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Research Article

Early Growth of Cloned Lipote (*Syzygium polycephaloides*)

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ABSTRACT

This study aimed to propagate lipote cuttings through clonal propagation using different growth hormones. The clones were raised in a non-misted closed chamber and transplanted into polyethylene bags for observation of their early growth. The growth performance of the clones was analyzed in terms of height, diameter, leaf number, chlorophyll content, leaf area, shoot biomass, root biomass, and total biomass. After three months, the study was terminated, and analysis of variance showed significant differences in percent survival, chlorophyll content, shoot biomass, and root biomass. Treatment 2, which used a mixture of garden soil and vermicompost at a 1:1 ratio, produced the best results in different growth parameters measurements.

Keywords*: Clones, Early growth, Growth performance, Soil conditioner*

Introduction

Native trees greatly protect our watershed and help recover the forest habitats for threatened native species of plants and animals. It also helps to secure the livelihood of local people. Native trees are also much better than exotic species because they adapt naturally to their surroundings and will not prevent other plants to grow and thrive. They also retain their natural ability to create destruction due to violent weather as well as pests and illnesses (DOST, 2015).

Lipote (Syzygium polycephaloides) is a native tree. It is a Philippine indigenous tree and its conservation status is vulnerable. It grows in primary forests at low to medium elevations. The islands with the most trees include Luzon (Cagayan, Laguna, Camarines, Albay, Sorsogon, and Mindoro), Leyte, and Samar. However, lipote is now barely found in its natural habitat. The occurrence of lipote in its natural habitat is currently scarce and many researchers suggested an immediate conservation for this tree. The propagation of lipote should be expanded and conserved for its fruit. Lipote can also serve as a windbreaker and it is known as aesthetically beautiful that makes it as urban tree. It can bear fruit within four to five years after planting. This species is also good for reforestation because of its economic and ecological importance (Florido & Cortiguerra, 2003). Lipote has also been said to have therapeutic benefits that is why residents in the area utilize it to treat diabetes, high blood pressure, and high

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cholesterol. The fruit is also used by the Ifugaos to alleviate coughs (Garrino, 2021).

Soil is a natural medium for plant growth. Unfortunately, the nutrients required by plants cannot be supplied by the soil itself. Poor soil can also limit plant water and nutrient uptake, as well as root development, causing plants to yellow, wilt, dry up, be stunted, and even die. Soil conditioners are soil additions that improve the structure of the soil by improving aeration, water holding capacity, and nutrient availability. They soften compacted, hard pan and clay soils, allowing nutrients to be released. Soil conditioners can also boost or drop pH levels (Grant, 2021). Fertilizer is used by many seedling growers to aid in the growth of their plants. A fertilizer is anything that is given to the soil to enhance the amount of plant nutrient (or plant food). Inorganic or synthetic chemicals must always be paid for in cash, whereas organic or non-synthetic fertilizers include manures, composts, and other materials that are frequently produced by food producers on their own farms. Soils with a high organic matter content requires less fertilizer than light, sandy soils with low organic matter content. The fundamental reason for this is that nutrients are generally leached more easily and quickly from low-organic-matter soils. Clay soils with poor structure require more fertilizer than loams or clay loams. When a plant's production is raised as a result of fertilizer application, that crop is said to respond to that fertilizer under those specific conditions (Winch, 2007).

The study evaluated the early growth of the lipote clones. It would show the initial success of growth of lipote clones in different soil conditioners. Therefore, the ultimate objective of this study was to analyze the growth performance of lipote clones in different soil conditioners. The study evaluated the early growth of the lipote clones. It would show the initial success of growth of lipote clones in different soil conditioners. Therefore, the ultimate objective of this study was to analyze the growth performance of lipote clones in different soil conditioners

The study was conducted at the College of Forestry, Environment and Resources Management Nursery, Nueva Vizcaya State University-Main Campus, Bayombong, Nueva Vizcaya. The duration of the study was three months. The study was performed from March to May 2022. This study showed the assessment of early growth of lipote clones and the best treatment for its growth performance.

Material and Methods

Soil and different treatment collection and analysis

The cow manure, vermicompost, and garden soil (control) were collected and placed in transparent plastic bags with ziplock seals and labeled. All the potting media samples were then sent to the Department of Agriculture Regional Field Office No. 02 in Tuguegarao City, Cagayan for further analysis.

Collection and Preparation of potting media

Different potting media were tested in this study to observe the response of lipote, with garden soil serving as the control group. The garden soil was purchased from a supplier of sand and gravel in Bayombong, Nueva Vizcaya, and was sterilized through 30 minutes of heating. Cow manure was collected from a farm located in Brgy. Magsaysay, Bayombong, Nueva Vizcaya, while vermicompost was obtained from CERMSD. Prior to refining through a 2-mm wire mesh, the potting media were cleaned of debris. The preparation of ratio per treatment was then carried out.

Transplanting and maintenance

After one month of clonal propagation, the rooted cuttings were transplanted directly into an 8" x 6" polyethylene bag filled with the prepared growth medium. Each bag was labeled to facilitate data collection. The clones were placed in the CFERM Nursery and watered as needed based on weather conditions. Regular weeding was also performed to maintain the growth of the lipote clones.

Termination of the Experiment

The study on the early growth of cloned lipote was concluded after three months of observation, during which various growth parameters were analyzed, including percent survival, growth increment, number of leaves, leaf area, fresh weight, shoot biomass, root biomass, total plant biomass, and chlorophyll content.

Data Collection

To determine the percent survival, the number of alive cloned lipote was counted and recorded. Each rooted cutting had been also marked 2 cm high and served as reference point for height and diameter measurements throughout the experiment. Heights and stem diameter were measured monthly using a ruler and caliper (calibrated in millimeter), respectively. The lipote is a winged stem. The wider and thicker side of the stem was marked 1-cm high from the base of plant and measured using caliper. The number of leaves per plant was evaluated at two points in time: at the beginning of planting and at the end of the experiment. Chlorophyll content was determined using chlorophyll content meter 200 plus. It is a reliable leaf absorption style meter. The CCM-200 plus measures the Optical absorbance in two different wavebands: 653nm (Chlorophyll) and 931nm (Near Infra-Red) providing CCI value. The amount of chlorophyll in the 1 cm2 sample region was then calculated (ADC BioScientific, 2019). For leaf area, the fully expanded leaves of experimental plants were selected randomly then were traced on bond paper. The traced leaf papers were cut out, then the weight of each paper was obtained using an analytical weighing scale with precision of .0001 g. The average weight of the paper models was obtained. The area of the second matured leaf from the top of each cloned lipote was obtained by the equation x/y wherein x was weight (g) of the area covered by the leaf outline on a bond paper multiplied by the actual leaf area and y was the constant weight of 25 cm^2 of the same bond paper. The area of the second matured leaf from the top of each clones was obtained by the following equation of Pandey and Singh (2011). The fresh weight was taken using a digital analytical balance right after the harvesting. After that, the shoot and root of cloned lipote was oven dried at 70℃ in an oven within 48 hours. The oven dry weight was taken using a digital weighing balance. Summation of shoot biomass and root biomass

Data Analysis

To assess the significance of the treatments in both Phase I and Phase II of the study, the data underwent Analysis of Variance (ANOVA) testing. To determine the significant differences between treatment means, the Least Significant Difference (LSD) was calculated using the Statistical Tool for Agricultural Research (STAR) application of the International Rice Research Institute (IRRI). STAR was developed using the Eclipse Rich Client Platform (RCP) and R language, specifically for crop scientists. Its user-friendly Graphical User Interface (GUI) provides modules for generating randomization and layout of experimental designs commonly used in crop research, as well as data management and basic statistical analysis such as descriptive statistics, hypothesis testing, and ANOVA of designed experiments.

Results and Discussions

The study on the early growth of lipote using different treatments was carried out utilizing the one hundred (100) surviving lipote rooted cuttings. These clones were subjected to different levels of concentrations of growth hormones. As soon as the root parameters of the lipote clones were measured, the clones were immediately transplanted into the 8" x 6" polyethylene bags. This was done to assess the growth response in terms of stem diameter, height, number of leaves, leaf area, and shoot and root biomass subjected in various soil enhancers. Various treatments were used to stimulate the highest amount of growth possible from lipote clones. However, not all treatments were suitable for lipote clones, resulting in stunted development.

a. Percent Survival

The survival rate of cloned lipote decreased after three months of observation. The Analysis of Variance on percent survival of lipote rooted cuttings revealed significant differences (Table I) using different organic fertilizers. Lipote clones that did not receive any treatment gave the highest percent survival (85%), while the lowest survival rate (50%) was found in the mixture of Garden soil and Vermicompost with the ratio of 1:1 (Treatment 2). Propagation circumstances such as environmental conditions could have a long-term impact on tree viability and growth, as well as enable the tree to adapt to climate change conditions and thrive successfully in the long run (Gudynaite-Franckeviciene et al. 2021). Another factor of mortality were the ants, spiders, bistle worms and earthworms that were found in the soil and leaves of lipote clones.

Table I. Summary Table of Growth Performance of Cloned Lipote

TREATMENTS	HEIGHT (mm)	DIAMETER (mm)	NUMBER OF LEAVES	CHLOROPHYLL CONTENT (nm)	LEAF AREA (cm^2)	SHOOT BIOMASS (g)	ROOT BIOMASS (g)	TOTAL BIOMASS (g)	PERCENT SURVIVAL (%)
T1- Garden Soil	128.50	3.25	2.55	52.42^{a}	161.59	206.39^{bc}	227.44^{d}	433.83^{d}	85%^{a}
T2- Garden Soil + Vermicompost (1:1)	65.65	1.92	1.60	30.12^{b}	52.76	287.60^{a}	692.20^{a}	979.62^{a}	50%^{b}
T3- Garden Soil + Vermicompost (2:1)	73.30	2.13	2.60	27.54^{b}	82.55	184.62^{c}	465.19^{b}	649.81^{b}	55%^{b}
T4- Garden Soil + Cow manure (1:1)	94.30	2.94	2.50	58.98^{a}	63.79	222.93^{abc}	350.69^{c}	573.62^{c}	80%^{a}
T5- Garden Soil + Cow manure (2:1)	84.75	2.67	2.85	38.27^{ab}	117.65	256.08^{ab}	321.24^{cd}	577.31^{bc}	70%^{ab}
p-value at 5%	0.0752	0.0501	0.5942	0.033	0.1053	0.0398	0	0	0.0282
Significant level	**Not Significant**	**Not Significant**	**Not Significant**	**Significant**	**Not Significant**	**Significant**	**Significant**	**Significant**	**Significant**

b. Chlorophyll Content

The analysis of variance on chlorophyll content of cloned lipote showed significant differences (Table I) as influenced by different soil treatments. Highest chlorophyll content was recorded in Treatment 4 (58.98 nm), the mixture of garden soil and cow mature with the ratio of 1:1 while Treatment 3 (27.54nm), the mixture of garden soil and vermicompost had the lowest chlorophyll content. According to Naumann et al. (2008), leaf chlorophyll content is a good indicator of photosynthesis activity, mutations and stress condition. Parallel findings were obtained in the study of Kaleri et. al (2020), which revealed that soil conditioner treatments such as cow dung had no significant effect on chlorophyll content of Bok Choy, and the mixture of dung and beetles showed an increase in the chlorophyll content of the species as compared to the cow dung and control group.

c. Shoot Biomass

The application of soil conditioners had significant effect (Table I) on shoot biomass of lipote rooted cuttings. Highest shoot biomass was found in Treatment 2 (287.6 g), the mixture of garden soil and vermicompost with the ratio of 1:1 while the lowest recorded shoot biomass was in Treatment 3 (184.62 g), the mixture of garden soil and vermicompost with the ratio of 1:1. Same findings with Xue et al. (2022) that there was also a significant interaction between species and soil treatment for the dry weights of shoots, coarse roots, fine roots, total roots, total biomass and the root/shoot ratio of native (*Leptospermum scoparium* and *Podocarpus totara)* and exotic tree species (radiata pine*)*. The effect of vermicompost and compost were not as effective as the chemical fertilizer for the species of radiata pine.

d. Root Biomass

The application of different soil conditioners had high significant effect (Table I) on root biomass of cloned lipote. Highest root biomass was found in Treatment 2 (692.02 g), the mixture of garden soil and vermicompost with the ratio of 1:1 while the controlled (227.44 g) cloned seedings revealed the lowest root biomass. Damtew et al. (2019) reported similar findings that vermicompost had a substantial increase in shoot biomass and root biomass of *Olea europaea*. Olive plants that were planted in vermicompost had better growth that in those grown without vermicompost.

e. Total Biomass

The analysis of variance on Root biomass of lipote rooted cuttings showed highly significant differences (Table I) as affected by the application of different soil treatments. The application of different soil amendments had high significant effect on total biomass of cloned lipote. Highest total biomass was found in Treatment 2 (972.62 g), the mixture of garden soil and vermicompost with the ratio of 1:1 while the control (433.83 g) cloned seedings revealed the lowest total biomass (Figure 21).

f. Height growth, Diameter, Number of leaf and Leaf area

Different treatments did not significantly affect the height growth, diameter, number of leaf and leaf area of cloned lipote (Table I). However, the untreated clones gave the highest mean of height measurement (12.99 cm) while Treatment 2, the mixture of garden soil and vermicompost with the ratio of 1:1 had the lowest mean of height measurement (9.43 cm). The height of the cloned lipote performed better in control and it might be due to too much organic matter present in soil treatments. In contrast with the result, Damtew et al (2019) revealed that adding of 30% vermicompost in soil media of *Oleas europaea* could significantly increase the lipote's leaf number, root collar diameter and plant height over the control. Parallel findings were also observed in the study of Dao et al. (2022) that the effect of vermicompost treatments on height growth of all the species they used (fast-growing *Betula platyphylla* and *Larix kaempferi* and slow-growing *Chamaecyparis obtusa*) was generally faster and greater than control.

Highest mean diameter measurement was found in lipote clones that did not receive any treatments (3.25 mm) while the thinnest measurement was in Treatment 2 (1.92 mm), mixture of garden soil and vermicompost with the ratio of 1:1. The lipote might not need soil treatments for its diameter because untreated cloned lipote had the highest diameter measurement. Similarly, Oyebamji (2018) also used cow manure as mixture on one of their soil media on seedling growth of Tamarind, but all of the soil media they used had no significant effect on the stem diameters across all the periods of growth in the experiment. In a parallel finding, Jibo et al. (2022) found in their study on growth performance (stem diameter, shoot height, number of leaves, root length, root diameter and root shoot ratio) of *Eucalyptus camaldulensis* that using soil amendments with lowest growth was in control (top soil) and the mixture of poultry droppings and cow dung had the second greatest growth. Treatment 5, mixture of garden soil and cow manure with the ratio of 2:1 had the highest leaf production of cloned lipote cuttings while Treatment 2 produced the lowest number of leaves. Even if Treatment 5 had the highest mean number of leaves, it was still not significantly different with other soil treatments. It implies that soil treatment might not help the leaf production of cloned lipote. This did not coincide with the findings of James et al. (2020) that the application of animal manure had a positive effect on the growth of the Tamarind such as plant height, basal girth and number of leaves produced and other leaf parameters including leaf area. Moreover, Gawankar et al. (2019) revealed that the soil growing media they used had a significant effect on number of leaves of jackfruit. The mixture of soil, vermicompost and Cocopeat had the maximum production of leaves.

The control gave the higher leaf area than those lipote clones that received soil treatments. The highest leaf area was recorded at Treatment 1 (161.59 cm^2) while the lowest least area was found in Treatment 2 (52.79 cm^2), using the mixture of garden soil and vermicompost with the ratio of 1:1. Control had the highest leaf area, but it was still not significantly different from other soil treatments. The results of the study were parallel to the findings of Sajana et al. (2018) that the different growing media had significant effect on the leaf area of growing marking nut seedlings. The maximum leaf area on their study was recorded in the treatment of soil mixture that had vermicompost while minimum leaf area was recorded in their soil mixture that contains the mixture of sand and pond soil only.

Conclusion

The application of different soil conditioners gave significant differences on percent survival, chlorophyll content, shoot biomass, root biomass and total biomass lipote rooted cuttings. Untreated lipote clones gave the highest survival rate, in chlorophyll content the Treatment 4 had the highest measurements, and in shoot biomass, root biomass and total biomass the Treatment 2 had the best results. For overall results, Treatment 2, the mixture of garden soil and vermicompost with the ratio of 1:1, was the best soil conditioner for lipote rooted cuttings.

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