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***RESEARCH ARTICLE***

# EFFECT OF VARIOUS GROWING MEDIA AND FERTILIZER LEVELS ON GROWTH OF *Antherura Rubra* Lour

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**ABSTRACT**

*Antherura rubra* Lour is one of the critical plant at Cibodas Botanical Garden. Study of cultivation through vegetative propagation of *A. Rubra* is infrequently. Therefore, the research of *A. rubra* on various media and inorganic fertilizers is required in order to conserve *A.rubra* at Cibodas Botanical Garden. This study was conducted at the Nursery - Cibodas Botanic Garden for 10 months. The experiment was conducted in randomized block design (RBD) with four replications. Treatments consisted of three combinations of natural compost media with three levels of inorganic fertilizer (0, 1g/L, and 2g/L), three katalek compost combination with three levels of inorganic fertilizer and a control (top soil without inorganic fertilizers). Variable tested consists of plant height, number of leaves, and dry weight shoot and root as an indicator of growth *A. rubra* Lour. The results showed that the growth of seedlings *A. rubra* Lour on katalek compost media's with one dose of levels inorganic fertilizer growth better than other treatments.

**Keywords:** *Antherura rubra, Cibodas Botanical Garden, compost, Fertilizier, vegetative propagation.*

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## INTRODUCTION

Cibodas Botanical Garden (KRC) is located at the foot of the Gede Pangrango Mountain with the altitude of 1300-1425 m above sea level. Cibodas Botanical Garden (KRC) was established on 11 April 1852 by a curator of Bogor Botanical Gardens, JE Tijsmann. The initial purpose of establishment KRC was as a place for acclimatization valuable plant species from foreign countries. KRC now serves as a center for ex-situ conservation, research, environmental education, and also tourism. KRC collection is dominated by upland wet crops which were coming from Indonesia and other.

One function of the KRC is for ex-situ conservation, but actually there is also a for vulnerable collections preservation. vulnerable collections is some plant species that only have two or less in a number whice are endangered. One of the collections that is classified as vunerable plant in KRC is *Antherura rubra* Lour (*A. rubra* Lour) which comes from the Moluccas and planted on November 27, 1989. Research propagation of *A. rubra* Lour in KRC is still rarely both in generative and vegetative mechanism. Vegetative propagation of *A. rubra* Lour can be carried out through cuttings, grafting and budding. Vegetative propagation can be carried out anytime beyond the flowering period (Purnomosidhi et al., 2002).

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The quality of seed depends on seed management, including selection media for seedlings (Sakai and Atok, 2007). Generally, seedling media consist of top soil containing macro and micro nutrients, furthermore, sand which has good aeration, organic materials such as coco peat, chaff or ferns. Continuity using top soil as seedling media will causing top soil degradation.

The Cibodas Botanical Garden has been producing litter compost from plant collection that has function for growing crops media, as well as an organic fertilizer. There are two types of compost produced by KRC there are natural compost and katalek compost. Natural compost is a compost-based litter without the addition of an activator, whereas katalek compost is a compost based-litter with the addition of katalek activator.

The media that originated from organic fertilizers such as compost are expected to be a proper growth media for seed collection at KRC. The proper organic media has a several characteristic such as good aeration, high ability of storing water, high cation exchange capacity, and strengthen the seedling roots (Sukmana et al., 2005). However, organic media also have the disadvantage, the nutrient content is relatively low when compared to top soil, so that in it utilization still need additional fertilizer as a source of nutrients for plants (Novizan, 2005).

Micro and macro elements nutrients absorbed by plants from the soil and its function can't be replaced by other elements. So that, NPK fertilizer should be added as an additional nutrients for the seedlings. Therefore the utilization of different media type and dose of fertilizer to seed *A. rubra* Lour in this research is expected to provide initial information as an attempt to conserve *A. rubra* Lour at KRC collection as well as providing information about the benefit of KRC compost.

**MATERIAL AND METHODS**

This study was carried out in the nursery unit of Cibodas Botanical Garden, from September 2009 to July 2010. Materials used are top soil (control), organic fertilizer, chaff, plant regulating substances (hormones /ZPT), cuttings *A. Rubra* Lour, Polybag 500 grams and 5 kilograms, labels, and NPK fertilizer. This study was conducted using a randomized block design (RBD) with seven treatments and four replications. The treatment are:

A : Top soil without fertilizer ( 3 Kg)
B : 2 kg Natural compost without fertilizer
C : 2 kg Natural compost + 1g/L NPK fertilizer
D : 2 kg Natural compost + 2 g/L NPK fertilizer
E : 2 kg Katalek compost without fertilizer
F : 2 kg Katalek compost + 1 g/L NPK fertilizer
G : 2 kg Katalek compost + 2 g/L NPK fertilizer

The observational data was analysed by analysis of variance (ANOVA) or F test at 95% confident interval. Furthermore, the significant treatment then tested by Duncan Multiple Range Test (DNMRT) at 5% level of significance. The parameters observed in this study were plant height, number of leaves every 4 weeks until the plant age of 24 Weeks After Planting (WAP) and the measurement of root and shoot dry weight on 24 WAP. This study also measures C/N and the pH value of each media as data supplements.

*Antherura rubra* Lour cutting was taken from parental tree of *A. rubra* Lour that was origin from vak IV E. 35 Cibodas Botanical Garden. Plantings of cutting were carried out by dipping the base of cutting on Rooter F and then planted it in the nursery like a container with medium sand. The container must be covered to prevent it from direct sunlight,

**Table 1.** The Height of plant seedlings (cm)

| Code | Treatment | Weeks After Planting | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | | 4 | | 8 | | 12 | | 16 | | 20 | | 24 | |
| A | *Top soil* (Control) | 10.8 | a | 12.0 | a | 12.7 | a | 13.2 | a | 13.6 | a | 13.6 | a | 13.6 | a |
| B | Natural Compost | 11.1 | a | 11.7 | a | 12.6 | a | 13.8 | a | 14.2 | a | 15.5 | a | 15.3 | ab |
| C | Natural Compost + 1gr/L NPK fertilizer | 10.8 | a | 11.5 | a | 12.2 | a | 12.7 | a | 14.0 | a | 15.2 | a | 15.5 | ab |
| D | Natural Compost + 2gr/L NPK fertilizer | 9.6 | a | 10.8 | a | 11.9 | a | 13.1 | a | 15.3 | a | 16.4 | a | 16.4 | ab |
| E | Katalek Compost | 10.8 | a | 12.0 | a | 13.2 | a | 13.7 | a | 15.8 | a | 16.7 | a | 17.2 | ab |
| F | Katalek Compost + 1gr/L NPK fertilizer | 11.1 | a | 12.6 | a | 13.3 | a | 13.6 | a | 15.9 | a | 17.4 | a | 17.9 | ab |
| G | Katalek Compost + 2gr/L NPK fertilizer | 10.0 | a | 11.0 | a | 13.0 | a | 13.5 | a | 16.1 | a | 19.0 | a | 20.3 | b |

*Remarks : the number followed by the same letter shows there is no significant difference, according to Duncan test at the 5 % level significantly*

contamination from pest and disease and also for keeping the seed moist. This process was carried out for 4 months. After 4 months the plant was transferred to media treatment such as top soil, compost and katalek compost media. The fertilizers that were used in this study were N: P: K with ratio 25: 5: 20 (Hyponex). Fertilizing was given at 1 month after planting and then it was performed every 2 weeks for 12 WAP, after 12 WAP, the fertilizer was given every 1 month until 24 WAP.

## RESULT AND DISCUSSION

### The Height of seedlings

There were no significant difference of plant height until 20 WAP (Table 1). This can be occured because before 20 WAP the nutrient for seedling plant was fulfilled from the nutrients contained in the soil or planting media.

The significant difference of plan height occur at the compost media katalek with two part fertilizer treatments were significantly different with the media top soil (control) at 24 WAP. In addition, the katalek compost media with two part fertilizer treatment also shows no significant differences with the other. The highest plant was obtained by katalek compost media because the availability of nutrients inline with the plants need, especially nitrogen (N). Havlin et. al. (1999) in Tirta (2006) states that increasing doses of N will increasing the availability of N in the soil which stimulate the activity of photosynthesis and vegetative growth of the plants.

There are no significant difference of *A. rubra* Lour seedling height between the treatment with natural compost media, the treatment using natural compost with addition of various dosages of fertilizer katalek compost and katalek compost with one dose of fertilizer. This was occur because the influence of the C/N in both of compost media.

**Figure 1.** The difference of seedling growth of *Antherura rubra* Lour at 16 WAP

**Table 2.** Measurement of Top Soil, natural compost and katalek compost

| No | Criteria | Top soil | Natural Compost | Katalek Compost |
|---|---|---|---|---|
| 1. | C- organic (%) | 3,05 | 8,92 | 11,91 |
| 2. | C/N ratio | 13 | 20 | 17 |
| 3. | pH | 5,1 | 7,1 | 6,4 |
| 4. | N total %) | 0,23 | 0,4 | 0,83 |
| 5. | $P_2O_5$ (%) | 0,08 | 0,19 | 0,12 |
| 6. | $K_2O$ (%) | 0,04 | 0,06 | 0,21 |

*Remarks :*
*Laboratorium Test Result : Instalation of Chemistry Laboratorium, Land Research Centre (2010).*

From Table 2 we can seen that the katalek compost media has a C/N lower (17) than natural compost media (20), but C/N at both of media were classified high. According to Rasyidin (2004), the ability of organic matter releasing the nutrients depends on the value of C and N ratio. The lower the value of the ratio between C and N, the ability of material organic for releasing the nutrient were higher. So that, the media treated with various dosages of natural compost and katalek compost media with one dose fertilizer plants shows no significant difference in height of plant because the nutrient availability is inadequate due to the slow releasing of nutrients.

**Number of leaves *Antheruran rubra* Lour**

Generally various of media treatments and dosages of fertilizer increasing the number of leaves if compared than control (Figure 2). Is was occur because of defoliation due to non-fulfillment of the nutrient needs of plants in the control medium.

The analysis of the soil macro substance availability (Table 2) showed that the NPK compound on media control is 0.23% N, 0.08% P, and 0.04% K. Based on criteria for soil physical and chemical assessment the NPK content in the control media clasified as moderate for N, very low

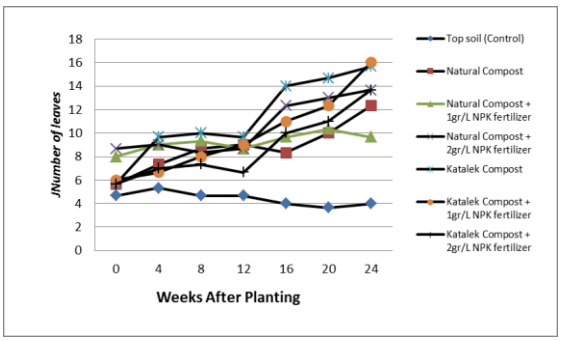


**Figure 2.** The number of leaves seedlings of *Antherura rubra* Lour for 0 to 24 WAP

for P and moderate for K (Eviati, et. al., 2009). So that the seedling plant of *A. rubra* Lour in control media experienced nutrient deficiency, which has an impact on metabolic processes and vegetative growth disorders. This is appropriate with the opinion of Lakitan (1993) which states that the symptoms of nutrient deficiency can be seen at the growth of roots, stems, or leaves that are stunted (dwarf) and chlorosis or necrosis in various plant organs.

Analysis of variance for the number of leaves of *A.rubra* Lour seedling due to the influence of various media and fertilizer are differently significant at 0 and 24 WAP (Table 4). The number of leaves seedling at 0 WAP is different, because it is difficult to find the same number of the leaves from seedling stock. The number of seedling leaves on natural compost and katalek compost media's treatment at 24 WAP are significantly different comparing with the control. *A. rubra* Lour that were planted in katalek compost media with a single dose of fertilizer at 24 WAP have high number of leaves (16 pieces of leaf) than the other. That number is significantly different with the control but no significance different with other treatments. This occurs because the amount of nutrient at this media (katalek compost with one dose of fertilizer) was optimum, thus supporting the growth of leaves. This is consistent with the statement Sutanto (2002) which states that

**Table 3.** The Number of leaves seedlings of *A. rubra* Lour (pieces) at 0 and 24 WAP

| Code | Treatment | WAP | | | |
|---|---|---|---|---|---|
| | | 0 | | 24 | |
| A | *Top soil* (Control) | 4.7 | a | 4.0 | a |
| B | Natural Compost | 5.7 | a | 12.3 | b |
| C | Natural Compost + 1gr/L NPK fertilizer | 8.0 | b | 9.7 | ab |
| D | Natural Compost + 2gr/L NPK fertilizer | 8.7 | b | 13.7 | b |
| E | Katalek Compost | 5.7 | a | 15.7 | b |
| F | Katalek Compost + 1gr/L NPK fertilizer | 6.0 | a | 16.0 | b |
| G | Katalek Compost + 2gr/L NPK fertilizer | 5.7 | a | 13.7 | b |
| Diversity Coeficient | | 17.38 % | | 37% | |
| F 0.05 | | 2.66 | | 2.66 | |
| F calculate | | 6.85* | | 3.36* | |

*Remarks : The number followed by the same letter shows there is no significant difference according to duncan test at 5% level significant*

the addition of fertilizer, such as N can stimulate root growth and improve the ability of roots to absorb nutrients, N elements are also needed for the growth of vegetative plant , including the growth of leaves.

In addition, K elements also affects the growth of leaves. Since potassium is one of nutrient that plays an active role in the physiology of plants by increasing the growth of meristem tissue. The result of a compost analysis in the laboratory, K content on katalek media (0.21% K) was higher than natural compost (0.06% K)(Table 3). This result shows that growth of leaves on Katalek compost media in correlation with Kalium content.

Table 3 also indicates that the number of *A. rubra* Lour Leaves on katalek compost added by one dose of fertilizer is more than the *A. rubra* Lour planted on katalek compost media added by two doses of fertilizer. This might occur due to the amount of fertilizer that has exceeded the needs of the plant. According Hardiana *et al.* (2008), the higher of N nutrient as a result of the higher doses of

**Table 4.** *Antherura rubra* Lour shoot and root dry weight (gr)

| Code | Treatment | Root Weight | | Shoot Weight | |
|---|---|---|---|---|---|
| A | *Top soil* (Control) | 0.7 | ab | 0.73 | a |
| B | Natural Compost | 0.7 | ab | 0.72 | ab |
| C | Natural Compost + 1gr/L NPK fertilizer | 0.6 | a | 0.63 | abc |
| D | Natural Compost + 2gr/L NPK fertilizer | 0.9 | ab | 0.85 | abc |
| E | Katalek Compost | 0.8 | ab | 0.75 | abc |
| F | Katalek Compost + 1gr/L NPK fertilizer | 1.1 | b | 1.14 | c |
| G | Katalek Compost + 2gr/L NPK fertilizer | 1.0 | ab | 0.95 | bc |

*Remarks : The number followed by the same letter shows there is no significant difference according to duncan test at 5% level significant*

NPK fertilizer can affect negatively the plant roots. It is also disclosed by Koesriningroem and Setyati (1979) in Rosman *et al.* (2004), which states that the high concentration of nitrogen will inhibit root growth. Inhibition of root growth will have implications on reducing absorption ability of other nutrients needed by plants and ultimately will affect the growth of plants.

Table 4 shows that there is significant difference the dry weight of *A. rubra* Lour root that were planting on katalek compost with the addition of one dose of fertilizer if it compared with natural compost media with one dose of fertilizer, but there is no significantly different from others. Shoot dry weight of *A. rubra* Lour plants that were planted in katalek compost media with one dose of fertilizer has a weight value that was significantly different from control and natural compost media treatment.

One of the main factors that affects the plant weight are nutrients. High amount of nutrients that can be absorbed by plants in optimal conditions would be a positive impact on formation of plant weight (fresh). Nitrogen element is one of nutrients that affect the

amount of the dry weight plant. According Fajarditta et al. (2012) The nitrogen uptake levels could affect the nitrogen level and dry matter production, so that the higher nitrogen uptake the higher the production of dry material. Phosphorus (P) elements are also an important element that affected dry weight plant. Phosphorus element deficiency can inhibit in various physiological functions in plant (Rinsema, 1983). According to Hardjowigeno (2003), P element plays a major role in stimulating the growth of lateral roots and fibrous roots. Abidin (1987), states that the root has a function at the transportation of water and mineral salts and $O_2$ from the soil and then distributed it to other plant parts (stems and leaves above it). In accordance with the opinion of foth (1995), that P deficiency will inhibit the root growth so that it can be reduced absorption of nutrients, which contribute negatively to the dry weight plant.

The statistic analysis of plant dry weight were shown that therse is no significantly different among treatment. This indicates that the amount of nutrients in each planting medium is also no significantly different. Phosphorus elements play a major role in the growth and generative development of plants (Leiwakabessy et al., 2003). So that the P element will also affect the dry weight plant. The result of test laboratory showed that the natural compost and katalek compost have a low P content, which is respectively 0.19% on natural compost and 0.12% on compost katalek. This is the main reason that the dry weight plant among the treatment were not significantly different.

A dry weight plant which was planted on katalek compost media treatment with one dose of fertilizer showed greater results when compared with the others. This result shows that the nutrient needed by plants for growth had been fulfilled. The addition of NPK fertilizers tends to reduce the growth of seedlings *A. rubra* Lour, it is also in line with the results of research conducted by Kurniawati and Miranti (2013) that the addition of inorganic fertilizer on katalek compost media tend to lowering the seedling growth of *Shorea javanica* until 24 WAP. It is also accordance with the Law of the Minimum Liebig law (Salisbury, 1999) which states that the growth of a plant depends on the minimum amount of several factors. The amount of nutrient below optimal condition will cause increasing growth of plant until it doses reach the optimal condition, and if the nutrient exceed the optimum amount, the plant growth will be constant or decline.

**CONCLUSION**

Natural composts and katalek compost media can improve the growth of seedlings *Antherura rubra* Lour compared than top soil (control). The seedling growth on compost katalek media with one portion dosage of fertilizer are better than other treatments.

**REFERENCES**

Abidin, Z. 1987. *Dasar Pengetahuan Ilmu Tanaman*. Angkasa. Jakarta.

Eviati dan Sulaeman. 2009. Juknis Analisis Kimia Tanah, Tanaman, Air, dan Pupuk. Balit Tanah. Bogor.

Fajarditta, F., Sumarsono., F. Kusmiyati. 2012. Serapan Unsur Hara Nitrogen dan Phospor Beberapa Tanaman Legum Pada Jenis Tanah yang Berbeda. *Animal Agriculture Journal*. Vl 1 (2) : 41-50.

Foth, H. D. 1995. *Dasar-dasar Ilmu Tanah*. Gadjah Mada University Press. Yogyakarta.

Hardjowigeno, S. 2003. *Ilmu Tanah*. Akademika Pressindo. Jakarta.

Herdiana, N., A.H Lukman., K. Mulyadi. 2008. Pengaruh Dosis dan Frekuensi Aplikasi Pemupukan NPK Terhadap Pertumbuhan Bibit Shorea Ovalis Korth (Blume). *Jurnal Penelitian Hutan dan Konservasi Alam*.Vol 5 (3).

Kurniawati Fitri dan Miranti Ariyani. 2013. Pengaruh Media Tanam dan Pemupukan NPK terhadap Pertumbuhan Bibit Damar Mata Kucing (*Shorea Javanica*). Sains Tanah- Jurnal Tanah dan Agroklimatologi Vol. 10 (1). Hal: 9-18.

Leiwakabessy, F. M., U.M. Wahjudin., Suwarno. 2003. *Kesuburan Tanah*. Jurusan Tanah. Fakultas Pertanian, Institut Pertanian Bogor. Bogor.

Muslihat, L. 2003. Teknik Percobaan Takaran Pupuk Kandang Pada Pembibitan Abaca. *Buletin Teknik Pertanian*. Vol 8 (1) : 37 – 39.

Novizan. 2005. *Petunjuk Pemupukan Yang Efektif*. Agromedia Pustaka. Jakarta.

Purnomosidhi P, Suparman, JM Roshetko dan Mulawarman. 2002. *Perbanyakan dan budidaya tanaman buah-buahan dengan penekanan pada durian, mangga, jeruk, melinjo, dan sawo*: suatu pedoman lapang. International Centre for Research in Agroforestry (ICRAF) dan Winrock International. Bogor, Indonesia.

Rasyidin, A., 2004. *Penggunaan Bahan Limbah untuk Perbaikan Lahan Kritis*. http://io.ppi-jepang. org /article.

Rinsema, W. T. 1983. *Pupuk dan Cara Pemupukan*. Bhratara Karya Aksara. Jakarta.

Rosman, R., S. Soemono dan Suhendra. 2004. Pengaruh Konsentrasi dan Frekuensi Pemberian Pupuk Daun terhadap Pertumbuhan Panili di Pembibitan. *Buletin TRO*. Vol 15 (2).

Sakai, Chikaya dan Atok Subiakto. 2007. *Pedoman Pembuatan Stek Jenis-jenis Dipterokarpa dengan Koffco System*. Kerjasama antara Badan Litbang Kehutanan, JICA dan Komatsu,Ltd. Litbang Kehutan dan Konservasi. Bogor.

Salisbury F.B. & Ross C.W. 1999. *Plant Physiology*. 4th edition. Brooks/Cole.

Subiakto, Atok. 2006.*Teknologi Perbanyakan Vegetatif Tanaman Hutan secara Massal*. Makalah Utama Ekspose hasil-hasil Penelitian : Konservasi dan Rehabilitasi Hutan 2007. Padang.

Sukmana, Asep dan Darwo. 2005. Tenik Produksi Bibit Tanaman Hutan dalam Mendukung Program Gerakan Nasional Rehabilitasi Hutan dan Lahan*. Prosiding Balai Penelitian Kehutaan Aek Nauli* Tahun 2005.

Sutanto, R. 2002. *Penerapan Pertanian Organik*. Kanisius. Yogyakarta.

Tirta, I.G. 2006. Pengaruh Beberapa Jenis Media Tanam dan Pupuk Daun Terhadap Pertumbuhan Vegetatif Anggrek Jamrud (*Dendrobium macrophyllum* A. Rich.). *Biodiversitas*. Vol 7 (1) : 81-84.