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Growth performance of rooted katmon (*Dillenia philippinensis* Rolfe) cuttings in varying vermicast concentrations

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Abstract

The study investigates the growth performance of *Dillenia philippinensis* Rolfe under various levels of vermicast combined with regular soil. The study was conducted at the nursery of the College of Forestry and Environmental Resources Management (CFERM), Nueva Vizcaya State University (NVSU), Bayombong, Nueva Vizcaya. A Completely Randomized Design (CRD) method was used with five (5) treatments and replicated three (3) times. Collected data were tabulated and analyzed with the used of Statistical Tool for Agricultural Research (STAR). The findings of the study revealed that there is no significant difference among the used treatments. However, treatment 5 (pure vermicast) observed with the highest height and diameter while treatment 1 (garden soil) is associated for leaf development. The survival rate of the *D. philippinensis* is manifested to treatment 1 (garden soil). The study gives an insight on the suitable media for the growth performance and survival rate of *Dillenia philippinensis* under various vermicast concentrations.

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Introduction

The *Dillenia philippinensis*, often known as katmon, is an endemic tree species in the Philippines that belongs to the Dilleniaceae family. It is valued for its edible, sour fruit, which is widely utilized in Filipino cuisine and herbal medicine (National Parks Board, n.d). The D. philippinensis has become a focus of conservation and reforestation efforts due to its ecological and economic importance. However, habitat degradation and low natural regeneration rates threaten the species' population (IUCN, 2021). As a result, studying alternative propagation and growing methods, such as soil amendments and organic fertilizers, is essential for sustainable production.

Plant growth and development are heavily influenced by soil fertility levels. Organic amendments such as vermicast, a nutrient-rich byproduct of earthworm activity, have been widely used to enhance soil quality and promote plant health (Domínguez and Edwards, 2011). In addition, vermicast enhances soil structure, microbial activity, and nutrient availability, promoting plant growth and biomass buildup (Lazcano and Domínguez, 2011). Vermicast has been proven in studies to improve seedling vigor and root development in a variety of plant species, making it a suitable soil enhancer for tree propagation (Suthar, 2009). However, there has been limited research on the effects of vermicast on the growth performance of native tree species such as katmon. Hence, understanding how different soil treatments affect its growth can provide insights for better cultivation practices. This study aimed to propagate cloned katmon under varying levels of vermicast concentrations.

Materials and methods

Duration and location of the study

The study conducted at Nueva Vizcaya State University - Bayombong Campus, in the Nursery of College of Forestry, Environmental and Resource Management (CFERM). The site was located at Coordinates: 16°28'47"N 121°8'44"E. Bayombong, Nueva Vizcaya classified as type I climate under the modified Corona's classification system dry season around November to April, and wet season May to October. The study lasted for 90 days, from February 2025 to May 2025.

Experimental design

The study was laid out in a Completely Randomized Design (CRD) and replicated three (3) times. The experiment contains five (5) treatments in this study. The following treatments are (Table 1):

Table 1. Different levels of vermicast concentration per treatment

Treatment	Levels of vermicast
T1	Control
T2	1 soil: 1 vermicast
T3	3 soils: 1 vermicast
T4	1 soil: 3 vermicast
T5	Pure vermicast

Seedling description and preparation

The plant materials used in this study were cloned Katmon seedlings propagated through stem cutting. The cuttings were initially planted in September 2024 under controlled nursery condition. Root initiation was observed in December 2024, indicating successful propagation. At 5 months old cuttings of *Dillenia philippinensis* were considered ready for nursery observation. In February 2025, the seedlings were transplanted into polyethylene bags containing soil mixed with varying concentration of vermicast. The used of various levels of vermicast concentration aimed to evaluate its influence to the growth performance of *Dillenia philippinensis* seedlings for 3 months observations.

Collection of soil and vermicast

The soil was collected at Purok 3, Vista Alegre, Bayombong Nueva Vizcaya. While the vermicast was obtained from the Center for Environmental Resources Management and Sustainable Development (CERMSD), Nueva Vizcaya State University (NVSU).

Preparation of potting media

The soil media and vermicast were measured based on the following ratio: treatment 1 - Control (soil), Treatment 2 - 1:1 (1 soil:1 vermicast), treatment 3 - 3:1

(3 soil: 1 vermicast), treatment 4 - 1:3 (1 soil: 3 vermicast), treatment 5 - Pure vermicast. Afterwards, each rooted katmon was carefully sown in each potted media. The seedlings were placed inside the nursery and watered as needed based on the weather condition. Regular weeding was also performed.

Parameters measured

Survival rate

The percentage of plant's survival was measured after three months. Determination of dead plants when the seedlings observed dried-up. The survival rate was measured and computed using the formula 1 (Bad-e *et al.*, 2020).

Rate of Survival = {(Total No. of Seedlings – No. of dead seedlings)/Total No. of Seedlings} × 100 (1)

Height and diameter of the katmon

Each seedling had been marked at 2 cm high to serve as a reference for measuring its height and diameter. To measure these, the researcher used a meter stick for height (cm) and a digital tree caliper (calibrated in millimeters), and measured every after two weeks.

Number of leaves and leaf area of the plant

The well-developed leaves were counted and recorded every two weeks. For every seedling, two mature leaves were selected: one from the top and one from the base of the plant. Each selected leaf was carefully traced onto paper to replicate its exact shape and size. A 10 cm x 10 cm paper was used to trace each leaf and subjected to a weighting scale to measure the trace leaf weight per gram. To convert the weight of the paper tracings into actual leaf area (cm^2), the formula used by Bad-e *et al.* (2020) was also employed.

Leaf Area = (Area of paper/Weight of each leaf paper)/Mean weight of leaf paper (2)

Data analysis

The data collected tabulated and analyzed with the used of Statistical Tool for Agricultural Research (STAR). The data were subjected to the Analysis of Variance (ANOVA) to establish statistical differences to the treatments used. Also to determine the significant differences among the treatments, the Least Significant Difference (LSD) was used in accordance with the objectives of the study.

Results and discussion

Percent survival

The percent survival of Katmon (*D. philippinensis*) seedlings after 3 months observations is shown in Fig. 1. The katmon seedlings applied varying levels of vermicast shown its effect in terms of percent survival rate. Seedlings applied with garden soil (Treatment 1) showed the highest percent survival obtaining 80%. This was followed by treatment 4 (1 soil; 3 vermicast) with a percent survival of 66.7%. On the other hand, seedlings for treatment 2 (1 soil; 1 vermicast), treatment 3(3 soil; 1 vermicast) and treatment 5 (pure vermicast) obtains a percent survival of 60% respectively.

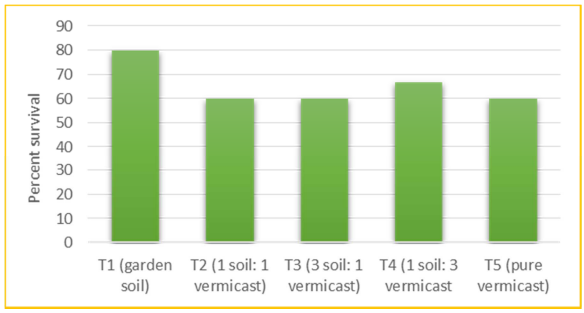

Fig. 1. Percent survival of *Dillenia philippinensis* in 90 days observations under various levels of vermicast concentration

Although there's a slight differences of percent survival rate of Katmon (D. philippinensis) seedlings. However, the data subjected to ANOVA, showed no significant difference among treatments with a p - value of 0.8450.

Height and diameter growth

In Fig. 2, shown the average height and diameter increment of katmon seedlings subjected to various levels of vermicast. The height growth of katmon seedlings subjected to analysis Variance revealed that there were no significant differences influenced by vermicast treatments. Although treatment 5 (pure vermicast) recorded the highest Mean height value of

11.14 cm (Table 2). Katmon Seedlings treated with 3 soils; 1 vermicast (T3) obtained a Mean height value of 11.03 cm. While treatment 2 (1 vermicast;1 soil) where recorded least Mean value of 7.17 cm among the treatment (Table 2). Result shows that higher vermicast applied does not generally mean higher height growth.

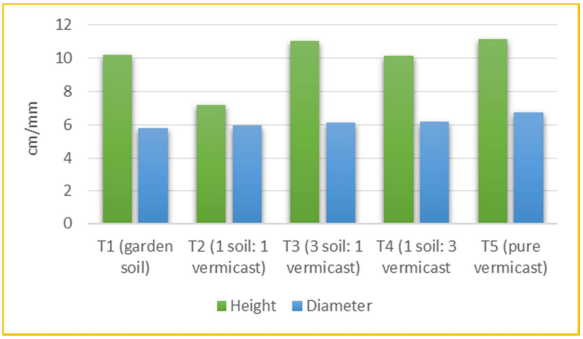

Fig. 2. Mean effect of various levels of vermicast concentration on the height (cm) growth and diameter (mm) of *D. philippinensis* seedlings

Diameter growth: the resulted revealed that seedlings treated with pure vermicast (T5) recorded the highest Mean value of 6.72 mm. While treatment treated with garden soil (T1) recorded least diameter value of 5.79 mm. Based on the analysis of Variance revealed that vermicast treatments has no significant effect on the diameter increment of katmon seedlings.

Table 2 presented the summary results of the growth performance of Katmon, in terms of percent survival rate, height, diameter, number of leaves and leaf area. The study observed with the highest survival rate on the T1(garden soil) at 80 percent, while the lowest was 60 percent in T2, T3 and T5. The results suggest that growing katmon with mixed amendments of soil, vermicast and garden soil is good for the ramet katmon, since it contains micro and macronutrients needed for plant growth and development. In addition, vermicast and garden soil contains high microbial elements which good for nutrient uptakes. According to the study of Atiyeh *et al.* (2000), proved that soil with vermicompost amendments increase nutrient uptake in plants grown. However, sometimes instances pure vermicast is not suggested because of the low soil texture and structure including nutrients content that may affect air and water circulation. In these case vermicast find out that have high water holding capacity which affects root development and produce stunted growth of ramet katmon (Yadav *et al.,* 2018) that may cause high mortality rate.

As for the height of the ramet katmon in three (3) months, it was observed in T5 (pure vermicast) the tallest seedling of 11.14 cm. It was followed by T3 (3:1 soil to vermicast) at 11.03 cm in height. It shows that pure vermicast increase in the height of ramet katmon, this is because of the micro and macronutrients it contains specially for the nitrogen and growth hormones responsible for the growth of height. In the study of Suthar (2009) found out that vermicompost helps in enhancing shoot to elongate due to high content of phytohormes such as auxins and gibberellins. In general, statistically speaking there is no difference/significant in the measured parameters for height.

In addition, for the stem with highest diameter was observed in the treatment 5 (pure vermicast) with 6.72 mm which is similar to height and the lowest manifested in T1 (garden soil) at 5.79 mm. This indicates that with a thicker stem hold strong structural support and better growth performance. According to Arancon *et al.* (2004), with the increasing stem diameter in various crops is due to nutrient content attributed by vermicast.

The number of leaves is manifested in T1 (garden soil) with highest number of leaves among the treatments, followed closely by T5 (pure vermicast) with 4.01. Some study says that garden soil is provides good physical support while vermicast offers nutrient enhancement. The leaves play significant role for the overall growth of a plant (Edwards *et al.,* 2007) Leaves responsible for the process of photosynthesis, gas exchange and transpiration. This means that with high number of leaves the higher it is more productive for flowering and fruiting.

Table 2. Summary table on the growth performance of katmon

Treatments	% survival	Height (cm)	Diameter (mm)	No. of leaves	Leaf area (cm)
T1 (garden soil)	80	10.21	5.79	4.33	87.45212
T2 (1 soil: 1 vermicast)	60	7.17	5.96	2.92	57.69065
T3 (3 soil: 1 vermicast)	60	11.03	6.13	3.33	71.78899
T4 (1 soil: 3 vermicast	66.7	10.17	6.19	3.17	56.3616
T5 (pure vermicast)	60	11.14	6.72	4.01	56.64049
P-value at 5%	0.8450	0.2269	0.5701	0.2828	0.882538
Significant level	Not significant	Not significant	Not significant	Not significant	Not significant

Lastly, the observed treatment with the largest leaf area of 87.45212 cm² is T1 (garden soil), followed by T3 (71.78899cm²). In this case, finding is same on the number of leaves which attributed to T1 and T3. Mainly, both of these treatments are containing high nutrient level that helps and support the development of broad leaf.

In general, although numerical outcome were differences among treatments, indicates that all treatments were not statistically significant. However, it appears that T5 is the leading in terms of enhancing height and diameter, while T1 (garden soil) is potential for survival and leaf development. The balance use/mix of different soil and vermicast produce best growth performances in ramet of Katmon.

Conclusion

Based on the results of the study, the following conclusions were drawn: First, among the different treatments used in the study, Treatment 5 (pure vermicast) has recorded the highest height and diameter, while Treatment 1 (garden soil) is potential for leaf development both increasing number of leaves and leaf area. Second, the survival rate was attributed to Treatment 1 (garden soil) most suitable, and effective for growth development of ramet Katmon. Lastly, after 90 days of observation, there were no significance among the treatment use for the growth performance of Katmon *D. philippinensis*. Therefore, it is recommended that proper care and handling of rooted katmon seedlings—such as temperature, effective drainage, regular weeding, and protection from pests—are essential to ensure uniform growth and reduce mortality. Additional studies are also encouraged to explore the long-term effects of vermicast on *Dillenia philippinensis* growth, including its influence on root biomass, nutrient uptake, soil microbial activity, and resistance to environmental stressors. And, future research may consider comparing vermicast with other organic soil amendments such as compost, biochar, or indigenous microbial concoctions.

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