

Growth Response of Grafted *Durio zibithenus* Seedlings Applied with Organic Materials

¹Christine Joy C. Ortiola, ²Loreto P. Merquillo, ³Jill T. Allego, ⁴Abdani D. Bandera, ⁵Jerich A. Boleros, ⁶Steven L. Subido

¹Special Science Teacher 1, Department of Education, Malangas National High School, Malangas, Zamboanga Sibugay, Philippines

²Associate Professor, Department of Forestry, College of Forestry and Environmental Studies, Mindanao State University- Buug Campus, Zamboanga Sibugay, Philippines

³RSBSA Encoder, Department of Agriculture – Regional Field Office IX, Lenienza, Pagadian City, Zamboanga del Sur, Philippines

⁴Assistant Professor, Department of Plant Science, College of Agriculture, Mindanao State University- Buug Campus, Zamboanga Sibugay, Philippines

^{5,6}Undergraduate Students, Department of Forestry, College of Forestry and Environmental Studies, Mindanao State University-Buug Campus, Zamboanga Sibugay, Philippines

Email: christineortiola13@gmail.com

ABSTRACT

The study was conducted to determine the growth response of the grafted Durian seedlings (*Durio zibithenus*) applied with organic fertilizers on its height, stem diameter and number of leaves, and to evaluate which of the organic fertilizers showed the best result on the growth of the seedlings. The study was conducted at the nursery site of the College of Forestry and Environmental Studies, Mindanao State University – Buug Campus. There were three (3) treatments used with ten (10) replications. The treatments used were as follows; Treatment one (T_1) which was decayed rice straws, treatment two (T_2) which was cow manure and treatment three (T_3) which was vermicompost, all of the treatments had the same exact amount of zero point seventy-five (0.75) kg applied on the top of the seedlings with three (3) kg garden soil. The treatments were observed on the 20th, 40th and 60th days after treatments application particularly on the increase of height, stem diameter and number of leaves of the plants. Based on the result of the study, there was no significant difference on the growth response of grafted durian seedlings (*Durio zibithenus*) applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) on the increase of height, stem diameter and number of leaves developed in seedlings in 20th, 40th and 60th day after treatment application. This was mainly because of environmental factors and the same nutrient content of the treatments. The study happened on dry spell, three months without rain occurred. Based on the conclusion made, it was highly recommended that follow up study be conducted by the future researchers during rainy seasons and not during drought.

Keywords : Fertilization, Durian, Cow Manure, Decayed Rice Straws, Vermicompost

1 INTRODUCTION

Climate change is very popular and one of the world's biggest problem in our environment today. These problems can be minimized and mitigated by planting fruit trees. Trees are also on the front lines of our changing climate and nature's water filters, capable of cleaning up the most toxic wastes, including explosives, solvents and organic wastes, largely through a dense community of microbes around the tree's roots that clean water in exchange for nutrients, a process known as carbon sequestration [7].

Durian tree (*Durio zibithenus*) is regal, majestic and prolific, earning its nickname "King of Fruits". These fascinating tree, with its addictive and curious fruit, only grow where it is very, very hot and humid [8]. Durian is a native of the rainforests of Malaysia and Indonesia, is a tall tree reaching as high as 40m in the jungle rainforest or in semi-orchard. Seed trees may take 8-10 years to fruit. Grafted durian grows to 15 – 20m tall and fruits in 5 to 6 years. The fruit is green to brown in color, pendulous, round to oblong in shape and is completely covered with strong sharp thorns. It is a capsule which splits into five parts when ripe and each segment contains brown seeds covered with thick, firm, creamy, yellow pulp with a strong and very distinctive aroma [3]. The durian is a good source of carbohydrates, protein, vitamins B and C. Its pulp is eaten raw, cooked as a vegetable, frozen or dried. The seeds can be boiled or roasted and used as confections [5].

Organic matter can be pollutant and eye sore if left on the road sides, field and everywhere. Organic matter such as animal manures, human waste, food wastes, yard wastes, sewage sludge's and composts have long been recognized in agriculture as beneficial for plant growth and yield and the maintenance of soil fertility. Organic matters are excellent source of plant-available nutrients and their addition to soil could maintain high microbial populations and activities, as Pascual et. al., 1997; Zink and Allen, 1998 stated in the study of [2].

Grafted durian has several economic benefits. It has shorter maturity compared to the durian grown from seedlings. Durian fruit can be a solution to economic problem due to its high market cost, popular to most consumers and high demand to the community. The estimated income of one durian tree is about 9,000 pesos per fruiting season. Durian plantation helps to minimize problems in the environment, such as climate change, air pollution, deforestation, biodiversity loss and soil degradation. Durian trees help to absorb carbon dioxide gases and release more oxygen. They serve as reforestation, restore some losses of biodiversity and one way of mitigating climate change.

2 METHODOLOGY

2.1 Materials

The materials used in conducting the study were hammer, vernier caliper, bolo, placards, meter stick, sprinkler, polyethylene bags, ballpen, record book, hand shovels, pencil, bamboo sticks, nails, ruler, and mosquito net. Grafted durian seedlings were used in the study. It is a good seedling that bear fruit in a short period of time. Cow manure, vermicompost, decayed rice straw were the organic fertilizers used in the study and sawdust as mulch material. Dithane was the pesticide used when the seedlings were attack by fungi.

2.2 Research Design

The study applied experimental research design that considered only one factor as a source of variation hence, it was carried out using Randomized Complete Block Design (RCBD) with three (3) treatments and each treatment was replicated ten (10) times, with a total of thirty (30) experimental grafted Durian seedlings. The study focused on the effect of applied organic fertilizers (Decayed rice straws, Cow manure, Vermicompost), particularly on the increased of height, increased of stem diameter and increased of number of leaves of the seedlings.

2.3 Management and Practices

This study was conducted at the Nursery site of the College of Forestry and Environmental Studies, Mindanao State University – Buug Campus, Buug, Zamboanga Sibugay from February 13, 2019 to April 14, 2019. An open area measuring 4m x 3m was used for the study. The area was thoroughly cleaned by eliminating weeds and shrubs using bolos and other tools in farming. When the area was totally cleaned, seedbeds and canals were established for proper drainage of the area. The area was covered by mosquito net to avoid disturbance and to protect the seedlings from falling leaves and twigs of the standing Para rubber trees. The perimeter was fenced using nylon screen to prevent destruction of seedlings.

The grafted Durian seedlings were procured at the Shared Service Facility (SSF) for Upgrading of Fruit Processing in Local Government of Jimenez, Misamis Occidental. It was brought to the College of Forestry and Environmental Studies nursery for 7 days acclimatization to the new environment. Grafted seedlings were carefully transferred in a large size polyethylene bags to avoid damage and filled with 3.0 kg of garden soil leaving enough space for the organic fertilizers.

There were three (3) treatments used in the study. Each treatment was replicated ten (10) times. For T₁, 0.75 kg of decayed rice straw was used as fertilizer to the seedling. It was applied to the potted seedlings and covered with saw dust. The same process was done with the rest of the treatments. The organic fertilizers (Decayed Rice Straws, Cow Manure, Vermicompost) were pulverized, and undergo sterilization.

The experimental area was visited constantly by the researchers to evaluate the performance of the plants and remove unwanted grasses that compete the seedlings in absorbing nutrients. The watering was done every morning and afternoon except on rainy days. Application of pesticide was based on the incidents of pest and disease infestation, when seedlings were attacked by fungi a fungicide (Dithane) was sprayed to the plants.

Collection of baseline data, the seedling height, stem diameter and number of leaves were done before the application of the treatment. It was on the 7th day after transplanting and acclimatization period. In the 20th day the first collection of data was done. The second and third data collections were done in the 40th and 60th days of observation.

2.4 Statistical Analysis

To analyze the data, the Analysis of Variance (ANOVA), one way classification was used to find out if there was a significant difference in the effect of different organic fertilizers on the number of leaves developed, seedling height, and seedling stem diameter of Durian (*Durio zibithenus*) seedlings. Duncan's Multiple Range Test (DMRT) was used to further test which of the treatment vary significantly.

2.5 Treatments and Field Lay-out

Table 1
The design and arrangement of the treatments and replication in Randomized Complete Block Design (RCBD)

Replication	Treatments		
	T ₁ (Decayed Rice Straw)	T ₂	T ₃
		(Cow Manure)	(Vermicompost)
R ₁	T ₁ R ₁	T ₂ R ₁	T ₃ R ₁
R ₂	T ₁ R ₂	T ₂ R ₂	T ₃ R ₂
R ₃	T ₁ R ₃	T ₂ R ₃	T ₃ R ₃
R ₄	T ₁ R ₄	T ₂ R ₄	T ₃ R ₄
R ₅	T ₁ R ₅	T ₂ R ₅	T ₃ R ₅
R ₆	T ₁ R ₆	T ₂ R ₆	T ₃ R ₆
R ₇	T ₁ R ₇	T ₂ R ₇	T ₃ R ₇
R ₈	T ₁ R ₈	T ₂ R ₈	T ₃ R ₈
R ₉	T ₁ R ₉	T ₂ R ₉	T ₃ R ₉
R ₁₀	T ₁ R ₁₀	T ₂ R ₁₀	T ₃ R ₁₀

3 RESULTS AND DISCUSSION

The study on the growth response of grafted durian (*Durio zibithenus*) seedlings applied with organic fertilizers gave the following results.

3.1 Increase in height (cm) of Grafted Durian Seedlings

Figure 1 presents the increased height of grafted durian seedlings at 20th day after treatment application. It shows that T₂ obtained the highest total with 21.90 cm, followed by T₁, 20.50 cm and lastly, T₃ obtained the lowest with a total of 20.0 cm.

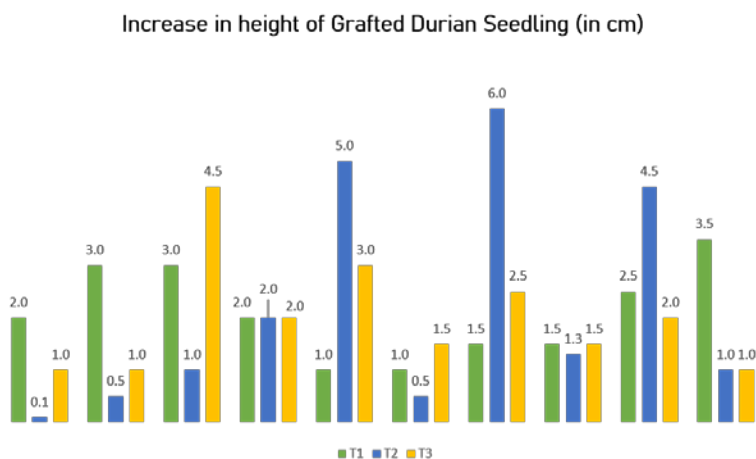


Figure 1. Increase in Height (cm) of Grafted Durian Seedling at 20th Day after Treatment Application

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	Compute d_f	Tabular f	
					5%	1%
Treatments	0.19	2	0.095	0.043ns	3.35	5.49
Error	60.22	27	2.23			
Total	60.41	29				

Table 1. Analysis of Variance (ANOVA) for the data in Figure 1

The Analysis of Variance (ANOVA) computation shows that the computed f value 0.043 is lesser than the tabular f value at both 5% (3.35) and 1% (5.49) levels of significance, respectively. Therefore, the null hypothesis is accepted that there is no significant difference on the growth response of grafted durian (*Durio zibethenus*) seedlings applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) particularly on the increased height of the seedlings at 20th day after treatment application.

Figure 2 presents the increased height of grafted durian seedlings at 40th day after treatment application. It shows that T₃ has the lowest total with a 33.0, followed by T₁ with total of 41.0 and the highest was the T₂ with a total of 57.0

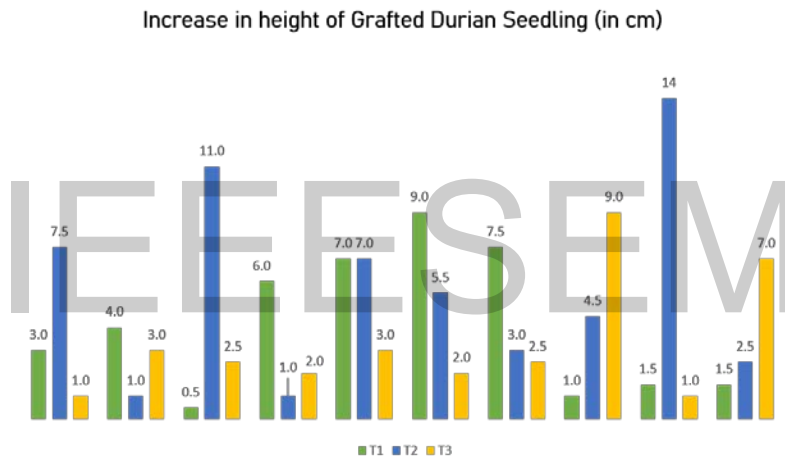


Figure 2. Increase of Height (cm) of Grafted Durian Seedling at 40th Day after Treatment Application

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	Compute d_f	Tabular f	
					5%	1%
Treatments	29.87	2	14.94	1.29ns	3.35	5.49
Error	311.6	27	11.54			
Total	341.47	29				

Table 2. Analysis of Variance (ANOVA) for the data in Figure 2

The Analysis of Variance (ANOVA) in figure 2 above shows that the computed f value 1.29 is lesser than the tabulated f value of 3.35 and 5.49 at both 5% and 1% levels of significance, respectively. This justifies the acceptance of the null hypothesis. This means that there is no significant difference on the growth response of grafted Durian (*Durio zibethenus*) seedlings applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) particularly on the increased height of the seedlings at 40th day after treatment application.

Figure 3 presents the increase height of grafted durian seedlings at 60th day after treatment application. It shows that T₁ obtained the lowest total with a 29.40 followed by T₂ with 49.90, and lastly the highest is T₃ with a total of 57.50.

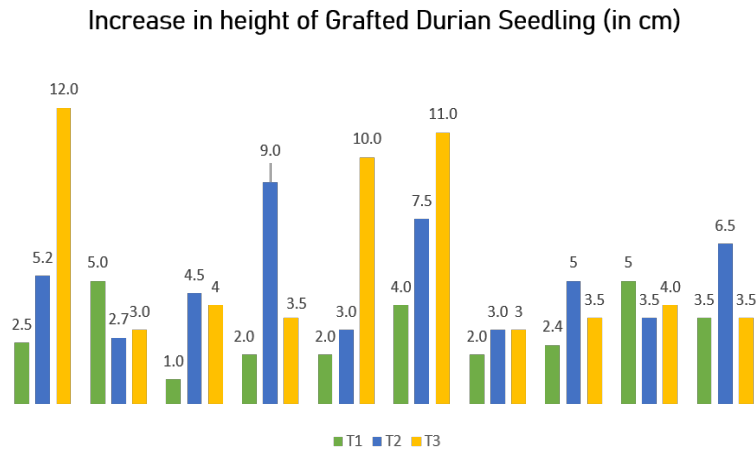


Figure 3. Increase of Height (cm) of Grafted Durian Seedling at 60th Day after Treatment Application.

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	Computed f	Tabular f	
					5%	1%
Treatments	42.25	2	21.12	3.20ns	3.35	5.49
Error	178.28	27	6.6			
Total	220.53	29				

Table 3. Analysis of Variance (ANOVA) for the data in Figure 3

When figure 3 were subjected to Analysis of Variance (ANOVA) Test it shows that the computed f value 3.20 found to be lesser than the tabular f value at both 5% (3.35) and 1% (5.49) levels of significance, respectively. Hence, the null hypothesis is accepted that there is no significant difference on the growth response of grafted Durian (*Durio zibethenus*) seedlings applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) particularly on the increased height of the seedlings at 60th day after treatment application.

3.1 Increase in stem diameter (mm) of Grafted Durian Seedlings

Figure 4 presents the increase of stem diameter of the grafted durian seedlings on the 20th day after the application of the treatments. It shows that T₃ obtained the highest with a total of 9.73. This is followed by T₂ with 7.45 and lastly is T₁ obtained the lowest total of 4.78

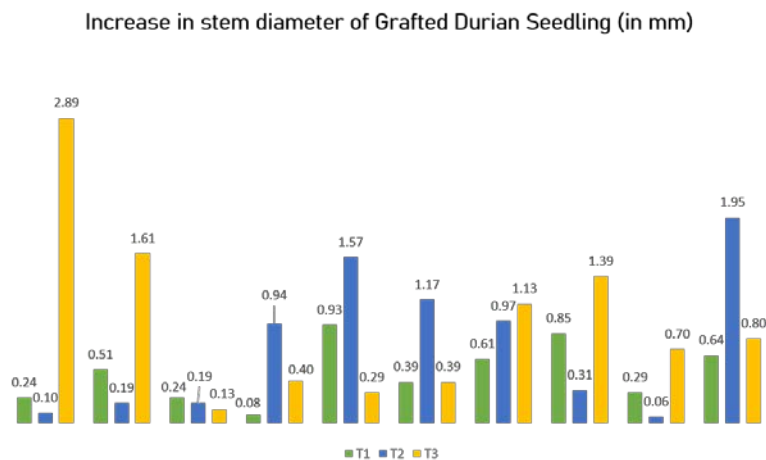


Figure 4. Increase of Stem Diameter (mm) of Grafted Durian Seedlings at 20th Day after Treatment Application.

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	Compute d_f	Tabular f	
					5%	1%
Treatments	0.82	2	0.41	0.98ns	3.35	5.49
Error	11.43	27	0.42			
Total	12.25	29				

Table 4. Analysis of Variance (ANOVA) Test for the Data in Figure 4

When figure 4 were subjected to Analysis of Variance (ANOVA) Test as shown in Table 4, the computed f value 0.98 is of lesser than the tabular f value at both 5% (3.35) and 1% (5.49) levels of significance, respectively. Therefore, the null hypothesis is accepted that there is no significant difference on the growth response of grafted Durian (*Durio zibethenus*) seedlings applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) particularly on the increase of stem diameter of the seedlings at 20th day after treatment application.

Figure 5 presents the increase of stem diameter of the grafted durian seedlings on the 40th days after the application of the treatment. It shows that T₃ obtained the highest total with 10.24, followed by T₂ with 9.24 and the T₁ obtained the lowest with a total of 6.33, treated with vermicompost.

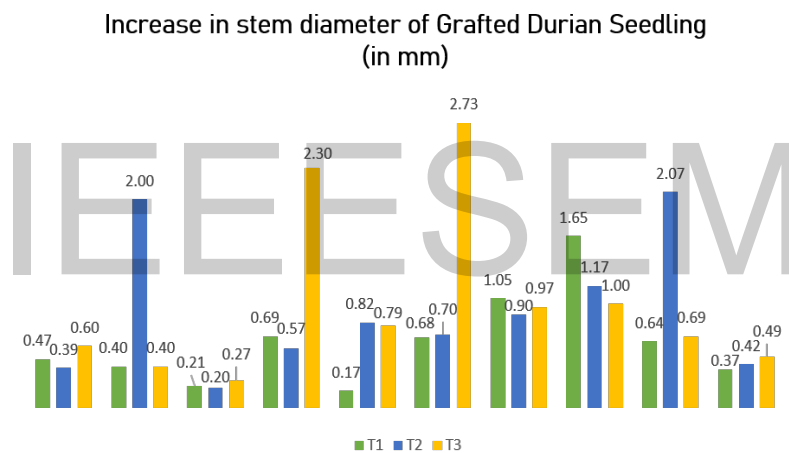


Figure 5. Increase of Stem Diameter (mm) of Grafted Durian Seedling at 40th Day after Treatment Application.

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	Compute d_f	Tabular f	
					5%	1%
Treatments	0.82	2	0.41	0.95ns	3.35	5.49
Error	11.67	27	0.43			
Total	12.49	29				

Table 5. Analysis of Variance (ANOVA) Test for the Data in Figure 5

When figure 5 were subjected to Analysis of Variance (ANOVA) Test the computed f value 0.95 is lesser than the tabular f value at both 5% (3.35) and 1% (5.49) levels of significance, respectively. Hence, the null hypothesis is accepted that there is no significant difference on the growth response of grafted Durian (*Durio zibethenus*) seedlings applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) particularly on the increase of stem diameter of the seedlings at 40th day after treatment application.

Figure 6 presents the increase of stem diameter of grafted Durian seedlings on the 60th days after treatment application. The table shows that the T₂ obtained the lowest with a total of 4.77, followed by T₁ with 5.23 and the T₃ obtained the highest increase with a total of 8.38.

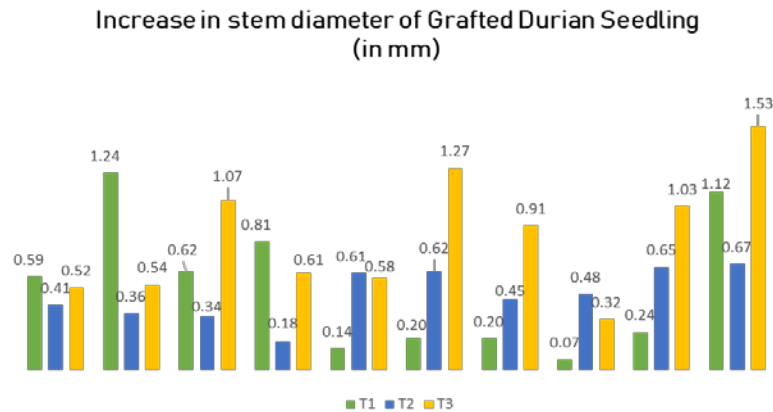


Figure 6. Increase of Stem Diameter (mm) of Grafted Durian Seedling at 60th Day after Treatment Application.

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	Compute <i>df</i>	Tabular <i>f</i>	
					5%	1%
Treatments	0.77	2	0.38	3.17ns	3.35	5.49
Error	3.18	27	0.12			
Total	3.95	29				

Table 6. Analysis of Variance (ANOVA) Test for the Data in Figure 6

The Analysis of Variance (ANOVA) in Table 6 shows the computed *f* value 3.17 is lesser than the tabular *f* value at both 5% (3.35) and 1% (5.49) levels of significance, respectively. Hence, the null hypothesis is accepted that there is no significant difference on the growth response of grafted Durian (*Durio zibethenus*) seedlings applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) particularly on the increase of stem diameter of the seedlings at 60th day after treatment application.

3.3 Increase in number of leaves of Grafted Durian Seedlings

Figure 7 presents the increase of number of leaves on the 20th day after treatment application. It shows that T₁ obtained the lowest with a total of 2, followed by T₂ with a total of 4, and the highest was obtained by T₃ with a total of 8.

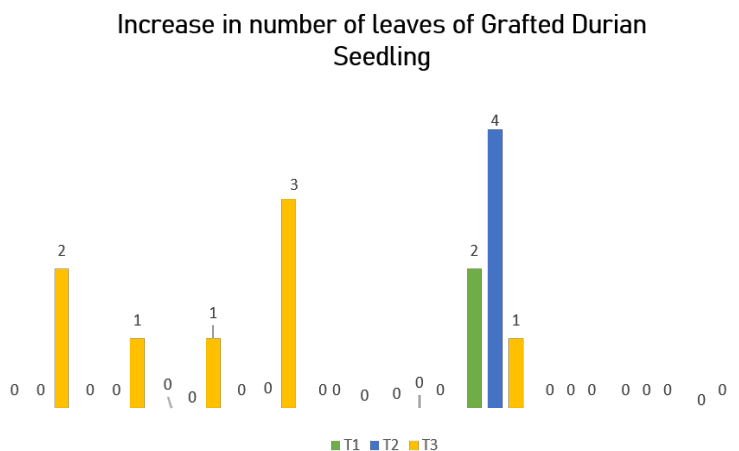


Figure 7. Increase of number of leaves of Grafted Durian Seedling at 20th Day after Treatment Application.

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	Compute d_f	Tabular f	
					5%	1%
Treatments	1.87	2	0.94	0.92ns	3.35	5.49
Error	27.6	27	1.02			
Total	29.47	29				

Table 7. Analysis of Variance (ANOVA) for the data in Figure 7.

When figure 7 were subjected to the Analysis of Variance (ANOVA) Test, the computed f value 0.92 is of lesser than the tabular f value at both 5% (3.35) and 1% (5.49) levels of significance, respectively. Therefore, the null hypothesis is accepted that there is no significant difference on the growth response of grafted Durian (*Durio zibethenus*) seedlings applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) particularly on the increased number of leaves of the seedlings at 20th day after treatment application.

Figure 8 above presents the increased number of leaves of grafted Durian seedlings on the 40th day after treatment application. The table shows that T₃ obtained the lowest with a total of 30.0 and followed by T₁ with a total of 31.0; T₂ obtained the highest with a total of 48.0.

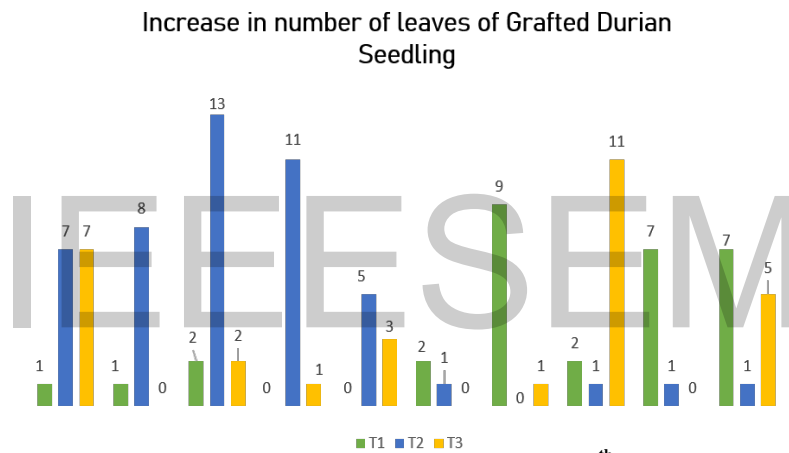


Figure 8. Increase of number of leaves of Grafted Durian Seedling at 40th Day after Treatment Application.

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	Compute d_f	Tabular f	
					5%	1%
Treatments	20.47	2	10.24	0.66ns	3.35	5.49
Error	418.5	27	15.5			
Total	438.97	29				

Table 8. Analysis of Variance (ANOVA) for the data in Figure 8.

The Analysis of Variance (ANOVA) Test, shows that in the computed f value 0.66 is lesser than the tabular f value at both 5% (3.35) and 1% (5.49) levels of significance, respectively. Hence, the null hypothesis is accepted that there is no significant difference on the growth response of grafted Durian (*Durio zibethenus*) seedlings applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) particularly on the increased number of leaves of the seedlings at 40th day after treatment application.

Figure 9 presents the increased number of leaves on the 60th day after treatment application of the grafted Durian seedlings. The table shows that the lowest total of 31.0 obtained by T₃ and followed by T₂ with a total of 36.0. The highest was obtained by T₁ with a total of 44.0.

Increase in number of leaves of Grafted Durian Seedling

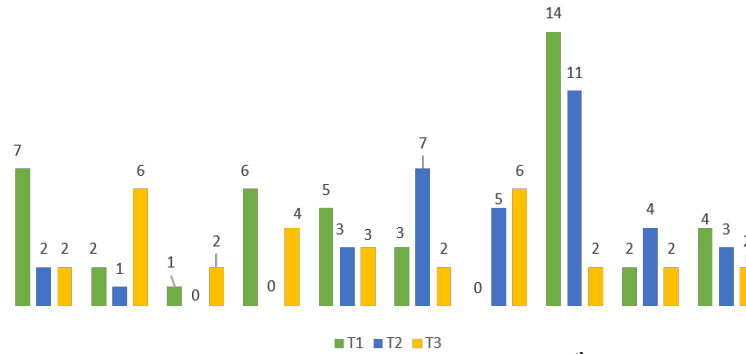


Figure 9. Increase of number of leaves of Grafted Durian Seedling at 60th Day after Treatment Application.

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	Compute d_f	Tabular f	
					5%	1%
Treatments	8.6	2	4.3	0.42ns	3.35	5.49
Error	275.7	27	10.21			
Total	284.3	29				

Table 9 Analysis of Variance (ANOVA) for the data in Figure 9.

The Analysis of Variance (ANOVA) Test shows the computed f value 0.42 is of lesser value than the tabular f value at both 5% (3.35) and 1% (5.49) levels of significance. Thus, the null hypothesis is accepted that there is no significant difference on the growth response of grafted Durian (*Durio zibethenus*) seedlings applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) particularly on the increased number of leaves of the seedlings at 60th day after treatment application.

The study resulted non – significant due to the following treatments, the decayed rice straw, cow manure, and vermicompost have the same nutrient contents. According to [1], decayed rice straw is rich in nitrogen, potassium and silicon. The straw produced contain more than a third of the nitrogen and more than four times the potassium annually used as fertilizer. [6] stated that the cow manure contains the three major plants nutrients, Nitrogen, Phosphorus and Potassium (NPK), as well as Calcium, Magnesium and Silicon. [2] mentioned that vermicompost contained nitrates, exchangeable phosphorus, and soluble potassium, calcium, and magnesium. The three (3) treatments have the same nutrient composition, all of them have macro nutrient which are Nitrogen, Phosphorus and Potassium, and the same nutrients such as calcium, manganese and silicon.

The environmental factors had affected the study, for the last three consecutive months, from January to March dry spell happened and the duration of the study was from February 13 to April 14, 2019 where seldom rain occurred. According to [4], a prolonged period of drought of up to three months is harmful to durian, which may suffer irreversible damage. The ideal annual rainfall for durian production is 2000 mm and above, and the yearly average total rainfall should exceed 3000 mm. Juvenile durian trees are very susceptible to drought and high mortality rate cannot be avoided. In our study the mortality rate of the grafted durian seedlings lessens because of proper watering but the plant suffers disease because of too much exposure with the sunlight, specifically in leaves such as sun scorched and necrosis disease.

4 CONCLUSION

Based on the results of the study, a conclusion was drawn that there was no significant difference on the growth response of grafted durian seedlings (*Durio zibithenus*) applied with organic fertilizers (decayed rice straw, cow manure, vermicompost) on the increase of height, stem diameter and number of leaves developed in seedlings in 20th, 40th and 60th day after treatment application. The three (3) treatments has the same results on the growth of the seedlings due to they have almost the same components of macro and micro nutrients.

5 RECOMMENDATION

1. Follow up study be conducted by the future researchers during rainy seasons and not during dry seasons or dry spell.
2. Similar studies using different treatments to the grafted durian seedlings may be done to compare the result of the study.
3. Similar studies using the same treatments on the other seedlings species to verify the result of the study.

REFERENCES

- [1] Amamsiri, S.L., Wickramasinghe, K. (1978) *Use of rice straw as a fertilizer material*. Central Agriculture Research Institute, Gannoruwa Peradeniya. Received 21.2.78
- [2] Arancon, N., Edwards, C. (2005) *Effects of vermicomposts on plant growth*. Soil Ecology Laboratory. The Ohio State University, Columbus. OH 43210 USA
- [3] Cunningham, T. (2000) *Durian market report*. Upland Development Programme in Southern Mindanao (UDP). Project A
- [4] Ketsa, S, Wisutiamonkul, A, Palapol, Y, Paull, R. (2020) *The Durian: Botany, Horticulture, and Utilization*. Horticultural Reviews, Volume 47. DOI: 10.1002/9781119625407.ch4
- [5] Ragasa, C., Bacar, J., Querido, M., Tan, M., Del Fierro, R., Choi, T. (2016) *Chemical constituents of Durio zibethinus Murr. Fruit*. International Journal of Pharmacology 8(8), 1300-1303 ISSN 0975-4873
- [6] Raj, A., Manoj, K.J., Pratap, T. (2014) *Cow dung for ecofriendly and sustainable productive farming*. International Journal of Scientific Research, (3)10 ISSN 2277-8179
- [7] Robbins, J. (2012). *Why trees matters*. The New York Times. Retrieved from <https://www.nytimes.com>
- [8] Spengler, T. (2017). *Durian tree fruit information*. Gardening Know How Blog. Retrieved from <ps://blog.gardeningknowhow.com>

IEEESEM