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The Effect of Planting Media and Foliar Fertilizer on the Acclimatization Stage on the Appearance of Aglaonema 'Lady Valentine'

Pangesti Nugrahani[1*], Sri Wiyatiningsih[1], Damasa Ines Larissa[1], Maryam[1]

[1](*Department of Agrotechnology, Faculty of Agriculture, Universitas Pembangunan Nasional Veteran Jawa Timur, Surabaya, Indonesia)*

***For Correspondence**

Pangesti Nugrahani
Department of Agrotechnology, Faculty of Agriculture, Universitas Pembangunan Nasional Veteran Jawa Timur, Surabaya, Indonesia

pangesti_n@upnjatim.ac.id

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Abstract: *The research was conducted to get the best treatment on the appearance of Aglaonema Lady Valentine ornamental plants grown on various types of growing media with foliar fertilizer application, at the acclimatization stage. The study was conducted using a completely randomized design with one factor consisting of 9 treatments. P1: soil + compost + husk charcoal, P2: soil + compost + cocopeat, P3: soil + compost + ferns, P4: soil + compost + husk charcoal + PLP fertilizer, P5: soil + compost + cocopeat + PLP fertilizer, P6: soil + compost + ferns + PLP fertilizer, P7: soil + compost + husk charcoal + Growmore, P8: soil + compost + cocopeat + Growmore, P9: soil + compost + ferns + Growmore. Parameters of plant appearance observed were number of leaves, leaf area, plant height, number of shoots/saplings, and leaf color. The results showed that the treatment of soil + compost + rice husk charcoal generally produced the best performance of Aglaonema plants, recorded in the parameters of plant height, number of leaves, width, length, and leaf area. Treatment of soil + compost + fern media with the addition of Aglaonema PLP foliar fertilizer, showed poor plant performance.*

I. Introduction

Ornamental plants are plants in the horticulture sub-sector whose crown, leaf, color, aroma, and flower shapes have aesthetic value. The increasing trend of ornamental plant cultivation production characterizes the development of ornamental plant agribusiness [1]. The production of ornamental plants is increasingly profitable because they are widely used for decoration, landscaping, parties, and other ceremonial activities. The attractiveness of ornamental plants is increasingly in demand when the Covid-19 pandemic occurs. Many people channel their hobbies towards ornamental plants so that the prices circulating in the market increase drastically. The aesthetic desire that arises from hobbyists to become a commercial venture. Types of ornamental plants such as Aglaonema, Anthurium, Calathea, Monstera, and Sansevieria are the favorites that are sought after by ornamental plant hobbyists.

Aglaonema is an easy-to-grow ornamental plant whose appeal lies in the beauty of its leaves [2]. Aglaonema, a pioneer of potted ornamental plants in Indonesia, has become an important source of income for farmers. Aglaonema prices tend to increase from 2015-2020, and peak during the Covid-19 pandemic [3]. Aglaonema ornamental plant cultivation needs to be done for the sake of continuous plant availability. The solution offered is in vitro plant propagation which is capable of producing plantlets (tissue-cultured seeds) in large numbers with characteristics that match those of the parent. These plantlets must go through the acclimatization stage to be able to grow in an open environment.

The appearance of Aglaonema resulting from micropropagation is related to plant growth in the acclimatization stage and is very dependent on the care given. Plants can grow even without treatment, but their appearance and growth will be less than optimal [4]. To get plants with a good appearance, special treatment such as the application of fertilizer needs to be done. Aglaonema has an aesthetic value on its leaves, so the use of foliar fertilizer is very suitable to improve the appearance of plants. The types of foliar fertilizers used are PLP and Growmore foliar fertilizers. The obstacle that is often faced at the acclimatization stage is slow growth. Another factor that also determines the success of acclimatization is the composition of the planting medium used. Planting media plays a role in providing nutrients as well as a place for plants to grow and develop. The rooting medium must provide good moisture and aeration, contain sufficient elements, be able to bind water, and be free from disease, pests, and weeds [5].

Materials commonly used as a mixture of planting media other than garden soil and compost include husk charcoal, cocopeat, and ferns. These materials are used because they are able to support plant development. Husk charcoal is a type of charcoal made from rice straw that has gone through a burning process. Husk charcoal acts as a soil loosening agent, stimulates the growth of microorganisms, regulates soil pH, and maintains soil moisture [6]. Biologically, loose soil is an excellent medium for the development of living organisms (root bacteria and earthworms). The process of making husk charcoal by burning makes it relatively sterile and does not carry pathogens. Chemically, husk charcoal contains essential nutrients such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg) [6]. According to DTC-IPB, the chemical content of rice husk charcoal is 1.33% carbon, 1.54% hydrogen, 33.64% oxygen, and 16.98% silica (SiO_2), with a neutral to alkaline acidity level (pH 6.5 – 7).

Cocopeat (coconut coir) is a growing medium that has the advantage of being able to bind and store water strongly and contains essential nutrients such as calcium, magnesium, potassium, sodium, and phosphorus [7]. Cocopeat has crumb properties that make the soil more friable and play a role in increasing water absorption which results in lateral roots easily penetrating the soil and getting good aeration [8].

Ferns are one of the ingredients commonly used as a planting media mixture. Ferns contain the elements Nitrogen (N), Carbon (C), Hydrogen (H), and Silica which are needed for plant vegetative growth [9]. Fern roots can increase soil aeration and drainage and are able to bind nutrients and water [10]. The fern weathering process also takes place gradually so that the nutrients needed by plants can be fulfilled during the plant growth process [11]. The study aimed to obtain the right composition of planting media and foliar fertilizer for the growth and appearance of Aglaonema plants at the acclimatization stage.

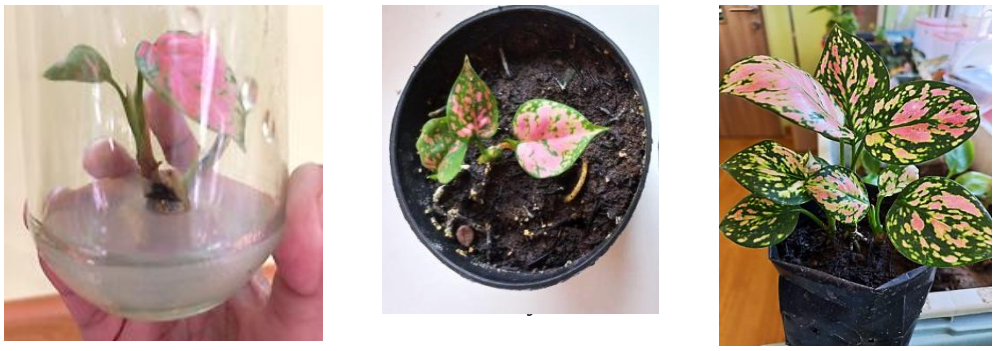
II. Material and Methods

The study was located at the Biotechnology Laboratory, Faculty of Agriculture, Universitas Pembangunan Nasional Veteran Jawa Timur, Surabaya, Indonesia, from January to June 2023. The study was arranged based on a one-factor Complete Randomized Design (composition of growing media and type of foliar fertilizer) which had nine treatments. P1: soil + compost + husk charcoal, P2: soil + compost + cocopeat, P3: soil + compost + ferns, P4: soil + compost + husk charcoal + PLP fertilizer, P5: soil + compost + cocopeat + PLP fertilizer, P6: soil + compost + ferns + PLP fertilizer, P7: soil + compost + husk charcoal + Growmore, P8: soil + compost + cocopeat + Growmore, P9: soil + compost + ferns + Growmore.

Each treatment was repeated three times. The plant material is using6 months old plantletsAglaonema var. 'Lady Valentine', from micropropagationat Biotechnology Laboratory, Faculty of Agriculture, Universitas Pembangunan Nasional Veteran Jawa Timur, Surabaya, Indonesia. Aglaonema plantlets resulting from micropropagation were then acclimatized to the growing media according to the treatment and were given foliar

fertilizer treatment according to the treatment. The Aglaonema plant appearance parameters observed were the number of leaves, leaf area, plant height, number of shoots/saplings, and leaf color.

III. Result



January 2023 June 2023

Figure 1. Aglaonema plant growth stages

3.1 Number of Leaves

The composition of the planting medium and foliar fertilizer produced different values for the number of leaves of the Aglaonema var. 'Lady Valentine'. The highest number of leaves was obtained in treatment P3 (soil + compost + ferns) with a total of 8 leaves. The lowest number of leaves was obtained in treatment P5 (soil + compost + cocopeat + PLP fertilizer) with a total of 3 leaves. The results of data on the number of Aglaonema leaves due to differences in the composition of the planting medium and foliar fertilizer are shown in Table 1.

3.2 Leaf Area

The composition of the planting medium and foliar fertilizer produced different values for the leaf area of Aglaonema var. 'Lady Valentine'. The largest leaf area was obtained in treatment P3 (soil + compost + fern) with a leaf area of 122.3 cm^2. The lowest leaf area was obtained in treatment P6 (soil + compost + fern + PLP fertilizer) with a leaf area of 31.4 cm^2. The results of Aglaonema leaf area data due to differences in the composition of the planting medium and foliar fertilizer are shown in Table 1.

3.3 Plant Height

The composition of the planting medium and foliar fertilizer produced different values for the plant height of Aglaonema var. 'Lady Valentine'. The highest plant height was obtained in treatment P1 (soil + compost + husk charcoal) with a plant height of 17.8 cm. The lowest plant height was obtained in treatment P6 (soil + compost + fern + PLP fertilizer) with a plant height of 10.5 cm. The results of data on Aglaonema plant height due to differences in the composition of planting media and foliar fertilizer are shown in Table 1.

3.4 Number of Shoots/Saplings

The composition of the planting medium and foliar fertilizer produced different values for the number of shoots/saplings of the Aglaonema var. 'Lady Valentine'. The highest number of shoots/saplings was obtained in treatments P3 (soil + compost + fern), P4 (soil + compost + cocopeat + PLP fertilizer), P7 (soil + compost + husk charcoal + Growmore), P8 (soil + compost + cocopeat + Growmore), P9 (soil + compost + fern + Growmore) with 3 shoots/saplings. The lowest number of shoots/saplings was obtained in treatments P1 (soil + compost + husk charcoal), P2 (soil + compost + cocopeat), and P5 (soil + compost + cocopeat + PLP fertilizer) with a total of 1 shoots/saplings. The results of data on the number of shoots/saplings of Aglaonema plants due to differences in the composition of the planting medium and foliar fertilizer are shown in Table 1.

Table 1. Effect of Composition of Planting Media and Foliar Fertilizer on Aglaonema Plants

Treatments	Number of Leaves (leaf)	Leaf Area (cm^2)	Plant Height (cm)	Number of Shoots (shoot)
P1: soil + compost + husk charcoal	5	95.7	17.8	1
P2: soil + compost + cocopeat	5	62.9	15.9	1
P3: soil + compost + ferns	8	122.3	15.0	3
P4: soil + compost + husk charcoal + PLP fertilizer	5	61.5	11.1	3
P5: soil + compost + cocopeat + PLP fertilizer	3	38.4	11.5	1
P6: soil + compost + ferns + PLP fertilizer	4	31.4	10.5	2
P7: soil + compost + husk charcoal + Growmore	4	64.8	14.5	3
P8: soil + compost + cocopeat + Growmore	6	62.3	12.9	3
P9: soil + compost + ferns + Growmore	7	109.2	15.3	3

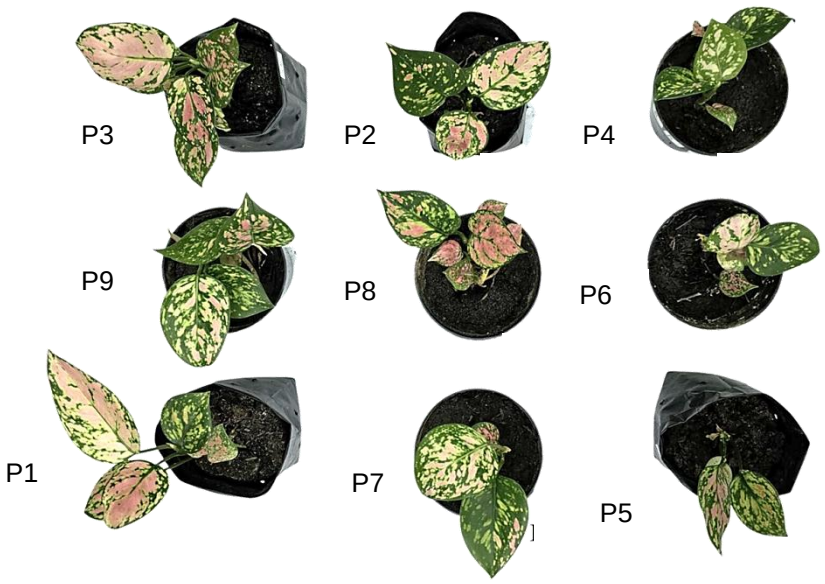


Figure 2. appearance of Aglaonema plants in each treatment

3.5 Leaf Color

Qualitative observations of leaf color were carried out using the Easy Leaf Area Meter, Color Grab, and Color Hexa applications.

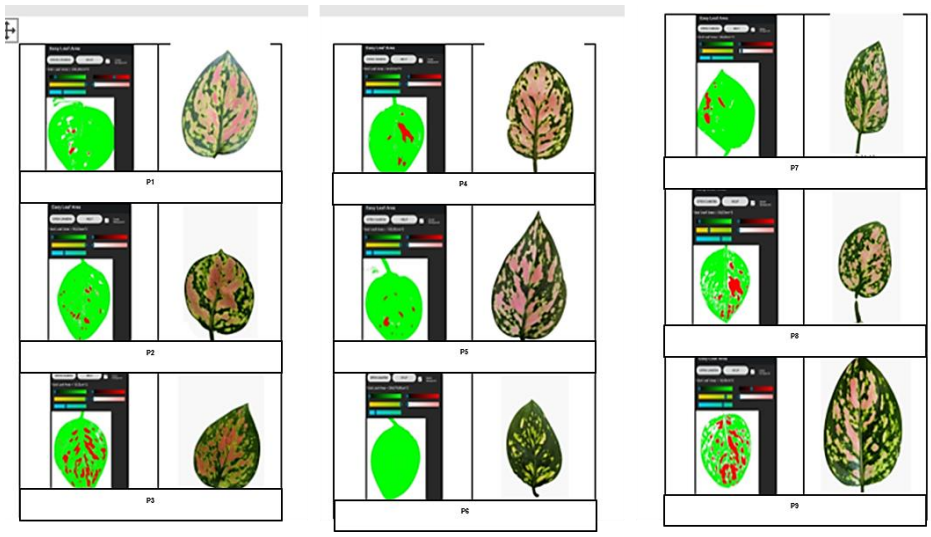


Figure 3. display the color of Aglaonema leaves using the Easy Leaf Area Meter application

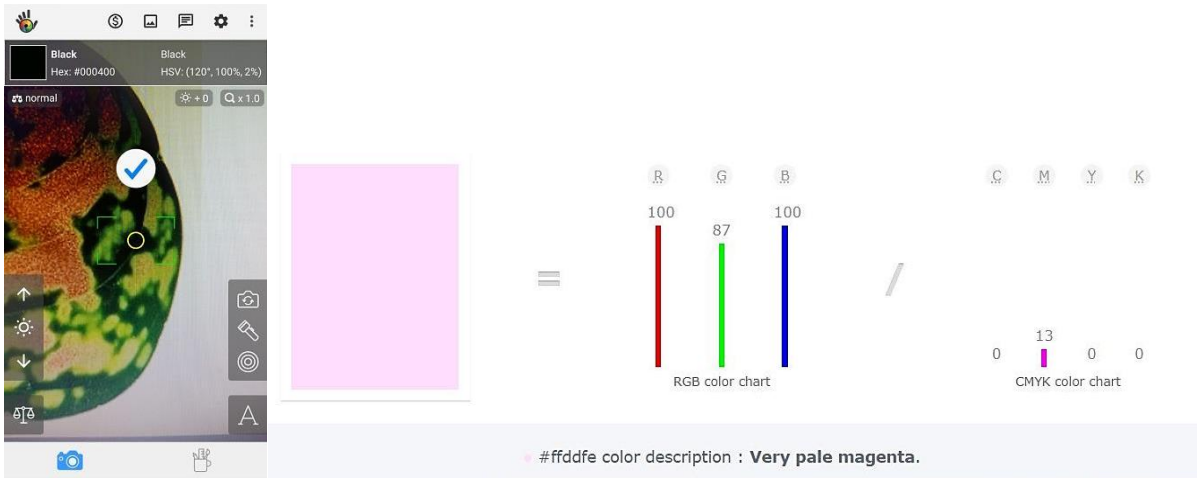


Figure 4. display the color of aglaonema leaves using the Color Grab and Color Hexa applications

Table 2. The Colors that Appear on the Appearance of Aglaonema Leaves

No	Code	Description	Composition
1.	#ffddfe	Very pale magenta	100.0% red, 86.7% green and 99.6% blue
2.	#fec8d7	Very soft pink	99.6% red, 78.4% green and 84.3% blue
3.	#fdaae5	Very soft pink	99.2% red, 66.7% green and 89.8% blue
4.	#fb58a0	Soft pink.	98.4% red, 34.5% green and 62.7% blue
5.	#dda296	Very soft red.	86.7% red, 63.5% green and 58.8% blue
6.	#33452d	Very dark greyish green	20.0% red, 27.1% green and 17.6% blue
7.	#7ab711	Strong green	47.8% red, 71.8% green and 6.7% blue
8.	#67814b	Mostly desaturated dark green.	40.4% red, 50.6% green and 29.4% blue
9.	#496310	Very dark green	28.6% red, 38.8% green and 6.3% blue
10.	#4b7b16	Dark green	29.4% red, 48.2% green and 8.6% blue

IV. Discussion

A good plant growth medium must have appropriate physical, chemical, and biological properties so that it can help realize the potential for overall plant growth and development. Selection of the right planting medium can encourage growth and increase the aesthetic value of Aglaonema plants. Plant growth media that can be developed apart from soil and compost are husk charcoal, cocopeat, and ferns which are specially formulated for ornamental plants such as Aglaonema.

The addition of organic matter can increase the fertility of the planting medium and increase the availability of nutrients needed by plants [12]. Compost can increase soil fertility and stimulate healthy roots. Apart from that, compost contains complete nutrients such as N, P, K, Ca, Mg, and S. The maturity level of compost can affect EC, oxygen content, and the number of volatile compounds [13]. Cocopeat is generally chosen because of its physical stability, good air holding capacity, and high cation exchange capacity [14]. Cocopeat is also able to absorb high amounts of water and contains several primary nutrients, such as N, P, K, Ca, and Mg [15].

The results of the research found that the P3 planting media composition treatment (soil + compost + fern) was the best planting media composition for the growth of Aglaonema at the initial acclimatization stage. The composition between soil + compost + fern gave the best value on the parameters of number of leaves, leaf area, and number of shoots/saplings. Meanwhile, the planting media composition treatment P5 (soil + compost + cocopeat + PLP fertilizer) was the lowest planting media composition for Aglaonema growth at the initial acclimatization stage. The composition of soil + compost + cocopeat + PLP fertilizer gave the lowest value for the number of leaves and shoots/saplings parameters.

Research conducted by [16] found that fern stems (P) as a planting medium gave the highest number of saplings, namely 2.22 stems or 32.93% more than wood charcoal planting media and a mixture of charcoal, wood, and fern stems with the number of saplings, each 1.67 tillers. The advantage of fern planting media compared to other planting media is that ferns are able to bind and store water well, have good aeration and drainage because they are porous, slow to rot, and contain nutrients that plants need during plant growth [17]. Ferns contain sugars, amino acids, aliphatic acids, and ester elements needed by plants. Fern planting media also has the advantage of not easily rotting so that plants can absorb the nutrients they contain for a longer period of time. Ferns contain the element Mg, which is very necessary for the formation of chlorophyll [18].

Apart from the composition of the media, a problem that is often encountered in ornamental plant cultivation is pale or wilted plant leaves [19]. Reducing the proportion of color in large-scale ornamental plant leaves still often occurs, this causes a decrease in the aesthetic value and selling value of the plant [20]. Color changes in ornamental plant leaves are caused by environmental factors such as planting media, light, and nutrients which can affect the quantity and quality of leaf color. Light intensity that is too high causes the plants to turn yellow, and the color of the leaves will fade [21]. Conversely, light intensity that is too low results in slow plant growth, decreased flower productivity, and soft stems. It was concluded by [22] that the relative performance of both the indoor foliage plants Aglaonema cv. Silver Queen and Dieffenbachia cv, Tropic Snow grown in media composed of 2 parts of farmyard manure (FYM) and 1 part of coco peat was most satisfactory with respect to all the growth and quality parameters showing slight variation in performance between the two plants.

Applying foliar fertilizer to plants can be done so that the leaves on the plants remain healthy and shiny. Proper fertilizer application can help plant growth and development. PLP and Growmore foliar fertilizers were chosen to help improve the color appearance of Aglaonema plant leaves. However, from the results of the research conducted, the application of PLP and Growmore foliar fertilizers did not have a real effect on the appearance of Aglaonema leaves. This is because during the initial growth of Aglaonema in the acclimatization stage, the foliar fertilizer given did not have a significant effect.

V. Conclusion

The treatment of planting media with the composition of soil + compost + fern (1:1:1) is the treatment that gives the best growth results and performance of Aglaonema plants at the initial acclimatization stage. Providing foliar fertilizer didn't effect on the growth and performance of Aglaonema seedlings in the initial acclimatization stage.

VI. Acknowledgements

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