E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(9): 1572-1575
Received: 12-08-2025
Accepted: 14-09-2025

Shravani V Sase
PG Student, Agronomy Section, RCSM College of Agriculture, Kolhapur, Mahatma Phule Krushi Vidyapeeth, Rahuri, Ahilyanagar, Maharashtra, India

Jagdish B Patil
Assistant Professor, Department of Agronomy, Agronomy Section, RCSM College of Agriculture, Kolhapur, Mahatma Phule Krushi Vidyapeeth, Rahuri, Ahilyanagar, Maharashtra, India

Sagar A Kamble
Assistant Professor, Department of Agronomy, Agronomy Section, RCSM College of Agriculture, Kolhapur, Mahatma Phule Krushi Vidyapeeth, Rahuri, Ahilyanagar, Maharashtra, India

Chetan V Sonawane
Junior Research Assistant, Agronomy Section, RCSM College of Agriculture, Kolhapur, Mahatma Phule Krushi Vidyapeeth, Rahuri, Ahilyanagar, Maharashtra, India

Sudarshan M Shende
Assistant Professor, Department of Agronomy, Agronomy Section, RCSM College of Agriculture, Kolhapur, Mahatma Phule Krushi Vidyapeeth, Rahuri, Ahilyanagar, Maharashtra, India

Hritik
PG Student, Agronomy Section, RCSM College of Agriculture, Kolhapur, Mahatma Phule Krushi Vidyapeeth, Rahuri, Ahilyanagar, Maharashtra, India

Corresponding Author:
Sudarshan M Shende
Assistant Professor, Department of Agronomy, Agronomy Section, RCSM College of Agriculture, Kolhapur, Mahatma Phule Krushi Vidyapeeth, Rahuri, Ahilyanagar, Maharashtra, India

Performance of different foliar nutrient applications on yield and nutrient uptake by finger millet (*Eleusine coracana* L.)

Shravani V Sase, Jagdish B Patil, Sagar A Kamble, Chetan V Sonawane, Sudarshan M Shende and Hritik

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i9p.3922

Abstract
A field experiment was conducted during *Kharif* 2024 at RCSM College of Agriculture, Kolhapur of Mahatma Phule Krushi Vidyapeeth, Rahuri, Ahilyanagar, Maharashtra, India using a randomized block design with 13 treatments and 3 replications. The study aimed to assess the effects of foliar nutrient sprays on the growth, yield, quality and nutrient uptake by finger millet. The soil was black vertisol with silty loam texture and moderate fertility. Foliar application of 19:19:19 @ 2% at tillering and flowering stages significantly improved yield attributes, grain yield (23.74 q/ha), straw yield (29.52 q/ha), and nutrient uptake (N: 44.88, P_2O_5: 16.04, K_2O: 43.10 kg/ha). These results were statistically on par with two foliar sprays of MPKV's Phule Liquid Micro Grade II @ 1%, making both treatments agronomically and economically viable for enhancing finger millet productivity.

Keywords: Finger millet, foliar nutrient applications, micro grade, 19:19:19, yield, nutrient uptake

Introduction
Millets are a group of nutrient-rich, small-seeded grasses traditionally grown in arid and semi-arid regions, particularly across Asia and Africa. In India, various millets like finger millet, pearl millet, barnyard millet, and foxtail millet are widely cultivated due to their adaptability and nutritional value (Bhatt *et al*., 2003; Shobana *et al*., 2013) [3, 14]. Finger millet (locally known as *ragi, nachani, or nagli*) is especially valued for its high calcium, dietary fiber, essential amino acids, and gluten-free properties-making it ideal for individuals with gluten intolerance, diabetes, or those pursuing a health-conscious diet (Chandrasekara and Shahidi, 2010; Senthilkumar and Gokul (2020) [6, 12]. It plays a prominent role in traditional and modern diets, being used in products such as baby foods, snacks, and desserts. India leads global millet production, with finger millet accounting for 85% of the minor millets cultivated. Karnataka is the top-producing state, followed by Tamil Nadu, Maharashtra, and Uttarakhand. The crop's resilience to drought, adaptability to poor soils, and suitability for rainfed farming make it a crucial component of food and nutritional security, especially in dryland regions (Reddy and Reddy, 2010; Shobana *et al*., 2013; Senthilkumar and Gokul (2020) [11, 14, 12].
Post-pandemic shifts in dietary preferences have further elevated the importance of finger millet due to its antioxidant, anti-aging, and metabolic health benefits. Nutritionally, it contains 72–79.5% carbohydrates, 12% dietary fiber, 7.3% protein, and exceptionally high calcium (344 mg/100g), supporting bone health. Beyond nutrition, its agronomic strengths include drought tolerance, rapid recovery from stress, and compatibility with multiple cropping systems. Given its increasing relevance, the Government of India declared 2018 as the National Year of Millets, and the UN recognized 2023 as the International Year of Millets. Millets are now referred to as "Nutricereals" or "*Shreeanna*" to reflect their health benefits and cultural importance.
To enhance productivity and maintain soil health, integrating inorganic and organic nutrient sources is essential, particularly in regions like the sub-montane areas of Maharashtra where finger millet is grown on steep slopes with high rainfall. Soil erosion and nutrient leaching are key concerns here.

Foliar application of macro- (NPK) and micro-nutrients (Zn, Fe, Mn, Cu, Mo, B), such as those found in formulations like Phule Liquid Micro Grade II, helps improve nutrient uptake, correct deficiencies quickly, and increase yield and crop quality. Foliar feeding enhances nutrient use efficiency (NUE), often achieving up to 90% uptake efficiency and reducing nutrient losses from volatilization and leaching. It also allows the combined application of nutrients and plant protection chemicals, supporting sustainable and efficient agriculture. Studies show that foliar nutrient applications significantly improve plant metabolism, stress tolerance, and productivity, making it a valuable strategy for modern crop management.

Materials and Methods

A field experiment was conducted during *kharif* 2024 at research farm, Agronomy section, RCSM College of Agriculture, Kolhapur of Mahatma Phule Krushi Vidyapeeth, Rahuri, Ahilyanagar, Maharashtra, India. It is located on 16° 41' N latitude, 74° 14' longitude. The experimental site was fairly uniform and levelled. Soil at the experiment field was clay loamy with available nitrogen (272.5 kg/ha), phosphorous(24 kg/ha), potassium(234.1 kg/ha), organic carbon(0.56percent) and chemical properties including EC(0.15 dSm^{-1}) and pH(7.8). Sowing of Finger millet (*Phule Kasari*) was done on 7th June, 2024 with spacing 30 cm (Line sowing) and the harvesting was completed by 1st October 2024. Prior to sowing, basal dose of 60:30:30 60:30:30 (N: P_2O_5: K_2O kg ha^{-1}) was uniformly applied to experimental plots. The gross and net plot sizes were 4.5 m x 3 m and 3.3 m x 2.4 m, respectively. The experiment followed a randomized block design, comprising thirteen treatments with three replications. thirteen treatments were as follows: absolute control (water spray) (T_1), Two foliar sprays of 19:19:19 @ 1% (T_2), Two foliar sprays of 19:19:19 @ 2% (T_3), Two foliar sprays of MPKV'S Phule liquid micro grade II @ 0.5% (T_4), Two foliar sprays of MPKV'S Phule liquid micro grade II @ 1% (T_5), Two foliar sprays of Vermiwash @ 5% (T_6), Two foliar sprays of Vermiwash @ 10% (T_7), Two foliar sprays of DAP @ 1% (T_8), Two foliar sprays of DAP @ 2% (T_9), Two foliar sprays of Cow urine @ 5% (T_{10}), Two foliar sprays of Cow urine @ 10% (T_{11}), Two foliar sprays of Urea @ 1% (T_{12}) and Two foliar sprays of Urea @ 2% (T_{13}). Foliar application was done at tillering and flowering stage at 45 DAS and 60 DAS respectively for each treatment. Observations were recorded at an interval of 30 days and at harvest. Tri-acid digestion method was followed for the estimation of phosphorous and potassium and for nitrogen estimation Kjeldahl method was followed. The data obtained by the investigation then subjected to Statistical analysis as per the standard procedure by using the techniques of analysis of variance and test of significance was carried out as given by Panse and Sukhatme (1967) [9]. In the tabular data C.D. values have been given for the comparison only where 'F' test was significant. The statistical analysis was carried out by computer.

Results and Discussion

Grain Yield: The effect of different foliar nutrient applications on grain yield was presented in the Table No.1. The mean grain yield of finger millet influenced by foliar application was recorded 20.88 q ha^{-1}. All treatments that involved foliar nutrient application significantly outperformed the absolute control in grain yield, clearly indicating the role of nutrient supplementation in improving finger millet productivity under summer conditions. Among the treatments, the two foliar sprays of 19:19:19 @ 2% (T_3) recorded the highest grain yield of 23.74 q ha^{-1}, followed closely by two foliar sprays of MPKV's Phule liquid micro Grade II @ 1% (T_5) with 23.48 q ha^{-1}, and two foliar sprays of 19:19:19 @ 1% (T_2) with 22.95 q ha^{-1}. The superiority of these treatments can be attributed to the balanced and readily available supply of macro and micro-nutrients at crucial crop growth stages, which enhanced nutrient absorption, photosynthetic activity, and grain formation. These findings are in line with Reddy and Reddy (2010) [11], Jadhav *et al.* (2024) [4], Ashoka and Rajkumar (2020) [1], Bulbule *et al.* (2018) [5], Sharifi *et al.*, (2018) [13] and Senthilkumar and Gokul (2020) [12]. observed increased yield due to foliar-applied nutrients improving nitrogen, phosphorus, and potassium uptake and contributing to higher biomass and grain yield. Moderate yields were recorded with Two foliar sprays of MPKV's Phule liquid micro grade II @ 0.5% (T_4) (22.78 q ha^{-1}), Two foliar sprays of Vermiwash @ 10% (T_7) (21.73 q ha^{-1}), and Two foliar sprays of DAP @ 2% (T_9) (21.32 q ha^{-1}), which were significantly higher than the absolute control. These results suggest that organic foliar treatments and phosphorus-based sprays have a beneficial but relatively lower effect compared to balanced NPK formulations. On the other hand, lower grain yields were observed in treatments such as Two foliar sprays of Cow Urine @ 10% (T_{11}) (18.79 q ha^{-1}), Two foliar sprays of Cow Urine @ 5% (T_{10}) (18.63 q ha^{-1}), and the Absolute Control (T_1) which recorded the lowest grain yield of 17.48 q ha^{-1}. This indicates the inadequacy of organic nutrient solutions like cow urine in meeting the nutrient demands of the crop when applied alone. A notable yield increase of 35.81% was observed in T_3 over the control (T_1).

Straw yield

The effect of different foliar nutrient applications on straw yield was presented in the table No.1. A significant response was observed for straw yield under nutrient treatments compared to the absolute control, reaffirming the positive impact of foliar application on total plant biomass. In contrast, the lowest straw yield was noted in the Absolute Control (T_1) with 21.73 q ha^{-1}, followed closely by Cow Urine @ 5% (T_{10}) (23.25 q ha^{-1}) and Cow Urine @ 10% (T_{11}) (23.77 q ha^{-1}), indicating insufficient nutrient supply through water or low-nutrient treatments. These findings align with earlier research (Mallesha, 2013; Banasode and Math, 2018; Sharifi *et al*., 2018; Senthilkumar and Gokul, 2020) [8, 2, 13, 12] (Kumar *et al*., 2022) [7], confirming that nutrient management involving foliar application plays a crucial role in improving not only grain yield but also straw productivity.

Table 1: Mean grain and straw yield of finger millet as influenced by different treatments

Tr. No	Treatments details	Grain yield	Straw yield
		------ (q ha^{-1})------	
T_1	Absolute Control	17.48	21.73
T_2	Two foliar sprays of 19:19:19 @ 1%	22.95	28.48
T_3	Two foliar sprays of 19:19:19 @ 2%	23.74	29.52
T_4	Two foliar sprays of MPKV'S Phule Liquid Micro Grade II @ 0.5%	22.78	27.58
T_5	Two foliar sprays of MPKV'S Phule Liquid Micro Grade II @ 1%	23.48	29.42
T_6	Two foliar sprays of Vermiwash @ 5%	20.48	26.64
T_7	Two foliar sprays of Vermiwash @ 10%	21.73	27.49
T_8	Two foliar sprays of DAP @ 1%	20.06	25.31
T_9	Two foliar sprays of DAP @ 2%	21.32	27.09
T_{10}	Two foliar sprays of Cow urine @ 5%	18.63	23.25
T_{11}	Two foliar sprays of Cow urine @ 10%	18.79	23.77
T_{12}	Two foliar sprays of Urea @ 1%	19.70	24.38
T_{13}	Two foliar sprays of Urea @ 2%	20.31	26.39
S.Em±		1.17	1.07
CD @ 5%		3.41	3.13
General Mean		20.88	26.24

Nutrient Uptake: From the mentioned data represented in Table No. 2, higher total uptake of N (52.34 kg ha^{-1}), P (6.41 kg ha^{-1}), and K (40.92 kg ha^{-1}), values were recorded by the application of T_3: Two foliar sprays of 19:19:19 @ 2%, however application of T_5: Two foliar sprays of MPKV'S Phule Liquid Micro Grade II @ 1% recorded statistically at par results with T_3 by showing total N (51.23 kg ha^{-1}), P (18.56 kg ha^{-1}) and K (40.32 kg ha^{-1}) uptake. Lowest results on uptake studies were recorded by T_1: Absolute Control with total N (36.51 kg ha^{-1}), P (12.56 kg ha^{-1}), and K (28.61 kg ha^{-1}). Similar findings were earlier reported by Rani *et al*. (2017) [10]; Senthilkumar and Gokul (2020) [12].

Table 2: Mean NPK uptake of finger millet as influenced by different treatments

Tr. No	Treatment details	N Uptake			P uptake			K uptake		
		----------(kg ha^{-1})----------								
		Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
T_1	Absolute Control	27.80	8.71	36.51	8.80	3.76	12.56	11.89	16.72	28.61
T_2	Two foliar sprays of 19:19:19 @ 1%	37.38	12.49	49.87	12.12	6.13	18.25	16.09	23.04	39.13
T_3	Two foliar sprays of 19:19:19 @ 2%	39.08	13.26	52.34	12.80	6.41	19.21	16.70	24.22	40.92
T_4	Two foliar sprays of MPKV'S Phule Liquid Micro Grade II @ 0.5%	36.91	11.94	48.85	11.85	5.78	17.63	15.91	22.22	38.13
T_5	Two foliar sprays of MPKV'S Phule Liquid Micro Grade II @ 1%	38.27	12.96	51.23	12.45	6.11	18.56	16.40	23.92	40.32
T_6	Two foliar sprays of Vermiwash @ 5%	32.92	10.92	43.84	10.45	5.25	15.70	14.23	21.30	35.54
T_7	Two foliar sprays of Vermiwash @ 10%	35.19	11.73	46.92	11.36	5.58	16.95	15.20	22.36	37.56
T_8	Two foliar sprays of DAP @ 1%	32.31	10.62	42.93	10.88	4.92	15.80	13.84	19.98	33.82
T_9	Two foliar sprays of DAP @ 2%	34.33	11.76	46.08	11.18	5.46	16.63	14.85	21.64	36.49
T_{10}	Two foliar sprays of Cow urine @ 5%	29.87	9.37	39.25	9.50	4.16	13.66	12.73	17.98	30.71
T_{11}	Two foliar sprays of Cow urine @ 10%	30.12	9.67	39.79	9.58	4.19	13.77	12.87	18.45	31.32
T_{12}	Two foliar sprays of Urea @ 1%	31.71	10.33	42.03	10.07	4.30	14.36	13.58	19.10	32.68
T_{13}	Two foliar sprays of Urea @ 2%	32.76	11.08	43.84	10.35	5.09	15.43	14.11	21.01	35.12
	S.Em±	2.08	0.50	2.24	0.63	0.57	0.90	0.82	0.79	1.12
	CD @5%	6.10	1.47	6.55	1.85	1.69	2.66	2.40	2.01	3.28
	General Mean	33.72	11.14	44.88	10.87	5.16	16.04	14.49	20.92	35.41

Conclusion

This experiment concludes that among the treatments of combination of fertilizer level along with various inputs, application of Two foliar sprays of 19:19:19 @ 2% gave the highest grain and straw yield and nutrient uptake.

Acknowledgement

Present experimental work as a part of M.Sc. research programme was supported by Agronomy Section, Rajarshee Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur and under the jurisdiction of Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahilyanagar, India. A very heartful thanks to Dr. J. B. Patil for the initial review of the manuscript and the authors are also thankful to Dr. S. M. Shende for helping in plant and soil chemical and statistical analysis. This research work is a result of combined efforts of the authors. We express our sincere gratitude towards all the authors.

References

1. Ashoka P, Rajkumar GR. Response of nutrient management on growth and yield attributes of brown top millet (*Brachiaria ramose*) in red sandy soil. J Pharmacogn. 2020;9(6):1298-301.
2. Banasode C, Math KK. Effect of foliar fertilization of water-soluble fertilizers on growth and economics of soybean in a vertisol. J Pharmacogn Phytochem. 2018;7(2):2391-3.
3. Bhatt A, Singh V, Shrotria PK, Baskheti DC. Coarse grains of Uttaranchal: Ensuring sustainable food and nutritional security. Indian Farmer's Dig. 2003;34-8.
4. Jadhav BR, Danawale NJ, Solanke AV, Durgude AG, Patil MR, Bodake PS, *et al*. Effect of micronutrient management on growth and yield of maize (*Zea mays* L.). Int J Res Agron. 2024;7(12S):424-8.
5. Bulbule AV, Gajbhiye PN, Kumbhar CT. Response of

finger millet (*Eleusine coracana* L.) cultivated on steep hill slopes to foliar nutrition. Int J Plant Sci (Muzaffarnagar). 2018;13(1):183-7.
6. Chandrasekara A, Shahidi F. Content of insoluble bound phenolics in millets and their contribution to antioxidant capacity. J Agric Food Chem. 2010;58:6706-14.
7. Kumar EH, Yassin MM, Somasundaram E, Latha MR, Anantham R. Effect of organic manures and organic foliar sprays on yield attributes and yield of barnyard millet (*Echinochloa frumentacea* L.). Int J Environ Clim Change. 2022;12(11):886-92.
8. Mallesha. Effect of foliar application of water-soluble fertilizer on growth and yield of pigeonpea (*Cajanus cajan* (L.) Millsp.). [MSc (Agri.) thesis]. Dharwad: Univ Agric Sci; 2013.
9. Panse VG, Sukhatme PV. Statistical methods for agricultural research workers. New Delhi: ICAR; 1967.
10. Rani SY, Triveni U, Patro TSSK, Divya M, Anuradha N. Revisiting of fertilizer doses in finger millet [*Eleusine coracana* (L.) Garten.] through targeted yield and soil test crop response (STCR) approach. Int J Curr Microbiol Appl Sci. 2017;6(7):2211-21.
11. Reddy MJ, Reddy VC. Developing organic package of practices for yield maximization of rainfed finger millet. Annu Programme Rep. Bengaluru: Res Inst Org Farming, Univ Agric Sci; 2010. p. 30-4.
12. Senthilkumar N, Gokul G. Effect of water-soluble fertilizer on yield and nutrient uptake of ragi. Plant Arch. 2020;20(2):5817-22.
13. Sharifi SK, Lalitha BS, Qasimullah R, Prajwal Kumar GK, Manjanagouda SS. Effect of foliar application of water-soluble fertilizer on growth and yield of soybean (*Glycine max* L. Merrill). Int J Pure Appl Biosci. 2018;6(5):766-70.
14. Shobana S, Krishnaswamy K, Sudha V, Malleshi NG, Anjana RM, Palaniappan L, *et al*. Finger millet (*Eleusine coracana* L.): A review of its nutritional properties, processing, and plausible health benefits. Adv Food Nutr Res. 2013;69:1-39.