

Early Growth Performance of Antipolo (*Artocarpus blancoi*) and Dao (*Dracontomelon dao*) As Affected by Different Ratio of Potting Media

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Abstract: The National Greening Program of President Benigno S. Aquino III demands high quality, massive, and readily available planting materials. These issues are partly addressed by this study which involved the production of high quality seedlings through the utilization of Kalinga State University (KSU) bio-organic fertilizer. It sought to evaluate the effect of this bio-organic fertilizer on the growth of Antipolo and Dao. Antipolo and Dao are viable to germinate in shorter period of time, have quality products like timber and fruits. The populations of these species are quickly decreasing in Kalinga, Philippines.

The experiment was laid out following the Completely Randomized Design with four levels of bio-organic fertilizers as the treatments and a control. Each treatment was replicated four times containing 20 plants for every replication.

Four months after planting, it was found that Antipolo seedlings applied with varying levels of KSU bio-organic fertilizer had up to 25.87 percent more leaves, up to 26.15 percent larger stem diameter, and were up to 34.98 percent taller than those without bio-organic fertilizer. The Dao seedlings grown in soil media with bio-organic fertilizer had up to 57.93 percent more leaves, up to 41.37 percent larger diameter, and were up to 43.94 percent taller than those grown in the control. These quality seedlings demand higher price since they recover fast due to strong roots and have increased water holding capacity; and their hauling is economical because they are light.

Keywords: bio-organic fertilizer, Antipolo, Dao, potting media, number of leaves, height, diameter.

I. INTRODUCTION

In the Philippines, the resurgence of concern for forests has been embodied in President Benigno S. Aquino III's Executive Order 26 known as National Greening Program (NGP) and Executive Order 23 that seeks a moratorium on the cutting and harvesting of timber in natural and residual forests.

The demand for planting materials continues to increase every year especially now that the greening program has gained greater attention and support from all walks of society (FMB-DENR, 2007). Moreover, the use of endemic species has gained attention in the reforestation or rehabilitation of denuded areas for ecological and economic importance.

The increased demand for seedlings calls for the intensified production of quality planting materials. This will support the government's effort for environmental services, enterprise development and self-sufficiency not only for major forest products, but also for fruit, ornamental, and medicinal crops (FMB-DENR, 2007).

However, the quality, quantity and availability of the planting materials at the right time are critical issues that need to be addressed in order to attain success of the massive greening program. These issues can be resolved by strengthening the production of planting materials, establishment of nurseries through the involvement of various stakeholders and adoption of appropriate technologies (FMB-DENR, 2007).

During the administration of Gloria Macapagal Arroyo, the law was passed for the development and utilization of organic fertilizer in the Philippines. In response, Kalinga-Apayao State College engaged in the production of bio-organic fertilizer, thus it is imperative that this material be used in the production of Antipolo and Dao seedling to test its effectiveness.

Sarhan et al. (2011) cited that the quantity and quality by many factors among which fertilization techniques are the most important ones. Instead of using the synthetic fertilizers, why not use other sources like biofertilizers and organic fertilizers. The use of biofertilizers promotes plant growth (Salih Ati, Hadi, Abdullah Abbas, 2013; Suge, Omunyin, & Omami, 2011) and positively influence yield (Berova, Karanatsidis, Sapundzhieva, & Nikolova, 2010) for economical production and quality seedlings.

Biofertilizers are eco-friendly fertilizers which are being used to improve the quality and fertility of the soil. Biofertilizers are made from biological wastes and they do not contain any synthetic chemicals. They are beneficial to the soil, as they enrich the soil with micro-organisms that help in producing organic nutrients, which in turn help the soil fight diseases. They therefore enrich the nutrient quality of the soil and also restore the depleted soil nutrients.

Artocarpus species was a genus of some 60 trees of Southeast Asian origin belonging to family Moraceae and endemic in the Philippines. *Artocarpus blancoi* is species of the plants in the Moraceae family that is also indigenous in the province of Kalinga. It is a large tree up to 30 m in height, stems 60 cm or more in diameter.

Dao (*Dracontomelon dao*) is a tropical canopy tree distinguished mostly by its height (reaching up to about 45 m or 148 ft) for its greyish-brown trunk which is branchless up to about 20 m (66 ft), and for its narrow buttresses which can reach up its trunk up to 6 m (20 ft) high. It is native to the riverine and limestone forests of Cambodia, China, India, Indonesia, Malaysia, Myanmar, Papua New Guinea, Philippines, Solomon Islands, and Thailand.

Recently Artocarpus species provides timber suitable for household use and is wildy grown in the Western Ghats. Its fruits were esteemed for sweet, juicy, romantic perianths surrounding the seeds, which can be eaten fresh or used as an ingredient in cakes.

Antipolo and Dao species were intended to be produced because of their viability to germinate in shorter period of time and their good quality products like timber and fruits. Their population is also decreasing as a result of forests lost.

This study therefore was designed to produce quality seedling through the utilization of the KSU bio-organic fertilizer.

Objectives of the study:

Generally, the study was undertaken to evaluate the production of quality planting materials using the KSU bio-organic fertilizer.

Specifically, the study was conducted to:

1. Determine the effect of the different ratio of potting media on the early growth performance of Antipolo and Dao in terms of number of leaves, stem diameter and plant height; and
2. Determine the return of investment in producing Antipolo and Dao seedling with the use of different ratio of potting media.

Conceptual Framework:

The production of quality planting materials is dependent on the seed quality, soil media and other environmental factors. Soil media plays a crucial role in the early growth of seedlings for it provides the necessary nutrients needed by plants. The process that was applied to antipolo and dao is the KSU bio-organic fertilizer. There have been literatures describing the benefits of using organic fertilizer such as the availability of mineral nutrient, increased water holding capacity among others. It is hope that the application of bio-organic fertilizer will improve the nursery stock for the selected species. (Figure 1)

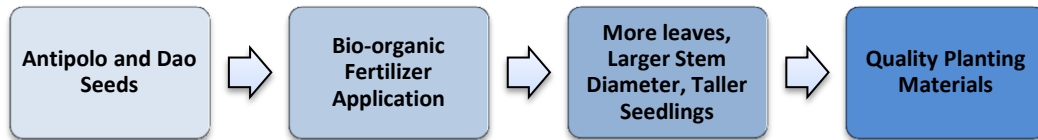


Figure 1. Conceptual framework of the study

II. METHODOLOGY

Nursery preparation:

The nursery was shaded to prevent direct sunlight from passing through. The ground was cleared. The removal of weeds was undertaken to maintain the sanitation of the area.

Soil preparation:

The components of the potting media were topsoil, sandy soil and organic fertilizer. Top soil and sandy soil were collected at the nearby area of the nursery. The organic fertilizer produced in the Organic Fertilizer Production of the State College was utilized in the study. Top soil and sandy soil components were pulverized, sieved thoroughly through a 2mm wire mesh and sundried for sterilization. The proportion was based on the treatment of the study.

Seed collection and preparation:

Seeds of Antipolo were taken from a good mother tree which had single and straight bole at Cawagayan, Pinukup, Kalinga from July to August 2012. The fruits were sliced and seeds were washed in clean water and air dried prior to sowing.

Seeds of Dao were taken from a good mother tree which had single and straight bole at Se-et, Tanudan, Kalinga from August to September, 2012. The seeds were washed in clean water and air dried prior to sowing.

Experimental Design, Treatments and Lay-out:

The experiment was laid out using Completely Randomized Design (CRD). Four replication and twenty plants were utilized in the experiment for every treatment replication.

The treatments were as follows:

Treatment	Soil	Sand	Organic Fertilizer
T ₀	50%	50%	0
T ₁	45%	45%	10%
T ₂	40%	40%	20%
T ₃	35%	35%	30%
T ₄	30%	30%	40%
T ₅	25%	25%	50%

Sowing. Antipolo and Dao seeds of similar sizes were selected and sown directly in the potting media. Drill method was applied in sowing the seed. The depth of sowing was just enough to cover the whole seed.

Nursery Management. All seedlings were watered with equal amount. The nursery was freed from weeds by pulling the growing grasses and other plants.

Growth Monitoring. The dates of seed germination were recorded. The plants' number of leaves, diameter and height of the sample seedlings randomly selected were measured. Permanent paint markers were placed on the sample seedlings to provide uniformity of data measurement. The number of leaves, diameter and height were recorded monthly after seed germination for four months.

Data Gathered:

Number of leaves. Leaves of the sample plants were recorded monthly.

Height. Initial height and monthly height until the termination of the study was taken. Height was measured above the soil surface of the polyethylene bags.

Diameter. Initial diameter and monthly diameter until the termination of the study were taken. Diameter was measured at the level of the polyethylene top portion.

Cost and return analysis. All expenses incurred were recorded. The income was projected according to the prevailing rates of seedlings in the locality. The net income was computed by subtracting the total costs from the gross income.

Statistical Analysis

All the data gathered was subjected to analysis of variance using GenStat Trial version.

III. RESULT AND DISCUSSION

Observation:

The researchers observed that the higher the ratio of organic fertilizer used the lighter is the potting media. The seeds of Antipolo germinated from 7 to 20 days after sowing. The germination of seeds is about 96 percent. The seeds of Dao germinated from 10 to 25 days after sowing. Seedlings grown in control have lighter color in terms of leaves compared to seedlings applied with organic fertilizer.

Results:

Effects of Treatments on the Number of Leaves, Leaf Area, Diameter and Height on Antipolo Seedlings:

TABLE 1. NUMBER OF LEAVES, LEAF AREA, DIAMETER AND HEIGHT OF ANTIPOLO SEEDLINGS GROWN IN DIFFERENT RATIO OF ORGANIC FERTILIZER

Treatments	Parameters				
	# of Leaves	Leaf Area (cm ²)	Diameter (mm)	Height (cm)	ROI (%)
T ₀	6.30c	250.5c	7.80c	22.04d	136.07
T ₁	7.18b	398.9b	9.00b	26.01c	150.75
T ₂	7.93a	403.3b	9.06b	27.82b	163.01
T ₃	7.60ab	394.9b	8.95b	24.68c	173.42
T ₄	7.93a	435.5b	9.42ab	29.23ab	210.59
T ₅	7.63ab	531.3a	9.84a	29.75a	190.11

Note: Means followed by a common letter are not significantly different by Least Significant Difference at 1% level of significance.

Antipolo seedlings grown in T₄ and T₂ are higher by 25.87 percent in the average number of leaves over those seedlings grown in pure topsoil and sandy soil.

Antipolo seedlings grown in T₅, T₄, T₂, T₁ and T₃ are higher by 112.12 percent, 73.88 percent, 61.01 percent, 59.25 percent, and 57.67 percent respectively in leaf area than those seedlings grown in pure topsoil and sandy soil. The application of organic fertilizer resulted to wider leaf area when compared to plants without organic fertilizer. This result is similar to the results in the study of Uka, Chukwuka, and Iwuagwu (2013) where organic manure was applied to Okra.

The application of organic fertilizer resulted to larger stem diameter of Antipolo seedlings. Seedlings grown in T₅, T₄, T₂, T₁ and T₃ increased by 26.15 percent, 20.77 percent, 16.15 percent, 15.38 percent, and 14.74 percent over those seedlings grown in control. This finding is the same to the findings of Khaple (2012): larger collar diameter resulted to increased amount of organic manure.

Antipolo seedlings grown in T₄, T₅, T₃, T₂ and T₁ are higher by 34.98 percent, 32.67 percent, 26.23 percent, 18.01 percent, and 11.98 percent in height over those seedlings grown in pure topsoil and sandy soil.

The highest return of investment with 210.59 percent is from the use of T₄ while 190.11 percent is realized by using T₅. It could be digested that if a nursery manager would like to earn P7, 160.00 monthly for a period of four months using T₄ as potting media in his seedling production; it needed him to produce at least 1,920 seedlings priced at P22.00/seedling.

Effects of Treatments on the Number of Leaves, Leaf Area, Diameter and Height on Dao Seedlings:

TABLE 2. NUMBER OF LEAVES, LEAF AREA, DIAMETER AND HEIGHT OF DAO SEEDLINGS GROWN IN DIFFERENT RATIO OF ORGANIC FERTILIZER

Treatments	Parameters			
	# of Leaves	Diameter (mm)	Height (cm)	ROI (%)
T ₀	11.79d	2.84e	12.57d	136.07
T ₁	14.46c	3.24d	14.55c	150.75
T ₂	16.61b	3.63c	16.38b	163.01
T ₃	17.50ab	3.71bc	17.15ab	173.42
T ₄	18.59a	3.96ab	17.98a	210.59
T ₅	18.62a	4.02a	18.11a	190.11

Note: Means followed by a common letter are not significantly different by Least Significant Difference at 1% level of significance.

The number of leaves is directly related to the increase of organic fertilizer. The differences are attributed to the increase of organic fertilizer component of the soil media. T₁, T₂, T₃, T₄, and T₅ have significantly more leaves compared to those in the control by 22.65 percent, 40.88 percent, 48.43 percent, 57.68 percent and 57.93 percent respectively.

The result revealed that after four months of study, significant differences in terms of seedling diameter was found. Dao seedlings in T₁, T₂, T₃, T₄, and T₅ have significantly larger diameter compared, to those in the control by 14.49 percent, 27.71 percent, 30.70 percent, 39.26 percent and 41.37 percent respectively. The important finding to note is that the application of organic fertilizer increases the diameter of Dao seedlings at early stage.

After four months of experiment, Dao seedlings in T₅ obtained the tallest plants with a mean of 18.62 cm followed by those in T₄, T₃, T₂, T₁ and T₀ with 18.59, 17.51, 16.61, 14.47 and 11.79 cm respectively. Dao seedlings grown in T₁, T₂, T₃, T₄, and T₅ is significantly have taller seedlings compared to seedlings in the control by 15.66 percent, 30.30 percent, 36.36 percent, 42.93 percent and 43.94 percent respectively. Organic fertilizers influence the height of Dao seedlings and so with the height of Cashew seedlings (Akanbi, et al., 2013).

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IV. CONCLUSIONS

Based from the results of the study, the following conclusions were drawn:

1. Plants applied with T₅ had the most number of leaves, largest diameter and tallest plants.
2. The utilization of the different ratio of potting media did significantly affect the number of leaves, diameter and height growth of Antipolo and Dao at the early stage on the duration of the study.
3. The utilization of the KSU bio-organic fertilizer improves the quality of Antipolo and Dao seedlings.
4. Though higher return is realized when no BOF is used, higher quality seedlings also demand higher price in the market.

V. IMPLICATIONS AND RECOMMENDATIONS

The study revealed that the Bio-organic fertilizer produced at the KSU organic fertilizer production program is effective in increasing the quality of seedlings of selected species in terms of number of leaves, larger diameter and taller height. The study gave solution by having lighter but more viable planting materials in the field.

Based from the findings of the study, the following recommendations were drawn:

1. The potting ratio for Antipolo and Dao seedling production should be 40 percent topsoil 40 percent sandy soil and 20 percent organic fertilizer for better quality of seedlings and higher income.
2. Moreover, similar studies should be conducted to further strengthen the result of the study.

ACKNOWLEDGEMENT

The authors would like to acknowledge Kalinga State University for providing us the necessary facilities for the conduct of this study.

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