentrations on growth and yield parameters of summer green gram (*Vigna radiata* L.) cv. *Phule Suvarna*. The experimental site featured semi-arid tropical conditions and alkaline, potassium-rich soils. The study adopted a randomized block design with eight treatments and Three Replication, integrating both soil and foliar potassium application (sources: MOP, SOP, and Schoenite). Results revealed that foliar application of potassium particularly Schoenite at 2% concentration significantly enhanced plant height (58.92cm), branch (11.22Plant⁻¹) and leaf count (35.73 Plant⁻¹), leaf area (25.67dm²), and dry matter accumulation (30.09g) over the control and at par with treatment T⁶ and T⁴. Yield attributes such as number of pods (23.86plant⁻¹), seeds (12.26pod⁻¹), seed yield (13.76gplant⁻¹), straw yield (16.33gplant⁻¹), and seed index (3.58g) also recorded the highest values under this treatment. These improvements underscore the synergistic benefits of multi-nutrient potassium sources and support the integration of foliar potassium sprays with conventional fertilization for maximizing green gram productivity in semi-arid, potassium-rich soils.

Keywords: Green gram, foliar nutrition, potassium schoenite, yield attributes, semi-arid tropics, *vigna radiata*

Introduction

Green gram (*Vigna radiata* L. Wilczek), commonly known as mung bean, represents one of the most important pulse crops in global agriculture, particularly valued for its short duration, drought tolerance, and soil fertility enhancement capabilities (Islam *et al.*, 2024). As a protein-rich legume crop, green gram plays a crucial role in sustainable cropping systems and nutritional security, being cultivated across diverse agro-climatic conditions as a sole crop, intercrop, or catch crop (Bhavya *et al.*, 2024) [1]. Despite its inherent advantages, green gram productivity remains constrained by various nutritional limitations, with potassium deficiency emerging as a significant yield-limiting factor in many production regions.

Potassium, being the third most essential macronutrient after nitrogen and phosphorus, governs numerous physiological processes in plants including photosynthesis, protein synthesis, enzyme activation, water regulation, and stress tolerance mechanisms (Sardans *et al.*, 2021) [14]. The critical role of potassium becomes particularly pronounced in leguminous crops like green gram, where it influences nodulation efficiency, nitrogen fixation, and overall plant metabolism. Recent research has demonstrated that potassium deficiency in green gram manifests through characteristic symptoms including yellowing of leaf margins, formation of dark spots on affected leaves, and subsequent reduction in photosynthetic efficiency (TNAU, 2023). These deficiency symptoms directly correlate with decreased yield attributes, compromised seed quality, and reduced stress tolerance under adverse environmental conditions. collect the reliable data on fuel wood consumption of the area and also to evaluate the impact of fuel wood collection on forest ecosystem.

Materials and methods

A field experiment entitled “Enhanced Growth and Yield of Summer Green Gram (*Vigna radiata* L.) through Foliar Application of Potassium Sources in Semi-Arid Tropics” was conducted at the AICRP On Integrated Farming System, MPKV, Rahuri, Dist. Ahilyanagar (Maharashtra) during the summer season of 2024-25. The site is situated between 19°19'-19°57' N latitude and 74°19'-74°32' E longitude, with an altitude of 491-537 m above mean sea level, falling under the semi-arid tropics with an average annual rainfall of 520 mm.

The experimental soil was clayey, non-calcareous, and alkaline (pH 8.18) with medium organic carbon (0.51%), low available nitrogen (195.35 kg ha⁻¹), medium phosphorus (17.03 kg ha⁻¹), and very high potassium (367.22 kg ha⁻¹).

The experiment was laid out in a randomized block design (RBD) with three replications and eight treatments. Each plot measured 3.60 × 3.00 m (gross) and 3.00 × 2.40 m (net). Land preparation involved ploughing and harrowing, followed by layout according to design. Phule Suvarna seeds were sown on 6th March, 2025, at 30 cm × 10 cm spacing using a seed rate of 15 kg ha⁻¹. Seeds were treated with phosphate-solubilizing bacteria (PSB) @ 250 g and Trichoderma culture @ 50 g per 10 kg of seed. A recommended basal dose of 20:40:00 N:P₂O₅:K₂O kg ha⁻¹ and 5 t ha⁻¹ FYM was applied through straight fertilizers (urea and single super phosphate).

Results

Growth Attributing Characters Studies

Table 1: Plant height, Number of branches plant⁻¹, number of leaves plant⁻¹, leaf area plant⁻¹ and dry matter plant⁻¹ at harvest of green gram as influenced by different treatments

Tr. No	Treatment Details	Plant height (cm)	Number of branches plant ⁻¹	Number of leaves plant ⁻¹	Leaf area plant ⁻¹ (dm ²)	Dry matter plant ⁻¹ (g)
T ₁	Absolute control	37.82	6.11	21.60	15.52	12.83
T ₂	GRDF 20:40:00 (N: P ₂ O ₅ : K ₂ O) kg ha ⁻¹ + FYM @ 5 t ha ⁻¹	47.93	9.12	29.26	21.02	24.75
T ₃	GRDF + foliar application of MOP (1%)	48.33	9.19	29.49	21.19	24.94
T ₄	GRDF + foliar application of MOP (2%)	53.38	10.26	33.25	23.89	28.15
T ₅	GRDF + foliar application of SOP (1%)	49.46	9.38	30.16	21.67	25.50
T ₆	GRDF + foliar application of SOP (2%)	56.03	10.48	34.03	24.45	28.68
T ₇	GRDF + foliar application of Potassium Schoenite (1%)	50.31	9.52	30.66	22.03	25.91
T ₈	GRDF + foliar application of Potassium Schoenite (2%)	58.92	11.22	35.73	25.67	30.09
	S. Em±	1.65	0.26	0.99	0.71	0.78
	C. D. at 5%	5.00	0.79	3.00	2.15	2.36
	General mean	50.27	9.41	30.52	21.93	25.11

Plant height

Plant height increased markedly with treatment compared to control, ranging from 37.82 cm (T₁: absolute control) to 58.92 cm (T₈: GRDF + foliar application of potassium Schoenite 2%). The highest plant height was observed with T₈, indicating the superiority of Schoenite at 2% concentration in promoting vegetative growth. Previous studies confirm that increased potassium application, particularly via foliar sprays, enhances plant height and overall vigor in green gram and other legumes (Jat *et al.*, 2021; Poovizhi Sindhu *et al.*, 2019) [8, 13]. Potassium is essential for cell elongation and turgor maintenance, which directly promotes stem growth.

Number of branches and leaves plant⁻¹

Branching and leaf development were significantly higher in potassium-treated plots. The maximum branches (11.22) and leaves (35.73) per plant were recorded with T₈, while the control had the lowest values (6.11 branches, 21.60 leaves). Enhanced branching and leaf numbers with increased potassium availability are reported widely, attributed to its roles in synthesis and transport of photosynthates and its effect on cytokinin activity. Application of potassium through foliar routes can supplement soil nutrition and stimulate shoot proliferation in semi-arid climates.

Leaf area plant⁻¹

Treatments with foliar potassium, especially Schoenite (T₈: 25.67 dm² per plant), led to substantial increases in leaf area compared to control (15.52 dm²). Leaf area enhancement

due to potassium nutrition is associated with improved cell expansion, leaf development, and photosynthetic capacity, supporting greater biomass accumulation (Patil & Basavaraja, 2017; Goud *et al.*, 2021) [3, 12].

Dry matter plant⁻¹

Dry matter yield followed a similar trend, with T₈ registering the highest value (30.09 g per plant), a considerable increment over control (12.83 g). Elevated dry matter production with potassium is attributed to enhanced photosynthesis, carbohydrate translocation, and nutrient use efficiency (Bhavya *et al.*, 2024; Jat *et al.*, 2021; Sidharam Patil *et al.*, 2016) [1, 8, 16]. Studies suggest using potassium Schoenite, due to its balanced K, Mg, and S content, as an efficient foliar supplement for yield enhancement.

Role of Potassium Sources

Among sources, Schoenite (comprising potassium, magnesium, and sulphur) outperformed MOP and SOP in all measured growth parameters. Recent research indicates that the additional magnesium and sulphur in Schoenite formulations further improve nutrient uptake and growth attributes compared to standard potassium fertilizers (Patil *et al.*, 2017; Nutrien Economics, 2024) [16, 11]. This aligns with the present findings, where T₈ consistently resulted in superior performance.

General Trends and Recommendations

Overall, foliar potassium application, particularly as Schoenite at a 2% concentration, enhanced growth

parameters substantially over the control and other treatments. These results corroborate ongoing research advocating combined soil and foliar potassium management for sustaining high yields under irrigated and semi-arid conditions. Adoption of this treatment regime in green gram cultivation can be recommended for maximizing biomass and potential yield.

Yield Attributing Characters Studies

Number of pods, seeds plant⁻¹, and seeds plant⁻¹

Potassium-treated plots exhibited significant improvement in yield attributes compared to absolute control. The maximum number of pods per plant (23.86), seeds per pod (12.26), and seeds per plant (204.06) were recorded with T₈ (GRDF + foliar application of potassium Schoenite 2%), whereas the control (T₁) showed the lowest values (13.51, 7.45, and 78.55, respectively). Such enhancement is directly linked to potassium's crucial role in flower retention, pod set, and nutrient translocation, as corroborated by Jat *et al.* (2021) and Goud (2021) [8, 3], who reported that potassium fertilization boosts pod and seed development in legumes. Foliar potassium, particularly as Schoenite, offers not only K but also supplementary magnesium and sulphur, further driving pod and seed set (Patil *et al.*, 2017) [16].

Seed yield and straw yield plant⁻¹

Seed yield per plant was markedly higher in Schoenite-based treatments, peaking at 13.76 g in T₈, compared to 8.41 g in the control. Straw yield followed a similar trend, with T₈ yielding 16.33 g per plant, illustrating potassium's comprehensive effect on both grain and biomass production. Several contemporary studies, including those by Kharkongor & Dhamak (2020) and Nayak *et al.* (2020) [9, 10], observed that potassium promotes photosynthate translocation, enhances filling of grains and pods, and increases both seed and straw output in green gram. The

significantly higher yields from potassium foliar sprays, especially with Schoenite, echo findings from maize, wheat, and groundnut literature, confirming the advantage of using multi-nutrient potassic sources.

Seed index (100 Seed Weight)

Seed index also improved significantly with potassium application, reaching 3.58 g in T₈, a clear increase from 2.22 g in the control. Improved seed index denotes better seed development and filling, which is closely tied to adequate post-anthesis nutrient supply—a process potentially enhanced by potassium nutrition (Sivakumar *et al.*, 2021; Ghosh *et al.*, 2017) [17, 2]. This demonstrates that balanced K supply, via soil and foliar routes, can optimize seed quality traits alongside yield quantity.

Comparison of potassium sources

Among all sources, potassium Schoenite (both 1% and 2%) consistently outperformed MOP and SOP, suggesting the beneficial synergistic effect of magnesium and sulfur with potassium in Schoenite. Such findings are supported by Goud (2021) [3], who noted similar results in greengram, and by Patil & Basavaraja (2017) [12], who showed this effect in other legumes.

Recommendations

Taken together, the data suggest that the combined application of recommended dose of fertilizers and foliar potassium—especially as Schoenite at a 2% concentration—significantly enhances all major yield attributes of green gram, including pods per plant, seeds per pod, total seed output, seed and straw yield, and seed index. This aligns with recent recommendations to adopt integrated potassium management for maximized pulse productivity in semi-arid and irrigated ecosystems

Table 2: Number of pods plant⁻¹, Number of seeds pod⁻¹, Number of seeds plant⁻¹, Seed yield plant⁻¹, Straw yield plant⁻¹, Seed index at harvest of green gram as influenced by different treatments

Treatments	No. of pods plant ⁻¹	No. of seeds pod ⁻¹	No. of seeds plant ⁻¹	Seed yield plant ⁻¹ (g)	Straw yield plant ⁻¹ (g)	Seed index (100 seeds) (g)
T ₁ : Absolute control	13.51	7.45	78.55	8.41	4.42	2.22
T ₂ : GRDF 20:40:00 (N: P ₂ O ₅ : K ₂ O) kg ha ⁻¹ + FYM @ 5 t ha ⁻¹	19.67	10.25	141.34	11.57	13.19	2.98
T ₃ : GRDF + foliar application of MOP (1%)	19.83	10.33	143.33	11.64	13.30	3.00
T ₄ : GRDF + foliar application of MOP (2%)	22.35	11.53	179.20	12.96	15.19	3.36
T ₅ : GRDF + foliar application of SOP (1%)	20.26	10.53	149.58	11.87	13.62	3.07
T ₆ : GRDF + foliar application of SOP (2%)	22.76	11.73	185.64	13.18	15.50	3.42
T ₇ : GRDF + foliar application of Potassium Schoenite (1%)	20.58	10.69	153.29	12.04	13.87	3.11
T ₈ : GRDF + foliar application of Potassium Schoenite (2%)	23.86	12.26	204.06	13.76	16.33	3.58
S. Em±	0.62	0.30	9.32	0.32	0.46	0.09
C. D. at 5%	1.88	0.90	28.27	0.98	1.39	0.27
General mean	20.35	10.60	154.37	11.93	13.18	3.09

Conclusion

The field investigation clearly established that combined application of general recommended dose of fertilizers (GRDF) with foliar supplementation of potassium—particularly as potassium Schoenite at 2% concentration—substantially improved both growth and yield attributes in summer green gram (*Vigna radiata* L.) cv. Phule Suvarna. Potassium foliar sprays significantly enhanced plant height, branch and leaf development, leaf area, and biomass

accumulation compared to control and other potassium sources. Yield parameters, including number of pods per plant, seeds per pod, seed and straw yield, and seed index, were maximized under Schoenite (2%) foliar application. This reflected a marked increase in productivity compared to absolute control and conventional fertilization, advocating integrated potassium management for green gram. The observed gains are attributed to potassium's essential roles in nutrient uptake, flower retention,

photosynthate translocation, and efficient seed filling. The outcomes confirm that integrating potassium foliar sprays especially multi-nutrient sources like Schoenite at critical crop stages serves as an effective agronomic strategy to maximize green gram productivity. Adoption of these recommendations can help achieve higher yield potential and net returns in semi-arid regions, supporting sustainable pulse intensification under current agroclimatic challenges.

Acknowledgement

AICRP on Integrated Farming System, Department of Agronomy.

References

- Bhavya M, Vidya NT, Doni YB. Influence of foliar application of 19:19:19 and mono-potassium phosphate on growth and yield of green gram (*Vigna radiata* L.). *J Sci Res Rep.* 2024;30(2):1-8. <https://doi.org/10.9734/jsrr/2024/v30i21836>
- Ghosh D, Sarkar S, Brahmachari K, Garai S, Pal M, Sharma A. Potassium schoenite: an emerging source of potassium for improving growth, yield and quality of potato. *J Exp Biol Agric Sci.* 2017;5(2):173-82. [https://doi.org/10.18006/2017.5\(2\).173.182](https://doi.org/10.18006/2017.5(2).173.182)
- Goud VV. Influence of potassium on growth, yield, water relation and nutrient uptake in greengram. *Legume Res.* 2021;44(1):99-106. <https://doi.org/10.18805/LR-4279>
- Hamze MR, Eshghi S, Rahemi M. The characteristics of foliar potassium uptake in pistachio (*Pistacia vera* L.) as affected by different K sources and pH. *Sci Hortic.* 2023;312:111841. <https://doi.org/10.1016/j.scienta.2023.111841>
- Ishfaq M, Akbar N, Anjum SA, Anwar-ul-Haq M. Foliar nutrition: Potential and challenges under changing climate. *Environ Exp Bot.* 2022;200:104909. <https://doi.org/10.1016/j.envexpbot.2022.104909>
- Islam MR, Karim AJMS, Haque KMF, Rahman MM, Hossain MA. Potassium augments growth, yield, nutrient content, and drought tolerance in mung bean (*Vigna radiata* L. Wilczek). *Sci Rep.* 2024;14:9227. <https://doi.org/10.1038/s41598-024-60129-z>
- Jat MK, Dotaniya ML, Saha JK, Patra AK, Singh AK. Effect of potassium application on yield and quality characteristics of green gram (*Vigna radiata* L.) grown on coarse textured soils. *Int J Environ Biol.* 2022;12(1):23-8.
- Jat MK, Yadav PK, Tikkoo A, Yadav SS. Effect of potassium application on yield and quality of green gram (*Vigna radiata* L.). *Indian J Exp Biol.* 2021;59(1):99-104.
- Kharkongor T, Dhamak AL. Growth, yield and quality parameters of green gram (*Vigna radiata*) as influenced by potassium and micronutrient application. *Int J Curr Microbiol Appl Sci.* 2020;9(9):995-1007.
- Nayak S, Nayak D, Parida S. Micronutrient foliar spray on growth performance of green gram (*Vigna radiata* L.). *Asian J Biol Life Sci.* 2020;9(2):234-8. <https://doi.org/10.5530/ajbls.2020.9.36>
- Nutrien Economics. Potassium fertilizers: Muriate of potash or sulfate of potash? 2024. Available from: <https://nutrien-economics.com/news/potassium-fertilizers-muriate-of-potash-or-sulfate-of-potash/>
- Patil SP, Basavaraja PK. Effect of different sources and levels of potassium on maize. *Int J Curr Microbiol Appl Sci.* 2017;6(6):193-9.
- Poovizhi Sindhu G, Swetha Reddy K, Gunasekar J, Vamshi M. Effect of Muriate of Potash (MOP) and Sulphate of Potash (SOP) on growth characters of greengram (*Vigna radiata* (L.) Wilczek) cv. VBN 2 in pot and field condition. *Int J Curr Microbiol Appl Sci.* 2019;8(2):2577-92. <https://doi.org/10.20546/ijcmas.2019.802.300>
- Sardans J, Grau O, Chen HY, Janssens IA, Ciais P, Piao S, Peñuelas J. Potassium control of plant functions: Ecological and agricultural implications. *Plants.* 2021;10(2):419. <https://doi.org/10.3390/plants10020419>
- Shivashankar K, Singh A, Singh A. Growth, yield and nutrient content of mungbean as influenced by foliar potassium application and irrigation levels. *Int J Plant Soil Sci.* 2023;35(8):7-18. <https://doi.org/10.9734/ijpss/2023/v35i82877>
- Sidharam Patil, Basavaraja PK. Effect of different sources and levels of potassium on yield, nutrient requirement and nutrient use efficiency by maize crop (*Zea mays* L.) in low K soils of eastern dry zone of Karnataka, India. *Int J Curr Microbiol Appl Sci.* 2017;6(6):193-9. <https://doi.org/10.20546/ijcmas.2017.606.023>
(Note: This is a duplicate of reference #12 but with an extended title; included separately as provided.)
- Sivakumar R, Parasuraman P, Vijayakumar M. Impact of foliar spray of plant growth retardants with potassium on growth traits, gas exchange parameters and grain yield in foxtail millet (*Panicum italicum* L.). *Indian J Agric Res.* 2022;56(2):147-51. <https://doi.org/10.18805/IJARE.A-5834>
- Tamil Nadu Agricultural University. Greengram-Potassium deficiency symptoms. Dept. of Plant Nutrition; 2023. Available from: https://agritech.tnau.ac.in/agriculture/plant_nutri/ggram_pota.html