Available online at: http://proceeding.rsfpress.com/index.php/ ess/index
LPPM UPN "Veteran" Yogyakarta Conference Series
Proceeding on Engineering and Science Series (ESS)
Volume 1 Number 1 (2020): 246-252

Effect of Fertilizer Frequency on Growth Varieties of Dendrobium Orchid

Heti Herastuti, Siwi Hardiastuti E.K.

Universitas Pembangunan Nasional Veteran Yogyakarta
E-mail address heti_astuti@yahoo.co.id; [2] E-mail address siwihek@yahoo.co.id

Abstract

Orchid is an ornamental plant usually used for an indoor plant or cuts flower because of its colorful flowers. Orchid performance can be improved with the use of leaf fertilizer. Therefore, this research aimed to determine the effect of fertilizer frequency on growth varieties of dendrobium orchid. The study was conducted in the experimental garden of the Faculty of Agriculture, UPN "Veteran" Yogyakarta, between June to September 2020, using a Completely Randomized Design with the factorial arrangement. The fertilizer frequency factors include once in 2 days, once in 3 days, and once in 4 days, while the varieties of Dendrobium are Syifa Agrihorti, Dian Agrihorti, and Zahra Fr-28. The result showed fertilizer frequency once in 3 days provided the best percentage to live, increasing leaf length and root length. Syifa Agrihorti and Dian Agrihorti are varieties that readily adapt to new environments. There was no interaction between fertilizer frequency and varieties of Dendrobium orchid on all growth parameters.

Keywords: Fertilizer frequency, Dendrobium, liquid organic fertilizer

I. INTRODUCTION

Orchid is the most attractive ornamental plant because it has various shapes and colors, and it is quite durable in room conditions. Nowadays, orchids are often used as decorative flowers and potted plants that have become a flower industry in the world (Mirani et al., 2017). One of the Orchid species that has a selling price and quite popular is Dendrobium. It has a large and diverse genus of about 1.600 species. *Dendrobium* orchid is one type of orchid that many consumers like because the flowers are durable and do not fall off easily, with shapes and colors wildly varied flowers, as well as easy packaging for cut flowers

Dendrobium comes from the word "dendros," which means tree, and "bios," which means life. *Dendrobium* can be defined as an orchid that grows on a living tree. *Dendrobium* is an epiphytic orchid with very compact flower growth even though relatively short stems support it. This orchid is the most widely maintained because it is easy to maintenance. Another advantage, *Dendrobium* is easy to cross so that new varieties of *Dendrobium* orchids appear.

Many *Dendrobiums* have been crossed to get new varieties, including those produced by the Balithi, Syifa Agrihorti, Dian Agrihorti, and Zahra Fr-28. The three types of *Dendrobium* have different appearances. Syifa Agrihorti flowers are star-shaped, purple flower color, large flower size (5.5 - 7.5 cm long; 7.5 cm wide - 8.5 cm), and the flowers' freshness to bloom is 1.5 – 2 months. Dian Agrihorti flowers have yellowish-green flower color, large flower size (4.5 - 5.0 cm long; width 5.0 - 7.5 cm), number of flower stalks per pseudobulb lot (1 - 5 stalks). Zahra Fr-28 has purple flowers all over the flower and many flowers with long stalks (Balithi, 2011).

Dendrobium will have a good plant appearance if the plants are growing optimally. The low quality of *Dendrobium* orchid plants is one of the problems in cultivation. Fertilization is an effort to improve orchid plants' quality, one of which is by increasing the orchid growth rate. It is conducted so that the fertilizer absorption process is effective. Fertilization through roots can only absorb about 10% of nutrients, while fertilization through leaves can absorb about 90% of nutrients. Therefore, the proper fertilizer application for orchids is through leaves (Widiastoety, 2010).

Orchids cannot significantly absorb nutrients from their roots, so the application of leaf nutrition is a widespread practice in orchid cultivation (Monda et al., 2014). *Dendrobium* orchids have a slow growth rate, so a strategy for providing the right fertilizer frequency is needed to have a real effect on their growth rate. Fertilizer is used to increase the growth of *Dendrobium* orchids. It contains the nutrients needed for orchids.

Fertilization of orchids can be conducted simultaneously as watering, but the provision must be appropriate so that the plant can be used for its growth. Fertilizer applications can be conducted regularly with the primary consideration of being effective and efficient. The concentration of the fertilizer solution made must be reduced to compensate for the frequency of fertilization. Plants have different abilities to absorb nutrients from fertilizers so that fertilizers can be applied at different frequencies. According to Sukma and Setiawan (2010), the frequency of fertilizing once every three days provides better orchid growth with leaf fertilizer (2 g-1) once in 3 days, compared to once in 6 days the best growth, indicated by the longest leaf blade.

Vegetative growth of orchids is determined by fertilization, but each variety of dendrobium orchids has different characteristics. The correct frequency of fertilization can affect the growth of three varieties of dendrobium orchids. This experiment's objective was to determine the best fertilizer frequency for growing orchid, determine the best varieties of *Dendrobium*, and evaluate whether there were interaction effects between fertilizer frequency and *Dendrobium* varieties orchid growth.

II. LITERATURE REVIEW

Dendrobium is one of the largest genera of the Orchidaceae family, and it represents Indonesia's natural resources with an estimated 275 species. *Dendrobium* includes sympodial orchids, namely orchids that grow through two horizontal indeterminate and vertical determinate growth shafts (Burhan, 2016). The dendrobium orchid has a basic structure: three sepals and three petals; one petal turns into a flower lip or labellum. Crossing orchids can produce various flower colors, sepals, and petals.

Several varieties of Dendrobium have been released by Balithi, including Syifa Agrihorti, Dian Agrihorti, and Zahra Fr-28. Syifa Agrihorti comes from crossing between *Den Red Bull x Den Golden Temple / Strebocerras x Den Siah Koko / Fuch Blue Twist,* Dian Agrihorti come from *Den. Eindhoven x Dendrobium antennatum Rchb.f*, while Zahra Fr-28 comes from *Dendrobium (Kiyosi*

Izumi x Royal Color) x Dendrobium Burana Gold Splash (Balithi, 2011). The freshness of flowers for Syifa Agrihorti and Dian Agrihorti is 1.5-2 months, while Zahra is three months. Syifa Agrihorti produces 2-3 tillers, Dian Agrihorti produces 6-8 tillers, and Zahra Fr-28 produces 1-3 tillers. Based on the description of the three varieties of *Dendrobium* orchids, continuous maintenance is needed, so that orchid growth is profitable.

Dendrobium maintenance can be done by spraying and fertilizing; spraying is carried out depending on the orchid variety, plant size, and environmental conditions. Meanwhile, fertilization must be given at the right dose. The fertilization method can be through the roots or leaves. Fertilization of orchids is generally done by spraying the leaves so that nutrients can be absorbed through the stomata. Excessive fertilizer application will cause poisoning to plants. Conversely, a lack of fertilizer can cause plants to wilt and grow abnormally. *Dendrobium* orchids also need to get an adequate supply of plant nutrients to support their growth.

The 3-month dendrobium orchid seed is a plant in the vegetative growth period after the juvenile period. This orchid seed is a plant resulting from tissue culture. At this stage of growth, the orchid plants require nutrients that are rich in nitrogen and low in phosphate (P) and potassium (K), so this plant needs supplements and fertilizers to support its growth (Kabir et al., 2012)

The fertilizer application should be adjusted to the growth of the orchid phase. Fertilizers that are usually given during the growing period are fertilizers that contain high nitrogen. In the vegetative phase (seedling), orchid fertilizer is given in a ratio of 60:30:10. According to Andriyani (2017), nutrients suitable for plants and the right dose depending on the plants and how often they will be sprayed. Sukma and Setiawati (2010) have explained this the perfect time to fertilize the plant very much urgent.

Foliar fertilizer is given when the orchid gets enough sunlight to absorb the nutrients is better. The appropriate time for fertilization is 07.00-09.00 in the morning (Dwiyani, 2012). If it is more than 09.00, then the irradiation is excessive, the water content evaporates, and the absorption of nutrients is inhibited (Andriyani et al., 2017). According to Sukma and Setiawati (2010), *Dendrobium* spraying orchids with foliar fertilizer (2 gl/1) once in 3 days, compared to once in 6 days, gives the best growth, characterized by the longest leaf blade. According to Febriani et al. (2019), the best fertilizing frequency to promote dendrobium orchid growth was once in 3 days or once in 4 days.

III. RESEARCH METHODOLOGY

The experiment was carried out in the experimental garden of the Faculty of Agriculture, UPN "Veteran" Yogyakarta, located at an altitude of 202 m above sea level between June to September 2020. Materials used in this study were orchid seedling from the community pot. This experiment's experimental design was Randomized Complete Design, arranged in factorial (2 factors, 3replications). The first factor was fertilizer frequency, three levels: once in 2 days, once in 3 days, and once in 4 days. The second factor tested was the *Dendrobium* orchid varieties, consisting of three: Syifa Agrihorti, Dian Agrihorti, and Zahra Fr-28.

III.1.Media Preparation

Mos sphagnum and fern roots were used as planting media. The planting media was soaked in water for 24 hours. The water was replaced with a mancozeb 80% solution for the next 24 hours.

The media was ready to use after air drying. The container used a 5 cm diameter pot, the bottom layer of the pot was filled with ferns root, then the top was filled with mos sphagnum.

III.2. Plant Preparation

The *Dendrobium* used was the seedlings from a community pot for two months. Before planting, the seedlings were measured for the percentage to live, leaf length, leaf width, and root length, followed by spraying 1 g / 1 of vitamin (B1.) Fertilizer was given once in 2 days, once in 3 days, and once in 4 days.

III.3. Variable Measured

At the end of the experiment, we measured the percentage to live, leaf length, leaf width, and root length. The data were analyzed for variance at the 5% level, followed by comparing the mean values with Duncan's Multiple Range Test.

IV. FINDING AND DISCUSSION

The variance analysis revealed a significant effect of fertilizer frequency and *Dendrobium* varieties on percentage seedling to live, leaf length, and root length, but no significant effect on leaf width. There was no interaction between fertilizer frequency and varieties of *Dendrobium* on all growth parameters. According to Tenaya (2015), no interaction means that the treatment of the first and second factors is independent or does not affect each other. Table 1. shows significant differences in the percentage of seedling to live. The frequency of fertilizing once in 3 days resulted in the highest percentage to live orchids (77.78%) compared to fertilizing once in 2 and 4 days.

However, this result is still below 80%, which means that the plant mortality rate is still relatively high. Factors that influence seedling mortality include temperature and humidity. At the time of the study, the microclimate conditions experienced relatively high temperatures of more than 30^{o} C with humidity below 50%. According to Sukma and Setiawati (2010), *Dendrobium* has a temperature of 28^{o} C during the day and 15^{o} C temperature at night. The 70-80% relative humidity is perfect for growing orchids in the shade. *Dendrobium* grows optimally at the temperature of 26-30^{o} C with a relative humidity of 60%. Humidity below 50% can inhibit seedling growth.

The percentage to live for Syifa Agrihorti and Dian Agrihorti was higher than that of Zahra varieties. Because of the leaf morphology of Syifa, Agrihorti, and Dian Agrihorti have an elongated shape with a narrow leaf width so that the evaporation of water is less at high temperatures. In contrast, Zahra Fr-28 has broad leaves, so it experiences high evaporation at high temperatures and low humidity. Table 1. shows a significant difference in the percentage to live of dendrobium varieties with the frequency of fertilization.

Table 1. The effect of fertilizer frequency and varieties of dendrobium orchid on percentage seedling to live (%)

Treatment	Varieties of Dendrobium Orchid			
Fertilizer Frequency	Syifa Agrihorti	Dian Agrihorti	Zahra Fr-28	Average
Once in 2 days	80.00	66.67	60.00	68.89 b
Once in 3 days	86.67	80.00	66.67	77.78 a
Once in 4 days	66.67	73.33	62.22	66.67 b
Average	77.78 p	73.33 p	62.22 q	

The means of each parameter followed by the same letter within a column and row are not significantly different according to Duncan Multiple Range Test 5%.

Figure 1. Describe increasing of leaf length, leaf width, and root length of *Dendrobium* orchid. Fertilization frequency once in 3 days gives the highest leaf length and root length in *Dendrobium* orchid seedling. Fertilizers given through the leaves are more effective at stimulating plant growth when sprayed with the right frequency. The foliar fertilizers used contain high nitrogen elements that function to stimulate plant vegetative growth. Giving fertilizer once in 2 days causes the plant to have excess nutrients, while the frequency of fertilizing once in 4 days, the plant is deficient in nutrients. Plants require optimal amounts of nutrients in order to support plant growth. Providing enough nutrients will increase the leaf length and the root length. Meanwhile, the leaf width did not have a real effect.

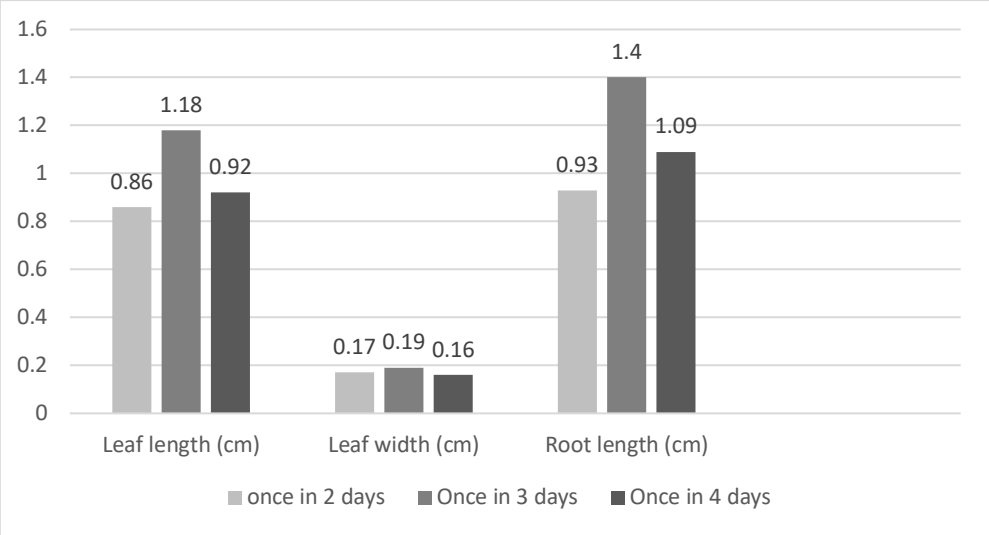

Figure 1. Graph increasing of leaf length, leaf width, and root length of dendrobium orchid as an effect by fertilizer frequency

Figure 2. Graph increasing in leaf length, leaf width, and root length as an effect of dendrobium orchid varieties

Figure 2. Describe the increase in leaf length, leaf width, and root length significantly different on the Dendrobium varieties. Syifa Agrihorti and Dian Agrihorti showed that the increase of leaf length, leaf width, and root length were higher than Zahra Fr-28 because Zahra was slower to grow. Syifa Agrihorti has the same leaf shape as Dian Agrihorti, namely narrow lanceolate. However, Zahra Fr-28 has wider and shorter leaves, so the frequency of applying fertilizer once in 2-4 days has no significant effect. The fertilizer concentration of 2 ml/liter has not been able to increase growth, so it needs a higher concentration. Inline Marlina et al. (2019), fertilizer concentrations of 2-6 ml/liter did not produce significant differences in the growth of dendrobium orchids. The provision of nutrients derived from foliar fertilizers did not affect Zahra Fr-28 varieties' growth because it was affected by plant genetic factors.

V. CONCLUSION AND FURTHER RESEARCH

The results and discussion can be concluded that the frequency of fertilizing once in 3 days provided 77.78% seedling to live. Meanwhile, the Syifa Agrihorti and Dian Agrihorti varieties have a larger percentage of seedling to live than the Zahra Fr-28 varieties. Fertilization frequency once in 3 days produced the increase in leaf length, and root length was highest compared to the frequencies of 2 and 4 days. Syifa Agrihorti and Dian Agrihorti are more adaptable to new environments than Zahra Fr-28, indicated by the higher increase in leaf length, leaf width, and root length than Zahra Fr-28. The effects of fertilization frequency with Dendrobium orchid varieties were independent or did not affect each other. For further research, it is hoped that it will focus more on the influence of watering frequency and planting media because they are important environmental factors for orchid growth.

V. REFERENCES

Andriyani, L.Y., Buhaira & Nancy. (, 2017). The Effect of Concentration and Frequency of Leaf Fertilizer Spraying on the Growth of Dendrobium Orchid (*Dendrobium Jade Gold*) Plantlets Acclimatization Stage. *Journal of Agronomy 10(1), 51-54*

Balithi, (2011). Description of Syifa Agrihorti, Dian Agrihorti, and Zahra Fr-28. Balithi Lembang.

Burhan, B. (2016). Effect of Fertilizer and Concentration benzyl adenine (BA) on The Growth and Flowering of Orchid Hybrid *Dendrobium*. *Journal of Application Agriculture Research* 16(33), 194-204.

Febriani, S., D.W. Ganefianti, A. Romeida & R. Herawati. (, 2019). Acclimatization of Pencil Orchid (*Papillionanthe hookeriana* Rehb.f) as Affected by Different Types of Planting Media and Fertilizing Frequency. *Akta Agrosia*, 22(1), 36 – 41.

Kabir, M., Mortuza, M., & Islam, M. (2012). Morphological Features Growth and Development of Dendrobium sp. Orchid as Influenced by Nutrient Spray. *Journal of Environmental Science and Natural Resources*, 5(1), 309–318.

Dwiyani, R. (2012). The Response to The Growth of *Dendrobium sp*. Seedling at The Time of Acclimatization to The Various Foliar Fertilizer Application Frequencies. *Journal Agrotrop*, 2(2), 171- 175.

Marlina, G., Marlinda, & H. Rosneti. (2019). Using Various Growing Media and Application of Growmore Fertilizer on The Acclimatization of *Dendrobium* Orchids. *Agricultural Scientific Journal*, 15(2), 105-114.

Mirani A.A., Abui-Soad, & G.S. Markland. (, 2017). Effect of different substrates on survival and growth of transplanted orchid (*Dendrobium nobile* cv) into the net house. *International Journal of Horticulture and Floriculture*, 5(4), 310-317.

Monda, T., Dash, P. K., Ahmed, M., Islam, Md. M. and Ali, Md. H. (2014). Growth performance of orchid (*Dendrobium sp.)* as influenced by different NPK spray concentration. *International Journal of Biosciences*, 4(7), 15-27.

Sukma, D. dan A. Setiawati. (2010). Pengaruh Waktu dan Frekuensi Aplikasi Pupuk Daun terhadap Pertumbuhan dan Pembungaan Anggrek *Dendrobium* 'Tong Chai Gold'. *J. Hort. Indonesia,* 1(2), 96-103

Tenaya, I.M.N. (2015). Pengaruh Interaksi dan Nilai Interaksi pada Percobaan Faktorial. *AGROTROP*, 5 (1), 9 – 20

Widiastoety, D., N. Solvia, N., & M. Soedarjo. (, 2010). The potential of Dendrobium orchids in increasing the variety and quality of cut flower orchids. *Journal of Agricultural Research and Development,* 29(3), 101-106.