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Influence of Different Soil Amendments on the Growth Performance of Lipote (*Syzygium polycephaloides* (C.B. Rob.) Merr) Seedlings

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ABSTRACT

Native fruit trees are valuable because they provide local communities with food, nourishment, and source of livelihood but only few are being utilized. *Syzygium polycephaloides* locally known as lipote in the Philippines is a native tree species from the family Myrtaceae. Hence, this study was conducted to determine the percent survival and growth response of this species treated with different soil amendments. There were four treatments namely: control or garden soil alone (Treatment 1), mixture of garden soil and cow dung (Treatment 2), mixture of garden soil and chicken manure (Treatment 3), and mixture of garden soil and sawdust (Treatment 4). Results revealed that height gained, leaf count, root collar diameter, and root length were significantly different among treatments. *S.polycephaloides* seedlings had 100% percent survival except for seedlings applied with chicken manure. Meanwhile, seedlings treated with cow dung gave significant growth response compared to other treatments. As a result, it can be suggested as a soil amendment for lipote seedlings in the nursery given the same set of condition employed in this investigation.

Keywords: Syzygium polycephaloides*, Percent survival, Soil amendments, Growth response, Cow dung*

Introduction

When it comes to preserving the ecosystem's equilibrium, native trees are more significant than introduced species since they protect watersheds, provide habitat for threatened native plant and animal species, and many other benefits (Vallesteros *et al.*, 2023; Llait, 2024). Lipote, also known as *Syzygium polycephaloides* C. B. Rob.) Merr., is a naturally occurring berry tree in the Myrtaceae family that is extensively grown in Southern and Northern Luzon, Philippines, using grafting, cuttings, and seeds (Novotný *et al.*, 2021). It can reach a maximum height of 15 meters and a diameter of 30 centimeters. Fruits can be processed into wine and jam (Cayetano *et al.*, 2023). According to Garino (2021), leaves provide therapeutic effects that can be used to treat diabetes, chronic disorders, cancer, and high blood pressure. Despite its many advantages, populations of this species are in decline due to anthropogenic activities. This species is hardly found in its native habitat. It has also been classified as vulnerable species by the IUCN Red List of Threatened Species for 2020.

Plant growth naturally occurs in soil, but soil alone is unable to provide plants with the nutrients they need. Plants planted in poor soil may also be less able to absorb water and nutrients, as well as produce roots. Soil amendment is a material added to the soil thatcontains both micro and macro nutri-

ents to improve its physical properties, particularly structure, permeability, water infiltration, and water holding capacity (Obi and Ebo, 1995). While soil amendments aid in increasing the water and nutrient holding capacity in sandy soil, they also improve soil aggregation, increase porosity and impermeability, promote aeration, drainage, and rooting depth in clayey soil (Grant, 2021). Compared to organic fertilizers, inorganic fertilizers have immediate nutritional availability, which is why farmers choose to utilize them. Nevertheless, overuse of chemical fertilizers can alter the pH of the soil, boost insect activity, result in acidification and soil crust, decrease beneficial organisms and soil organic carbon, restrict plant development and yield, and even produce greenhouse gases (Krasilnikov *et al*., 2022). When it comes to overapplication, organic fertilizer poses no harm and is less expensive than synthetic fertilizer. Therefore, this study evaluated the percent survival andearly growth performance of lipote seedlings applied with different soil amendments.

Methodology

Experimental setup

The experiment was conducted at Ramada, Maria Aurora, Aurora for 12 weeks (Figure 1). Ninety-six (96) pregerminated seedlings of *S. polycephaloides* of more or less uniform size were transplanted in black polyethylene bags (4" ×4" ×7") filled with heat-sterilized garden soil and pulverized organic amendments such as cow manure, chicken manure,and sawdust. The experiment was laid out following a Randomly Complete Block Design (RCBD) with the following treatments; control or pure garden soil (Treatment 1), mixture of garden soil and cow dung (Treatment 2), mixture of garden soil and chicken manure (Treatment 3) and mixture of garden soil and saw dust (Treatment 4). Four replications were made per treatment with six seedlings comprising each replicate for a total of ninety-six (96) seedlings. Plants were watered as needed. Moreover, monitoring of pest and disease incidences were done.

Determination of percent survival

Percent survivalwas determined by counting the number of seedlings survived divided by the total number of seedlings transplanted multiplied by 100 (Bhardwaj, 2014). Seedlings with driedup aboveground biomass were considered dead based on the procedure of Bad-e *et al*. (2020).

Measurement of growth parameters

Height gained (cm) and root length (cm) were determined using ruler. Root length was measured from the point of origin up to the tip of the elongated roots. Secondary roots were not measured. Root collar diameter (mm) was measured using digital vernier caliper. The root collar was marked at 0.5 cm from the ground with white paint to serve as reference to ensure consistent measurement. Meanwhile, leaf count (LC) were done manually. All measurements common need before transplanting and dur-

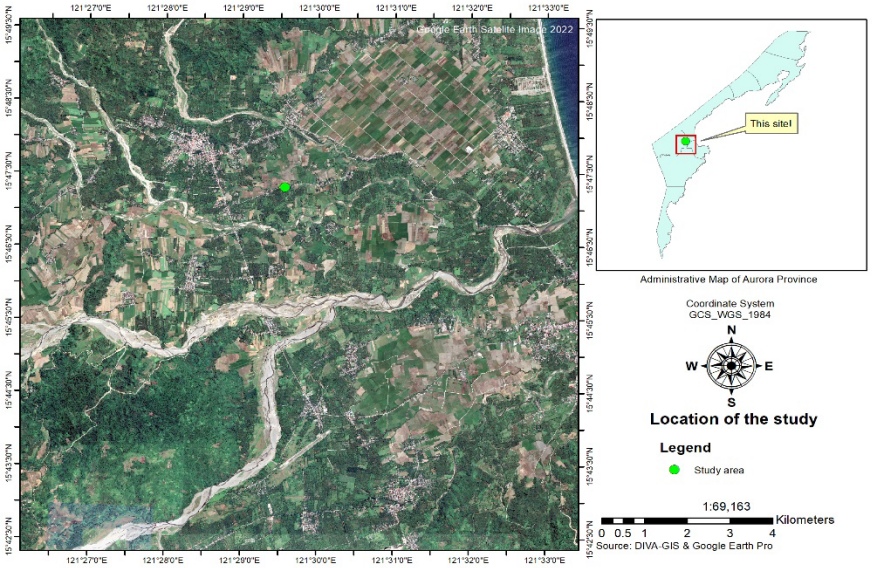

Fig. 1. Location of the study site.

ing the termination of the set-up. The increase in the growth parameters were obtained bysubtracting the initial measurement from the final measurement.

Statistical Analysis

The data gathered were statistically assessed using One-way Analysis of Variance (ANOVA) using IBM SPSS version 27.0.7 to identify the growth performance among different treatments. The ANOVA results with significance were subjected to Duncan Multiple Range Test (DMRT) post hoc analysis with confidence level set at $p< .05$. Results of ANOVA and DMRT post hoc test for each growth parameters are presented in tabular form with corresponding p values.

Results

Table 1 shows the result of One-way ANOVA at 95% confidence level of percent survival and growth response of lipote seedlings applied with different soil amendments.

Result revealed that there is no significant effect in percent survivalacross the four treatments ($p<0.88$). However, all treatments obtained 100% survival except Treatment 3 with 91.66%survival after 12 weeks observation.

Findings show that seedlings applied with cow dung (Treatment 2) performed higher in all parameters measured. Moreover, analysis showed significant differences on the height gained ($p < 0.0000$), leaf count ($p < 0.0117$), root collar diameter ($p < 0.0298$), and root length ($p < .001$). Meanwhile, DMRT post hoc test for height gained revealed that Treatment 1, Treatment 2, and Treatment 4 performed better than Treatment 3. In terms of leaf count and root collar diameter, it was found that Treatment 2 and Treatment 4 had significant difference in Treatment 3. Additionally, DMRT post hoc test for root length revealed that Treatment 2 was found to have significant difference among treatments.

Discussion

Seedlings with slow process development are susceptible to environmental stresses since growth and survival of plants vary considerably. Some tree species are environment sensitive, or even light demanding, while others are shade tolerant. The success of plant growth and survival are the primary goal of any reforestation activities (Di Sacco *et al.*, 2021) therefore, alterations to the natural process such as the application of fertilizers and othersoil amendments are being tested and made available for the use of environmentally friendly initiatives (Wang *et al.*, 2020. As observed, six seedlings from Treatment 3 died before they enter the second month period. As a result, seedlings treated with chicken manure got the least percent survival (91.66%). Similar findings were obtained from the study of Abadayan and Coracero (2024) wherein *Pterocarpus indicus* seedlings applied with poultry manure did not meet 100 percent survival compared to other treatments. This aligns with the information from various literatures which states that chicken manure can burn plant tissues due to its high nitrogen content, which attributed to excessive ammonia (Hue and Silva, 2000; Chaudhry *et al.,* 2013). Moreover, the findings of this study are contradicting to the results of Christophe *et al.* (2019) wherein *Moringa oleifera* treated with chicken manure got 100 percent survival.

The results clearly revealed that cow dung with

Table 1. Results onthe percent survival, height gained, leaf count, root collar diameter, and root length of Lipote seedlings applied with different soil amendments.

Treatment	Percent survival (%)	Height gained (cm)	Leaf count	Root collar diameter (mm)	Root length (cm)
Treatment 1	100 ± 0.00	105.08 ± 3.13^{a}	4.54 ± 1.17^{ab}	0.63 ± 0.08^{ab}	16.50 ± 2.35^{b}
Treatment 2	100 ± 0.00	108.67 ± 3.29^{a}	5.75 ± 1.05^{a}	0.79 ± 0.18^{a}	29.88 ± 1.47^{a}
Treatment 3	91.66 ± 4.08	47.58 ± 3.56^{b}	3.67 ± 2.10^{b}	0.60 ± 0.41^{b}	10.21 ± 0.38^{c}
Treatment 4	100 ± 0.00	99.58 ± 1.72^{a}	5.62 ± 1.75^{a}	0.78 ± 0.17^{a}	18.29 ± 0.17^{b}
DMRT (0.05)	0.88	0.00	0.01	0.02	0.00
Level of significant	Not significant	Significant	Significant	Significant	Significant

In each column, means with the same letter superscript are not significantly different from each other at a 5% level of significance using DMRT.

garden soil greatly provides beneficial effect on the improvement of growth parameters of Lipote seedlings. This could be due to the key nutrients present in cow dung such as N, P, K, Ca, and Mg. The highest mean value for height gained was recorded in seedlings treated with cow dung. The findings are in conformity with the report of Egwunatum *et al.* (2020) wherein *Gambeya albida* seedlings treated with cow dung obtained the highest mean stem heightcompared to poultry manure and goat manure. According to Zaman *et al.* (2017) in their study on *Stevia rebaudiana*, increasing cow dung doses can influence plant height resulted to higher mean average compared to control.However, the results of this study vary from the findings of Imoro *et al.* (2012) in which poultry manure produced the highest mean in shoot height, stem girth, root length, and root girth of *M. oleifera*.

Large number of leaves indicates better growth development of plant. The result of this study is parallel to the result obtained by Zaman *et al.* (2017) in which leaf numbers of the test plants had significant increase after 45-60 days compared to control. In contrast, the study of Adekiya *et al*. in 2022 shown that the control obtained the highest mean in terms of leaf countsince organic fertilizer induce onlythe photosynthesis process and enhance root development but not the leaf production.

Application of cow dung can enhance soil fertility and improve the physical, chemical, and biological properties of the soil (Hatibi and Garantjang, 2022) which help increase the growth and development of lipote seedlings. The result of the conducted study is in support with the study of Marwa (2022)that cow dung increase stem diameter.

Deep roots absorb more nutrients which indicates better development in plant. Prasetyoet al. (2014) stated that the nutrient deficiency and physical characteristics of the soil can be enhance by adding cow manure asithelps in improving the soil physical and chemical condition. The result of this study is in line with the findings of Muktiyanta *et al*. (2018) in which they reported that 781.25g of cow manure applied in soybean had significant difference to control. The same outcome from the study of Uddin *et al.* (2012) on *Acacia auriculiformis*. However, excessive amounts of cow dung can cause detrimental effect on plant cells (Marwa, 2022).

Conclusion

This study provided a demonstration of the percent survival and early growth performance of lipote seedlings applied with different soil amendments. Although there is no significant effect in percent survival across treatments, findings revealed that *S. polycephaloides* can potentially grow well with or without the application of organic fertilizers since all treatments obtained 100% survival except those seedlings applied with chicken manure. In terms of height gained, leaf count, root collar diameter, and root length,*S. polycephaloides* seedlings treated with cow dung outperformed all treatments. Therefore, when soil amendment is required, using moderate amount of cow dung may be recommended.

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Conflict of Interest - None

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