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Effect Of Foliar Fertilizer Interval And Types Of Planting Media On The Growth Of *Dendrobium Hybrid* Orchids

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Abstract. Orchids are epiphytic plants that only absorb a few nutrients through the roots, so using leaf fertilizers and planting media is one solution to increase the nutrients in orchid plants. This research was conducted in the greenhouse of Situgangga Village, Karyaryamulya Village Kesambi District, Cirebon City, West Java Province in June-September 2024. The experimental design was a completely randomized (CRD) treatment consisting of 9 repeated treatments 3 times. The variables observed were plant height, leaf length, leaf width, leaf thickness, number of leaves, number of roots, stomata density, and chlorophyll content. The results showed that using fern planting media and foliar fertilizer at intervals of 9 days gave good results on plant height, leaf length, and number of leaves.

Keywords: *Dendrobium*, foliar fertilizer, interval, planting media

INTRODUCTION

Orchids are plants in the Orchidaceae tribe that are very popular and much favored by ornamental plant lovers in Indonesia. One type of orchid with a high interest level is the Dendrobium orchid. Dendrobium orchid is one type of orchid with high aesthetic value, with various types, shapes, and colors, so it has its own uniqueness and high economic value in each type.

Based on data from the Ornamental Plant Production Statistics in 2022, the production of cut orchids in Indonesia in 2022 amounted to 6,78 million stalks; this number decreased by 40,24% from the previous year, with the total production of cut orchids reaching 11,35% (Ridhwan, 2022). With the decline in orchid production, orchid cultivation activities need to be improved, considering that orchid plants are a source of income.

Dendrobium is an epiphytic plant that absorbs nutrients from other plants through roots in limited quantities, slowing orchid growth and development (Hayu & Neli, 2018). Nutrient deficiency is one problem with orchid growth. Applying leaf fertilizer is one solution to meet

the nutrient needs of dendrobium orchid plants. The vegetative growth of orchid plants is influenced by applying foliar fertilizer in the right way.

The suitability of planting media is one of the important factors in the growth of orchid plants; the conditions of planting media that are suitable for the growth of orchid plants are planting media that are not easily rotten, have good air circulation, have enough cavities, plant roots easily attach to the media, can bind water and store nutrients, and are not easily a source of disease (Arthagama, 2021).

LITERATURE

Foliar fertilizers are fertilizers applied directly to the leaves. Fertilization through leaves is considered effective because plants can absorb nutrients needed for growth through stomata and epidermal layers on the leaves (Patil, 2018). One of the leaf fertilizers that can be used on Dendrobium orchid plants is Grow More 32-10-10 fertilizer with macronutrient content, namely N (32%), P (10%), K (10%), and micronutrient content, namely Calcium (Ca), Magnesium (Mg), Sulfur (S), Boron (B), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), and Zinc (Zn). Grow More fertilizer has more Nitrogen than phosphate and potassium content, so Grow More 32-10-10 fertilizer is good to use when the orchid is still in the vegetative growth phase.

Providing fertilizers with high N content in orchids will offer better and faster growth because nitrogen is the main ingredient for amino acids, proteins, nucleic acids, various enzymes and as a leaf greening agent (Astri et al., 2019). In general, foliar fertilizer application to meet the nutrient needs of orchid plants is carried out at intervals of 1-2 weeks. According to (Parawita, 2023), the best leaf foliar fertilizer interval for Dendrobium orchid acclimatization is once every 6 days.

Orchid plants can be growth on various media, including ferns, coconut fibre, charcoal, and moss (Tini et al., 2019). Black moss is an orchid planting media made from the roots of ferns or kadaka, which are found in many forests. Black moss has several advantages, including the ability to bind water well, good aeration, not easily weathered, and organic nutrients (Herlina et al., 2017).

Head fibres are widely used as orchid planting media because they can increase the ability to bind water and nutrients (Khilari, 2023). besides that, coconut fibres also contain several organic nutrients, namely Calcium (Ca), Magnesium (Mg), Potassium (K), Sodium (Na), and Phosphorus (P). Fern roots are suitable for orchid planting media because they can

store water, so moisture in the media can be maintained, ultimately affecting the growth of orchid plants (Suryani, 2019). According to research (Febriani, 2019), fern planting media greatly affected the observation parameters of plant height and number of leaves.

METHOD

The research was conducted in a greenhouse in Situgangga Village, Karyamulya Urban Village, Kesambi District, Cirebon City, West Java Province. The research site is located at an altitude of 16-17 meters above sea level with an air temperature of 30°-32°C. The experimental design was a completely randomized design (CRD) it two treatment factors: the interval of foliar fertilizer application and the types planting media of Dendrobium Hybrid orchids. Each treatment combination was repeated three times, so the number of experimental units was 27 experimental units, with each treatment consisting of 10 plant pots or planlets. The foliar fertilizer interval treatment consisted of three days, six days, and nine days intervals. The types of planting media consisted of ferns, black moss, and coconut fibres.

The observation parameters included plant height increase, leaf length, leaf width, number of leaves, leaf thickness, number of roots, stomatal density, and chlorophyll content. Observations were made on orchid plants aged 21, 35, 49, 63, and 77 DAP (Days After Planting) by taking five plants in each treatment for the observation parameters of plant height increase, leaf length, leaf width, number of leaves, and number of roots one plant for the observation parameters of leaf thickness, stomatal density, and chlorophyll content.

Observations of plant height, leaf length, and leaf width were made using a ruler. The number of leaves was counted manually per blade. The number of roots was manually counted per fruit. Leaf thickness is calculated using the Image J application by thinly slicing the leaf samples of orchid plants using a razor blade; the slices are then observed with a microscope with a magnification of 40× and then photographed. The photo results will be measured in the Image J application and the measurement results will be displayed in the application. Stomata density is observed by making a replica of the leaf sample using nail polish applied to the stomata.

The number of stomata on the replicas was then observed using a microscope with 40× magnification of the eyepiece and Image J application; then, the stomata density was calculated by dividing the number of stomata and the area of the microscope field of view. Chlorophyll content was measured by extracting 0,1 grams of leaf samples, which were

crushed in a mortar and then dissolved with 96% ethanol as much as 5 ml, after which the results of the leaf sample solution were centrifuged at 6000 1 PM for 7 minutes. The chlorophyll content in the centrifuge chlorophyll extract (supernatant) was measured using a spectrophotometer with 649 nm and 665 nm wavelengths. The absorbance value that has been obtained is calculated using the Wintermans and De Mots formula (1965) in (Pratama, 2015)

Chlorophyll a =13,7 (A.665) – 5,76 (A.649) mg/L

Chlorophyll b = 25,8 (A.649) – 7,60 (A.665) mg/L

Total chlorophyll = 20,0 (A.649) + 6,10 (A.665) mg/L

Observation data are processed using a linear model statistical test of a completely randomized design from the data processing results using variance analysis; if there are significant differences, the test is continued with the Scott-Knott Cluster Test at a real level of 5%.

DISCUSSION

Plant Height Increase

Based on the analysis of variance, it shows that the interval of foliar fertilizer application and the types of planting media have a significant effect on plant height increase and produce the highest average at the age of 35 DAP (1.29 cm), 49 DAP (2.46 cm), 63 DAP (2.91 cm), 77 DAP (3.17 cm), while at the age of 21 DAP does not show significant differences (Table 1). This is because fern planting media is more suitable for use in lowland areas because it has good aeration and drainage and easily binds water, in line with (Suryani, 2019) states that fern roots are suitable for orchid planting media because they can store water so that moisture in the media can be maintained and ultimately affect the growth of orchid plants, besides that other factors increase plant height growth, namely due to the use of Growmore leaf fertilizer with 32% Nitrogen content so that it is good for vegetative growth of orchid plants. Opinions (Aritonang & Surtinah, 2018) explain that water and the availability of nutrients in plants will help the process of cell division and cell enlargement; with sufficient nutrients, cell organelles that play a role in producing food for plants will be maximally formed, and can function optimally.

Table 1. Effect of Foliar Fertilization and Planting Media Plant Height Increase at 21 to 77 DAP

Treatment	Plant Height Increase (cm)				
	21 DAP	35 DAP	49 DAP	63 DAP	77 DAP
A (Fern + Interval of 3 days)	0,47 a	**1,29 d**	**1,77 b**	**2,31 d**	**2,80 d**
B (Fern + Interval of 6 days)	0,28 a	**0,71 c**	1,26 a	**1,63 c**	**2,01 c**
C (Fern + Interval of 9 days)	0,53 a	**1,03 c**	**2,46 c**	**2,91 d**	**3,17 d**
D (Black Moss + Interval of 3 days)	0,45 a	**0,68 b**	0,93 a	**1,56 b**	**1,79 c**
E (Black Moss + Interval of 6 days)	0,31 a	0,52 a	0,97 a	1,21 a	**1,48 b**
F (Black Moss + Interval of 9 days)	0,37 a	**0,61 b**	1,15 a	1,52 a	**1,71 c**
G (Coconut Fiber + Interval of 3 days)	0,33 a	0,47 a	0,73 a	1,21 a	**1,39 b**
H (Coconut Fiber + Interval of 6 days)	0,22 a	0,37 a	0,87 a	1,05 a	1,20 a
I (Coconut Fiber + Interval of 9 days)	0,19 a	0,43 a	0,81 a	1,01 a	1,13 a

Notes: Numbers with the same lowercase letter in a column are similar according to the Scott-Knott cluster test at the 5% level.

Leaf Length Increase

Based on the analysis of variance, it shows that the interval of leaf fertilizer application and the types of planting media have a significant effect on the increase in leaf length and produce the highest average at the age of 49 DAP (2,21 cm), 63 DAP (2,62 cm), 77 DAP (2,83 cm), while at 21 DAP and 35 DAP do not show significant differences (Table 2). This is because using Growmore 32-10-10 fertilizer with an interval of 9 days can potentially increase leaf length. After all, the provision of Nitrogen (N) can spur the formation of more chlorophyll so that photosynthesis will occur more optimally (Surtinah, 2018). So that the increase in leaf length is maximized. They also use fern planting media that easily binds water and is not easily weathered. According to Andalasari (2014), fern media is superior for orchid plants because it has water-binding capacity and adequate aeration and drainage. Ferns are also considered to have some nutrient contents needed by orchid plants for their development and growth and also contain amino acids, acidic sugars, and aliphatic and ester constituents that orchid plants also need.

Table 2. Effect of Foliar Fertilization Interval and Planting Media on Leaf Length Increase at 21 to 77 DAP

Treatment	Leaf Length Increase (cm)				
	21 DAP	35 DAP	49 DAP	63 DAP	77 DAP
A (Fern + Interval of 3 days)	0,23 a	0,65 a	**1,11 b**	**1,53 c**	**1,97 b**
B (Fern + Interval of 6 days)	0,16 a	0,63 a	**1,17 c**	**1,51 b**	**1,79 b**
C (Fern + Interval of 9 days)	0,43 a	0,94 a	**2,21 d**	**2,62 d**	**2,83 c**
D (Black Moss + Interval of 3 days)	0,30 a	0,63 a	**0,89 b**	**1,52 b**	**1,69 b**
E (Black Moss + Interval of 6 days)	0,25 a	0,48 a	0,81 a	1,01 a	1,22 a
F (Black Moss + Interval of 9 days)	0,25 a	0,58 a	**0,93 b**	1,09 a	1,22 a
G (Coconut Fiber + Interval of 3 days)	0,32 a	0,34 a	0,65 a	**1,15 b**	1,33 a
H (Coconut Fiber + Interval of 6 days)	0,23 a	0,30 a	0,67 a	0,91 a	1,05 a
I (Coconut Fiber + Interval of 9 days)	0,13 a	0,33 a	0,66 a	0,89 a	1,01 a

Notes: Numbers with the same lowercase letter in a column are not significantly different according to the Scott-Knott cluster test at the 5% level

Leaf Width Increase

Based on the analysis of variance intervals showed that the application of leaf fertilizer and the planting media significantly influenced the increase in plant height and produced the highest average at the age of 21 DAP (0,43), 35 DAP (0,93 cm), 49 DAP (1,24 cm), 63 DAP (1,47 cm), 77 DAP (1,64 cm) (Table 3).

Table 3. Effect of Foliar Fertilization Interval and Planting Media on Leaf Width Increase at 21 to 77 DAP

Treatment	Leaf Width Increase (cm)				
	21 DAP	35 DAP	49 DAP	63 DAP	77 DAP
A (Fern + Interval of 3 days)	**0,43 c**	**0,93 d**	**1,24 d**	**1,47 d**	**1,64 d**
B (Fern + Interval of 6 days)	0,10 a	**0,29 b**	**0,51 b**	**0,70 b**	**0,86 b**
C (Fern + Interval of 9 days)	**0,17 b**	**0,29 c**	**0,67 c**	**0,83 c**	**0,95 c**
D (Black Moss + Interval of 3 days)	0,08 a	0,20 a	**0,29 b**	**0,53 b**	**0,63 b**
E (Black Moss + Interval of 6 days)	0,11 a	0,23 a	**0,61 c**	**0,77 b**	**0,91 b**
F (Black Moss + Interval of 9 days)	0,07 a	0,17 a	**0,57 b**	**0,73 b**	**0,89 b**
G (Coconut Fiber + Interval of 3 days)	0,08 a	0,19 a	**0,26 b**	0,33 a	0,40 a
H (Coconut Fiber + Interval of 6 days)	**0,13 b**	0,22 a	**0,31 b**	0,39 a	0,44 a
I (Coconut Fiber + Interval of 9 days)	0,07 a	0,13 a	0,18 a	0,24 a	0,30 a

Notes: Numbers with the same lowercase letter in a column are not significantly different according to the Scott-Knott cluster test at the 5% level

This is because orchids in the vegetative growth phase need macronutrients, especially N, P, and K, so using Growmore fertilizer for the increase in orchid leaf width is suitable. According to the opinion (Surtinah, 2018), the provision of nitrogen (N) can spur the formation of more chlorophyll so that photosynthesis will take place more optimally and the leaf width will increase.

Increase in Number of Leaves

Based on the observation data in (Table 4) shows that the treatment of leaf fertilizer application interval and the type of fern and black moss planting media have a significant effect on the number of leaves. Treatment C, namely ferns and 9 days fertilization interval, gave the largest average number of leaves, namely 6,67 leaves; this is due to the high content of N elements in the fertilizer growing more able to meet the needs of nitrogen nutrients in orchid seedlings so that the vegetative growth of orchid seedlings takes place well. Nitrogen nutrients are one of the important factors in plant growth in the vegetative phase, which is in line with the opinion (Indriani, 2019) that nitrogen supports plant growth in the vegetative phase.

The fern planting medium also influences the number of leaves parameter because it has good water binding capacity and aeration, which affects the growth of the number of leaves. This is in line with the results of Arman's research (2022), which showed that the chopped fern planting medium produces the best number of Phalaenopsis leaves.

Table 4. Effect of Foliar Fertilization Interval and Planting Media on Increase in Number of Leaves at 21 to 77 DAP

Treatment	Increase in Number of Leaves		
	35 DAP	63 DAP	77 DAP
A (Fern + Interval of 3 days)	4,33 a	4,57 a	**5,67 b**
B (Fern + Interval of 6 days)	5,05 a	5,23 a	**5,73 b**
C (Fern + Interval of 9 days)	5,11 a	5,30 a	**6,67 c**
D (Black Moss + Interval of 3 days)	4,20 a	4,43 a	4,67 a
E (Black Moss + Interval of 6 days)	4,83 a	5,00 a	**5,53 b**
F (Black Moss + Interval of 9 days)	5,07 a	5,24 a	**5,93 b**
G (Coconut Fiber + Interval of 3 days)	4,17a	4,30 a	4,53 a
H (Coconut Fiber + Interval of 6 days)	4,10 a	4,28 a	4,47 a
I (Coconut Fiber + Interval of 9 days)	4,27 a	4,59 a	5,00 a

Notes: Numbers with the same lowercase letter in a column are not significantly different according to the Scott-Knott cluster test at the 5% level

Leaf Thickness, Stomatal Density, Chlorophyll Content, Number of Roots

The analysis of variance showed a significant effect of fertilization interval treatment and planting media on leaf thickness (Table 5). The treatment of A fern and fertilization interval every 3 days gave the highest average result of 3,06 mm; it is suspected that giving leaf fertilizer too often can stimulate rapid and thicker leaf growth. (Ningsih, 2022) states that the availability of water and nutrients is one factor affecting the growth and development of leaves. Grow More leaf fertilizer contains several micronutrients needed by plants in the process of chlorophyll synthesis and photosynthesis in leaves to increase biomass and leaf thickness, one of which is Manganese (Mn), according to the opinion (Zewide, 2021) Manganese (Mn) plays an important role in chlorophyll production and photosynthesis system II, and is involved in the process of plant cell division. In addition, fern planting media with maintained humidity will affect the absorption of nutrients so that leaf growth can take place optimally.

The results of the variance analysis showed that the treatment of foliar fertilizer application interval and the type of planting media had a significant effect on stomatal density (Table 5). The highest average stomata density was obtained in treatment I coconut fibers at an interval of 9 days at 42,44 stomata/mm2. This is because applying leaf fertilizer with high nitrogen elements will increase the chlorophyll content, which is the main component of the photosynthesis process. The rate of photosynthesis will affect the number of stomata on the leaves; according to (Sumadji, 2020), a high photosynthetic rate will produce more photosynthate for the process of cell division of plants, thereby increasing the number of stomata. In addition, the use of coconut fibre planting media containing the nutrient Calcium (Ca) is thought to play a role in the formation of plant cell walls, a good and strong cell wall structure will affect the process of stomata formation; this is in line with the opinion (Eticha, 2017) which states that Calcium has several roles in plant growth and development, one of which is to play a role in the formation of cell wall structures and plant membrane systems.

The results of the variance analysis showed that the interval of leaf fertilizer application and the type of planting media had a significant effect on the chlorophyll content of orchid plants (Table 5). Treatment H Coconut fibres and fertilization intervals once every six days gave the highest average chlorophyll content of 11,46 mg/L; this is because the high N element in growing more leaf fertilizer can trigger chlorophyll formation, according to (Solikhah et al., 2019) the N element acts as a shaper and catalyst in the chlorophyll synthesis

process. In addition, the content of phosphorus (P) in coconut fibre can affect the chlorophyll synthesis process. This is in line with the opinion of (Ying et al., 2018), which states that the content of the element phosphorus (P) in the growth medium is needed by plants for the chlorophyll synthesis process.

Based on the analysis of variance, it shows that the interval of foliar fertilizer application and the types of planting media has a significant effect on the number of plant roots (Table 5). Treatment F (Black moss, an interval of 9 days), once produced the highest average at the age of 77 DAP of 9,80 cm. This is because the black moss planting media has many cavities so that the roots can freely grow on the black moss planting media. According to (Didik et al., 2022), black moss has a higher water storage capacity than other planting media so that root growth will occur optimally. In addition, fertilizing at intervals of 9 days produces the highest average number of roots compared to other treatments because fertilization is carried out when the leaf stomata are open so that the absorption of nutrients through the leaves can be maximized. According to (Purwanto, 2023), Growmore fertilizer application increases the number of roots because the nature of Growmore fertilizer is easily soluble in water and has many macronutrients.

Tabel.5 Effect of Foliar Fertilization Interval and Planting Media on Leaf Thickness, Stomata Density, Chlorophyll Content, Number of Roots at 21 to 77 DAP

Perlakuan	Number of Roots	Leaf Thickness	Stomata Density	Chlorophyll Content
A (Fern + Interval of 3 days)	**6,40 b**	**3,06 d**	30,57 a	**9,74 b**
B (Fern + Interval of 6 days)	**7,40 c**	**2,33 b**	**33,96 c**	**11,00 c**
C (Fern + Interval of 9 days)	**8,33 c**	**2,77 c**	**32,26 b**	**11,19 c**
D (Black Moss + Interval of 3 days)	**9,60 d**	**2,56 b**	**33,96 b**	5,25 a
E (Black Moss + Interval of 6 days)	**7,80 c**	1,85 a	**32,26 b**	5,62 a
F (Black Moss + Interval of 9 days)	**9,80 d**	1,86 a	30,57 a	4,83 a
G (Coconut Fiber + Interval of 3 days)	6,20 a	2,05 a	**32,27 b**	**9,29 b**
H (Coconut Fiber + Interval of 6 days)	5,67 a	**2,39 b**	**35,66 c**	**11,46 d**
I (Coconut Fiber + Interval of 9 days)	5,13 a	1,93 a	**42,44 d**	**10,76 b**

Notes: Numbers with the same lowercase letter in a column are not significantly different according to the Scott-Knott cluster test at the 5% level

CONCLUSION

The interval of foliar fertilization and the type of planting media significantly affect on the growth of *Dendrobium* Hybrid orchids. Fern planting media and foliar fertilization interval of 9 days gave the best effect on plant height, length, and number of leaves. Fern planting media and foliar fertilization interval every three days had the best effect on the parameters of leaf width and thickness. Black moss planting media and foliar fertilization interval of 9 days gave the best effect on the number of roots parameter. Coconut fibre planting media and foliar fertilization interval of 9 days gave the best effect on stomata density parameters. Meanwhile, coconut fibre planting media and foliar fertilization interval of 6 days gave the best effect on the chlorophyll content parameters.

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