IJSSR
International Journal of Social Service and Research

Vol. 04, No. 02, February 2024
e-ISSN: 2807-8691 | p-ISSN: 2807-839X

The Growth of Anglonema *Dus Anjamani* Plants Due to the Composition of the Growing Medium and Different Water Intervals

Heny M.C. Sine[1*], I Komang Sudarma[2], Aloysius Ngongo Lende[3]
Politeknik Pertanian Negeri Kupang, Kupang, East Nusa Tenggara, Indonesia[1,2,3]
E-mail: henysine2019@gmail.com*

Keywords
Aglonema, Growing Medium, Watering Intervals.

ABSTRACT
This research investigates the influence of planting media and watering intervals on the growth of Aglaonema. The study utilizes a Randomized Group Design (RAK) with various compositions of planting media, including husk charcoal, chicken manure bokashi, and eggshell flour, in ratios M1=1:2:1, M2=2:1:2, M3=3:2:1. Watering time intervals were set as I1=once every 2 days, I2=once every 4 days, and I3=every 6 days. There were 27 experimental units, each combination repeated thrice. Statistical analysis, including Sidik Ragam and Duncan's New Multiple Range Test (DNMRT), revealed a significant interaction effect between planting media and watering intervals on plant height, leaf number, leaf length, and leaf width of Aglaonema. Notably, the composition 3:2:1 showed the highest growth in plant height (5.03cm), leaf number (4.53 strands), leaf length (4.83cm), and leaf width (4.13cm). This composition did not significantly differ from 1:2:2 with a 2-day watering interval and 3:2:1 with a 2 and 6-day watering interval, but it significantly outperformed other treatments. The findings contribute valuable insights into optimizing Aglaonema growth conditions for enhanced quality and productivity.

INTRODUCTION

Aglaonema plant or Sri Rejeki is a leaf ornamental plant that can live in tropical climates, this causes this plant to be familiar to the people of Indonesia. This plant has characteristics on its large leaves, varied shapes, and color patterns also vary, because these characteristics are not surprising if this plant is a prima donna for ornamental and nursery plant traders. The high market demand affects the cultivation production of Aglaonema plants, thus making it possible to use Aglaonema plants widely. In addition, this plant has high popularity among the public, and has an expensive selling value, for some types it can reach Rp.1,000,000 per plant pot (Akbar, 2021). The beauty of the leaves of the aglaonema plant makes local and international breeders compete to produce Aglaonema that is superior in terms of color and leaf width.

In 2018 Indonesia was able to produce 853,544 potted Aglaonema plants, this decreased compared to 2017 which was 874,822 pots (Indonesian Central Bureau of Statistics, 2019). Statistical data in 2019 shows national Aglaonema production reached 816,468 trees. Aglaonema has a wide variety of varieties, with more than 22 species of Aglaonema with hundreds of varieties. Aglaonema trends often change according to the most popular leaf shapes and colors (Jasmine et al., 2023). Aglaonema plants can be planted in the field/land in the form of gardens in the yard of offices or homes or potted media as indoor plants. Growing conditions that must be considered are planting media.

This plant requires a growing medium that has fertility physically, chemically, and biologically. Aglaonema plants are prone to rotting of the roots. The decay is caused by bacteria or fungi caused by a

https://doi.org/10.46799/ijssr.v4i02.730

humid environment, so the planting media needed in Aglaonema cultivation is a planting medium that is able or easy to flow water so that the planting media does not store high moisture content so as not to cause rot in the roots. Furthermore, the planting medium must contain nutrients needed by plants. Plants in growth need macro and micronutrients.

One of the compositions of planting media commonly used for Aglaonema plants is a mixture of fern, humus, poor sand, and cocopeat with a ratio of 2: 1: 1: 1 (Wiryanta, 2007). The use of ferns as a planting medium should not be used because it is included in the list of CITES (Convention on International Trade in Endangered Species), which is a planting medium derived from plants that are almost extinct and highly protected (Shang et al., 2019; Zainab, 2019; Zamin et al., 2023). One way to overcome this problem is to find a replacement planting media composition so that Aglaonema plants can grow better or at least the same as using a mixture of fern planting media. Planting media that can be used include husk charcoal, chicken manure boakshi, and eggshells.

Chicken manure is an organic matter that has good prospects for being used as organic fertilizer (bokashi), because it has a high nutrient content (Vatika et al., 2021). The nutrient content contained in chicken manure bokashi is as follows: N = 1.610%, P = 1.131%, K = 1.015%, C-organic 17.6%, C/N ratio = 10.93. Emi, et al., (2021) explained that applying chicken manure bokashi fertilizer with the right dose can improve the physical, chemical, and biological properties of the soil so that the soil can provide space in the soil for air and water, improve soil structure to be more friable so that it will support the development of plant roots, increase nutrient availability, improve soil nutrient cycles, and the formation of micro and macro pores in the soil.

Mubarok, et al., (2012) showed that husk charcoal becomes lighter and suitable for potted ornamental plants when added as a growing medium. The specific gravity of the media plays an important role, especially in distribution or transportation. If the growing medium is loose and porous, Aglaonema can thrive. In addition to allowing plant roots to move freely to absorb nutrients, loose and porous growing media also circulate air to prevent stagnation and excess volume in the air (Chhabra & Chhabra, 2021; Dayananda, 2021; Wallach, 2019)). The ideal acidity for Aglaonema plants is pH 7 or neutral pH (Refugio et al., 2023; Saini et al., 2020; Widjaja et al., 2023). Porosity, water and air capacity, pH, EC, and other characteristics, as well as physical, chemical, and biological characteristics, must all be considered when choosing a growing medium.

In addition to these two-planting media, the addition of eggshell flour can also help maintain soil pH. Eggshells are household waste that can be processed and used as a substitute for lime to increase soil pH (Zulfita & Raharjo, 2012). The application of eggshell flour only has a noticeable effect on increasing the P-available soil. The interaction of chicken manure and eggshell flour has a real effect on increasing plant height and P-available soil (Simanjuntak, 2015). Eggshells generally consist of water (1.6%) and dry matter (98.4%). Of the total dry matter present, eggshells contain mineral elements (95.1%) and proteins (3.3%) (Nursiam, 2011) (Simanjuntak, 2015). Treatment of chicken eggshell powder can have a real effect on the height growth of Japanese frangipani (Adenium obesum) therefore eggshell waste can be used as fertilizer to obtain calcium elements and neutralize soil acidity levels (Darmadi et al., 2023; Tatsuzawa et al., 2021).

Aglaonema, recognized for its low maintenance as it does not require daily watering, still demands a regulated water supply to prevent stress and drought. Water, both essential and limiting for plant growth, plays a crucial role in maintaining physiological processes, including photosynthesis, and consequently influences crop yield and quality. The absence or excess of water can lead to a tipping point, causing a decline in plant processes.

Notably, Zainab and Salmawati's (2019) research demonstrates the significant impact of varied planting media compositions on parameters such as plant length, leaf number, and Aglaonema stem diameter. However, watering intervals did not exhibit a noticeable effect on observed parameters, and the interaction between both treatment factors remained inconspicuous.

In light of the aforementioned findings, this research aims to determine the optimal composition of planting media with specific water intervals for enhancing the growth of Aglaonema Dus Anjamni. The objective is to achieve improved growth comparable to or surpassing that obtained using a fern planting media mixture. This study addresses the need for tailored cultivation strategies to maximize Aglaonema growth, contributing novel insights to the cultivation practices of this low-maintenance ornamental plant.

METHODS

Experiment Design and Data Analysis

The study used a Randomized Group Design (RAK). Treatment tried: Composition of Planting Media with a ratio (v:v:v) of husk charcoal, chicken manure bokashi, and eggshell flour, M1= husk charcoal + chicken manure bokashi + eggshell flour (1:2:2), M2= husk charcoal + chicken manure bokashi + eggshell flour (2:1:2), M3 = husk charcoal + chicken manure bokashi + eggshell flour (3:2:1) with Watering Time Interval I1= once every 2 days, I2 = once every 4 days, I3 = once every 6 days and there are 9 combinations, repeated 3 times so that there are 27 experimental units. Each treatment contained 3 pots and 2 sample plants, and a total of 81 plants. The research data was analyzed using Sidik Ragam and there was a real effect, followed by Duncan's New Multiple Range Test (DNMRT) tests at a real level of 5%.

Tools and Materials

Equipment and materials used: pots (diameter 15 cm) cuter knives, shovels, buckets, mixed spoons, scales, hygrometers, thermometers, soil pH, meters, blenders, measuring cups, spoons, cameras, stationery, Aglonema saplings type of Anjamani Box, chicken manure bokashi, husk charcoal, eggshells, betadine, furandan, plastic sacks, anthracel, water, vitamin B1.

Research Procedure

Making bokashi laying hens according to Hidayat (2020) modified. Ingredients used for making chicken manure bokashi: chicken manure as much as 200 kg, rice husk 10 kg, bran as much as 10 kg, sugar 200 g, Gamal leaves 25 kg, EM4 as much as 220 ml, and water as 20 l. Mix chicken manure, rice husks, rice bran, and gamal leaves until evenly mixed. Dissolve EM4 and granulated sugar in water in a bucket container then sprinkle the solution slowly on the dough mixture of chicken manure, rice husks, gamal leaves, and rice bran while stirring evenly until the dough is compact when clenched by hand. Put the dough in sacks and keep it in the shade for 21 days. The dough will undergo a fermentation process so that to maintain temperature stability, stirring is done every day and then closed again. The fermentation process is 21 days, and the dough has been physically shown to smell like tape, loose and not hot.

Eggshell flour making. Eggshells are boiled with water to boil to kill all microorganisms. Boiled eggshells are drained of water and then dried in the sun, after drying chopped using mortal (crusher) to chop eggs. Mixing plant medium. Mixing the substrate according to treatment. Measurement of the volume of each plant medium using a container in the form of a bucket with a capacity of 5 liters. Husk charcoal is obtained from husk charcoal sellers. Media that has been mixed according to the treatment is put in a pot and followed by planting.

Separation of Aglaonema Dus Anjamani saplings. Separating Aglaonema plants from their parents. Remove all plants from the propagation pot then water the roots of the plants so that the soil is released so that it is easier to separate. Separation by cutting the roots that are still connected to the mother using a sterile knife (Cuter), then the cut wound is smeared with betadine to prevent infection. The plants used are plants that have 3 to 5 leaves. Fill the planting media as much as 1/2 part of the pot, then input the plant followed by the addition of planting media until filling the pot 3/4 part. Free up space approximately 5 cm from the lip of the pot so that when watering water can absorb perfectly.

Watering is carried out immediately after planting until the medium is wet, which is characterized by the discharge of water from the pothole.

Watering is carried out in the afternoon according to the treatment with intervals of 2 days, 4 days, and 6 days. The amount of water given is the same for all plants, which is as much as 250 ml per pot. Give Vitamin B1 when plants are 30 days old after plants by dissolving 5 ml of vitamin B1 in 1 liter water and then spraying on plants using a sprayer.

Plant height gain is measured by dividing plant height at the age of 12 MSPT by plant height at the beginning of planting (0 MSPT). Increase in the number of leaves per plant (strands): calculates the number of leaves that increase from the beginning of planting to the age of 12 MSPT. Leaf length was measured by leaf length at the age of 12 MSPT with leaf length at the beginning of planting (0 MSPT); leaf width was measured by leaf width at the age of 12 MSPT to leaf width at the beginning of planting (0 MSPT).

RESULTS

Increase in Plant Height (cm) and Number of Leaves (strands)

The results of the variance analysis showed that there was a significant influence of the interaction between the composition of the growing medium and the interval of water application on plant height increase and the number of Aglaonema leaves. The average increase in plant height and number of leaves of Aglaonema are listed in Table 1.

Table 1. Effect of Planting Media and Watering Interval on Plant Height Increase (cm) and Number of Leaves (Strands)

Treatment (Husk charcoal:Bokashi Chicken manure:Eggshell + watering interval)	Plant Height (cm)	Number of leaves (strands)
M1I1 = 1:2:2 + 2 days of watering	3.25 ab	3.32 ab
M1I2 = 1:2:2 + 4 days of watering	3.82 AB	3.22 ab
M1I3 = 1:2:2 + 6 days of watering	2.72 b	2.98 b
M2I1 = 2:1:2 + 2 days of watering	2.64 b	3.22 ab
M2I2 = 2:1:2 + 4 days of watering	2.80 b	2.70 b
M2I3 = 2:1:2 + 6 days of watering	2.41 b	2.62 b
M3I1 = 3:2:1 + 2 days of watering	5.00 A	4.20 a
M3I2 = 3:2:1 + 4 days of watering	5.03 a	4.53 a
M3I3 = 3:2:1 + 6 days of watering	4.83 a	3.82 AB

Description: The numbers followed by the same letter did not differ markedly based on Duncan's New Multiple Range Test (DNMRT) at a real level of 5%

In Table 1 it can be seen that the treatment of the composition of the planting media 3: 2: 1 and 4 days of water application (M3I2) resulted in the highest increase in plant height (5.03cm) and was no different from the composition of the planting media 1: 2; 2, 2 days and 4 water administration, planting media composition 3: 2: 1, intervals 2 and 6 days water administration but different from other treatments. The composition of the planting medium is 3:2:1 and the interval of application of water provides optimal growing space. The composition of the planting medium is very influential on the physical properties of the soil such as porosity and soil moisture content. The composition of the growing medium 3: 2: 1 and 4 days of water administration produces good pore space so that it can bind the water given at intervals of 4 days of administration. In addition, the composition can have a good influence on soil chemical properties such as macro and micronutrients needed for plant vegetative growth.

Aglaonema plants want porous media and bind water so that water remains available for plant growth. The composition of husk charcoal, chicken manure bokashi, and eggshell flour (3:2:1) is a composition that can provide good physical and chemical properties of the growing media for the growth of Aglaonema while giving water at intervals of 4 (four) days keeps the planting media moist even though the weather is hot. Husk charcoal can have a good effect on porosity, chicken manure bokashi will bind water and provide nutrients while eggshells can keep soil pH in the neutral range so that plant roots can absorb water and nutrients well.

Jemrifs et al., (2013), Water stress that occurs in cultivated plants has an impact on inhibiting the distribution of assimilate in reproductive organs and the process of photosynthesis. Assimilation itself is the process of forming organic compounds (glucose/carbohydrates) from inorganic compounds (in the form of water and Kabondioxide) and photosynthesis is included in the assimilation process. Water is the raw material for the photosynthesis process and if water is available, all nutrient absorption processes and nutrient translocation to leaves run well so as not to inhibit the process of cell division and cell enlargement. This statement is in line with Nugroho and Setiawan (2022) that increasing the number of cells and enlarging cell size can affect plant height. Nurrohman et al., (2019) added that the lower the water content available, the lower the height of the plant.

Treatment of the composition of the planting media 3: 2: 1 and 4 days of water (M3I2) resulted in the largest increase in the number of leaves of Aglaonema plants (4.53 strands) and was no different from the composition of the planting media 1: 2; 2, intervals of 2 days and 4 days of watering, composition of planting media 2: 1: 2, interval of 2 days of watering, composition of planting media 3: 2: 1 intervals of 2 days and 6 days of water but different from other treatments. The composition of the planting media 3: 2: 1 provides optimal growing space, where the planting media can prepare enough water so that the cell division process in multiplying cells can run well it can increase the volume of Aglaonema plant cells which has an impact on increasing the number of plant leaves.

Bokashi chicken manure plays a role in binding water and providing nutrients, husk charcoal can provide porosity that provides the optimum amount of oxygen and water while eggshell flour can affect soil pH thereby reducing the acidity level of the growing medium. The function of water for plants is very important, especially in the process of growth and development because water is the raw material for the photosynthesis process with carbon dioxide. Water available to plants will support the process of nutrient absorption by the roots and translocated to the leaves so that the photosynthesis process can run properly.

Photosynthesis is the result of photosynthesis and the energy source needed by plants for the process of cell division and enlargement in leaf organs. Karimuna, et al., (2022), stated that plants that have many leaves are plants that produce high photosynthetic yields because the results of photosynthesis are used by plants to form leaves. The right combination of garden media can provide fertility physically, chemically, and biologically so that all plant physiological processes can run properly. According to Tome, et al., (2016), the availability of sufficient water during growth will have an impact on increasing the number of leaves, because water plays a role in the enlargement and growth of plant cells.

Increase in Leaf Length and Width (cm)

The results of variance analysis show that there is a significant influence of interaction between the composition of the growing medium and the interval of water application on the increase in length and width of Aglaonema leaves. The average increase in leaf length and leaf width of Aglaonema is shown in Table 2.

Table 2. Effect of Planting Media and Watering Interval on Increase in Leaf Length and Width (cm)

Treatment (Husk charcoal:Bokashi Chicken manure:Eggshell + watering interval)	Leaf Length (cm)	Leaf Width (cm)
M1I1 = 1:2:2 + 2 days of watering	3.22 ab	3.32 ab
M1I2 = 1:2:2 + 4 days of watering	3.82 AB	3.22 ab
M1I3 = 1:2:2 + 6 days of watering	2.70 b	2.98 b
M2I1 = 2:1:2 + 2 days of watering	2.62 b	3.22 ab
M2I2 = 2:1:2 + 4 days of watering	2.80 b	2.70 b
M2I3 = 2:1:2 + 6 days of watering	2.41 b	2.62 b
M3I1 = 3:2:1 + 2 days of watering	4.10 a	4.20 a
M3I2 = 3:2:1 + 4 days of watering	4.83 a	4.13 a
M3I3 = 3:2:1 + 6 days of watering	3.82 AB	3.60 AB

Description: The numbers followed by the same letter did not differ markedly based on Duncan's New Multiple Range Test (DNMRT) at a real level of 5%

Table 2 can be seen that the treatment of the composition of the planting media 3: 2: 1 and 4 days of water application (M3I2) resulted in the highest increase in plant leaf length (4.83 cm) and was no different from the composition of the planting media 1: 2; 2, interval 2 days and 4 water feeding, Composition 2: 1: 2 interval 2 days watering planting media composition 3: 2: 1, interval 2 and 6 days water administration but different from other treatments. The best leaf width (4.13cm) is found in the composition of the planting medium 3: 2; 1 and a watering interval of 4 days does not differ from the composition of the growing medium 1:2; 2, intervals of 2 days and 4 giving water, the composition of the growing medium 3: 2: 1, intervals of 2 and 6 days of giving water but different from other treatments.

The composition of the planting medium is 3:2:1 and the interval of application of water that provides optimal growing space. Good growing media is a medium that is able to provide water and nutrients in sufficient quantities for plant growth. It can be determined on soils with good air and water management, have stable aggregates, good water-holding ability and sufficient space for roots. Drought-choked plants experience a decrease in water in the cells resulting in a rate of leaf elongation due to a decrease in cell turgor. Plants that experience drought have smaller leaves due to a decrease in the number of cells (Paula, et al., 2022).

Sahetapy, et al., (2017) stated that chicken manure bokashi fertilizer can increase nutrient concentrations in the soil, especially N, P and K and other nutrients. In addition, chicken manure fertilizer can improve soil structure to be more friable, improve soil air and groundwater management, increase soil cation exchange capacity (CEC), and as a source of energy and food for soil microorganisms, thus plant roots will develop well and roots can absorb more nutrients, especially N nutrients which will increase plant growth.

The composition of the planting medium contains chicken manure bokashi fertilizer has the ability to change soil fertility factors such as nutrients, increase humus content, and soil structure becomes more friable, so as to support plant growth and development (Latarang and Syakur 2006). Bokashi chicken manure contains various macronutrients such as nitrogen which has an important role in the vegetative growth of plants. Nitrogen serves for the vegetative growth of plants. This is in line with Eko's opinion (2010) that nitrogen has a major role for plants, namely stimulating overall plant growth, especially stems, branches, and leaves. Nitrogen also plays a role in the formation of leaf green matter, which plays an important role in the process of photosynthesis. The availability of nutrients needed by plants will increase the number of leaves and leaf surface area thereby expanding the surface area available for photosynthesis.

The increase in leaf length and leaf width results from an increase in plant cell size. According to Sari (2016), the process of plant growth is characterized by increasing the size and weight of plants. This increase is caused by increasing the size of plant organs such as leaf surface area as a result of plant

metabolism which is also influenced by nutrients in the soil. The surface area of the leaves describes the process of photosynthesis that takes place. The wider the leaf area, the higher the photosynthesis process, so that more photosynthetes are formed. Export nutrients have an important role in the formation of root structure so that plant absorption of nutrients becomes better so that plant metabolic processes are not disturbed.

The addition of eggshells can improve soil pH and add calcium (Ca). this element that plays the most role in cell growth. Calcium is a component that strengthens and regulates penetrating power and cares for cell walls. Its role is very important at the point of root growth. Even if there is Ca deficiency, root formation and growth are disrupted, resulting in inhibited nutrient absorption. Ca plays a role in the process of cell division and elongation and regulates the distribution of photosynthesis products. The ideal acidity for Aglaonema plants is pH 7 or neutral pH (AgroMedia, 2008).

The experiment explored the effects of different planting media compositions and watering intervals on the growth parameters of Aglaonema plants, specifically plant height, number of leaves, leaf length, and leaf width.

CONCLUSION

Based on the findings of the study, it is evident that both the planting medium and the frequency of water application significantly impact various growth parameters of Aglaonema plants. The investigation revealed that there is a notable difference in plant height, leaf number, leaf length, and leaf width based on variations in the planting medium and the time intervals of water application. Specifically, the implementation of the 3:2:1 composition (Husk charcoal: Bokashi chicken manure: eggshell flour) demonstrated the most favorable outcomes, leading to the highest increases in Aglaonema plant height (5.03cm), leaf number (4.53 strands), leaf length (4.83 cm), and leaf width (4.13 cm). Furthermore, this composition did not show significant differences when compared to the treatment involving the media composition of 1:2:2 with 2 days of water administration and the composition of 3:2:1 with a water administration interval of 2 and 6 days. These results indicate the efficacy of the 3:2:1 composition in promoting optimal growth, emphasizing its superiority over other treatments in the study.

REFERENCES

Akbar, A. (2021). Penggunaan dan nilai ekonomi dari tanaman Aglaonema sp. di kalangan pedagang tanaman hias sekitar Cengkareng dan Pulo Gadung. *Jurnal Bios Logos*, *11*(2), 122–128.

Chhabra, R., & Chhabra, R. (2021). Biodrainage. *Salt-Affected Soils and Marginal Waters: Global Perspectives and Sustainable Management*, 161–207.

Darmadi, A. A. K., Watiniasih, N. L., Dalem, A. A. G. R., & Gari, N. M. (2023). The Use of Garden Plants-A Form of Balinese Local Wisdom in the Conservation. *Journal of Environmental Management & Tourism*, *14*(1), 16–22.

Dayananda, H. (2021). *One Square Meter Yield: A Hydroponic System Design*.

Jasmine, F., Hartati, R. M., & Firmansyah, E. (2023). Pengaruh Intensitas Penyinaran dan Komposisi Media Tanam terhadap Pertumbuhan Aglaonema Varietas Dud Unyamanee. *AGROISTA: Jurnal Agroteknologi*, *7*(1), 18–25.

Karimuna, L., Ansi, A., Marfi, W. E., Wijayanto, T., & Hasanuddin, L. (2022). Growth and yields of two varieties of maize (Zea mays L.) intercropped with peanut (Arachys hypogaea L.) applied by bokashi plus fertilizer between the rows of teak trees based agroforestry system. *IOP Conference Series: Earth and Environmental Science*, *951*(1), 012041.

Mubarok, S., Salimah, A., Farida, F., Rochayat, Y., & Setiati, Y. (2012). *Pengaruh kombinasi komposisi media tanam dan konsentrasi sitokinin terhadap pertumbuhan Aglaonema*.

Nugroho, C. A., & Setiawan, A. W. (2022). Pengaruh Frekuensi Penyiraman dan Volume Air terhadap Pertumbuhan Tanaman Sawi Pakcoy Pada Media Tanam Campuran Arang Sekam dan Pupuk Kandang. *AGRIUM: Jurnal Ilmu Pertanian*, *25*(1), 12–23.

Nurrohman, E., Zubaidah, S., & Kuswantoro, H. (2019). Agronomical performance of soybean genotypes infected by Cowpea Mild Mottle Virus in various level of nitrogen. *Biodiversitas Journal of Biological Diversity*, *20*(5).

Refugio, L., Porsona, A., Castillon, I., Vegafria, N. J., Evangelista, E., & Yllano, O. B. (2023). Identification and Assessment of Sensitive and Robust Plants Species to Volcanic Ashes. *9th International Scholars'conference Proceedings*.

Saini, I., Chauhan, J., & Kaushik, P. (2020). Medicinal value of domiciliary ornamental plants of the Asteraceae family. *Journal of Young Pharmacists*, *12*(1), 3.

Shang, Y., Hasan, M. K., Ahammed, G. J., Li, M., Yin, H., & Zhou, J. (2019). Applications of nanotechnology in plant growth and crop protection: a review. *Molecules*, *24*(14), 2558.

Simanjuntak, D. (2015). *Pengaruh Tepung Cangkang Telur dan Pupuk Kandang Ayam Terhadap pH, Ketersediaan Hara P dan Ca Tanah Inseptisol dan Serapan P dan Ca pada Tanaman Jagung (Zea mays. L)*.

Tatsuzawa, F., Yoshikoshi, A., Takehara, A., & Suzuki, S. (2021). Flavonoids from the Flowers of Adenium obesum (Forssk.) Roem. & Schult., Mandevilla sanderi (Hemsl.) Woodson, and Nerium oleander L.(Apocynaceae). *Biochemical Systematics and Ecology*, *99*, 104347.

Tome, V. D., Pandjaitan, C., & Neunufa, N. (2016). Kajian Beberapa Tingkat Cekaman Kekeringan Terhadap Pertumbuhan Dan Hasil Bawang Merah Lokal Ntt. *Partner*, *21*(2), 311–316.

Vatika, E., Taher, Y. A., & Afrida, A. (2021). Pengaruh Pemberian Bokashi Kotoran Ayam Terhadap Pertumbuhan dan Hasil Kacang Panjang (Vigna Sinensis L). *Menara Ilmu*, *15*(1).

Wallach, R. (2019). Physical characteristics of soilless media. In *Soilless Culture* (pp. 33–112). Elsevier.

Widjaja, H., Hidayah, A. N., Suryaningtyas, D. T., & Oktariani, P. (2023). Zeoponic formula for plant growth media for ornamental plants Aglaonema siam aurora and Anthurium crystallinum. *IOP Conference Series: Earth and Environmental Science*, *1208*(1), 012051.

Wiryanta, B. T. W. (2007). *Media tanam untuk tanaman hias*. AgroMedia.

Zainab, S. (2019). *Pengaruh Media Tanam dan Interval Penyiraman Terhadap Pertumbuhan Tanaman Aglaonema Varietas Siam Aurora* .

Zamin, M., Adnan, M., Begum, S., Murad, W., & Khan, S. (2023). *The Effect of Medium-term Protection on the Abundance and Diversity of Natural Flora in District Kohat, Pakistan*.

Zulfita, D., & Raharjo, D. (2012). Pemanfaatan Tepung Cangkang Telur Sebagai Substitusi Kapur dan Kompos Keladi terhadap Pertumbuhan dan Hasil Cabai Merah Pada Tanah Aluvial. *Jurnal Sains Pertanian Equator*, *1*(1).