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Influence of seed treatments on growth and yield of fenugreek (*Trigonella foenum-graecum*) microgreens

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Abstract
The present investigation was conducted at No. 4 Nursery, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, Dist. Ratnagiri, during the academic year 2024-25. The results of the experiment have revealed that treatment S_1 (Cattle urine 100 ml/litre) found superior in growth parameters like days for germination, seedling height, root length while yield parameters like days required for harvest and yield/m^2. Minimum number of days required for germination (avg. 3.58), maximum seedling height (6.48 cm), root length (avg. 3.47 cm), minimum number of days for harvest (avg. 8.31), maximum yield/m^2 (avg. 769 g) was observed in treatment S_1 (Cattle urine 100 ml/litre). The data recorded in present investigation revealed that seed treatment influenced the germination, growth and yield parameters of fenugreek microgreens.

Keywords: Fenugreek microgreens, seed treatments, growth, yield

1. Introduction
Fenugreek (*Trigonella foenum-graecum* L.) is an annual leafy vegetable from the Leguminosae family that is often grown in Asia and the Mediterranean region (Khorshidian *et al.,* 2015) [4]. It is also known as Methi (Hindi and Marathi) or Fenugreek (French) (Shrinivasan *et al.,* 2006) [11]. The word fenugreek comes from the species name foenum-graecum, which means "Greek hay" (Flammang *et al.,* 2004) [2]. Economically significant Trigonella species include *T. corniculata* (Kasuri methi) and *T. foenum graecum* (common methi). This variety grows slowly and primarily in rosette form during the vegetative period. Fenugreek thrives in cool climates and is resistant to frost and freezing temperatures. Early crop stages require low temperatures for optimal vegetative growth (Singh *et al.,* 2020) [12].

Microgreens are little, fragile seedlings from many crop species that can be eaten raw or partially cooked. "Microgreens," also known as "Nutrigreens," are young edible greens from various vegetables, herbs and plants that are full of flavor and nutrients. The first pair of true leaves are partially or entirely grown, while the cotyledonary leaves are fully extended. The seedlings are often described as "green" in color. Microgreens normally have roots, a central stem, two cotyledonary leaves and a pair of juvenile true leaves (Koley *et al.,* 2016) [6].

Microgreens have a higher nutritional concentration than mature herbs and vegetables. Some vitamins, such vitamin E, are 40 times more abundant in microgreens than in mature plants. Minerals including K, Fe, Zn, Mg and Cu are abundant in them.

Lutein, violaxanthin, α-carotene and β-carotene are typically considered to be abundant in microgreens (Xiao *et al.,* 2016) [15].

Combining the proper growth medium with pre-sowing seed treatments can improve yield and yield-related characteristics. You may grow fenugreek microgreens year-round at home with the right growing medium and climate under supervision because they are grown inside on a massive scale. These suggest that the atmosphere you create is the only factor influencing them. In recent years, eating microgreens rather than mature leafy vegetables has grown in popularity and awareness. From seed to harvest, fenugreek microgreens take seven to fourteen days to grow. Harvesting doesn't require farmers to wait an entire season or more.

Farmers can grow microgreens, an annual crop, to provide variety to their business and enhance their income. Therefore, the key to increasing growth is selecting the appropriate growing medium and using a pre-sowing seed treatment.

2. Materials and Methods

The field experiment was conducted in 2024-2025 at the College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. It involved two factors and twelve treatment combinations that were replicated three times using the using the Factorial Randomized Block Design (FRBD). The experiment consists of four pre-sowing seed treatments: S_1: Cattle urine (100ml/liter), S_2: Vermiwash (100ml/liter), S_3: Humic acid (2 ml/liter) and S_4: Water soaking (control).

Fenugreek seeds were soaked in respective seed treatment for overnight and treated with 10 g/kg boric acid before planting. Following seed treatment, treated seeds were planted on beds with various growing media at a distance of 10 to 15 cm between two lines. After being sown at a depth of two centimeters, the seeds were carefully covered with a thin coating of medium. Irrigation was provided on a regular basis. When the microgreens' cotyledon leaves have fully opened, either with or without the first pair of genuine leaves emerging, they can be harvested in 8-12 days. For six months, the consecutive sowings were carried out. Five plants in total from each treatment were chosen at random to serve as observational plants so that observations could be made at harvest.

Various growth factors, such as days needed for germination, seedling height (cm), root length (cm) and yield parameters, such as days required for harvest and yield (g/m^2) were noted. The method and design recommended by Panse and Sukhatme were followed in the statistical analysis of the experiment's data.

3. Results and Discussion

The effect of seed treatments on growth and yield of fenugreek microgreens is given in Table 1 respectively.

3.1 Days Required for Germination

Treatment S_1 (Cattle urine 100 ml/litre) recorded minimum number of days for germination in month of September (3.22 days), October (3.43 days), November (3.55 days), December (3.69 days), January (3.66 days) and February (3.97 days) respectively while treatment S_4 recorded maximum number of days for germination. It might be due to number of things, including increased moisture, nutrient availability and growth-promoting compounds in urine. Priming cucumber seeds with cattle urine results in maximum mean germination period (3.65 days) according to Magar *et al.* (2025) [7]. Shreesty *et al.* (2019) [10] in karonda seedlings and Sharma and Parmar (2023) [9] in custard apple seedlings also reported similar outcomes.

3.2 Seedling height (cm)

Maximum seedling height was recorded in treatment in S_1 (Cattle urine @ 100 ml/litre) in the month of September (6.27 cm), October (6.44 cm), November (6.56 cm), December (6.70 cm), January (6.49 cm) and February (6.43 cm). In contrast, treatment S_4 (water soaking) had the lowest seedling height in September (5.36 cm), October (5.72 cm), November (6.07 cm), December (5.69 cm), January (5.37 cm) and February (5.58 cm). According to Ambika and Balakrishnan (2015), soaking seeds in 2% cow urine produced cluster beans with the longest shoots (16.05 cm). When cluster bean seeds were treated in 2% cow urine for three hours, Tagore and Shankar (2017) [13] found the maximum shoot length (8 cm).

3.3 Root length (cm)

The maximum root length was reported in September (3.65 cm), October (3.28 cm), November (3.38 cm), December (3.87 cm), January (3.44 cm) and February (3.22 cm) in treatment S_1 (Cattle urine @ 100 ml/litre) while, minimum root length in month of September (3.19 cm), October (2.74 cm), November (2.36 cm), December (2.74 cm), January (2.73 cm) and February (2.56 cm) was recorded with treatment S_4 (Water soaking). The longest roots (average 4.93 cm) were found in fenugreek microgreens cultivated on cocopeat medium, according to Kolambe *et al.* (2024) [5]. According to Tiwari *et al.* (2018) [14], the roots of chickpea seedlings treated with 6% cow urine were the longest (21.03 cm).

3.4 Days required for harvest

The minimum number of days required for harvesting was recorded in September (7.63 days), October (7.85 days), November (8.40 days), December (8.50 days), January (8.81 days), and February (8.68 days) for Treatment S1 (Cattle urine at 100 ml/litre), while the maximum number of days to harvest was recorded in September (8.22 days), October (8.65 days), November (8.72 days), December (9.08 days), January (9.37 days) and February (9.20 days).

3.5 Yield (g/m^2): The highest yield among the different seed treatments was recorded in September (836.81 g), October (857.78 g), November (845.89 g), December (727.59 g), January (693.94 g) and February (654.72 g). In contrast, the lowest yield was recorded in September (591.07 g), October (598.41 g), November (588.81 g), December (520.30 g), January (473.48 g) and February (442.56 g).

Table 1: Effect of seed treatments on germination, growth and yield of fenugreek microgreens

Months	Treatments	Germination (days)	Seedling height (cm)	Root length (cm)	Days required for harvest (days)	Yield (g/m^2)
September	S_1	3.22	6.27	3.65	7.63	836.81
	S_2	3.53	5.92	3.67	7.75	799.33
	S_3	3.63	5.8	3.46	7.87	774.85
	S_4	3.92	5.36	3.19	8.22	591.07
October	S_1	3.43	6.44	3.28	7.85	857.78
	S_2	3.62	6.19	3.24	7.98	815.89
	S_3	3.72	5.95	3.15	8.21	772.56
	S_4	4.02	5.72	2.74	8.65	598.41
November	S_1	3.55	6.56	3.38	8.4	845.89
	S_2	3.7	6.43	3.07	8.48	796.88
	S_3	3.76	6.22	2.91	8.48	718.41
	S_4	4.09	6.07	2.36	8.72	588.81
December	S_1	3.69	6.7	3.87	8.5	727.59

	S_2	3.76	6.27	3.7	8.63	715.85
	S_3	3.89	6.03	3.29	8.76	667.7
	S_4	4.16	5.69	2.74	9.08	520.3
January	S_1	3.66	6.49	3.44	8.81	693.94
	S_2	3.86	6.21	3.0	8.87	666.25
	S_3	4.03	5.84	2.95	9.08	597.5
	S_4	4.23	5.37	2.73	9.37	473.48
February	S_1	3.97	6.43	3.22	8.68	654.72
	S_2	4.17	6.23	3.19	8.57	577.24
	S_3	4.4	5.95	3.11	8.7	541.89
	S_4	4.95	5.58	2.56	9.2	442.56

S_1: Cattle Urine @ 100 ml/litre	S_2: Vermiwash @ 100 ml/litre	S_3: Humic acid @ 2 ml/litre	S_4: Water soaking

4. Conclusion

When it comes to pre-sowing seed treatments, treatment S_1 (Cattle Urine 100ml/litre) has demonstrated the best results in terms of growth parameters, such as days needed for germination, seedling height and root length, as well as yield parameters, such as days needed for harvest, number of cycles per month, total cycles in six months and yield/m^2. Minimum number of days required for germination (avg. 3.58), maximum seedling height (6.48 cm), root length (avg. 3.47 cm), minimum number of days for harvest (avg. 8.31) and maximum yield/m^2 (avg. 769 g) was observed in treatment S_1 (Cattle urine 100 ml/litre).

5. Disclaimer (Artificial Intelligence)

Authors here by declare that No generative AI technologies such as large language models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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7. Competing interests

Authors have declared that no competing interests exist.

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