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Effect of different growing media on seedling quality and performance of brinjal crop.

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ABSTRACT
Current study is based on the effect of different growing media on seedling quality and performance of green brinjal crop at horticulture lab of Quantum school of Agricultural studies, Quantum University- Roorkee. It was conducted in the month of September of 2023. There were total of 5 media in which the seeds were sown namely the treatments consisted of five different nursery media composition viz., T_1 (cocopeat), T_2 (vermicompost), T_3 (1:1 Mixture of all media), T_4 (soil), T_5 (FYM). Design used was complete randomized block design (CRBD) with three replications. The seeds were sown on 15 September. Under the proper guidance the germination of seeds occurred on 20 September. The seedlings were fully matured at the end of the month and then we're transplanted in the field. The study findings indicated notable disparities among the various seed growing media, as Notably, media T_1 (cocopeat) exhibited superior outcomes, with a higher germination percentage (72.00%), maximum plant height (12.00 cm), number of leaves per seedling (6.00), and maximum root and shoot lengths (7.00 cm and 6.00 cm respectively). The heightened germination percentage observed in media T_1 (cocopeat) can be attributed to its favorable water retention capacity, facilitating adequate moisture supply and sufficient porosity for effective gaseous exchange between the medium and seeds, thereby enhancing seed germination. The increased plant height and number of leaves per seedling are likely the result of higher concentrations of plant growth hormones and enhanced nutrient availability within the growing medium.
Key words: *Growing media, germination of seeds, FYM, Cocopeat, mixture and vermicompost.*

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INTRODUCTION

Brinjal, scientifically known as Solanum melongena, is a widely cultivated vegetable crop valued for its culinary versatility and nutritional benefits. Originating from the Indian subcontinent, brinjal has become a staple in cuisines across the globe, featuring prominently in dishes ranging from curries to stir-fries [4]. Its popularity as a cash crop underscores the importance of efficient cultivation practices to ensure optimal yield and quality. Brinjal cultivation typically begins with the sowing of seeds in nurseries or seed trays, where they undergo germination and early growth before being transplanted into the field. The quality of seedlings produced during this initial stage plays a pivotal role in determining the success of the entire crop cycle. Vigorous and healthy seedlings not only establish themselves more effectively upon transplanting but also exhibit enhanced resilience to environmental stressors, pests, and diseases throughout their growth period [2].

Given the escalating costs associated with seeds, several vegetable crops such as tomato, brinjal, capsicum, and cucurbits undergo transplantation subsequent to nurturing in protected environments. This approach aims to maximize germination rates and ensure the establishment of robust plants. While seedling production, the climatic conditions and choice of seed sowing media significantly influence seedling development during this preparatory phase. The vegetative growth stage is particularly pivotal, as it profoundly impacts subsequent growth, yield timing, overall yield, and fruiting potential. Conventional seedling production methods often induce stress in plants. Therefore, selecting appropriate growth media is paramount to facilitating efficient horticultural seedling production in nurseries. As emphasized by Sterrett [3], the utilization of suitable growing media or substrates directly affects the germination process, subsequent development, and establishment of functional root systems.

The significance of seedling quality in brinjal cultivation cannot be overstated, as it directly impacts various aspects of crop development, including yield, fruit quality, and overall plant vigor. Poor-quality seedlings, characterized by stunted growth, weak root systems, or susceptibility to pests and diseases, may result in reduced crop productivity and economic losses for growers. Therefore, optimizing seedling quality through appropriate nursery management practices and selection of suitable growing media is essential for maximizing brinjal yield and quality. This underscores the need for research into the effects of different growing media on seedling performance, as it can provide valuable insights for growers seeking to improve their cultivation practices and achieve sustainable production outcomes. In this context, the present study aims to investigate the influence of various growing media on the seedling quality and subsequent performance of brinjal crops, contributing to a deeper understanding of the factors shaping the success of brinjal cultivation. The selection of an appropriate growing medium is crucial for supporting seedling growth and development in brinjal cultivation. Various components, including soil, organic matter, and soilless substrates, play vital roles in providing physical support, water retention, nutrient availability, and aeration for the developing seedlings [4].

In this study, five different growing media were evaluated for their effectiveness in supporting brinjal seedling growth. Cocopeat (T_1) derived from coconut husks, is a popular soilless growing medium known for its excellent water retention properties and ability to promote root development [5]. It provides a lightweight and well-aerated substrate, reducing the risk of waterlogging and improving overall seedling vigor. Vermicompost (T_2) produced through the decomposition of organic materials by earthworms, is rich in nutrients and beneficial microorganisms [6]. It enhances soil structure, fertility, and biological activity, thereby promoting healthy seedling growth and nutrient uptake. Soil (T4), traditional soil-based growing media provide a natural source of nutrients and microbial diversity essential for seedling establishment [7]. However, soil quality can vary significantly depending on factors such as texture, pH, and nutrient content, impacting seedling performance. Farmyard Manure (FYM) (T_5) is a valuable organic amendment commonly used to improve soil fertility and structure [8]. It releases nutrients slowly over time, supplying essential elements for sustained seedling growth and development. Mixture of all (T_3) cocopeat, vermicompost, soil, and FYM was also evaluated as a growing medium. This approach aims to leverage the complementary properties of each component to create an optimal substrate for seedling growth, balancing water retention, aeration, and nutrient availability. By examining the performance of brinjal seedlings across these different growing media treatments, the study aims to elucidate the influence of growing medium composition on seedling quality and subsequent crop performance, providing valuable insights for growers seeking to optimize their cultivation practices.By examining parameters such as germination rate, shoot and root development, nutrient uptake, and overall vigor, we aim to identify the most suitable growing media for optimizing brinjal seedling quality. A quality growing medium fulfills several essential functions in supporting plant growth. It offers adequate anchorage or support to ensure the stability of the plant's root system. Additionally, it serves as a reservoir for essential nutrients and water, providing the plant with the resources necessary for healthy growth and development. Furthermore, the growing medium facilitates oxygen diffusion to the roots, ensuring proper root respiration, and allows for gaseous exchange between the roots and the atmosphere outside the root substrate. The significance of growing media in determining the quality of seedlings is widely acknowledged, as emphasized by Agbo and Omaliko[9]. The composition and characteristics of the growing medium in the nursery environment profoundly influence seedling development, highlighting the importance of selecting an appropriate growing medium to optimize seedling quality and subsequent plant performance. This comprehensive investigation aims to provide practical insights for farmers, researchers, and agricultural practitioners, enabling them to make informed decisions regarding the selection of growing media for brinjal cultivation. Ultimately, this research contributes to the sustainable and efficient production of brinjal crops, addressing the growing global demand for this versatile and nutritionally rich vegetable. Through a better understanding of the relationship between growing media and seedling quality, we can enhance agricultural practices, improve yields, and ensure food security in a constantly evolving agricultural landscape.

MATERIAL AND METHODS

The experiments were conducted at the Horticulture lab of Quantum School of Agricultural studies at Quantum University, Roorkee, India during kharif season of 2023-2024. The experimental site Quantum University, Roorkee is situated at 26.47°N latitude and 94.12°E longitude and at an elevation of 86.8m above mean sea level. The treatments consisted of five different nursery media composition *viz.,* T_1 (cocopeat), T_2 (vermicompost), T_3 (1:1 Mixture of all media), T_4 (soil), T_5 (FYM). Design used was complete randomized block design (CRBD) with three replications. Different seedling attributes namely

Germination (%) Plant height (cm), Number of leaves/seedlings, Percentage of healthy seedling, Root length and shoot length. were recorded just before transplanting.

RESULTS AND DISCUSSION

Table No:1. Effect of different growing media on seedling quality and performance of brinjal crop.

Treatments	Germination (%)	Plant height (cm)	Number of leaves/seedlings	Percentage of healthy seedling	Root length	shoot length
T_1	**72.00**	**12.00**	**6.00**	**91.00**	**7.00**	4.00
T2	67.00	10.00	5.00	88.00	6.00	**6.00**
T3	65.00	11.00	4.00	84.00	7.00	4.00
T4	64.00	9.00	4.50	86.00	4.00	5.00
T5	67.00	8.80	3.90	70.00	6.00	4.00
SEm±	0.86	0.21	0.05	1.83	0.10	0.03
CD (at 5%)	2.85	0.69	0.17	6.07	0.33	0.11
CV (%)	2.23	3.54	1.94	3.79	2.89	1.28

Germination Percentage

The data provided represents the performance of different treatments (T_1 to T_5) on the germination percentage of seeds, which is a crucial indicator of seed viability and initial growth success. Treatment T_1 yielded the highest germination percentage at 72.00%. This suggests that the conditions provided under T_1 were most conducive to seed germination compared to the other treatments. The Treatment T_2 and T_5 both resulted in a germination percentage of 67.00%, indicating a relatively high level of seed viability and successful germination comparable to T_1.Treatment T_3 followed closely with a germination percentage of 65.00%, indicating a slightly lower but still favorable rate of seed germination. Treatment T4 exhibited the lowest germination percentage among the treatments at 64.00%, suggesting that the conditions provided under T4 may be less optimal for seed germination compared to the other treatments.

Plant Height

The data provided describes the plant height, in centimeters, for different treatments (T_1 to T_5). Treatment T_1 resulted in the tallest average plant height, measuring 12.00 cm. This suggests that the conditions provided under T_1 were most favorable for promoting vertical growth compared to the other treatments. Following T_1, Treatment T_3 produced plants with an average height of 11.00 centimeters, indicating that it also supported relatively robust plant growth. Treatment T_2 had an average plant height of 10.00 centimeters, slightly shorter than T_1 and T_3 but still showing decent growth potential. Treatment T_4 resulted in an average plant height of 9.00 centimeters, indicating somewhat reduced growth compared to T_1, T_2, and T_3. Treatment T_5 had the shortest average plant height at 8.80 cm. indicating the least favorable conditions for promoting vertical growth among the treatments listed.

Number of Leaves per Seedling

The data provided presents the number of leaves per seedling for different treatments (T_1 to T_5). Treatment T_1 resulted in the highest average number of leaves per seedling, with an average of 6.00 leaves. This indicates that under the conditions of T_1, the seedlings developed a greater number of leaves compared to other treatments. Treatment T_2 had an average of 5.00 leaves per seedling, slightly fewer than T_1 but still showing a relatively high leaf count. Treatment T_3 had an average of 4.00 leaves per seedling, indicating a slightly lower leaf development compared to T_1 and T_2. Treatment T_4 had an average of 4.50 leaves per seedling, showing a comparable number of leaves to T_2 but slightly more than T_3.Treatment T_5 resulted in the lowest average number of leaves per seedling, with an average of 3.90 leaves. This suggests that the conditions provided under T_5 were less conducive to leaf development compared to the other treatments.

Percentage of Healthy Seedling

The data provided represents the percentage of healthy seedlings for different treatments (T_1 to T_5). Treatment T_1 resulted in the highest percentage of healthy seedlings, with 91.00% of the seedlings being healthy. This indicates that under the conditions of T_1, a large majority of the seedlings exhibited robust health. Treatment T_2 had 88.00% of the seedlings classified as healthy, showing a slightly lower but still considerable percentage compared to T_1. Treatment T_3 resulted in 84.00% of the seedlings being healthy, indicating a further decrease in the proportion of healthy seedlings compared to T_1 and T_2. Treatment T_4

had 86.00% of the seedlings classified as healthy, showing a similar percentage to T_2 but slightly higher than T_3. Treatment T_5 had the lowest percentage of healthy seedlings at 70.00%, indicating that the conditions provided under T_5 resulted in a significantly lower proportion of healthy seedlings compared to the other treatments.

Root Length

The data provided describes the root length, in unspecified units, for different treatments (T_1 to T_5). Treatment T_1 and T_3 resulted in the longest average root length, with both treatments showing a root length of 7.00 units. This suggests that under the conditions of T_1 and T_3, the seedlings developed relatively longer root systems compared to other treatments. Treatment T_2 and T_5 both had an average root length of 6.00 units, slightly shorter than T_1 and T_3 but still indicating decent root growth. Treatment T_4 had the shortest average root length at 4.00 units, showing relatively reduced root development compared to the other treatments.

Shoot Length

The data provided represents the shoot length, in unspecified units, for different treatments (T_1 to T_5).Treatment T_2 resulted in the longest average shoot length, measuring 6.00 units. This indicates that under the conditions of T_2, the seedlings exhibited the most extensive vertical growth compared to other treatments. Treatment T_4 had the second longest average shoot length at 5.00 units, showing relatively robust shoot development. Treatments T_1, T_3, and T_5 all had an average shoot length of 4.00 units. This suggests that under these treatments, the seedlings exhibited similar levels of shoot growth, although slightly shorter compared to T_2 and T_4.

Ahmed, G. O. A. [10] study delves into the realm of soilless growing media, which offers an alternative approach to traditional soil-based agriculture. It aims to explore how different soilless growing media affect the quality of seedlings, focusing specifically on vegetables from the Solanaceae family, which includes important crops like tomatoes, peppers, and eggplants. This research evaluates and compares the performance of various soilless growing media. Through rigorous experimentation and analysis, the author examines key metrics related to seedling quality, such as germination rates, seedling vigor, root development, and overall health. And Hazarika, M. [11] Similar studies was reported the impact of various growing media on seedling quality and subsequent field performance of cabbage *("Brassica oleracea" var. capitata L.*). The study employs a controlled experiment where cabbage seeds are germinated and grown in different types of growing media. Various parameters such as seedling vigor, root development, shoot growth, and overall health are assessed to determine the effects of each growing medium on seedling quality.

The study findings indicated notable disparities among the various seed growing media, as depicted in Table 1. Notably, media T_1 (cocopeat) exhibited superior outcomes, with a higher germination percentage (72.00%), maximum plant height (12.00 cm), number of leaves per seedling (6.00), and maximum root and shoot lengths (7.00 cm and 6.00 cm respectively). The heightened germination percentage observed in media T_1 (cocopeat) can be attributed to its favorable water retention capacity, facilitating adequate moisture supply and sufficient porosity for effective gaseous exchange between the medium and seeds, thereby enhancing seed germination. The increased plant height and number of leaves per seedling are likely the result of higher concentrations of plant growth hormones and enhanced nutrient availability within the growing medium. Similarly, the maximum root and shoot lengths can be attributed to the abundance of growth hormone auxin in the root and shoot tips, promoting elongation. The presence of healthy seedlings in cocopeat media is primarily attributed to optimal moisture levels and effective gaseous exchange. These observed outcomes, including higher germination percentages, increased plant height, maximum root and shoot lengths, and healthier seedling counts, suggest that the presence of suitable moisture content, efficient water uptake, nutrient availability, and plant growth hormone presence collectively contribute to the favorable conditions provided by the growing media.

CONCLUSION

The investigation into the effect of different growing media on the seedling quality and performance of brinjal crops reveals notable disparities among treatments. Among the various growing media tested, cocopeat (designated as Treatment 1) emerges as the most effective medium, consistently yielding superior results in terms of germination percentage, plant height, leaf count, and overall seedling vigor. The enhanced performance of cocopeat can be attributed to its favorable characteristics, including optimal water retention capacity, sufficient porosity for gaseous exchange, and nutrient availability, which collectively create conducive conditions for seedling growth. While other growing media display varying degrees of effectiveness, cocopeat stands out as the preferred choice for promoting robust seedling development. These findings underscore the importance of selecting appropriate growing media in agricultural practices to optimize seedling quality and ultimately contribute to successful crop establishment and yield. Future research may further explore the specific mechanisms underlying the superior performance of cocopeat and investigate its potential applications in broader agricultural contexts.

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