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Effect of different growing media on germination & seedling growth of jackfruit (*Artocarpus heterophyllus* Lam.) cv. Siddu

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Abstract

The present investigation entitled “Effect of Different Growing Media on Germination and Seedling Growth of Jackfruit (*Artocarpus heterophyllus* Lam.)” was conducted during 2025–2026 at the Department of Horticulture, SHUATS, Prayagraj, to evaluate the influence of different organic growing media on germination and seedling growth. The experiment was laid out in a Randomized Block Design (RBD) with nine treatments and three replications. Observations were recorded on germination percentage, days to seedling emergence, chlorophyll content, seedling height, number of leaves, leaf length, stem girth, leaf area, and Leaf Area Index (LAI). Among the treatments, T₈ (Soil + Vermicompost + Rice Husk + Sawdust + Bone Meal) produced the highest germination (84.00%), earliest seedling emergence (14.95 days), maximum chlorophyll content (70.84), seedling height (28.99 cm), number of leaves (10.77), leaf length (15.11 cm), stem girth (1.53 mm), leaf area (86.57 cm²), and LAI (0.87) at 90 DAS. The superior performance of T₈ was attributed to improved nutrient availability, moisture retention, and aeration provided by the combined organic amendments. The study concludes that the integrated use of vermicompost, rice husk, sawdust, and bone meal with soil is an efficient and sustainable growing medium for producing healthy and vigorous jackfruit seedlings under nursery conditions.

Keywords: *Artocarpus heterophyllus*, growing media, germination, vermicompost, rice husk, sawdust, bone meal, seedling growth

Introduction

Jackfruit (*Artocarpus heterophyllus* Lam.) is an important tropical fruit crop belonging to the family Moraceae and is widely cultivated in tropical and subtropical regions, particularly in India, Bangladesh, Sri Lanka, Indonesia, and Thailand. India is one of the leading producers of jackfruit, where the crop is valued for its nutritional, economic, and ecological significance. The fruits are rich in carbohydrates, vitamins, minerals, dietary fibre, and antioxidants, while the seeds, leaves, wood, and latex have considerable food, medicinal, and industrial uses. Despite its immense potential, jackfruit remains an underutilized fruit crop due to the limited availability of quality planting material and standardized nursery production techniques (Singh *et al.*, 2020) [20].

The production of healthy and vigorous seedlings is a prerequisite for successful orchard establishment. Although vegetative propagation methods are available, seed propagation remains the most common and economical method for raising jackfruit seedlings. However, jackfruit seeds are recalcitrant in nature and rapidly lose viability after extraction from the fruit, necessitating immediate sowing under favourable nursery conditions. Seed germination and early seedling growth are greatly influenced by the physical, chemical, and biological characteristics of the growing medium, making the selection of a suitable medium essential for producing high-quality planting material (Kumar & Singh, 2019) [10, 21].

Growing media provide physical support to developing seedlings and regulate moisture availability, aeration, nutrient supply, and root development. An ideal growing medium should possess adequate porosity, good water-holding capacity, low bulk density, optimum pH, and sufficient nutrient availability while supporting beneficial microbial activity and remaining free from soil borne pathogens (Patil *et al.*, 2018) [15].

Conventional nursery soil often exhibits poor aeration, compaction, inconsistent nutrient availability, and disease incidence, which adversely affect germination and seedling vigour. Consequently, the use of organic amendments and agricultural by-products as components of growing media has gained considerable attention for improving nursery performance (Singh *et al.*, 2021)^[19].

Among the various organic amendments, vermicompost is recognized as an excellent source of essential macro and micronutrients, humic substances, enzymes, and beneficial microorganisms that enhance nutrient availability, stimulate root growth, and improve seedling vigour (Das & Borthakur, 2021)^[5]. Rice husk, an abundantly available agricultural by-product, improves aeration, drainage, and moisture regulation due to its porous structure (Kumar *et al.*, 2017). Sawdust, when used in appropriate proportions with nutrient-rich amendments, enhances porosity and water-holding capacity, thereby promoting better root development. Bone meal, a slow-release organic source of phosphorus and calcium, plays a vital role in root initiation, cell division, and early seedling establishment (Reddy *et al.*, 2019)^[18].

The combined use of these organic materials can substantially improve the physical, chemical, and biological properties of nursery media. Soil provides structural support and mineral nutrients, vermicompost enhances fertility and microbial activity, rice husk and sawdust improve aeration and moisture retention, while bone meal supplies essential phosphorus and calcium for root development. Such integrated media combinations create a favourable root-zone environment that promotes rapid germination, vigorous seedling growth, and improved physiological performance (Meena *et al.*, 2020)^[12].

Materials and Methods

Experimental details

The present investigation entitled “Effect of different growing media on germination and seedling growth of jackfruit (*Artocarpus heterophyllus* Lam.) cv. Siddu” was conducted during the year 2025-26 in the Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The study aimed to evaluate the influence of various growing media on germination and early seedling development of jackfruit under nursery conditions. The experiment was laid out in a Randomized Block Design (RBD), comprised nine treatments, including one control, to evaluate the effect of different growing media on germination and seedling growth of jackfruit. The control treatment (T₀) consisted of garden soil alone. Treatment T₁ comprised soil and bone meal mixed in a 2:2 ratio, while T₂ consisted of soil and vermicompost (2:2). Treatment T₃ included soil and rice husk (2:2), whereas T₄ comprised soil and sawdust (2:2). Treatment T₅ consisted of soil, vermicompost, and bone meal mixed in a 2:1:1 ratio, T₆ included soil, vermicompost, and rice husk (2:1:1), and T₇ comprised soil, vermicompost, and sawdust (2:1:1). The final treatment, T₈, consisted of an integrated growing medium containing soil, vermicompost, rice husk, sawdust, and bone meal in equal proportions (1:1:1:1:1).

Seed sowing and treatment application

Healthy, disease-free, and uniform seeds of jackfruit cv. Siddu were selected for the experiment. The seeds were cleaned thoroughly and treated with a suitable fungicide to minimize fungal infection before sowing. Polybags of uniform size were filled with the respective growing media prepared according to the treatment combinations. The treatments comprised T₀ (soil alone as control), T₁ (soil + bone meal, 2:2), T₂ (soil + vermicompost, 2:2), T₃ (soil + rice husk, 2:2), T₄ (soil + sawdust, 2:2), T₅ (soil + vermicompost + bone meal, 2:1:1), T₆ (soil + vermicompost + rice husk, 2:1:1), T₇ (soil + vermicompost + sawdust, 2:1:1), and T₈ (soil + vermicompost + rice husk + sawdust + bone meal, 1:1:1:1:1). The media were thoroughly mixed to ensure uniformity before filling the polybags. Three seeds were sown in each polybag at a depth of 2–3 cm, followed by light irrigation. The seedlings were maintained under uniform nursery conditions with regular irrigation and intercultural operations throughout the experimental period. Observations on germination and seedling growth parameters were recorded at regular intervals according to the experimental schedule.

Observations recorded

Observations on germination and seedling growth were recorded at regular intervals throughout the experimental period. Germination percentage was calculated based on the number of seeds germinated out of the total seeds sown, while the days required for seedling emergence were recorded from the date of sowing until the appearance of the first seedling. Chlorophyll content was measured using a SPAD chlorophyll meter on fully expanded leaves at 90 DAS. Seedling height, number of leaves, leaf length, stem girth, leaf area, and Leaf Area Index (LAI) were recorded at 30, 60, and 90 Days after Sowing (DAS). Seedling height was measured from the collar region to the apical tip, stem girth was determined using a digital Vernier caliper, and leaf length was measured with a ruler. Leaf area was estimated using the formula Leaf Area = Leaf Length × Leaf Width, while Leaf Area Index (LAI) was calculated by dividing the total leaf area per plant by the ground area occupied by the seedling. All recorded observations were statistically analyzed to evaluate the effect of different growing media on the germination and growth performance of jackfruit seedlings.

Result and discussion

Germination percentage (%)

The data presented in the table 1. showed that the germination percentage was significantly influenced by different growing media combinations. Among the treatments, T₈ (Soil + Vermicompost + Rice Husk + Sawdust + Bone Meal) recorded the highest germination percentage (84.00%), followed by T₆ (83.58%) and T₅ (80.57%), whereas the lowest germination (41.23%) was observed in the control (T₀). The enhanced germination under integrated organic media may be attributed to improved moisture retention, aeration, and nutrient availability, which created a favorable environment for seed germination. Similar findings have been reported by Ahmed *et al.*, (2021) and Banik *et al.*, (2019)^[1, 3].

Days to seedling emergence

Significant differences were observed among the treatments for days required for seedling emergence (Table.1). The earliest emergence was recorded in T₈ (14.95 days), whereas the control (T₀) required the maximum time (23.25 days). The incorporation of vermicompost and organic amendments enhanced moisture availability and metabolic activities, resulting in faster germination and emergence. These findings are in agreement with the reports of Kumar *et al.*, (2018) and Nath *et al.*, (2017)^[11, 13].

Seedling height (cm.)

Seedling height increased progressively with crop growth and was significantly influenced by different growing media at 30, 60, and 90 DAS (Table.1). At 30 DAS, the maximum seedling height was recorded in T₈ (11.45 cm), followed by T₇ (11.04 cm), while the minimum was observed in T₀ (4.15 cm). Similarly, at 60 DAS, T₈ (23.00 cm) recorded the highest value, followed by T₇ (22.45 cm), whereas the control recorded 12.23 cm. At 90 DAS, the highest seedling height (28.99 cm) was recorded in T₈, followed by T₇ (28.50 cm) and T₆ (27.64 cm), while the lowest (18.68 cm) was observed in T₀. The superior growth under integrated media could be attributed to enhanced nutrient availability, better root development, and improved physical properties of the growing medium. Similar observations were reported by Patil *et al.*, (2018) and Islam *et al.*, (2016)^[9, 15].

Number of leaves

The number of leaves was significantly affected by different growing media throughout the study period (Table.1). At 30 DAS, the highest number of leaves was recorded in T₈ (2.58), followed by T₇ (2.38), while the control recorded only 1.24 leaves. At 60 DAS, T₈ (5.84) remained superior, followed by T₇ (5.70), whereas T₀ recorded 3.02 leaves. At 90 DAS, the highest number of leaves (10.77) was recorded in T₈, followed by T₇ (10.49) and T₆ (10.27), while the minimum (4.82) was observed in the control. Improved nutrient availability and favorable growing conditions promoted vegetative growth and leaf production in the integrated media treatments. These findings corroborate the results of Rahman *et al.*, (2018) and Paul *et al.*, (2021)^[16, 17].

Leaf length (cm.)

Table 2. Represents that the Leaf length varied significantly among the treatments at different growth stages. At 30 DAS, the maximum leaf length was recorded in T₈ (2.37 cm), followed by T₇ (2.07 cm), while the minimum (1.37 cm) was observed in the control. At 60 DAS, the highest leaf length (7.90 cm) was also recorded in T₈, followed by T₇ (7.54 cm), whereas the control recorded 3.19 cm. At 90 DAS, T₈ (15.11 cm) remained significantly superior, followed by T₇ (14.04 cm), while the lowest (7.12 cm) was observed in T₀. Enhanced leaf expansion may be attributed

to balanced nutrition, improved water availability, and better root activity provided by the organic media combinations. Similar results were reported by Chowdhury *et al.*, (2018) and Das *et al.*, (2019)^[4].

Leaf area (cm.²)

Leaf area was significantly influenced by the different growing media combinations (Table.2). The highest leaf area (86.57 cm²) was recorded in T₈, followed by T₇ (79.36 cm²), whereas the lowest (32.46 cm²) was recorded in the control. The increase in leaf area may be attributed to enhanced nutrient availability, improved photosynthetic activity, and better vegetative growth under integrated organic media. These findings are consistent with those of Pant *et al.*, (2009) and Singh *et al.*, (2010)^[14, 21].

Leaf area index (LAI)

Table 2. Revealed that the Leaf Area Index (LAI) differed significantly among the treatments. The maximum LAI (0.87) was recorded in T₈, followed by T₇ (0.79), while the minimum (0.32) was observed in the control. Higher LAI indicated improved canopy development and greater light interception, which ultimately enhanced seedling growth and vigor. Similar observations have been reported by Gruda (2012) and Li *et al.*, (2024)^[7].

Chlorophyll content (SPAD)

Growing media significantly affected the chlorophyll content of jackfruit seedlings (Table.1). The highest chlorophyll content (70.84 SPAD) was recorded in T₈, followed by T₇ (69.62 SPAD), while the lowest value (46.12 SPAD) was observed in the control. The higher chlorophyll content may be due to improved nitrogen availability and balanced nutrient supply from vermicompost and other organic amendments, which enhanced chlorophyll biosynthesis. Comparable results were reported by Arancon *et al.*, (2007) and Ho Wang *et al.*, (2014)^[2, 14].

Stem girth (mm.)

A significant increase in stem girth was observed with the application of different growing media (Table.2). At 30 DAS, the maximum stem girth was recorded in T₈ (0.65 mm), followed by T₇ (0.61 mm), while the minimum (0.24 mm) was observed in the control. At 60 DAS, T₈ (0.95 mm) recorded the highest stem girth, followed by T₇ (0.93 mm), whereas the control recorded 0.46 mm. At 90 DAS, the highest stem girth (1.53 mm) was observed in T₈, followed by T₇ (1.48 mm) and T₄ (1.35 mm), while the lowest (0.95 mm) was recorded in the control. The integrated use of vermicompost, rice husk, sawdust, and bone meal improved nutrient uptake and stem development, resulting in sturdier seedlings. Similar findings were reported by Singh *et al.*, (2021) and Reddy *et al.*, (2019)^[18, 19].

Table 1: Effect of different growing media on growth attributes of jackfruit seedling

Treatments	Germination (%)	Days to Seedling Emergence	Seedling Height (cm)			Number of Leaves			Chlorophyll Content (SPAD)
			30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	
T ₀ Control (soil)	41.23	23.25	4.15	12.23	18.68	1.24	3.02	4.82	46.12
T ₁ Soil + bone meal	70.02	20.37	5.37	14.4	22.43	1.53	4.35	9.5	57.1
T ₂ Soil + vermicompost	70.89	20.59	8.36	19.07	25.37	1.98	5.02	9.59	60.82
T ₃ Soil + Rice husk	79.34	21.72	7.04	16.93	23.6	1.94	5.04	9.69	55.26
T ₄ Soil + Saw dust	71.23	20.51	6.95	16.78	23.73	1.73	4.61	9.18	56.57
T ₅ Soil + vermicompost + bone meal	80.57	20.74	9.08	20.66	27.08	2.07	5.07	9.9	57.39
T ₆ Soil + vermicompost + rice husk	83.58	21.9	10.16	21.49	27.64	2.22	5.45	10.27	54.75
T ₇ Soil+ vermicompost + sawdust	80.22	19.81	11.04	22.45	28.5	2.38	5.7	10.49	69.62
T ₈ Soil + vermicompost + rice husk + saw dust + bone meal	84	14.95	11.45	23	28.99	2.58	5.84	10.77	70.84
F-Test	S	S	S	S	S	S	S	S	S
S.E.M (±)	0.81	0.34	0.04	0.08	0.05	0.03	0.03	0.05	0.62
C.D. at5%	2.45	1.02	0.13	0.25	0.18	0.1	0.11	0.17	1.87
C.V	1.93	2.88	0.94	0.77	0.41	3.19	1.34	1.09	1.84

Table 2: Effect of different growing media on growth attributes of jackfruit seedling

Treatment	Leaf Length (cm)			Stem Girth (mm)			Leaf Area (cm ²)	Leaf Area Index
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	90 DAS	(90 DAS)
T ₀ -Control (soil)	1.37	3.19	7.12	0.24	0.46	0.95	32.46	0.32
T ₁ Soil + bone meal	1.51	5.21	11.58	0.47	0.85	1.25	51.2	0.51
T ₂ Soil + vermicompost	1.8	7.01	13.17	0.5	0.83	1.29	60.45	0.6
T ₃ Soil + Rice husk	1.74	5.29	11.95	0.43	0.82	1.18	54.18	0.54
T ₄ -Soil + Saw dust	1.56	6.94	12.52	0.54	0.89	1.35	56.74	0.56
T ₅ Soil + vermicompost + bone meal	1.88	7.44	13	0.56	0.83	1.28	63.52	0.63
T ₆ Soil + vermicompost + rice husk	2	7.14	12.85	0.55	0.87	1.31	68.41	0.68
T ₇ Soil+ vermicompost + sawdust	2.07	7.54	14.04	0.61	0.93	1.48	79.36	0.79
T ₈ Soil + vermicompost + rice husk + saw dust + bone meal	2.37	7.9	15.11	0.65	0.95	1.53	86.57	0.87
F-Test	S	S	S	S	S	S	S	S
S.E.M (±)	0.05	0.11	0.15	0.01	0.015	0.008	0.82	0.011
C.D. at5%	0.16	0.35	0.47	0.03	0.04	0.02	2.48	0.033
C.V	5.19	3.2	2.23	3.7	3.25	1.08	2.12	2.45

Conclusion

The present study demonstrated that different growing media significantly influenced the germination and growth of jackfruit (*Artocarpus heterophyllus* Lam.) seedlings. Among all the treatments, T₈ (Soil + Vermicompost + Rice Husk + Sawdust + Bone Meal) consistently produced the highest germination, earliest seedling emergence, and superior growth attributes, including chlorophyll content, seedling height, number of leaves, leaf length, stem girth, leaf area, and leaf area index. The improved performance was attributed to enhanced nutrient availability, moisture retention, and better physical properties of the growing medium. Therefore, the integrated use of soil, vermicompost, rice husk, sawdust, and bone meal is recommended as an effective and sustainable growing medium for raising healthy and vigorous jackfruit seedlings under nursery conditions.

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