Original Research Article

Effect of potting media on seed germination and seedling growth of jackfruit *(Artocarpusheterophyllus)* under Pryagraj Agro climatic condition

Abstract

The present study aims to investigate the **Effect of potting media on seed germination and seedling growth of jackfruit** at the Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, during the period 2023-24. The experiment was laid in completely randomized block design with three replications and ten treatment combinations. viz, T0 Control(soil), T1 (Soil + FYM + cocopeat)(3:1:1), T2 (Soil + vermicompost + cocopeat)(2:1:2), T3 (Soil + FYM + cocopeat)(1:1:3), T4 (Soil + FYM + vermicompost)(1:2:1), T5 (Soil + vermicompost)(1:1), T6 (Soil + FYM + vermicompost)(1:1:1) T7 (Soil + FYM + vermicompost)(2:2:2), T8 (Soil + FYM)(2:2), T9 (Soil + vermicompost)(2:2). The seeds were kept in moist area so seed do not dry. The seeds were then sown in the pre-filled polybags and various parameters related to Germination Parameters, Growth Parameters, Economics and Survival were evaluated. Present investigation found that treatment **T9(Soil + vermicompost)(2:2).** Performed best in term of Germination percentage, Number of leaves, Plant height, Leaf length, Chlorophyll content and stem Diameter. The lowest observation was recorded in T1 (Control)(soil). The highest **B:C** Ratio (2.23**)** was found in the same treatment

Keywords: FYM, Cocopeat, Vermicompost, Jackfruit.

1.Introduction

Germination is a critical stage in the life cycle of plants, marking the transition from seed to seedling and laying the foundation for subsequent growth and development. Jackfruit *(Artocarpus heterophyllus)*, a tropical fruit tree native to South and Southeast Asia, is renowned for its large, sweet, and aromatic fruits. Propagation of jackfruit often begins with the germination of its seeds, a process that can be influenced by various factors, including the germination medium used.

In horticulture, the choice of germination medium plays a pivotal role in providing optimal conditions for seedling emergence and early growth. Different media offer varying levels of moisture retention, aeration, and nutrient availability, thereby influencing the germination success rate and subsequent seedling vigor. Understanding the characteristics of different germination media is essential for growers seeking to propagate jackfruit seedlings efficiently [2,16,17,18].

In this context, this paper explores the diverse range of media commonly utilized for germinating jackfruit seeds. From traditional methods to modern innovations, each medium offers unique advantages and considerations for promoting successful germination and establishing healthy seedlings. By examining the characteristics and outcomes associated with different germination media, growers can make informed decisions to optimize the germination process and enhance the overall success of jackfruit propagation [1].

Healthy soil creates healthy plants that are less vulnerable to pests and disease. Healthy soil sticks together and has a sponge-like structure. It holds moisture and prevents erosion.

Holds necessary nutrients for plant growth,filters rainwater and regulates its discharge. Buffers against pollutants,protecting groundwater quality, Improves moisture retention. Reduces soil erosion, enhances nutrient absorption and Protects against pathogens and insects.

Using FYM in agriculture offers many benefits to farmers. For example, FYM can create a nutrient-rich environment in the soil, allowing plants to better absorb water and minerals.

Increases soil fertility, a natural source of available nitrogen, FYM adds humus and slowreleasing nutrients to the soil, aids water and nutrient retention helps break down heavy soils, adds structure to light and sandy soils, and attracts worms.

The major benefits of Vermicompost to plants is Vermicompost nutrients are easily available for the plants to uptake minerals and nutrients. Vermicompost is less cost rather than other fertilizers. It is very easy to produce or prepare Vermicompost. Any farmer can make Vermicompost at their own fields.

Promotes Aeration and Reduces Erosion: The earthworms' action in the composting process creates tiny channels in the soil, which improves aeration and reduces soil erosion.

Helps soil retain moisture, can kill some pathogens, boosts the nutrients available to plants, helping seeds to germinate more quickly, grow faster, develop better root systems and produce higher yields, Increases microorganism populations and suppresses pests.

Benefit of cocopeat

Cocopeat keeps the soil free of weeds. It has a neutral soil pH. Peat is acidic. Cocopeat offers better moisture retention and aeration. It provides good resistance against root diseases.

Increased Water Capacity Cocopeat can increase the water holding capacity of your potting mix, at the same time that it also increases the porosity of your soil.

It requires very less cocopeat and has better nutrient absorption. Thus this experiment aimed to evaluate best potting media of jackfruit for good seed germination and survival percentage and to estimate the economics of different treatment combination of jack fruit seedling.

2.Materials and Methods

The present investigation was carried out in the department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology and Sciences which is located in Prayagraj and it is situated in the south-east part of Uttar Pradesh 2023- 24 India. Prayagraj falls under agroclimate zone IV which is named as “middle Gangetic plains” the site of experiment is located at 25.57º N latitude 81.51º E longitude and 98 meter above the sea level the temperature falls down as low as 4-5ºc during winter, the average rainfall in this area is around 798.900 mm annually with maximum concentration during July to September with few showers and drizzles in winter also.

Randomized Block Design was used to set up the experiment, and nine treatments were reproduced three times. The nine treatments consist ofT0 Control(soil), T1 (Soil + FYM + cocopeat)(3:1:1), T2 (Soil + vermicompost + cocopeat)(2:1:2), T3 (Soil + FYM + cocopeat)(1:1:3), T4 (Soil + FYM + vermicompost)(1:2:1), T5 (Soil + vermicompost)(1:1), T6 (Soil + FYM + vermicompost)(1:1:1) T7 (Soil + FYM + vermicompost)(2:2:2), T8 (Soil + FYM)(2:2), T9 (Soil + vermicompost)(2:2).Effect of potting media were applied at the time of seed sowing and observations were recorded on Germination percentage, Number of leaves, Plant height, Leaf length, Chlorophyll content and stem Diameter.

Table 1: Treatment details

Treatment	Treatment Composition	
T_0	Control	
T_1	Soil + FYM + cocopeat	(3:1:1)
T_2	Soil + vermicompost + cocopeat	(2:1:2)
T_3	Soil + FYM + cocopeat	(1:1:3)
T_4	Soil + FYM + vermicompost	(1:2:1)
T_5	Soil + vermicompost	(1:1)
T_6	Soil + FYM + vermicompost	(1:1:1)
T_7	Soil + FYM + vermicompost	(2:2:2)
T_8	Soil + FYM	(2:2)
T_9	Soil + vermicompost	(2:2)

2.1 Observations Recorded

The following observations were recorded and average was computed at growing successive stages.

2.1.1 Germination (%)

The germination percentage refers to the proportion of seeds that successfully sprout and begin to grow under specific conditions. It is commonly expressed as a percentage and is calculated by dividing the number of germinated seeds by the total number of seeds tested, then multiplying by 100.

Here's the formula:

$$\text{Germination percentage} = \frac{\text{Number of germinated seeds}}{\text{Total number of seeds}} X100$$

2.1.2 Plant Height (cm)

A measuring scale was used to measure the height of the plant from ground level to the tip of the seedling at different intervals i.e. 30, 60, 90 Days after germination and 30 days after transplanting.

2.1.3 Numbers of leaves per seedling

Total number of leaves is counted in all treatments each replications at 30, 60, 90 DAS.

2.1.4 Leaf length (cm)

Measuring scale is used for the measurement of leaf length. To measure it the scale was aligned along the midrib of the leaf, starting from the base to the tip, and the measurement was recorded in centimetres (cm) at different intervals i.e. 30, 60, 90.

2.1.5 Stem Girth (cm)

Girth of the stem was measured with the help of digital vernier calliper at 90 Days after germination.

2.1.6 Chlorophyll Content (SPAD Value)

Chlorophyll is the most important pigment for photosynthesis and growth. The determination of chlorophyll content in plant leaves can be used to investigate plant physiological and nutritional status, and consequently has important implications on crop stress. Chlorophyll content was measured after 90 days after germination with the help of SPAD meter.

2.1.7 Cost of Cultivation (Rs.)

The cost of cultivation refers to the total expenses incurred in growing. It encompasses all the costs associated with various inputs and activities involved in the cultivation process.

2.1.8 Gross income (Rs.)

Gross return, also known as gross revenue, refers to the total income generated. Gross return is calculated by multiplying the quantity of agricultural produce sold by its selling price per unit.

Here's the formula for calculating gross return:

$$\text{Gross Return} = \text{Quantity of Produce Sold} \times \text{Selling Price per Unit}$$

2.1.9 Net income (Rs.)

Net return refers to the profit remaining after deducting all expenses, including production costs and overhead, from the gross revenue generated.

The formula for calculating net return is:

$$\text{Net Return} = \text{Gross Return} - \text{Total Production Costs} - \text{Overhead Expenses}$$

2.1.10 B:C ratio

The Benefit-Cost Ratio (B:C ratio) is a financial metric used to assess the profitability or economic viability of an investment or project. B:C ratio is commonly used to evaluate the returns generated.

The B:C ratio is calculated by dividing the total benefits of the investment by the total costs:

$$\text{B:C Ratio} = \frac{\text{Total Bene its}}{\text{Total Costs}}$$

Result and Discussion

Germination %, Days to required initial germination, and chlorophyll content all showed in the data **(Table 1).** Result on potting media indicated that T1 (Soil + FYM + Cocopeat) recorded the minimum germination% (38.80%) over all other treatment where as Treatment T9 (Soil + vermicompost) was found to be maximum germination% (88.80%).

Result on potting media indicated that T1 (Soil + FYM + Cocpeat) recorded the minimum number of days required for initial germination (14.12 days) over all other treatment where as Treatment T9 (Soil + vermicompost) was found to be maximum number of days(18.89 days).

Result on potting media indicated that T1 (Soil + Fym + Cocpeat) recorded the minimum number of chlorophyll content (44%) over all other treatment where as Treatment T9(Soil + vermicompost) was found to be maximum number chlorophyll content (69%).

Seeds of jackfruit are germinated with vermicompost, FYM, cocopeat they increasing cell wall plasticity and provided better water absorption, metabolic activity increases, respiration ramps up. Oxygen is consumed, and carbon dioxide is released as the embryo converts stored energy into usable forms then emergence of the radicle, which is the embryonic root. It grows downward into the soil, anchoring the emerging plant and absorbing water and nutrients from the soil. After this Cotyledon Expansion takes palceit produces true leaves help in photosynthesis[7].Root System and Shoot is established. Then maturation takes place with sufficient growth and development, the seedling matures into an adult plant capable of reproduction. environmental factors such as temperature, light, and soil conditions play crucial roles in regulating germination[5].

Table 1. Effect of potting media on Germination %, Days to germinate and chlorophyll content of jackfruit.

Treatment Notion	Treatment details	Germination %	Days to required initial germination	Chlorophyll content
T0	Control	44.57	19.65	55.5
T1	Soil + FYM + cocopeat (3:1:1)	38.80	14.12	44.6
T2	Soil + vermicompost + cocopeat (2:1:2)	72.20	19.58	55.4
T3	Soil + FYM + cocopeat (1:1:3)	66.50	18.87	60.1
T4	Soil + FYM + vermicompost (1:2:1)	77.60	19.77	55.4
T5	Soil + vermicompost (1:1)	61.23	17.60	56.8
T6	Soil + FYM + vermicompost (1:1:1)	78.57	18.97	58.8
T7	Soil + FYM + vermicompost (2:2:2)	83.33	19.17	54.7
T8	Soil + FYM (2:2)	77.53	18.30	69.4
T9	Soil + vermicompost (2:2)	88.80	21.18	69.7
F-Test		**S**	**S**	**S**
S.Ed (+)		**0.11**	**1.07**	**0.67**
C.D. at 5%		**0.32**	**2.24**	**1.42**

Leaf length, Stem Diameter all showed in the data **(Table 2).** Result on potting media indicated that T1 (soil + FYM + cocopeat) recorded the minimum leaf length in seedlings in 30 days (1.3cm), 60 days (4.7cm) and 90 days (10.6cm) respectively.Whereas T_9 (soil + vermicompost) was found to be maximum height of seedlings 30 days (2.1cm), 60 days(7.8cm) and in 90 days (14.1cm) respectively.

Result on potting media indicated that T1 (soil + FYM + cocopeat) recorded the minimum stem diameter inseedlings in 30 days (0.2mm), 60 days (0.2mm) and in 90 days (0.8mm) respectively whereasT_9 (soil + vermicompost) was found to be maximum height of seedlings 30 days (0.7mm), 60 days(0.9mm) and in 90 days (1.7mm) respectively.

Leaf length and stem diameter jackfruit seedlings is increased by vermicompost and cocopeat by adding these nutrients ability is smother by the cocopeat but vermicomposthavemore nutrient availability. and provided better water absorption, metabolic activity increases and respiration ramps up.pH RegulationCocopeat tends to have a slightly acidic to neutral pH, which is generally suitable for most plants. Proper pH levels ensure optimal nutrient uptake, which can impact overall plant growth, including leaf and stem development [1].

Table 2. Effect of potting media on Leaf Length, Stem Diameter of jackfruit.

	Leaf Length (cm)			**Stem Diameter (mm)**		
Treatment Notion	**30DAYS**	**60DAYS**	**90DAYS**	**30DAYS**	**60DAYS**	**90DAYS**
T_0	1.5	6.6	11.3	0.3	0.5	1.4
T_1	1.3	4.7	10.6	0.2	0.2	0.8
T_2	1.4	7.7	13.1	0.4	0.7	1.1
T_3	1.8	5.1	11.4	0.4	0.6	1.1
T_4	1.4	6.9	13.2	0.5	0.6	1.5
T_5	1.6	7.4	12.9	0.5	0.7	1.7
T_6	1.9	6.8	11.9	0.6	0.7	1.4
T_7	1.5	7.1	12.3	0.5	0.7	1.7
T_8	1.9	6.6	13.2	0.5	0.7	1.2
T_9	2.1	7.8	14.1	0.7	0.9	1.7
F-Test	**S**	**S**	**S**	**S**	**S**	**S**
S.Ed (±)	**0.12**	**0.19**	**0.11**	**0.08**	**0.10**	**0.15**
C.D. at 5%	**0.56**	**0.14**	**0.22**	**0.18**	**0.21**	**0.31**
C.V	**9.28**	**4.24**	**1.04**	**20.75**	**19.64**	**13.64**

Height of seedlings, Number of leaves on seedlings all showed in the data **(Table 3).** Result on potting media indicated that T1 (soil + FYM + cocopeat) recorded the minimum height of seedlings in 30 days (4.2cm), 60 days (14.8cm) and in 90 days (21.2cm) respectively where as T9 (soil + vermicompost) was found to be maximum height of seedlings 30 days (11.4cm), 60 days(23.5cm) and in 90 days (25.1cm) respectively.

Result on potting media indicated that T1 (soil + FYM + cocopeat) recorded the minimum number of leaves on seedlings in 30 days (1.2), 60 days (2.8) and in 90 days (4.5) respectively whereas T_9 (soil + vermicompost) was found to be maximum number of leaves on seedlings in 30 days (1.7), 60 days(4.07) and in 90 days (6.3) respectively

Higher number of leaves per plant and height of plant is might be due to invigoration of physiological process of plants by help of vermicompost to form new leaves at faster rates and thus increased vegetative growth that could have attributed to higher metabolic activities, enhanced growth and better aeration. And the potting media was vermicompost it helps in stem diameter by the nutrition get from vermicompost[5].

Table 3. Effect of potting media on Height of seedlings, Number of leaves on leaves on jackfruit seedlings

	Height of seedlings (cm)			**Number of leaves on seedlings**		
Treatment	**30DAYS**	**60DAYS**	**90DAYS**	**30DAYS**	**60DAYS**	**90DAYS**
T_0	4.7	15.1	22.2	1.3	3.5	5.4
T_1	4.2	14.8	21.2	1.2	2.8	4.5
T_2	7.3	20.6	22.3	1.4	3.7	6.2
T_3	10.5	19.4	23.6	1.4	3.9	5.6
T_4	7.9	20.4	25.1	1.5	3.1	5.3
T_5	7.3	20.3	22.8	1.3	3.9	5.2
T_6	10.1	20.2	23.3	1.4	3.8	6.1
T_7	8.6	20.9	24.2	1.5	3.7	5.9
T_8	7.1	22.1	22.1	1.2	3.1	5.3
T_9	11.4	23.5	25.1	1.7	4.07	6.3
F-Test	**S**	**S**	**S**	**S**	**S**	**S**
S.Ed (±)	**1.07**	**0.25**	**0.19**	**0.12**	**0.27**	**0.21**
C.D. at 5%	**2.24**	**0.53**	**0.59**	**0.25**	**0.56**	**0.41**
C.V	**6.69**	**1.57**	**1.48**	**10.27**	**9.28**	**4.24**

Total cost of cultivation, Gross return, net return and B:C ratio seedlings all showed in the data **(Table 4)** Result on potting media indicated that Benefit cost ratioformaking1000polybagforT1(Soil+FYM+ cocopeat)islow (2.02) hence giving less return but T9 (soil + vermicompost) Is heigh (2.23) with high returns.

T1Soil + FYM + cocopea (3:1:1) has the lowest B:C ratio (2.02) in comparison with rest of treatments. But the T9 has the best B:C ratio (2.23) in comparison with others respectively.

Table 4.Total cost of cultivation, Gross return, net return and B:C ratio of jackfruit seedlings.

Treatment	Fixed cost (Rs)	Variabe cost (Rs)	Total cost of cultivation/1 000 polybags	Selling price (Rs)	Gross return (Rs)	Net return (Rs)	B:C
T0	4650	0	10398	50	22200	11802	2.13
T1	4650	70	10174	53	20664	10390	2.02
T2	4650	140	19213	55	49710	20447	2.06
T3	4650	160	17197	55	36630	19433	2.13
T4	4650	110	20537	55	42735	22198	2.08
T5	4650	120	16191	57	34827	18636	2.15
T6	4650	110	19092	57	41154	22062	2.14
T7	4650	160	22259	58	48314	26055	2.17
T8	4650	170	20806	58	45066	24260	2.16
T9	4650	180	23828	60	53280	29452	2.23

Conclusion

From the present investigation it is concluded that treatment T9 (Soil + vermicompost) performed best in terms of germination %, number of day to germinate, leaves per plant, height of seedlings, leaf length, stem diameter, chlorophyll content, and in economic difference of jackfruit seedling under Pryagraj agro-climatic condition.

The maximum benefit cost ratio was observed in the same treatment with 2:2.

Reference

1. **Arvind, R.K. (2014).** Effect of different growing media and containers on seed germination and seedling growth of papaya (*Carica papaya L.*) cv. Madhubindu. *Unpublished M. Sc. (Agri.) Thesis*, Anand Agricultural University, Anand, Gujarat, India.
2. **Bhardwaj, R.L. (2014).** Effect of growing media on seed germination and seedling growth of papaya cv. 'Red lady'. *African Journal of Plant Science***8**(4): 178-184.
3. **Doijode, S.D. (2001).***Seed Storage of Horticultural Crops*, Food Products Press. An Imprint of the Haworth Press, Inc., New York, London. pp. 73-76.
4. **Geetha, R., Selvakumari, A. and Sujatha, K. (2007).**Evaluation of mango stones under nursery conditions. *Plant Archives***7**(2): 697-698.
5. **Jyoti, and Beniwal, B.S. (2016).**Effect of different growing media on seed germination and seedling growth of papaya (*Carica papaya L.*). *Unpublished M.Sc. Thesis*, CCS Haryana Agricultural University, Hisar, Haryana, India.
6. **Meena, V.D., Dotaniya, M.L. Coumar, V., Rajendiran, S., Ajay Kundu, S. and Rao. A.S. (2014).** A case for silicon fertilization to improve crop yields in tropical soils. *Proceedings of Notational Academy of Sciences India Sect Biological Sciences* **84**: 505-518.
7. **Panchal, G.P., Parasana, J.S., Patel, S.R. and Patel, M.V. (2014).** Effect of different growing medias and level of IBA on growth and development of Kharni (*ManilkarahexandraRoxb*) seedlings cv. Local. *Global Journal of Bio-Science and Biotechnology***3**(4): 379-383.
8. **Panse, V.G. and Sukhatme, P. V. (1995).** Statistical *Methods for Agricultural Workers*, Fourth edition, Indian Council of Agricultural Research, New Delhi, India.
9. **Phutankar, N.R. (2013).** Effect of packaging and storage conditions on storage of jackfruit. *Unpublished M.Sc.* (*Agri.*) *Thesis.* Dr. BalasahebSawant Konkan KrishiVidyapeeth, Dapoli, Maharashtra, India.
10. **Prajapati, D.G., Satodiya, B. N., Desai. A. B. and Nagar, P.N. (2017**). Influence of storage period and growing media on seed germination and growth of acid lime seedlings (*Citrus aurantifolia Swingle*) cv. Kagzi. *Journal of Pharmacognosy and Phytochemistry***6**(4): 1641-1645.
11. **Purwantoro, R. S. (2016).** Effect of growing media on seed germination and seedling growth of *Aganopeheptaphyllua*. *Nusantara Bioscience***8**(2): 150 154.
12. **Ramteke, V., Paithankar, D.H., Ningot, E.P. and Kurrey, V. K. (2015**). Effect of GA3 and propagation media on germination, growth and vigour of papya (*Carica papaya L.*) cv. Coorg Honey Dew. *The Bioscan***10**(3): 1011-1016.
13. **Rice, E.L. (1979).** Allelopathy- an update. *Botanical Review* **45**: 15-109
14. **Bihari, M., Surya Narayan and Rakesh Kumar (2009).** Effect of growing mediaon seed germination, rate of seed germination, transplanting success and seedling mortality in Aonla (Emhlicaofficinalis Garten.). *Journal of Interacademicia***13**(4): 408-411.
15. **Babu, K. D., Patel, R. K., Singh, A., Yadav, D. S., Singh, A., Yadav, D. S., De, L.C. and Deka, B. C. (2010).** Seed germination, seedling growth and vigour of papaya under North

East Indian condition. *Acta Horticulture***851**: 299-306.

16. Thakur, Tanya, and Arushi Garg. 2024. “Seed Priming and Media for Enhanced Seedling Growth in Pansy (Viola Tricolor)”. Asian Journal of Soil Science and Plant Nutrition 10 (2):261-68. https://doi.org/10.9734/ajsspn/2024/v10i2283.
17. Yusuf, S. C., N. N. Zakawa, T. D. Tizhe, D. Timon, J. J. Obot, and S. G. Linus. 2019. “Dormancy Breaking and the Influence of Gibberellic Acid on the Early Growth of TamarindusIndica Seedlings in Mubi, Nigeria”. Asian Journal of Soil Science and Plant Nutrition 5 (2):1-6. https://doi.org/10.9734/ajsspn/2019/v5i230063.
18. Gebregiorgs G, Tekeste N, Mengesha B. Germination and seedling growth response of mango (MangiferaIndica L.) cultivars to different nursery potting media. Agriculture & Food Security. 2021 Dec;10:1-1.