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Effects of Different Soil Media (Clay, Loam, Sandy Loam) on the Early Growth Performance of Golden Chain (*Laburnum anagyroides*) Seeds

Chrizza E. Bustamante[1], Hersie C. Suarez[1], Marc Joseph B. Sinangote[1], Niña Chieque Diane O. Briones[1], Bryan L. Bitantos[2], Rosienie D. Gallardo[2], Reybhoy A. Ramos[3], Leziel Digang[3]

[1]MSU-BC Senior High School Deparment, [2]Environmental Science Department, College of Forestry and Environmental Studies, Mindanao State University - Buug Campus,[3] College of Agriculture, Mindanao State University - Buug Campus
Email: bryan.bitantos@msubuug.edu.ph

ABSTRACT

Laburnum anagyroides commonly known as golden chain is a deciduous tree commonly grown as an ornamental tree for landscaping throughout Europe. In the Philippines, its use as an ornamnental plant is not widely exploited. Hence, it is important to understand this plant in terms of its seedling growth and production. The effects of different soil media on the early growth performance of golden chain tree in terms of average height, average number of leaves, and average stem diameter are reported here. Three treatments were used to determine the effects of different soil media on the early growth performance of golden chain seeds: treatment one (T_1) 2 kg of clay, treatment two (T_2) 2 kg of loam, and treatment three (T_3) 2 kg of sandy loam. The treatments were replicated five times, which resulted into a total of 15 experimental golden chain seeds. Collection of data on the changes in the height and number of leaves were done on the 10th, 15th, and 20th day after sowing (DAS). On the changes of stem diameter, data were collected on the 20th DAS. The findings of the study indicated that there were no significant differences on the effects of different soil media on the early growth performance of the golden chain seeds in terms of average height and average number of leaves on the 10th, 15th, and 20th DAS. No significant difference was also evaluated on the average stem diameter on the 20th DAS. Based on the result, it implied that golden chain seeds with different soil treatments showed same early growth performance in terms of average height, average number of leaves and average stem diameter. For future studies, it is recommended to evaluate the growth performance of golden chain using different soil media in a one year observation.

Keywords : clay, early growth performance, *Laburnum anagyroides*, loam, sandy loam

I. INTRODUCTION

Trees and shrubs play a vital role in maintaining the ecological balance and improving the livelihood of the people in different regions of the world. Further, trees and shrubs can act as a soil stabilizer and prevent water and soil erosion. They are important source of forage for livestock and wildlife. They are a source of wood products, including paper, fuel wood, poles, and lumber (Sjöholm, 1989).

Trees can be used as borders or boundary in a certain area or site. Even in roadsides, trees were planted sequentially. It does not act just as borders, but they also give freshness and beauty to roads and highways. They refreshes the eye of those people walking and passing by. Trees were also used as ornamental designs and decorations, especially those tree that have beautiful and colorful flowers. They give beauty to houses, buildings, halls, and any places they are placed in.

Laburnum anagyroides (golden chain tree) is a deciduous tree growing to 40 feet tall. It is in flower from May to June, and the seeds ripen from September till October. The species has both male and female organs and is pollinated by insects. It can grow in semi-shade (light woodland) or no shade. The plant can withstand strong winds but not maritime exposure. It can endure atmospheric pollution (Medik, 1996).

Laburnum anagyroides is commonly grown as an ornamental tree in parks and gardens throughout Europe (Szentesi & Wink, 1991). It is frequently used as a rootstock for other members of the *Fabaceae*. Its wood is utilized to make instruments and furniture (Plants for a Future, 2008). The golden shower tree is a show stopper when in flower. The tree produces yellow flowers that hang in clusters 12 to 18 inches in length. Typically flowers occur just after leaf drop in May, so that for several weeks the naked tree is covered with long yellow chains, each with a dozen or more flowers.

Though *Laburnum anagyroides* is widely used as an ornamental plants in parks and roads in other countries, here in Philippines, its utilization as an ornamental plant is not yet widely exploited. This ornamental plant when planted on roads and streets in our locality will promote good aesthetic value, tourism and even biodiversity. With these, it is important to understand this plant with regards to its seedling production and growth.

Soil media can be one of the important factors required for the survival and production of the plant for it not only supports the plant but also supplies moisture and mineral nutrient to it (Mehwish, 2007). There are various types of soil for plant growth which includes clay, loam, and sandy loam. Clay is a finely-grained natural rock or soil material that integratess one or more clay minerals with traces of metal oxides and organic matter. Moreover, loam soil refers to a soil mixture that consists of organic matter, sand and clay. On the other hand, sandy loam soil is a type of soil mixture that is generally well-balanced, but has sand as a main component (Bliss, 2017). In this light, this study would like to know which soil media will give a favorable effect on the early growth performance of *L. anagyroides* seedlings.

II. MATERIALS AND METHODS

The study was conducted at nursery site of the College of Forestry and Environmental Studies at MSU, Datu Panas, Buug, Zamboanga Sibugay from March 26 to April 15, 2019. The selected area was an open space, wherein sunlight and air can pass through. The area is away from destructive animals that may damage the plants.

The golden chain seeds were collected at Mindanao State University Buug Campus in front of the Centre of Information Technology building. The seeds were carefully placed in zip lock bags to avoid damage. After reaching the research area, the seeds were transferred into polyethylene bags with different soil type. To germinate the seeds of golden chain plant, the seeds were soaked in hot and cold water treatment. First, the seeds were soaked into warm water for 24 hours. After 24 hours, the seeds were taken and placed into a bowl then a boiling water was poured into it and let it stay for five minutes and then planted it in a one to two centimeter deep. There were five seeds planted in every polybag but only one plant was considered as source of data.

The clay soil was obtained from Briones' residence at Del Monte, Buug, Zamboanga Sibugay. This was dried and pounded into smaller particles and filtered to remove unwanted materials. The finished product was placed on a separate sack.

The loam soil was obtained from Clark 8, Del Monte, Buug, Zamboanga Sibugay. It was also dried and filtered to remove unwanted materials. The finished product was placed on a separate sack.

The sandy loam soil was obtained from Clark 14, Poblacion, Buug, Zamboanga Sibugay. It was also dried and filtered to remove unwanted materials. The finished product was also placed on a separate sack.

The study considered only one factor as source of variation hence, it was carried out using Randomized Complete Block Design (RCBD) with three treatments and replicated five times, giving a total of 15 experimental golden chain trees.

The following treatments wereused in the study:

T_1 – clay soil 2 kg per bag
T_2 – loam soil 2 kg per bag
T_3 – sandy loam soil 2 kg per bag

TABLE 1
Randomized Complete Block Design

Replication	Treatments		
R_1	T_3R_1	T_2R_1	T_1R_1
R_2	T_3R_2	T_1R_2	T_2R_2
R_3	T_2R_3	T_1R_3	T_3R_3
R_4	T_2R_4	T_3R_4	T_1R_4
R_5	T_1R_5	T_2R_5	T_3R_5

The experimental area was visited constantly by the researchers to evaluate the performance of the plants, to maintain cleanliness and to preserve the source of data to avoid contamination. The watering was done every morning and afternoon except on rainy days. To protect the wildlings from stray, the area was fenced with bamboo sticks. To allow proper drainage of water, a canal was constructed around the area. The area was covered to protect from the scorching heat of the sun by using fishnet.

The first measurement for the height and number of leaves was considered as baseline data on the 5th day after sowing. The first collection of data for the height and number of leaves was done on 10th day after sowing. The second collection of data was gathered on the 15th day after sowing, and the last collection of data was done on the 20th day after sowing.

The first measurement for the stem diameter which was considered as the baseline data was on the 15th DAS. For the stem diameter, the collection of data was only on the 20th day after sowing. After the last collection of data, the golden chain plant seedlings were donated to MSU-Buug and distributed to people who were interested to the plant the seedlings.

The following parameters were considered in this study:
1. Increase height of the plants - was measured (in mm) from the base of the plant just above the soil surface to the tip of the plant per replicate, per treatment with the use of a ruler.
2. Increase number of leaves of the plants - was done by counting the leaves of plant per replicate.
3. Increase stem diameter of the plants – was measured (in mm) in the stem directly above the soil surface of the plant per replicate using Vernier caliper.

The average height and the average number of leaves of the plant was determined on the 10th, 15th and 20th day after sowing. The aver-

age stem diameter was determined only on the 20th day after sowing. The data gathered were recorded and tabulated. They were recorded in the table form.

The Analysis of Variance (ANOVA), one way classification was used to find out if there were significant differences in the effect of different soil types on the early growth performance of the golden chain (*Laburnum anagyroides)* tree in terms of average height, average number of leaves, and average stem diameter.

III. RESULTS AND DISCUSSIONS

This study was conducted primarily to determine the effects of the different soil media (clay, loam and sandy loam) on the early growth performance of golden chain tree (*Laburnum anagyroides*) seeds. Specifically, it aimed to determine which of this soil media, clay, loam and sandy loam, gave the highest effect on the average height, average stem diameter, and average number of leaves of the plants.

A. Height of Golden Chain Tree

TABLE 2
Height (in mm) of Golden Chain Tree at 10th DAS

Replicates	Treatments		
	T1	T2	T3
R1	27	51	13
R2	53	58	49
R3	38	63	0
R4	0	38	42
R5	0	0	56
Total	118	210	160
Average	23.6	42	32
Grand Mean = 32.5			

Table 2 shows the height of golden chain tree seeds per treatment during the first observation period or at the 10th day after sowing. It shows that golden chain tree seeds from T_2 (loam) obtained the highest increase of height with 210 mm, followed by T_3 (sandy loam) with the second highest increase of height with 160 mm, and T_1 (clay) which has the least increase of height with 118 mm.

The ANOVA for the height of golden chain tree seeds during the first observation revealed that the computed f (0.72) is lesser in value than the tabulated f at both 5% (3.89) and 1% (6.93) levels of significance. Hence, the null hypothesis is accepted and the alternative hypothesis is rejected. Therefore, there is no significant difference on the effect of different soil media on the early growth performance of golden chain tree seeds in terms of average height on the 10th DAS.

TABLE 3
Height (in mm) of Golden Chain Tree at 15th DAS

Replicates	Treatments		
	T1	T2	T3
R1	54	29	62
R2	55	20	65
R3	34	33	0
R4	0	44	70
R5	0	0	35
Total	143	126	232
Average	28.6	25.2	46.4
Grand Mean = 33.4			

Table 3 shows the height of golden chain tree seeds per treatment during the second observation period or at the 15th day after sowing. It shows that golden chain tree seeds from T_3 (sandy loam) obtained the highest increase of height with 232 mm, followed by T_1 (clay) with the second highest increase of height of 143 mm, and T_2 (loam) which has the least increase of height with 126 mm.

The ANOVA for the height of golden chain tree seeds during the second observation revealed that the computed f (1.03) is lesser in value than the tabulated f at both 5% (3.89) and 1% (6.93) levels of significance. Hence, the null hypothesis is accepted and the alternative hypothesis is rejected. Therefore, there is no significant difference on the effect of different soil media on the early growth performance of golden chain tree seeds in terms of average height on the 15th DAS.

TABLE 4
Height (in mm) of Golden Chain Tree at 20th DAS

Replicates	Treatments		
	T1	T2	T3
R1	33	36	46
R2	37	44	58
R3	26	31	0
R4	0	58	53
R5	0	0	41
Total	96	169	198
Average	19.2	33.8	39.6
Grand Mean = 30.8			

Table 4 shows the height of golden chain tree seeds per treatment during the third observation period or at the 20th day after sowing. It shows that golden chain tree seeds from T_3 (sandy loam) obtained the highest increase of height with 198 mm, followed by T_2 (loam) with the second highest increased of height of 169 mm, and T_1 (clay) which has the least increased of height with 96 mm.

The ANOVA for the height of golden chain tree seeds during the third observation revealed that the computed f (1.26) is lesser in val-

ue than the tabulated f at both 5% (3.89) and 1% (6.93) levels of significance. Hence, the null hypothesis is accepted and the alternative hypothesis is rejected. Therefore, there is no significant difference on the effect of different soil media on the early growth performance of golden chain tree seeds in terms of average height on the 20th DAS.

B. Number of Leaves of Golden Chain Tree

TABLE 5
Number of Leaves of Golden Chain Tree at 10th DAS

Replicates	Treatments		
	T1	T2	T3
R1	2	4	2
R2	3	4	4
R3	3	4	0
R4	0	3	2
R5	0	0	4
Total	8	15	14
Average	1.6	3	2.8
Grand Mean = 2.4			

Table 5 shows the number of leaves developed from the golden chain tree seeds at 10th DAS. It shows that golden chain tree seeds from T_2 (loam) obtained the highest increase number of leaves with a number of 15 leaves, followed by T_3 (sandy loam) with the second highest increase number of leaves of 14 leaves, and T_1 (clay) which has the least increase of number of leaves with a number of 8 leaves.

The ANOVA for the number of leaves of golden chain tree seeds at 10th DAS revealed that the computed f (1.56) is lesser in value than the tabulated f at both 5% (3.89) and 1% (6.93) levels of significance. Therefore, the null hypothesis is accepted and the alternative hypothesis is rejected. This implies that there is no significant difference on the effect of different soil media on the early growth performance of golden chain tree seeds in terms of average number of leaves on the 10th DAS.

TABLE 6
Number of Leaves of Golden Chain Tree at 15th DAS

Replicates	Treatment		
	T1	T2	T3
R1	4	2	4
R2	1	4	0
R3	1	2	0
R4	0	1	2
R5	0	0	0
Total	6	9	6
Average	1.2	1.8	1.2
Grand Mean = 1.4			

Table 6 shows the number of leaves developed from the golden chain tree seeds at 15th DAS. It shows that golden chain tree seeds from T_2 (loam) obtained the highest increase number of leaves with a number of 9 leaves, followed by T_1 (clay) and T_3 (sandy loam) with the same number of leaves of 6 leaves.

The ANOVA for the number of leaves of golden chain tree seeds at 15th DAS revealed that the computed f (0.22) is lesser in value than the tabulated f at both 5% (3.89) and 1% (6.93) levels of significance. Therefore, the null hypothesis is accepted and the alternative hypothesis is rejected. This implies that there is no significant difference on the effect of different soil media on the early growth performance of golden chain tree seeds in terms of average number of leaves on the 15th DAS.

TABLE 7
Number of Leaves of Golden Chain Tree at 20th DAS

Replicates	Treatments		
	T1	T2	T3
R1	4	2	4
R2	4	0	4
R3	4	2	0
R4	0	4	4
R5	0	0	4
Total	12	8	16
Average	2.4	1.6	3.2
Grand Mean = 2.4			

Table 7 shows the number of leaves developed from the golden chain tree seeds at 20th DAS. It shows that golden chain tree seeds from T_3 (sandy loam) obtained the highest number of leaves with a number of 16 leaves, followed by T_1 (clay) with the second highest number of leaves of 12 leaves, and T_2 (loam) which has the least number with a number of 8 leaves.

The ANOVA for the number of leaves of golden chain tree seeds at 20th DAS revealed that the computed f (0.89) is lesser in value than the tabulated f at both 5% (3.89) and 1% (6.93) levels of significance. Therefore, the null hypothesis is accepted and the alternative hypothesis is rejected. This implies that there is no significant difference on the effect of different soil media on the early growth performance of golden chain tree seeds in terms of average number of leaves on the 20th DAS.

C. Stem Diameter of Golden Chain Tree

TABLE 8
Stem Diameter of Golden Chain Tree at 20th DAS

Replicates	Treatments		
	T1	T2	T3
R1	0.1	0.36	0.84
R2	0.55	0.19	0.76
R3	0.19	0.22	0
R4	0	0.21	0.36
R5	0	0	0.1
Total	0.84	0.98	2.06
Average	0.168	0.196	0.412

Grand Mean = 0.2

Table 8 shows the stem diameter of the golden chain tree seeds at 20th DAS. It shows that golden chain tree seeds from T_3 (sandy loam) obtained the highest increase of stem diameter with 2.06 mm, followed by T_2 (loam) with the second highest increase stem diameter of 0.98 mm, and T_1 (clay) which has the least increase of stem diameter with 0.84 mm.

The ANOVA for the stem diameter of golden chain tree seeds at 20th DAS revealed that the computed f (1.26) is lesser in value than the tabulated f at both 5% (3.89) and 1% (6.93) levels of significance. Therefore, the null hypothesis is accepted and the alternative hypothesis is rejected. This implies that there is no significant difference on the effect of different soil media on the early growth performance of golden chain tree seeds in terms of average stem diameter on the 20th DAS.

No significant differences on the effect of different soil media on the early growth performance of the golden chain seeds in terms of average height and average number of leaves on the 10th, 15th, and 20th DAS. Further, no significant difference was also evaluated on the average stem diameter on the 20th DAS. There are no significant difference results that could be attributed to the short time gap of data collection on the different variables. The time gap is only five days and the whole study duration for observation on the growth performance of golden chain is only 20 days. Isirimah et al. (2003) stressed that the germinating embryos depend on stored nutrients within the seed for their initial growth and other metabolic activities. Hence, the early growth of germinating embryos including that of golden chain depend mostly on the stored nutrients within the seed and not on the nutrients from the different soil media. For future studies, it is recommended to evaluate the growth performance of golden chain using different soil media in a longer period of time like six months or one year observation.

IV. Conclusion

Based on the results of the study, the following conclusions were made:

There were no significant differences on the effect of different soil media on the early growth performance of golden chain seeds in terms of average height and average number of leaves on the 10th, 15th, and 20th DAS, and average stem diameter on the 20th DAS.

The golden chain seeds with different soil treatments showed same early growth performance in terms of average height, average number of leaves and average stem diameter.

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