

Effect of Potting Media on Seed Germination and Growth of Papaya Seedling (*Carica papaya* L.) cv. Pusa Delicious under Uttar Pradesh Conditions

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Abstract

The present study was conducted to evaluate the effect of different potting media combinations on seed germination and early growth parameters of papaya (*Carica papaya* L.) cv. Pusa Delicious under Uttar Pradesh conditions. The experiment was conducted using Randomized Block Design with seven treatments replicated thrice. The treatments included T0 (Soil Control), T1 (Soil + FYM), T2 (Soil + FYM + Cocopeat 1:1:1), T3 (Soil + FYM + Vermicompost 1:1:1), T4 (Soil + FYM + Sand 1:1:1), T5 (Soil + FYM + Poultry Manure 1:1:1), and T6 (Soil + FYM + Sand + Vermicompost 1:1:1:1). Results revealed that treatment T6 showed superior performance in terms of germination percentage (81.3%) and plant height at 30 DAS (20.5 cm), while T3 demonstrated the highest survival percentage (85.7%) and fastest germination initiation (13 days). The study concludes that potting media enriched with vermicompost significantly enhance seed germination, survival rate, and early seedling growth in papaya cultivation.

Keywords: Papaya, potting media, vermicompost, FYM, seed germination, seedling growth, nursery management

1. INTRODUCTION

Papaya (*Carica papaya* L.) is one of the most important tropical fruit crops belonging to the family Caricaceae, widely cultivated for its nutritional and economic value. The crop is known for its rapid growth, early fruiting, and high productivity, making it an attractive option for farmers in tropical and subtropical regions. In India, papaya cultivation has gained significant importance, with states like Uttar Pradesh showing considerable potential for commercial production.

The variety Pusa Delicious is a gynodioecious cultivar developed by the Indian Agricultural Research Institute (IARI), characterized by medium-tall plants, high fruit quality, and excellent taste. This variety begins yielding within 8-10 months after planting and produces fruits weighing 1-2 kg with superior organoleptic qualities.

Successful papaya cultivation largely depends on the production of healthy and vigorous seedlings in the nursery stage. The choice of appropriate potting media plays a crucial role in determining seed germination percentage, seedling vigor, and subsequent field performance. Various organic amendments such as farmyard manure (FYM), vermicompost, cocopeat, and poultry manure have been extensively studied for their beneficial effects on seed germination and seedling growth:

Vermicompost, being rich in essential nutrients and beneficial microorganisms, has shown remarkable potential in improving soil physical properties and enhancing plant growth¹. Similarly, cocopeat provides excellent water holding capacity and aeration, making it an ideal component for nursery media^{[17][14][18]}. The integration of these organic materials with conventional soil and FYM can create synergistic effects that optimize growing conditions for papaya seedlings.

Poultry manure is a nutrient-rich organic amendment derived from the excreta of poultry birds, and it is widely recognized for its high content of readily available nitrogen, phosphorus, and potassium, as well as essential micronutrients. The rapid mineralization and nutrient release from poultry manure likely contributed to enhanced seedling establishment, though care must be taken to ensure proper composting to avoid phytotoxicity.

Farmyard manure (FYM), composed of decomposed cattle dung, urine, and bedding materials, is a traditional organic fertilizer valued for its ability to improve soil structure, increase microbial activity, and provide a balanced supply of nutrients over time. FYM's gradual nutrient release and improvement of soil physical properties make it an essential component for sustainable nursery management in papaya cultivation.

Despite the widespread cultivation of papaya in Uttar Pradesh, limited research has been conducted on standardizing potting media compositions for optimal seedling production under local agro-climatic conditions. Therefore, this study was undertaken to evaluate the effect of different potting media combinations on seed germination and early growth parameters of papaya cv. Pusa Delicious, with the objective of identifying the most suitable media composition for nursery management under Uttar Pradesh conditions.

2. MATERIALS AND METHODS

2.1 Experimental Site and Design

The present study was conducted during the rainy season of 2023-24 at the horticulture farm of Shri Durga Ji Post Graduate College, Chandeshwar, Azamgarh, in Uttar Pradesh, India. The experiment was laid out in Randomized Block Design (RBD) with seven treatments replicated three times, following standard experimental design principles.

2.2. Treatment Details

The experiment comprised seven different potting media combinations as follows:

Treatment	Media Composition
T0	Soil (Control)
T1	Soil + FYM (1:1)
T2	Soil + FYM + Cocopeat (1:1:1)
T3	Soil + FYM + Vermicompost (1:1:1)
T4	Soil + FYM + Sand (1:1:1)
T5	Soil + FYM + Poultry Manure (1:1:1)
T6	Soil + FYM + Sand + Vermicompost (1:1:1:1)

2.3. Seed Material and Preparation

High-quality seeds of papaya cv. Pusa Delicious were procured from a certified source. Before sowing, seeds were treated with fungicide and pre-soaked to enhance germination potential.

2.4. Nursery Management

Polythene bags of 15 cm × 20 cm size, each with proper drainage holes, were used as containers for raising papaya seedlings in this experiment. The bags were filled with the respective potting media as per the treatment combinations. Two seeds were sown per polybag, ensuring uniform sowing depth and spacing to promote healthy and even seedling emergence. For each treatment in every replication, a total of fifty seeds were sown, reflecting careful experimental design and adequate

sample size for statistical analysis. The nursery was maintained under green shade net to protect young seedlings from direct sunlight and excessive rainfall, with regular irrigation and standard cultural practices followed throughout the study to ensure optimal conditions for germination and seedling growth.

3. Data Collection

The following parameters were recorded during the study:

1. Germination Parameters:

- Number of seeds germinated
- Germination percentage
- Days to first germination
- Days to 50% germination

2. Growth Parameters:

- Survival percentage at 30 days after sowing (DAS)
- Plant height at 30 DAS (cm)

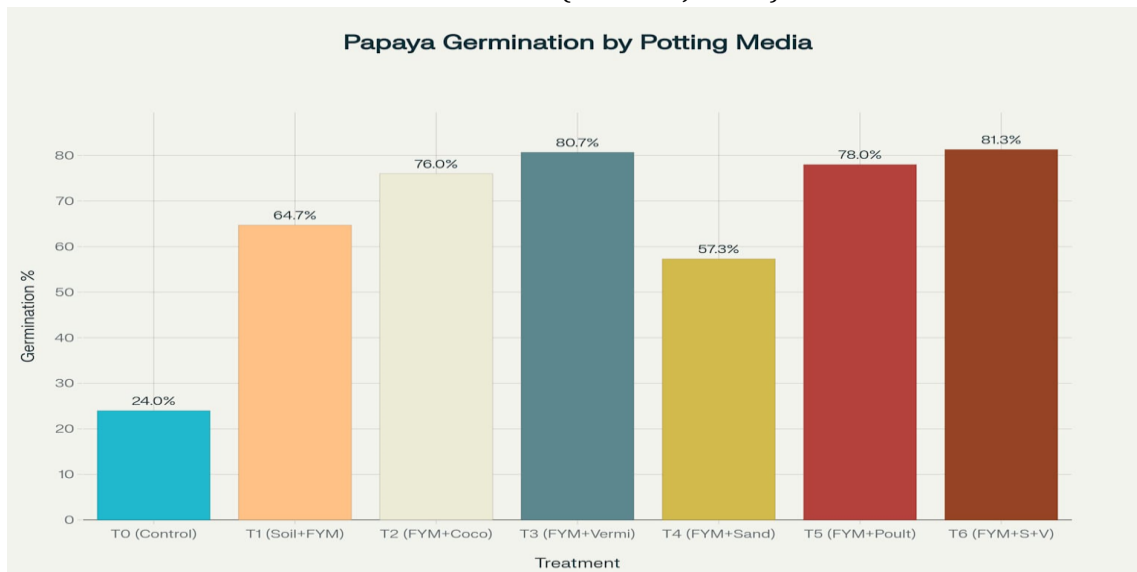
3. Statistical Analysis:

Data were subjected to analysis of variance (ANOVA) using appropriate statistical methods for RBD. Treatment means were compared using standard error and critical difference values at 5% level of significance.

4. RESULTS AND FINDINGS

4.1. Germination Parameters

The study revealed significant differences among treatments for all germination parameters studied. Treatment T6 (Soil + FYM + Sand + Vermicompost) recorded the highest germination percentage of 81.3%, followed by T3 (Soil + FYM + Vermicompost) with 80.7%. The control treatment (T0) showed the lowest germination percentage of 24.0%, which was significantly inferior to all other treatments.

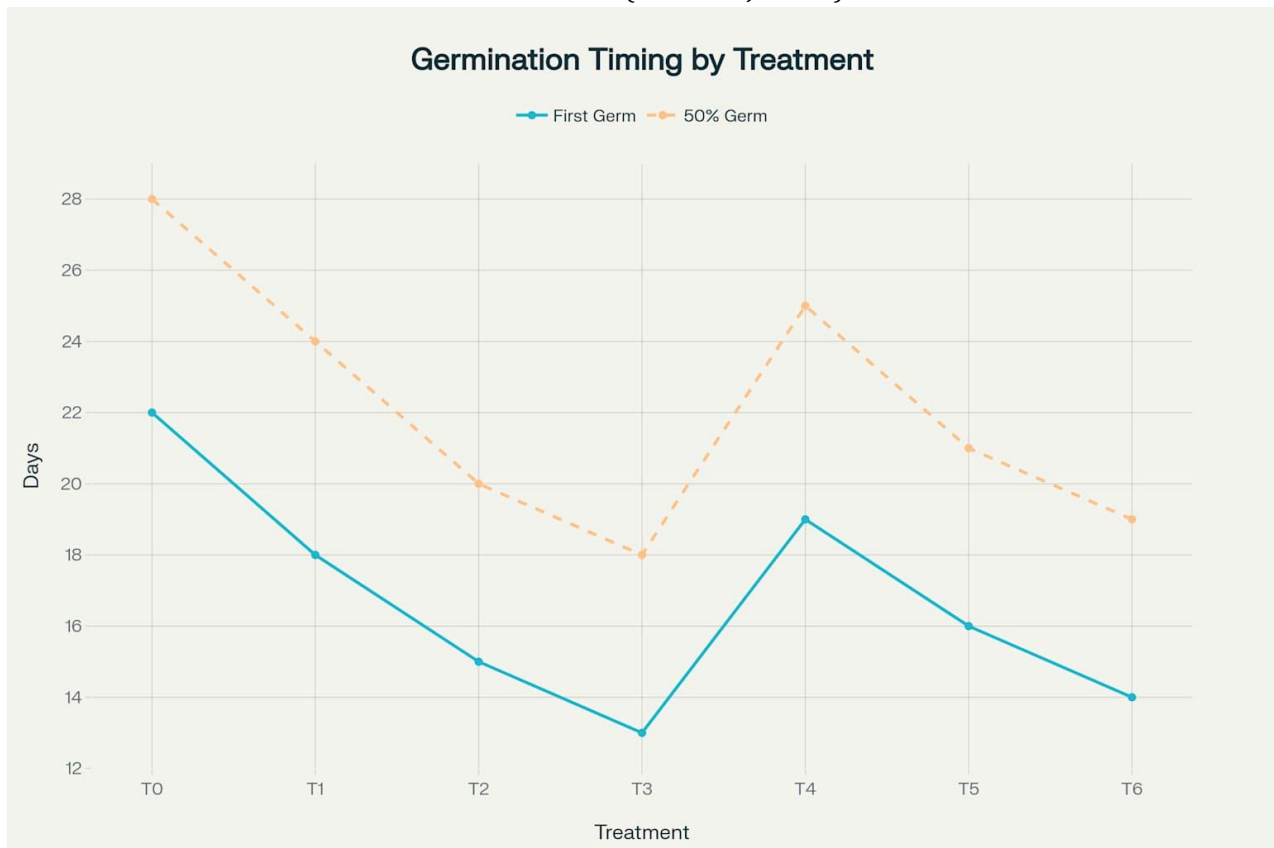


Germination percentage of papaya seeds under different potting media treatments, showing that T6 (Soil + FYM + Sand + Vermicompost) achieved the highest germination rate at 81.3%

The mean number of germinated seeds ranged from 12.0 in T₀ to 40.7 in T₆, demonstrating the substantial impact of organic amendments on germination success. Treatments containing vermicompost (T₃ and T₆) consistently outperformed other combinations, indicating the beneficial role of vermicompost in promoting seed germination.

4.2. Germination Timing

Days to first germination varied significantly among treatments, with T₃ showing the earliest germination at 13 days, followed by T₆ at 14 days. The control treatment (T₀) exhibited delayed germination, taking 22 days for initial emergence. Similarly, days to 50% germination ranged from 18 days in T₃ to 28 days in T₀, highlighting the acceleration effect of organic amendments on germination processes.

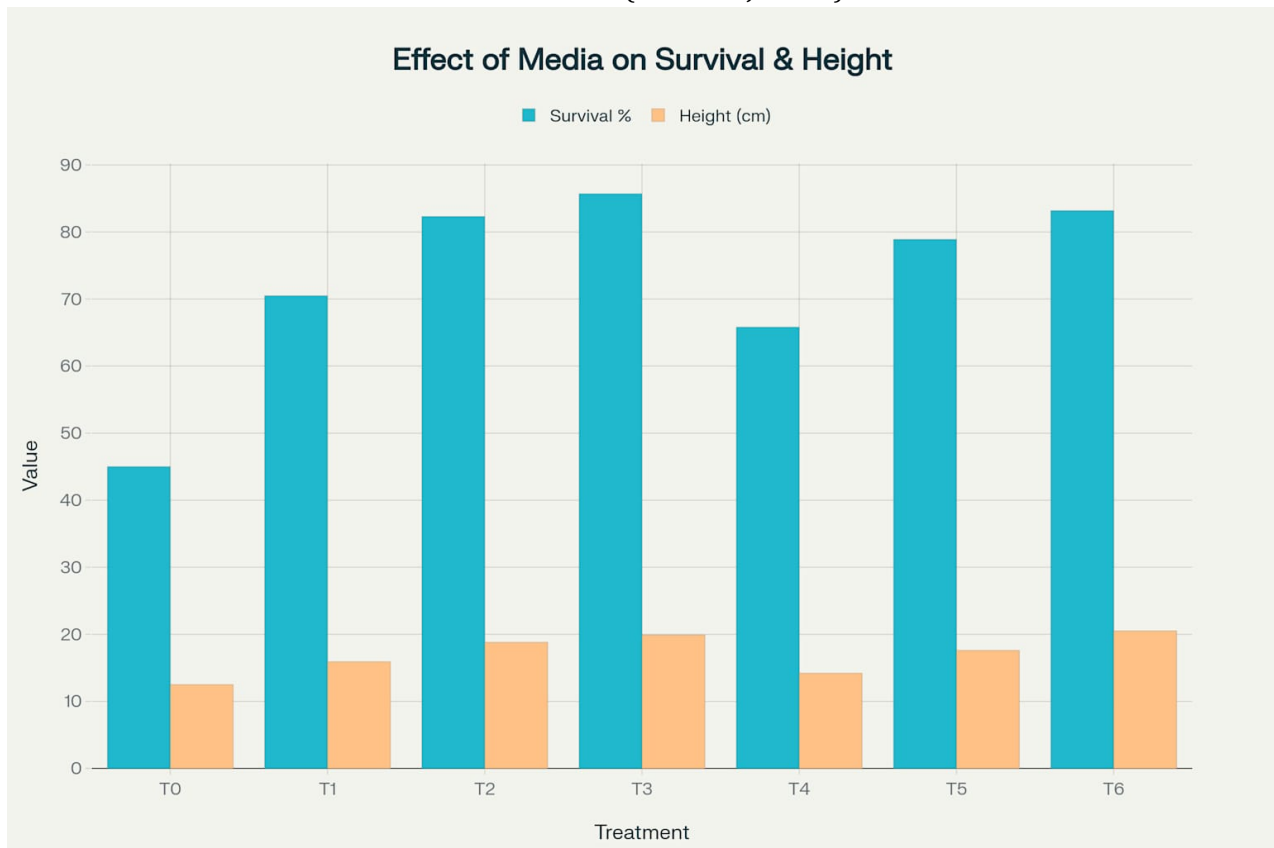


Germination timing response showing that treatments with vermicompost (T₃ and T₆) resulted in the fastest germination initiation and completion

4.3. Survival and Growth Parameters

Survival percentage at 30 DAS showed remarkable variation among treatments. T₃ recorded the highest survival rate of 85.7%, followed by T₆ with 83.2% and T₂ with 82.3%. The control treatment exhibited poor survival at 45.0%, emphasizing the critical importance of organic matter incorporation in potting media.

Plant height at 30 DAS ranged from 12.5 cm in T₀ to 20.5 cm in T₆. Treatments T₆, T₃, and T₂ produced significantly taller seedlings compared to the control, indicating enhanced vigor and growth potential in organically enriched media.



Comparison of survival percentage and plant height (30 DAS) for papaya seedlings grown in different potting media, demonstrating the superior performance of organic amendments

5. DISCUSSION

5.1. Germination Enhancement

The superior performance of treatments containing vermicompost (T₃ and T₆) can be attributed to the unique properties of vermicompost, including balanced nutrition, improved soil structure, and presence of growth-promoting substances. Vermicompost provides readily available nutrients and creates favorable micro-environmental conditions that facilitate rapid seed germination and emergence.

The inclusion of cocopeat in T₂ also demonstrated significant improvement over the control, supporting previous research indicating its excellent water retention and aeration properties. Cocopeat helps maintain optimal moisture levels while preventing waterlogging, creating ideal conditions for seed germination.

5.2. Growth Promotion

The enhanced plant height and survival rates observed in organically amended treatments align with findings reported in similar studies. The synergistic effect of combining multiple organic components, as seen in T₆, provides comprehensive nutrition and creates optimal rooting environment for young papaya seedlings.

Poultry manure treatment (T₅) showed moderate performance, which could be attributed to its high nutrient content, though proper decomposition and balanced application are crucial for optimal results. The sand components in T₄ and T₆ improved drainage and aeration, contributing to better root development and overall plant health.

5.3. PRACTICAL IMPLICATIONS

The results demonstrate that simple soil-based media are inadequate for optimal papaya seedling production. The incorporation of organic amendments, particularly vermicompost, is essential for achieving commercial-grade nursery production. The superior performance of T₆ suggests that multi-component organic media can provide comprehensive benefits for seedling development.

These findings have significant practical implications for papaya nursery management in Uttar Pradesh, where farmers can adopt these proven media combinations to improve seedling quality and reduce production costs through enhanced survival rates and faster growth.

6. CONCLUSION

Based on the experimental findings, it can be concluded that potting media composition significantly influences seed germination and early growth parameters of papaya cv. Pusa Delicious. Treatment T₆ (Soil + FYM + Sand + Vermicompost 1:1:1:1) emerged as the best performing combination, recording the highest germination percentage (81.3%) and plant height (20.5 cm). Treatment T₃ (Soil + FYM + Vermicompost 1:1:1) demonstrated the highest survival rate (85.7%) and fastest germination initiation.

The study demonstrates that vermicompost-based potting media are superior to conventional soil-based media for papaya seedling production. The incorporation of organic amendments not only improves germination rates but also enhances survival, and early growth, which are critical factors for successful transplanting and subsequent field performance.

For commercial papaya cultivation in Uttar Pradesh, nursery managers are recommended to adopt T₆ or T₃ media combinations to achieve optimal seedling production with higher success rates and improved economic returns.

REFERENCES

1. Annapurna, D., Rathore, T. S., and Joshi, G., Effect of potting medium ingredient and sieve size on the growth of seedling of sandalwood in root trainers. *Indian Forester*. **133(2)**: 179–188 (2007).
2. Pio et al., (2007) Effect of growing media on seed germination and seedlings growth of papaya cv. Red lady. *African Journal of Plant Science*, 8(4): 178-184. Borah, A. S., Nath, A., Ray.
3. Abharim, M., Subair, S., and Ayyappan, P., Effect of different propagation media on seed germination, seedling growth and vigour of nutmeg (*Myristica fragrans*). *J. of Medicinal Plants Res.* **4(19)**: 2054–2058 (2010).
4. Ameri, A., Goldani, M., and Sadeghi, H., Influence of the substrate in germination of litchi seeds. *Rev. Bras. Frutic. Jaboticball.* **26(2)**: 375–376 (2011).
5. Wilson, S. B., Stoffella, P. J., and Graetz, D. A., Use of compost as a media amendment for containerized production of two subtropical perennials. *J. Environ. Hortic.* **19**: 37–42 (2001).
6. Dayeswari, D., Auxilia, J., Malarkodi, K., and Vijayakumar, R. M., Effect of chemicals and bio-inoculants on seedling growth and vigour of TNAU Papaya CO.8 (*Carica papaya L.*). *Int. J. Curr. Microbiol. App. Sci.* **7(3)**: 3007–3014 (2018).
7. Paratap et al., (2015) The effects of substrate and cultivar in quality of strawberry. *J. Biol. Environ. Sci*, 6 (17): 181-188.