Global Forest Journal
Journal homepage: https://talenta.usu.ac.id/gfj

Responses of avocado (*Persea americana*) to various doses of compost fertilizer and watering interval

Kansih Sri Hartini[*1], Afifuddin Dalimunthe[1], Vinny Alvionita Br Tarigan[1], Aqilah Insani[2]
[1]*Faculty of Forestry, Universitas Sumatera Utara, Kampus 2 USU Bekala, Deli Serdang 20353, Indonesia*
[2]*PT. ITCI Hutani Manunggal, Jl. 1519 Simpang Terunen, Bumi Harapan Village, Sepaku District, Penajam Paser Utara Regency, East Borneo*
[*]Corresponding Author: kansih_sri_hartini@usu.ac.id

ARTICLE INFO
Article history:
Received 12 January 2024
Revised 19 January 2024
Accepted 22 January 2024
Available online 30 January 2024

E-ISSN: 3024-9309

How to cite:
K. S. Hartini. A. Dalimunthe. V. A. B. Tarigan. A. Insani "Responses of avocado (*Persea americana*) to various doses of compost fertilizer and watering interval", *Global Forest Journal*, vol. 02, no. 01, January 2024

http://doi.org/10.32734/gfj.v2i01.15562

ABSTRACT
Avocado is a multifunctional plant that can be utilized in all parts. The growth of avocado and its yield can be achieved by fulfilling requirements for the growth and maintenance of the plant well. Planting on dry land requires the addition of organic fertilizer and optimal water requirements to increase organic matter content and plant fertility. This research aims to obtain the optimal dosage of compost and watering intervals for the growth of avocado (*Persea americana*). The research was carried out in the Greenhouse Faculty of Agriculture, Universitas Sumatera Utara. This research used a factorial completely randomized design (F-CRD) with the addition of compost fertilizer doses (K0:0 kg, K1:0.5kg. K2: 1 kg. K3: 1.5 kg and K4: 2 kg) and watering intervals (A1: once a day. A2: once every three days. A3: once every five days and A4: once every seven days) with parameters of observation of height, diameter, top fresh weight, root fresh weight, top dry weight and root dry weight. The results showed that the interaction of compost and watering intervals significantly affected the height and diameter increase, root fresh weight, and root dry weight of avocado plants. The interaction of giving 1.5 kg of compost and watering intervals every day had the best effect on the growth and quality of avocado seedlings.
Keyword: Compost, Dry Land, *Persea americana*, Water Requirements

1. Introduction

Planting on drylands generally requires the addition of organic matter due to its low fertility. According to [1], the problems in dryland management are limited water and lack of organic content in the soil. Drylands can be improved with soil and water conservation—commodity selection cropping patterns and planting periods to increase land and crop productivity [2]. Soil and water conservation can be done by adding organic materials to improve soil fertility. The Besitang area has quite dry soil and low organic matter content. Therefore, properly managing drylands in Besitang that leads to a sustainable increase in production is necessary. Using land resource technology to increase dryland productivity, which is relatively easy to do, is using organic materials. Mulch, organic waste, compost, and manure (organic materials) can improve soil's physical and chemical properties and increase crop production. One thing that can be done is to use compost; the role of compost in improving soil properties, among others, is that compost contains high levels of C-organic, N, P, and K and has a high CEC value [3]. According to [4], compost fertilizer can restore soil fertility by providing microelements for plants, loosening the soil, improving soil structure and texture, and binding water in the soil.

The selection of commodities to be planted on dry land must have land suitability—environmental benefits and also economic benefits for the surrounding community [5]. Avocado is one of the multipurpose tree species

(MPTS) that can be used as a solution for planting on dry land. Avocado plants have taproots that can increase infiltration and the potential for cultivation on marginal land [6]. Even so, to get optimal avocado growth results, it is necessary to add organic materials. One of which is compost. According to the research results [7], adding compost fertilizer can increase the wet weight, dry weight, and root shoot ratio of mahogany seedlings.

In addition to applying compost fertilizer, avocado planting must consider water needs. Plant water supply must follow their needs because too little or too much will harm plants [8]. Providing suitable water needs can be known by watering intervals; watering intervals significantly affect breadfruit plants' growth on height parameters and the percentage of lower plant water content [9]. Therefore, this study aims to provide information on the optimal dose of compost fertilizer and watering interval for avocado (*Persea americana*) growth.

2. Method

2.1. Research design

The research was conducted in the Greenhouse of the Faculty of Agriculture, Universitas Sumatera Utara. The materials used in this study were avocado seedlings aged three months, as many as 60 seedlings, topsoil, compost fertilizer, and water. This study used several pieces of equipment, namely polybags of 40 x 50 cm size, buckets, rulers, calipers, scales, scissors, analytical balances, ovens, cameras, and Microsoft Excel software. The trial in this study used a Factorial Completely Randomised Design (F-CRD) with three replications and two factors, namely the dose of compost fertilizer (K0:0 kg. K1:0.5 kg. K2:1 kg. K3:1.5 kg and K4:2 kg) and watering interval (A1: once a day, A2: once every three days, A3: once every five days and A4: once every seven days). There were 20 (twenty) treatment combination of this study, describe on Table 1. Parameters observed included height, diameter, number of leaves, fresh weight of the top of the plant, fresh weight of the root of the plant, dry weight of the top of the plant, and dry weight of the root of the plant [10]-[11].

Tabel 1. Treatment combination of this study

No	Treatment combination	K (Dose of Compost Fertilizer)	A (Watering Interval)
1	K0A1	0 kg compost	watering everyday
2	K0A2	0 kg compost	watering once every three days
3	K0A3	0 kg compost	watering once every five days
4	K0A4	0 kg compost	watering once every seven days
5	K1A1	0.5 kg compost	watering everyday
6	K1A2	0.5 kg compost	watering once every three days
7	K1A3	0.5 kg compost	watering once every five days
8	K1A4	0.5 kg compost	watering once every seven days
9	K2A1	1 kg compost	watering everyday
10	K2A2	1 kg compost	watering once every three days
11	K2A3	1 kg compost	watering once every five days
12	K2A4	1 kg compost	watering once every seven days
13	K3A1	1.5 kg compost	watering everyday
14	K3A2	1.5 kg compost	watering once every three days
15	K3A3	1.5 kg compost	watering once every five days
16	K3A4	1.5 kg compost	watering once every seven days
17	K4A1	2 kg compost	watering everyday
18	K4A2	2 kg compost	watering once every three days
19	K4A3	2 kg compost	watering once every five days
20	K4A4	2 kg compost	watering once every seven days

2.2. Research procedure

The seedlings were three months old and healthy, with an average height of 30-50 cm. Seedling gathered from commercial nursery at Jl. Bunga Herba, Padang Bulan. Soil as a planting medium was taken from Besitang District, Langkat Regency, North Sumatra Province. Then, the compost was obtained from a nursery shop in Padang Bulan, Medan. Each polybag used 6 kg of soil and added compost according to the predetermined treatment (Figure 1a.). The media was mixed evenly and then put into polybags. Then, each polybag is labeled based on the treatment and replication given. Planting avocado on each polybag (Figure

1b.) After that, it was watered based on the treatment that had been determined and observed for three months (90 days) [10]-[11].

(a) (b)

Figure 1. (a) Homogenized media (soil+ compost) according the treatment; (b) Avocado seedling planted on media

2.3. Data analysis

Data analysis used in this research is an analysis of variance (ANOVA) to determine whether or not compost fertilizer doses and watering intervals affect avocado plant growth. If Anova has a significant effect, it is continued with further tests based on Duncan's Multiple Range Test (DMRT). Scoring was carried out based on the DMRT test. The smaller total scoring value describes the optimal treatment growth for *Persea americana* seedlings.

3. Result and Discussion

The interaction of compost application and watering interval significantly affected the increase in height, diameter, top fresh weight, and root dry weight. The recapitulation of the results of the analysis of variance is shown in Table 2.

Table 2. Analysis of varians for observation parameters

Parameters	F-calculation		
	Compost fertilizer	Watering Interval	Interaction
Height increase	6.24*	10.20*	2.27*
Diameter increase	9.78*	16.95*	3.90*
Number of leaves	1.96ns	5.95*	1.31ns
Top fresh weight	1.30ns	7.05*	1.90ns
Root fresh weight	1.43ns	29.92*	2.45*
Top dry weight	1.27ns	7.87*	1.70ns
Root dry weight	1.01ns	30.08*	2.07*

Notes: *: Treatment is significant at 0.05 confidence level; ns: treatment has no significant effect.

3.1. Height increase

Based on Table 2, the interaction between compost fertilizer and watering interval significantly affects the average height gain of avocado seedlings. The average height increase of avocado seedlings is 7.14 cm. This height increase shows that compost fertilizer and proper watering play an important role in the growth of avocado plant height. According to [4], compost contains minerals that can improve soil's physical properties and soil structure so that plant roots can absorb nutrients to help plant height growth.

The best height increase is by applying the highest compost fertilizer dose of 2 kg. This is because the dose of 2 kg of compost causes the soil structure to become crumbly. According to [12], crumbly media causes the roots to continue to absorb nutrients and root extension, affecting plant height growth. Daily watering intervals provide the best height gain, indicating that avocados need water in the growth process. According to [13], water is very influential on the growth of a plant; the lack of available water conditions can interfere with the physiological processes of plants and cause stress.

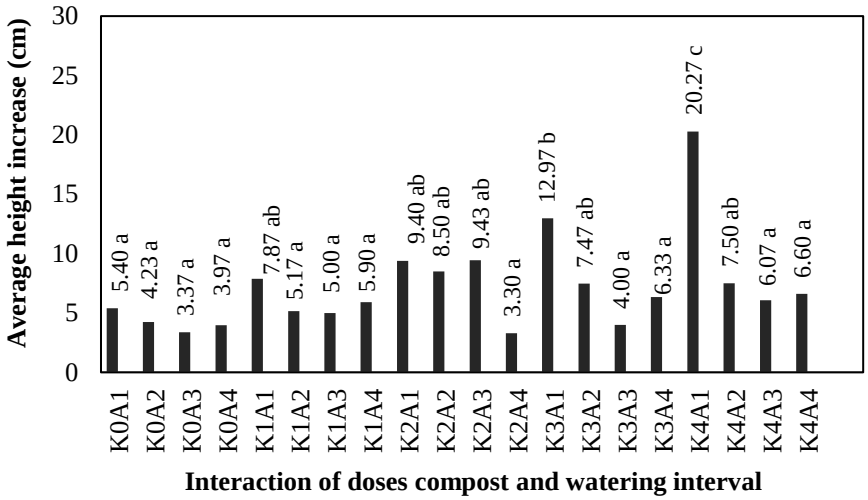

Figure 2. Duncan's multiple range test of average height increase
Notes: Numbers followed by the same letter indicate no significant difference in the 5% DMRT test.

3.2. Diameter increase

The interaction of compost fertilizer and watering intervals significantly affects diameter increase, so further diameter tests are carried out, as in Figure 3. The highest diameter increase is in adding 0.5 kg of compost with daily watering intervals, similar to the treatment of adding doses of 1 kg and 2 kg. Still, from the effectiveness of the dose used, 0.5 kg has obtained the same results as 2 kg. Based on research [14], the treatment of various doses of compost fertilizer significantly increases the diameter growth of *Gmelina arborea* seedlings. Compost fertilizer contains mineral nutrients that provide food for plants [15], so compost at a dose of 0.5 kg gets good diameter growth. It is necessary to water every day to get optimal avocado diameter growth; this is in line with research [16]. Dry environmental conditions cause plants to need a lot of water to survive. So, the best watering interval for avocado seedlings is every day. Water is a vital component plants need for growth and development [17].

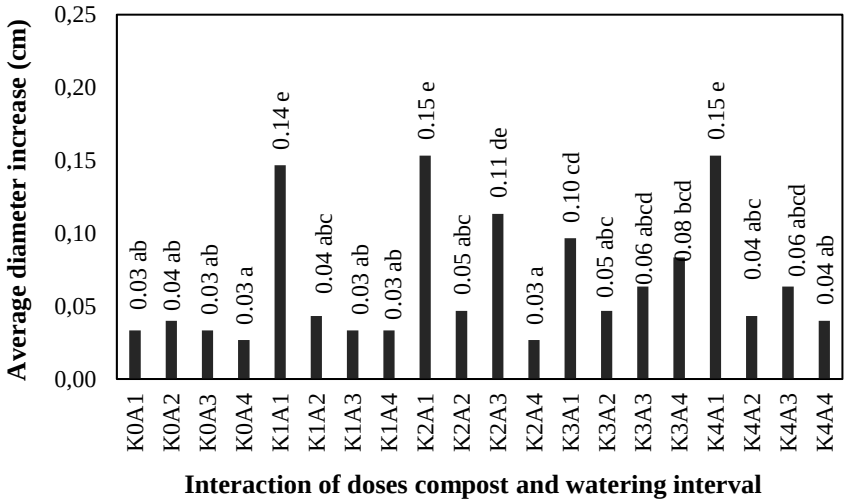

Figure 3. Duncan's multiple range test of average diameter increase
Notes: Numbers followed by the same letter indicate no significant difference in the 5% DMRT test

3.3. Number of leaves

Based on the analysis of variance in Table 1, the interaction of the addition of compost and watering intervals and the single factor of compost fertilizer application does not significantly affect the growth of the number of leaves of avocado seedlings. The treatment of watering intervals separately has a significant effect on the number of leaves of avocado seedlings, so that it is continued with the DMRT further test to determine the differences between each treatment level in Figure 4.

The results of further tests in Figure 3 show that treatment A1, namely watering every day, is similar to treatment A2, namely watering every three days. Watering every day with an increase in the number of leaves

of 18 strands is not significantly different from watering every three days as many as 15 strands on avocado plants (*Persea americana*). Based on research [16] the frequency of watering once a day shows the highest average value because watering every day fulfills the need for water in plants to carry out the photosynthesis process. As states [19], all physiological processes of plants require water, including cell division and leaf formation processes.

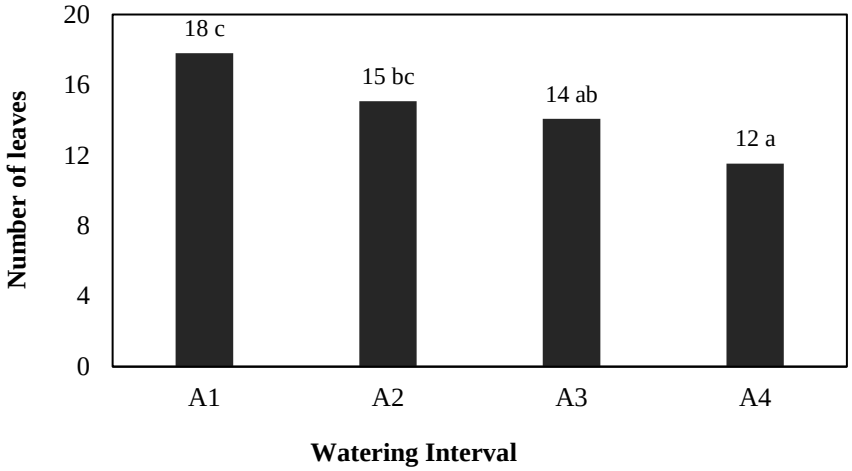

Figure 4. Duncan's multiple range test of number leaves
Notes: Numbers followed by the same letter indicate no significant difference in the 5% DMRT test

3.4. Top fresh weight

The fresh weight of the top of the avocado plant (*Persea americana*) is the weight of the plant before the plant experiences decay and water loss; the top fresh weight is the plant's total weight without roots. Based on the analysis of variability, the treatment of watering intervals significantly affects the average fresh weight of the top of the avocado plant (*Persea americana*), so further tests are carried out in Figure 5. The results of further tests showed that the treatment of watering every day gave the best results on the average fresh weight of the top of the plant, with a weight of 32.41 g. These results are based on research [20] on cocoa plants. The fresh weight of the crown gets the greatest weight on the watering interval every day. Plants that get more optimal water can develop a larger leaf area [17], which increases the fresh weight of the top of the plant.

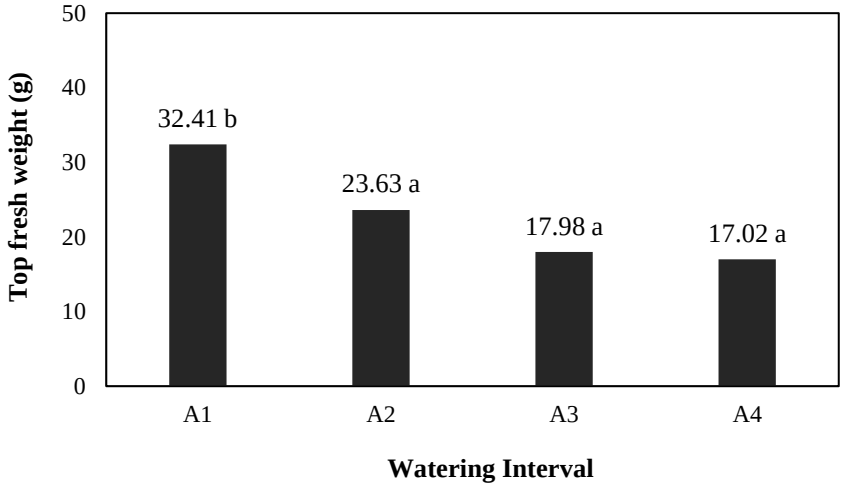

Figure 5. Duncan's multiple range test of the effect of watering interval on top fresh weight of avocado
Notes: Numbers followed by the same letter indicate no significant difference in the 5% DMRT test

3.5. Root fresh weight

The interaction of compost fertilizer application and watering interval significantly affected the root's average weight. The fresh root weight shows the number of roots plants produce to absorb water and nutrients in the growing medium [12]. Figure 6 shows that the average fresh weight of the root of the avocado seedlings in the observation is 16.94 g. The fresh weight of the root of the avocado plant (*Persea americana*) is highest in the K3A1 treatment, namely the interaction of the treatment of 1.5 kg compost fertilizer dose and watering

once a day, namely 65.63 g. According to [21], compost can absorb water and nutrients, especially N, P, and K elements, which are conducive to better root growth, so that more plant roots will directly increase the fresh weight of the roots. The fresh weight of the root of the plant is an important factor in plant growth that shows the ability to absorb nutrients and metabolism that occurs in plants [22]. The application of compost fertilizer at a dose of 1.5 kg can improve the physical soil so that the roots can grow well. Based on the results of research [23]. Compost fertilizer contains 1.05% P element, which plays a role in root development. Providing sufficient water also affects the root biomass of avocado plants. According to [24], giving water intervals in optimal conditions allows certain hormones to affect and stretch cell walls positively. When the plant produces new cells, it can accelerate the growth of stems, leaves, and roots.

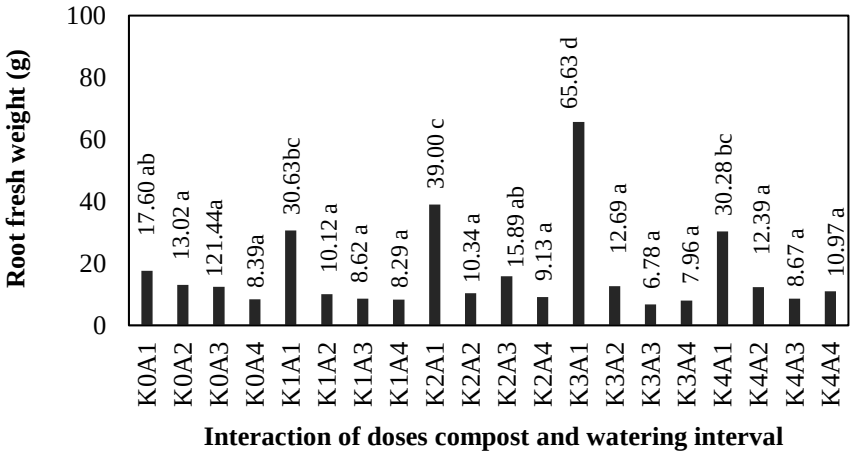

Figure 6. Duncan's multiple range test of root fresh weight of avocado
Notes: Numbers followed by the same letter indicate no significant difference in the 5% DMRT test

3.6. Top dry weight

The dry weight of the top of the avocado plant at 90 days after planting observation resulted in an average top dry weight of 13.05 g. The treatment of watering intervals significantly affected the average dry weight of the top part of the plant, so further tests were carried out in Figure 7. The treatment of watering intervals every day obtained the highest top dry weight of 18.37 g and the lowest dry weight in the treatment of watering intervals every seven days, which is 10.05 g. These results are based on research conducted [20] on cocoa plants with the highest dry weight at daily watering intervals. Dry weight, as a result of the representation of the wet weight of plants, is a plant condition that states the amount of accumulated organic matter contained in plants without water content [19]. The dry weight reflects the nutrients in the plant [12], and the availability of sufficient water helps plants carry out the photosynthesis process so that the dry weight of avocado plants in optima water conditions gets significant results.

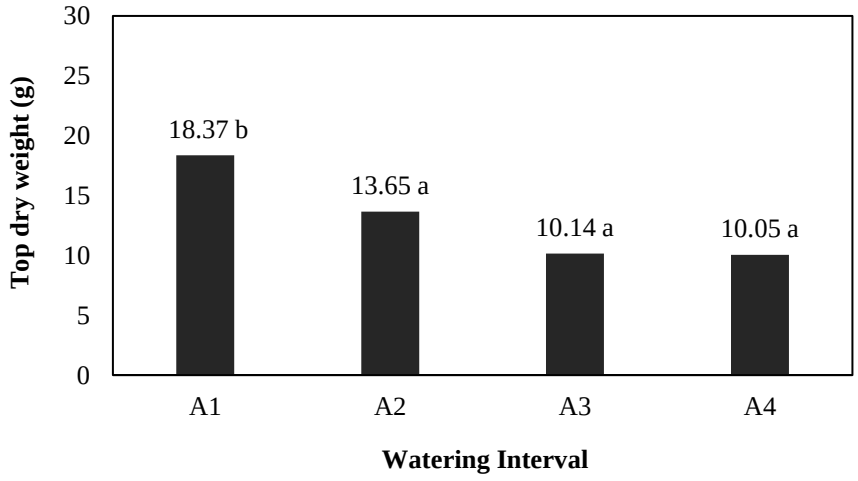

Figure 7. Duncan's multiple range test of the effect of watering interval on top dry weight of avocado
Notes: Numbers followed by the same letter indicate no significant difference in the 5% DMRT test

3.7. Root dry weight

Observation data on the root dry weight of the avocado plant based on the results of the analysis of variance shows that the application of compost fertilizer and watering intervals has a significant effect on the parameters of the root dry weight. Based on the analysis of variance, it is continued with the DMRT further test in Figure 8. A dose of compost fertilizer of 1.5 kg with daily watering shows the best root dry weight with a weight of 35.29 g, while the lowest root dry weight is in the control treatment / without giving compost fertilizer with watering every seven days. According to the opinion, the plant's dry weight shows the plant's nutritional status. It is an indicator that determines whether the plant is growing well and whether plants are utilizing nutrients [25]. This shows that compost fertilizer at a dose of 1.5 kg has met avocado plants' nutritional and nutrient needs. The availability of nutrients will determine the dry-weight production of plant seedlings. According to [22], compost can improve the physical, chemical, and biological properties of soil so that nutrients are available to support plant growth.

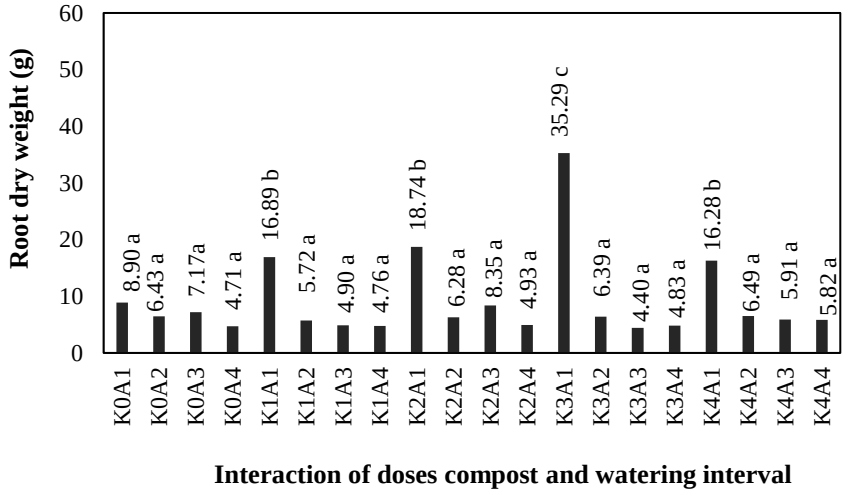

Figure 8. Duncan's multiple range test of root dry weight of avocado
Notes: Numbers followed by the same letter indicate no significant difference in the 5% DMRT test

3.8. Scoring the treatment of combination of compost fertilizer and watering interval

The results of the scoring of several treatments are given (Table 3). The scoring aimed to determine the best treatment on the parameters that show the results of a real effect on the provision of a combination of compost addition treatment and watering interval. The combined treatment of 1.5 kg compost fertilizer dose and watering interval got the highest results in the root fresh weight and the root dry weight, and the increase in plant height showed a relatively high value, so it became the best treatment combination suggested by the results of this study.

Table 3. Scoring results of the combined treatment of compost fertilizer and watering interval on avocado (*Persea americana*) seedling growth parameters

Parameters	Scoring				
	K1A1	K2A1	K2A3	K3A1	K4A1
Height increase	2.5	2.5	2.5	2	1
Diameter increase	1	1	1.5	2.5	1
Root fresh weight	2.5	2	3.5	1	2.5
Root dry weight	2	2	3	1	2
Total	8	7.5	10.5	6.5	6.5

4. Conclusion

The results showed that seedling height, stem diameter, root fresh weight, and root dry weight increased significantly in the combination of compost fertilizer treatment and watering interval. The treatment by adding 1.5 kg of compost fertilizer and watering intervals every day gave the best results in the growth of avocado seedlings.

References

[1] N. Hadiyanti, A.D. Pamujiati, N. Lisanty, "Sistem Budidaya Lahan Kering dan Pemanfaatan Pekarangan di Desa Kuncir Kabupaten Nganjuk," *Jurnal Masyarakat Merdeka*. vol. 04, no. 01. pp. 7-12. 2021.

[2] H. Helviani, A.W. Juliatmaja, D.I. Bahari, M. Masitah, H. Husnaeni, "Pemanfaatan dan Optimalisasi Lahan Kering untuk Pengembangan Budidaya Tanaman di Desa Puday Kecamatan Wongeduku Kabupaten Konawe Provinsi Sulawesi Tenggara," *Mitra Mahajana*: *Jurnal Pengabdian Masyarakat*. vol. 02. no. 01. pp. 49-55. 2021.

[3] A.A. Idjudin, S. Marwanto, "Reformasi Pengelolaan Lahan Kering untuk Mendukung Swasembada Pangan," *Jurnal Sumberdaya Lahan*, vol. 2, no. 2, pp. 115-125. 2008.

[4] R.C.M. Siregar, A. Dalimunthe, U. Budi, "Penggunaan Berbagai Dosis Kompos pada Tanaman Sukun (*Artocarpus communis*) di Daerah Tangkapan Air Danau Toba Kecamatan Horison Kabupaten Simalungun Solok Provinsi Sumatera Barat," *Peronema Forestry Science Journal*. vol.04. no.04. pp. 173-177. 2015

[5] N. L. Nurida, A. Mulayani, F. Widiastuti, F. Agus, "Potensi dan Model Agroforestri untuk Rehabilitasi Lahan Terdegradasi di Kabupaten Berau. Paser. dan Kutai Timur Provinsi Kalimantan Timur," *Jurnal Tanah dan Iklim*. vol. 42. no. 01. pp.13-26. 2017

[6] A. Nursaiidah, N. Bafdal, K. Amaru, "Analisis Kesesuaian Lahan Tanaman Alpukat (*Persea americana*) dalam Pengelolaan Lahan di Sub Das Cimanuk Hulu," *Jurnal Agrotek Indonesia*. vol 07. no. 01. pp. 1-8. 2022.

[7] B. Wasis, M. Fikri, "Pertumbuhan Semai Mahoni (Swietenia macrophylla) pada Media Tailing dengan Penambahan Arang Tempurung Kelapa dan Pupuk Kompos," *Journal of Tropical Silviculture*, vol. 12. no. 03. pp. 109-117. 2021.

[8] M. Lubis, S. Rosita, Irsal, "Tanggap Pertumbuhan Bibit Kako (*Theobroma cacao* L.) terhadap Berbagai Komposisi Media Tanam dan Frekuensi Penyiraman," *Jurnal Pertanian Tropik*. vol. 01. no. 06. pp. 1-10. 2019.

[9] A. Dalimunthe, B. Utomo, R. Fransiska, "Pengaruh Ketebalan Mulsa Ampas Tebu dan Interval Penyiraman terhadap Pertumbuhan Tanaman Sukun (*Artocarpus communis Forst*)," *TALENTA Conference Series: Agriculturan and Natural Resources*. vol. 03. no. 01. pp. 76-84. 2020.

[10] J.A. Yisau, A.M. Aduradola, "Growth response of Sysepalum dulcificum seedlings to watering regimes and nitrogen-based fertilizers," *Journal of Research in Forestry, Wildlife and Environment*, vol. 11, pp. 349-357. 2019.

[11] J.A. Yisau, A.R. Adesewa, E.P. Ndidi, M.A. Agnes, "Early Growth Response of Khaya senegalensis Seedlings to Water Requirement," *European Journal of Agriculture and Food Sciences*. 2023.

[12] F. Ahmad, Fathurrahman, Bahrudin, "Pengaruh Media dan Interval Pemupukan terhadap Pertumbuhan Vigor Cengkeh," *Jurnal Mitra Sains*. vol. 04. no. 04. pp. 36-47. 2016.

[13] F.J. Karo, A. Barus, M.K. Bangun, "Pengaruh Komposisi Media Tanam dan Interval Penyiraman terhadap Pertumbuhan Bibit Jambu Air Madu Deli Hijau (*Syzygium samarangense*)," *Jurnal Agroekoteknologi*. vol. 04. no. 01. pp. 1786-1795. 2015.

[14] K. Khairunnisa, "Pengaruh Komposisi Media Tanam dan Pemberian Pupuk Kompos terhadap Pertumbuhan Semai Gmelina," Disertasi. Universitas Hasanudin, Makasar, 2020. [Online]

[15] P. Tefa, M.R.I.C.O. Taolin, M.A. Lelang, "Pengaruh Dosis Kompos dan Frekuensi Penyiraman pada Pertumbuhan Bibit Sengon Laut (*Paraserianthes falcataria* L.)," *Jurnal Pertanian Konversi Lahan Kering*. vol. 01. no. 01. pp. 13-16. 2015.

[16] A. Dalimunthe, K.S. Hartini, G.I. Tampubolon, "Peningkatan Pertumbuhan Semai Alpukat (P*ersea americana*) dengan Aplikasi Berbagai Dosis Pupuk Kandang dan Interval Penyiraman," *Prosiding Seminar Nasional Silvikultur VIII Juli 2022 Lampung*, pp. 78-86. 2022.

[17] B.A. Kurniawan, S. Fajriani, Arifin, "Pengaruh Jumlah Pemberian Air terhadap Respon Pertumbuhan dan Hasil Tanaman Tembakau (*Nicotiana tabaccum* L.)," *Jurnal Produksi Tanaman*. vol. 02. no. 01. pp. 59-64. 2014.

[18] H. Afifah, R. Sutriono, I.M.L. Aji, "Pengaruh Media Tanam dan Frekuensi Penyiraman terhadap Pertumbuhan Semai Tanaman Kayu Putih (*Melaleuca cajuputi*)," *Jurnal Ganec Swara*. vol. 10. no. 01. pp. 107-114. 2016.

[19] S.H. Jafar, A.T. Josephus, I. Kalangi, M.T.Lasut, "Pengaruh Frekuensi Pemberian Ait terhadap Pertumbuhan Bibit Jabon Merah (*Anthocephalus macrophyllus* (Roxb.) Havil)," *Jurnal In Cocos*. vol. 02. no. 02. pp. 1-13. 2013.

[20] J. Pandiangan, "Pertumbuhan Bibit Kakao (Theobroma cacao L) pada Berbagai Komposisi TKKS dan Interval Penyiraman," Skripsi, Universitas Sumatera Utara. Medan, 2019. [Online]

[21] C.C. Mosooli, M.T. Lasut, J.I. Kalangi, S. Jos, "Pengaruh Media Tumbuh Kompos terhadap Pertumbuhan Bibit Jabon Merah (*Anthocephalus macrophyllus*)," *Jurnal Cocos*. vol. 07. no. 03. pp. 1-11. 2016.
[22] Samsudin, Nelvia, E. Ariani, "Aplikasi Trichokompos dan Pupuk NPK pada Bibit Kakao (*Theobroma cacao* L.) di Medium Gambut," *Jurnal JOM Faper*ta. vol. 04. no. 02. pp. 1-11. 2017.
[23] Surtinah, "Pengujian Kandungan Unsur Hara dalam Kompos yang Berasal dari Serasah Tanaman Jagung Manis (*Zea mays* saccharata)," *Jurnal Ilmiah Pertanian*. vol 11. no. 01. pp. 11-17. 2013.
[24] Haryadi, *Pengantar Agronomi*, Departemen Agronomi Fakultas Pertanian Institut Pertanian Bogor, Bogor, 1986.
[25] U.K.P Sitorus, B. Siagian, N. Rahmawati, "Respons Pertumbuhan Bibit Kakao (*Theobroma cacao* L.) terhadap Pemberian Abu Boiler dan Pupuk Urea pada Media Pembibitan," *Jurnal Online Agroekoteknologi*. vol. 02. no. 03. pp. 1021-1029. 2014.