GROWTH EVALUATION OF CLONED INDIGENOUS FOREST TREE SPECIES APPLIED WITH MYCORRHIZAL FERTILIZER UNDER GUIMARAS STATE COLLEGE-BATERNA CAMPUS CONDITION

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ABSTRACT The study was conducted to evaluate the growth of cloned indigenous forest species applied with mycorrhizal fertilizer as to their plant height, number of branches, survival rate, and number of days to reach plantable height under the GSC Baterna Campus condition. A Factorial Experiment on Completely Randomized Design (F-CRD) was used in this study. Factor A represented different indigenous forest tree species: A1- Batino, A2- Bangkal, A3-Kubi, and A4- Antipolo. Factor B represented the application of mycorrhiza: B1- Without mycorrhiza, B2- with mycorrhiza. There will be eight (8) treatment combinations to be replicated four (4) times, making a total of thirty-two (32) variates. Based on the result of the study, the application of mycorrhiza did not significantly influence the growth of cloned indigenous forest tree species in terms of plant height, survival rate, and the number of days to reach the desired plantable height. However, it significantly influenced in terms of the number of branches.

Keywords: growth, indigenous and forest species, mycorrhiza

INTRODUCTION

As ecosystems worldwide are increasingly endangered by environmental change, new strategies that rely on mycorrhizal are being developed to alleviate the negative consequences associated with these changes (Barea, Palenzuela, Cornejo, Castro, Fernandez, Garcia, & Aguilar, 2011). The National Greening Program (NGP) for 2011-2016 was launched as per Executive Order No. 26 Series of 2011, with requires planting one and a half billion trees of indigenous and fast-growing trees to cover one and a half million hectares of public forests and private lands nationwide. The Research Sector of the Department of Environment and Natural Resources was given the responsibility of administering the production of quality planting materials before they were released for out-planting. One of the developed matured technology appropriate for the National Greening Program is boosting the growth and development of plants in degraded lands and marginal areas of the country using mycorrhizal inoculants. In line with this Ecosystems Research and Development Bureau and Natural Resources Defense Council have been tasked to mass produce endomycorrhiza as inoculants to make it available as a biofertilizer for public use (Castillo, 2012).

Mycorrhizas are symbiotic relationships between fungi and plant roots. Perhaps more than 80% of the species of higher plants have these relationships. Whereby the fungus invades and parasitizes the roots of the host plant, but unlike other harmful parasites, it does not damage or kill the host. Instead, it provides many physical and physiological benefits to the latter. In return, the fungus obtains its food and other growth requirements from the host plant. These are as common on crop plants (cereals, peas, tomatoes, onions, and many others) as in wild communities, and in several cases, they have been shown to be important or even essential for plant performance.

To a large degree, mycorrhizas seem to be symbiotic relationships in which the fungus obtains at least some of its sugars from the plant, while the plant benefits from the efficient uptake of mineral nutrients (or water) by the fungal hyphae (Deacon,1992).

This study aims to evaluate the growth of cloned Indigenous forest species applied with mycorrhizal fertilizer as to their plant height, number of leaves, leaf length, leaf width, number of branches, and number of days to reach plantable height (1 foot), under GSC Baterna Campus condition.

METHODOLOGY

This study was conducted inside the hardening area of the Clonal Nursery Complex of the GSC Baterna campus, San Lorenzo, Guimaras, last June-July, 2017.

Experimental Design, Treatments and Replication

A Factorial Experiment on Completely Randomized Design (F-CRD) was used in this study. Factor A was represented by different indigenous forest tree species: A1- Batino (Alstonia macrophylla), A2- Bangkal (Nauclea orientalis), A3-Kubi (Artocarpus nitidus), and A4- Antipolo (Artocarpus blancoi). Factor B represented the application of mycorrhiza: B1- Without mycorrhiza, B2- with mycorrhiza. There were eight (8) treatment combinations to be replicated four (4) times, making a total of forty-eight (32) variates. Each variate was ten (10) cloned seedlings as experimental plants.

Table 1. Treatment combinations.

Factor A (Different Indigenous Forest Trees Species)	Factor B (Application of mycorrhiza)	
	B1	B2
A1	A1B1	A1B2
A2	A2B1	A2B2
A3	A3B1	A3B2
A4	A4B1	A4B2

Table 2. Experimental Lay-out.

A2B1	A1B1	A1B1	A2B1
A4B2	A4B1	A2B2	A3B2
A1B2	A3B1	A4B2	A4B1
A3B2	A1B2	A2B1	A4B2
A1B2	A2B1	A3B2	A1B2
A2B2	A2B2	A4B1	A4B1
A3B1	A3B2	A2B2	A4B2
A3B2	A3B1	A1B1	A1B1

Legend:
Factor A (Different indigenous forest tree species)
Factor B (Mycorrhiza Application)
A1- Batino
B1- Without mycorrhiza
A2- Bangkal
B2- With mycorrhiza
A3- Kubi
A4- Antipolo

Preparation of the Research Area

The hardening area of the clonal nursery was utilized in this study. Weeding and underbrushing were conducted to minimize the presence of weeds in the area. The area was laid based on the experimental layout (Table 2). Treatment labels and a title board were also placed before the study started.

Collection of Potting Media

The potting media was pure garden soil. Garden soil was collected in the production area of GSC Baterna Campus.

Source and collection of Planting Materials

Newly rooted ramets were collected from the rooting chambers of the nursery. Ramets with good root development and shoots were selected for the study. Seedlings were carefully uprooted to avoid root damage. It was placed directly inside a plastic pale with water to avoid transplant shock and brought to the potting area.

Potting and Planting

Potting media was pure garden soil. After the collection, potting media was sieved to have a finer particles and remove debris and other biological remains.
The plastic was filled with potted media before applying the mycorrhiza. The rooted cuttings were placed at the top of the inoculants, then filled again and arranged according to the experimental layout.

Water Management

Cloned seedlings were watered twice daily.

Pest Management

Neem tree extract was sprayed once a week to prevent pest infestation.

Data Gathering

To evaluate the growth of cloned Indigenous tree forest species applied with mycorrhizal fertilizer, the following data were gathered: plant height, number of leaves, leaf length, leaf width, number of branches , number of days to reach plantable height (1 foot) and survival rate. Data gathering was conducted every seven (7) days.

Data Analysis

All the data were analyzed using Two (2) ways Analysis of variance (ANOVA). Significant means were tested using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Table 1. Presents the summary of means on plant height, number of branches, survival rate, and number of days to reach the plantable height (1 foot).

Factor 1	Plant height (cm)	Number of branches	Survival rate	Number of days to reach the plantable height (1 foot)
A(Batino)	34.0	4a	1.0	33.4ab
B(Bangkal)	33.5	3b	1.0	32.8b
C(Kubi)	33.3	4a	1.0	34.1a
D(Antipolo)	33.0	3b	1.0	34.0a
f-test	ns	*	ns	*
cv%	3%	13%	N/A	3%
Total	33.4	3.6	1.0	33.6

Plant height

The second column of Table 1 shows the plant height of indigenous forest trees. The result shows that the highest mean was obtained by treatment A (Batino) with a mean of 34.0 cm, while the lowest mean was obtained by Treatment D (Antipolo) with a mean of 33 cm.
Analysis of variance shows that there is no significant effect among treatment means. This implies that the different forest species have the same growth performance in terms of height.

Table 1.1. Two-way table on the plant height of Indigenous Forest tree species seedlings

Mycorrhiza Application			
Indigenous forest tree species	B1	B2	Mean
A1	33.3	34.8	34.05
A2	33.3	33.8	33.55
A3	33.0	33.5	33.25
A4	33.8	32.3	33.05
Mean	33.35	33.6	
f-test	Ns		
cv%	3%		

Number of Branches

The third column of Table 1 shows the number of branches of indigenous forest trees. The result reflects that Treatments A (Batino) and C (Kubi) were higher, with a mean of 4.0 than Treatments B (Bangkal) and D (Antipolo), with a mean of 3.0. Analysis of Variance shows a significant difference among treatment means in terms of the number of branches. This implies that Treatments A and C perform better in terms of branching than Treatments B and D. Table

1.2. Two-way table on the number of branches of Indigenous Forest tree species seedlings

Mycorrhiza Application			
Indigenous forest tree species	B1	B2	Mean
A1	3.5	4.0	3.75
A2	3.5	3.3	3.4
A3	3.8	4.0	3.8
A4	3.3	3.3	3.3
Mean	3.52	3.6	
f-test	Ns		
cv%	13%		

Survival rate

The fourth column of Table 1 shows the survival rate of indigenous forest trees. Factor 1 shows that the survival rate of indigenous forest trees is the same with and without the application of mycorrhiza at 1.0%. Analysis of variance shows that there was a significant effect between treatment means of factor 2.
Pankhow, Boller, & Wiemken (1991) suggested that the main role of the mycorrhizal symbiosis is in the protective stages. Poor plant health can predispose them to diseases as mycorrhizae play an important role in protecting plant-hosts against pathogens.

Table 1.3. Two-way table on the survival rate of Indigenous Forest tree species seedlings

Mycorrhiza Application			
Indigenous forest tree species	B1	B2	Mean
A1	100	100	100
A2	100	100	100
A3	100	100	100
A4	100	100	100
Mean	100	100	
f-test	Ns		
cv%	N/A		

Number of days to reach the plantable height (1 foot)

The fifth column of Table 1 shows the number of days to reach the plantable height (1 foot) of indigenous forest trees. For factor 1, A and B were statistically higher than C and D. Analysis of variance shows a significant effect between treatment means of factor 1. The coefficient of variance is 3%.

Table 1.4. Two-way table on the number of days to reach the plantable height of Indigenous Forest tree species seedlings

	Mycorrhiza Application		
Indigenous forest tree species	B1	B2	Mean
A1	34.0	32.8	34
A2	32.3	33.3	32.2
A3	34.5	33.8	34.5
A4	34.0	34.0	34
Mean	33.7	33.47	
f-test	Ns		
cv%	3%		

Plant Height

The second column of Table 2 shows the plant height of indigenous forest trees. For factor 2, treatment B2 (W/O Mycorrhiza) obtained the highest mean, which is 33.6 cm.

Table 2.0 presents the summary of means on plant height, number of branches, survival rate, and number of days to reach the plantable height (1 foot).

Factor 2	Plant height (cm)	Number of branches	Survival rate	Number of days to reach the plantable height (1 foot)
B1(With Mycorrhiza)	33.3	3.5	1.0	33.7
B2(W/O Mycorrhiza)	33.6	3.6	1.0	33.4
f-test	ns	ns	ns	ns
cv%	3%	13%	N/A	3%
Total	33.4	3.6	1.0	33.6

Analysis of variance shows that there is no significant effect among treatment means of factor 2. The coefficient of variance is 3%.

Number of Branches

The third column of Table 2 shows the number of branches of indigenous forest trees. The highest mean was obtained by treatment B2 (W/O Mycorrhiza), which is 33.6 cm. Analysis of variance shows that there is no significant effect between treatment means of factor 2. The coefficient of variance is 13%.

Survival rate

The fourth column of Table 2 shows the survival rate of indigenous forest trees. It shows that the survival rate of indigenous forest trees is the same with and without the application of mycorrhiza at 1.0%. Analysis of variance indicates that there is no significant effect between treatment means of factor 2.

Number of days to reach the plantable height (1 foot)

The fifth column of Table 2 shows the number of days to reach the plantable height (1 foot) of indigenous forest trees. For factor 2), treatment B1 (With Mycorrhiza) obtained the highest mean, which is 33.7 cm. Analysis of variance shows that there is a significant effect between treatment means of factor 2. The coefficient of variance is 3%.

Several studies have observed beneficial influence of mycorrhizal on the growth and yielding of trees and crops and the improvement of soil properties (Gluszeck, Derkowska, Sas-Paszt, Sitarek, & Sumorok, 2020; Diouf, Kane, Bakhoum, Ba, Ba, & Duponnois, 2013; Mrabet, Ouhmane, Mousadik, Msanda, & Abbas, 2014). In addition, Bona, Cantamessa, Manassero, Masano, Copetta, Lingua, D'Agostino, Gamalero, & Berta (2017) advised the use of mycorrhizal and bacterial consortia in which the microorganisms mutually increase their beneficial effects on the growth of plants, and on the quality of the obtained crops. Moreover, through their observation application of mycorrhizal fungi increased the number of flower and fruits, the weight and size of the plants and their dry matter content compared with non-inoculated plants.

CONCLUSIONS

The application of mycorrhiza did not significantly influence the growth performance of cloned indigenous forest tree species in terms of plant height and survival rate based on the analysis of variance. However, it had a significantly influenced in terms of the number of branches, and it was obtained by Treatments A (Batino) and C (Kubi), which are higher with a mean of 4.0 than Treatments B (Bangkal) and D (Antipolo) with a mean of 3.0.

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