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Effect of growing media on germination, growth and yield of fenugreek (*Trigonella foenum- graecum* L.) 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 M_3 [Soil+ cocopeat (1:1)] 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. 3.43), maximum seedling height (7.46 cm), root length (avg. 3.83 cm), minimum number of days for harvest (avg. 8.15), maximum yield/m^2 (avg. 863.65 g) was observed in treatment M_3 [Soil+ cocopeat (1:1)]. The data recorded in present investigation revealed that growing media influenced the germination, growth and yield parameters of fenugreek microgreens.

Keywords: Fenugreek microgreens, media, soil, cocopeat

1. Introduction
Fenugreek (*Trigonella foenum-graecum* L.) is a leafy vegetable and a significant seed spice Govindaraj *et al.* (2019) [11]. It is a self-pollinating annual plant of the Leguminosae family that is extensively grown throughout the Mediterranean and Asia (Khorshidian *et al.*, 2015) [13]. It is grown commercially in North Africa, the Middle East, Argentina, France, Spain, Turkey, Iran, Nepal, India, Pakistan, Afghanistan, and Morocco Altuntas *et al.*, (2005) [3].
The genus Trigonella now has more than 260 species. *Trigonella foenum graecum* L. is one diploid species that has (2n=16) chromosomes (Acharya *et al.*, 2014). Two commercially significant species found in fenugreek are *T. corniculata* (Kasuri methi) and *T. foenum-graecum* (common methi) (Ghadge *et al.*, 2021) [9].
Compared to other plants, fenugreek is more adaptable and can grow in a wide range of environments. It thrives in colder temperatures and can withstand frost and freezing. Early crop development requires low temperatures (Singh *et al.*, 2020)."Microgreens" refers to the tiny, delicate seedlings of different crop species that are eaten raw or partially cooked. A central stem, two cotyledon leaves, and the first pair of genuine leaves-which, depending on the species, may be as young as 4 to 14 days - make up the three components of the plant. The cotyledonary leaves have grown to their full size, and the first two true leaves are either fully or partially formed (Mishra *et al.*, 2021) [15].
Microgreens are diverse in terms of color, texture and flavor. Depending on the variety planted, these plants are harvested in 7 to 21 days and eaten fresh (Bhaswant *et al.*, 2023). Larger than sprouts but smaller than baby greens, microgreens are delicate, immature greens (Paradiso *et al.*, 2018) [18]. Often referred to as "Vegetable Confetti," microgreens are made from the seeds of a variety of crops, such as legumes, cereals, oilseeds, vegetables and herbs (Ebert 2022) [8]. Fresh microgreens are frequently consumed in soups, salads and sandwiches. They can be used as stuffings, toppings, garnishes and spices (Riggio *et al.*, 2019) [20].
Microgreen development is influenced by a number of factors, including the growing media. The quality, productivity, and sustainability of microgreens are all impacted by the choice of growth substrate, which is one of the most crucial factors of microgreen production. (Gioia *et al.*, 2017) [10].

2. Materials and Methods

Experimental site

The experiment was conducted from September 2024 to February 2025 at No. 4 Nursery, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. The altitude of this place is about 280 m above MSL. Geologically, it is located in subtropical region with 17°45' North Latitude and 73°12' East Latitude.

Sowing seeds

Soaked seeds were spaced 10-15 cm apart between two lines on beds with different growing media. The seeds were carefully coated with the thin layer of medium after being seeded at a depth of 2 cm. Regular irrigation was carried out. Regardless of whether the first pair of true leaves had appeared, microgreens were harvested at 8 to 12 days after the cotyledon leaves had opened. The repeated sowings were done for six months. To document harvesting observations, five plants were selected at random from each treatment to serve as observational plants.

Various growth-promoting elements were recorded, including the number of days required for germination, the height of the seedlings (cm), the root length (cm) and yield characteristics such the days required for harvest and yield (g/m^2). The method and design recommended by Panse and Sukhatme were followed in the statistical analysis of the experiment's data.

3. Results and Discussion

3.1 Days Required for Germination (days)

In September (3.20 days), October (3.35 days), November (3.38 days), December (3.53 days), January (3.48 days), and February (3.66 days) treatment M_3 [Soil + Cocopeat (1:1)] recorded a minimum of days to germination among the different growing media treatments. Kolambe *et al.* (2024) [14] discovered that the [Soil+ Cocopeat (1:1)] media in fenugreek microgreens had the lowest number of days needed for germination (3.33 days). Additionally, mung bean and coriander microgreens took at least two to four days to grow on cocopeat media, according to Archana and Lal (2021) [4].

3.2 Seedling height (cm)

The treatment M_3 [Soil + Cocopeat (1:1)] had the highest seedling height in September (6.59 cm), October (6.75 cm), November (6.91 cm), December (6.93 cm), January (6.95 cm), and February (6.97 cm) as compared to treatment M_1. Similar results were observed by Naik *et al.* (2022) [16] in mustard microgreens, Hazarika *et al.* (2022) [12] in cabbage, and Arya and Kutty (2022) [5] in amaranthus microgreen height (5.8 cm) on cocopeat media.

3.3 Root length (cm)

The maximum root length was reported in September (4.05 cm), October (3.86 cm), November (3.55 cm), December (4.31 cm), January (3.55 cm), and February (3.68 cm) in treatment M_3 [Soil + Cocopeat (1:1)] while, minimum root length in month of September (3.11 cm), October (2.05 cm), November (2.14 cm), December (2.36 cm), January (2.30 cm) and February (2.18 cm) was recorded with treatment M_1 (Sand). The longest roots (average 4.93 cm) were found in fenugreek microgreens cultivated on cocopeat medium, according to Kolambe *et al.* (2024) [14]. Similar findings were observed in Chinese cabbage by Chhetri *et al.* (2022) [6] and kale by Yanti *et al.* (2020) [23].

3.4 Days required for harvest

Media M_3 [Soil + Cocopeat (1:1)] recorded the minimum number of days to harvest in September (7.41 days), October (7.59 days), November (8.29 days), December (8.39 days), January (8.68 days) and February (8.59 days) while, media M_1(Sand) recorded maximum number of days to harvest in September (8.39 days), October (8.77 days), November (8.77 days), December (9.16 days), January (9.57 days) and February (9.29 days). Kolambe *et al.* (2024) [14] reported that fenugreek microgreens grown in [Soil + Cocopeat (1:1)] medium required an average of 8.90 days to harvest. Similar outcomes were noted by Dalal *et al.* (2022) [7] in microgreens of spinach and carrots, and Sinha and Thilakacathy (2021) in microgreens of fenugreek and amaranthus.

3.5 Yield (g/m^2)

Treatment M_3 (Soil + Cocopeat (1:1)) had the highest yield in September (946.67 g), October (946.92 g), November (910.63 g), December (819.42 g), January (788.31 g) and February (770.00 g) whereas lowest yield was recorded in treatment M_1 (Sand), which was in September (470.50 g), October (498.00 g), November (499.36 g), December (425.69 g), January (344.59 g) and February (250.46 g). Kolambe *et al.* (2024) [14] discovered that the soil + cocopeat (1:1) media provided the maximum yield (1086.03 g/m^2) of fenugreek microgreens. In cocopeat medium, Priyadarshini and Kumari (2021) [19] obtained a maximum yield of 7.68 g. The results align with those of Arya and Kutty (2022) [5] in green gram, Naik *et al.* (2022) [16] in mustard microgreens, and Allah *et al.* (2023) [2] in mustard microgreens.

Table 1: Effect of growing media 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	M_1	4.01	5.04	3.11	8.39	470.50
	M_2	3.52	5.87	3.40	7.80	834.39
	M_3	3.20	6.59	4.05	7.41	946.67
October	M_1	4.13	5.24	2.05	8.77	498.00
	M_2	3.60	6.23	3.40	8.16	838.56
	M_3	3.35	6.75	3.86	7.59	946.92
November	M_1	4.28	5.52	2.14	8.77	499.36
	M_2	3.67	6.53	3.10	8.50	803.50
	M_3	3.38	6.91	3.55	8.29	910.63
December	M_1	4.37	5.32	2.36	9.16	425.69
	M_2	3.73	6.27	3.53	8.67	728.47
	M_3	3.53	6.93	4.31	8.39	819.42
January	M_1	4.45	4.59	2.30	9.57	344.59
	M_2	3.91	6.39	3.24	8.84	690.48
	M_3	3.48	6.95	3.55	8.68	788.31
February	M_1	5.08	4.67	2.18	9.29	250.46
	M_2	4.39	6.50	3.19	8.49	641.84
	M_3	3.66	6.97	3.68	8.59	770.00

M_1: Sand, M_2: Soil + FYM (3:1), M_3: Soil + Cocopeat (1:1)

Conclusion

Based on the results, it concluded that media affected the fenugreek microgreens development and yield. Among the three different growing media, treatment M_3 [Soil+ cocopeat (1:1)] found superior in some of the growth parameters like days for germination, seedling height, root length while yield parameters like days required for harvest and yield/m^2. Treatment M_3 [Soil+ cocopeat (1:1)] showed a minimum number of days needed for germination (avg. 3.43), maximum seedling height (7.46 cm), root length (avg. 3.83 cm), the minimum number of days needed for harvest (avg. 8.15), and maximum yield/m^2 (avg. 863.65 g/m_2). The current study is suggestive and requires more research to provide suitable suggestions. "Further research is required to validate and confirm the results, as these findings are based on a one-year study."

Disclaimer (Artificial Intelligence)

In this manuscript there is no use of Al technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text to image generators.

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