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Application of glyocompost for propagation of Anthurium clones

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Abstract. Reduction of chemical application for disease control is important to reduce environmental pollution. An environmental friendly alternative was used Glyocompost. Glyocompost is medium with double functions, there were fungicide and fertilizer. The objectives of the study was to find out best composition of glyocompost and bamboo moss in media for propagation anthurium clones. Anthurium clone “CC” was clone from breeding programme as materials. CC was crossing of Anthurium cv. Cromosum x Anthurium cv. Castano. The composition of media were 1: 18, 1:19, 1: 20 and 1:21 as treatment to apply in CC clones. The parameter observation were plant height, total number of leaves, leaves length, leaves width and total number of shoots. The best composition of glyocompost was obtained 1:19 (glyocompost : bamboo) for leaves width and leaves length. The best of total number of shoots were obtained by composition media 1: 18. While, all treatments were not significantly different for leaves length and total number of leaves. Glyocompost was also accelerated blooming in anthurium clones.

1. Introduction

Anthurium is neotropic herbaceous epiphytes [1], it belongs to the family *Araceae*. It consists of 108 genera [2], and it's about 1000 species. The ornamentals which is the same in these family are *Spathiphyllum*, *Zantedeschia*, *Philodendron*, and *Monstera* [3]. Anthurium is native in tropic area, from Mexico to the north Uruguay, Argentina and America. Anthurium had long vase life of about six weeks and even more depending on variety and season [1].

Anthurium is commercially produced as potted plants and cut flowers [4]. Anthurium was propagated by conventional method using seed, vegetative part of plants and tissue culture. The seed propagation produced heterozygous progenies due to cross pollination [2]. Propagation used vegetative part of plants by stem cutting and suckers [4]. In tissue culture, anthurium were propagated using part of plants as explants. The explants were leaf, petiole, spadix, spathe, seeds, lateral buds and shoot tip [5]. First report of tissue culture in anthurium was obtained through adventitious shoots formation from callus [6]. Some explants such lamina, adventitious [6], axillary buds, [7] were also successfully used as explants for propagation anthurium through *in vitro* culture.



Anthurium was propagated as cutting and potted plants, interior also. These flowers were important in floriculture industries. Anthurium had long vase life of about six weeks and even more depending on variety and season [1].

Anthurium is consist of two words, there were “Anthu” which means flower, and “Oura” which means tail, Painted Tongue, Flamingo Flower (Flamingo Lily or Tail Flower). Pollen tube was likes the tail [1]. The specific character of anthurium was “spathe” and “spadix”, spathe was modified of leaves, and spadix was arising from the base of the spathe, which is commonly known as “candle” [8].

Management control of propagation Anthurium was usually using chemical fertilizer and chemical fungicide. At present, the friendly agriculture is important and necessary to use for preventing of environmental damage and pollution. Reducing chemical agricultural product is crucial. One of friendly agriculture product was glyocompost. Glyocompost was biofungicide which is consist of *Gliocladium* sp. *Gliocladium* sp is soil microbe. The optimum growth is 25-32° C, it is saprophyte for other fungi. This microbe is CO₂ tolerance, and in media consist NaCl 5% the microbe growth and spore were decreased [9].

This product have double function, there are fertilizer and fungicide. As biofungicide, glyocompost was effective to control pathogen. The pathogens were *Fusarium oxysporum* f.sp *dianthy* in Dianthus, *Fusarium oxysporum* f.*cubense* and *R.solanacearum* in banana. The advantages of glyocompost were (1) reduce the expense of production such as chemical fungicide. Pathogen decreased and plant damage reduced it. The yield was optimal and increased. (2) Increasing farmers income, (3) glyocompost provided essential elements, macro and micro nutrient for growth [9].

In previous research, the *Glyocompost* could depress rot fruit disease in chilli, *oryza sativa*, and banana. It also was increased high yield to 13.4% in banana. Glyocompost was increased growth of ornamental plants, such total number of flower, flower diameter and percentage of flowering in dianthus [9]. There are mutualistic and antagonistic fungi in soil communities, and plants can interact simultaneously [10].

2. Materials And Methods

The research was conducted in Indonesian Ornamental Crops Research Institute Segunung – Cianjur, West Java- Indonesia. The study was started on July 2017 until August 2018.

2.1. Materials

Anthurium clones number CC and SQ (sprout stadia) were used as materials. Clones CC and SQ were anthurium F1 progenies obtained through conventional breeding. CC were F1 progenies of Cromosum x Castano, SQ were F1 progenies of Sempre x Qtazu. Ratio of Glyocompost and organic media (bamboo + manure) were 1: 17, 1: 18, 1: 19, 1: 20 and 1: 21. Ratio of Glyocompost + organic media were used as treatments.

2.2. Methods

There were four growing media as treatments which is contain of Glyocompost. All the treatments were:

1. Ratio 1:17 (arranged by mix 1 part of Glyocompost with 17 part of organic media (bamboo+ manure).
2. Ratio 1:18 (arranged by mix 1 part of Glyocompost with 18 part of organic media (bamboo+ manure).
3. Ratio 1:19 (arranged by mix 1 part of Glyocompost with 19 part of organic media (bamboo+ manure).
4. Ratio 1:20 (arranged by mix 1 part of Glyocompost with 20 part of organic media (bamboo+ manure).
5. Ratio 1:21 (arranged by mix 1 part of Glyocompost with 20 part of organic media (bamboo+ manure).

The growing media of every treatment put in plastic pot (diameters 15 cm). The anthurium sprout cultivate in this media based on the ratio. Other maintenance such fertilizer, irrigation and weed were ordinary maintenance in cultivation.



Figure 1. Glycompost media for cultivation of anthurium. Glycompost (A&B), Manure (C), Bamboo (D), Manure (E), Bamboo (F & G)

Glycompost was comprised of some microbes namely *Azotobacter* sp, *Azospirillum* sp, *Bacillus* sp, *Pseudomonas* sp, and *Gliocladium* sp (Table 1).

Table 1. Composition of Glycompost

Composition		
Microbe	Total	Function
<i>Azotobacter</i> sp	$1.7- 5.6 \times 10^9$ cfu/g	Produce phytohormon, N ₂
<i>Azospirillum</i> sp	$1.5 - 7.3 \times 10^7$ cfu/g	Produce phytohormon, N ₂
<i>Bacillus</i> sp	$2.4- 7.5 \times 10^9$ cfu/g	Leaching P soil
<i>Pseudomonas</i> sp	$1.5 - 7.3 \times 10^7$ cfu/g	Controlling soil born pathogen agent and phytohormon
<i>Gliocladium</i> sp	$1.9 - 3.7 \times 10^7$ sporee/g	Controlling soil born pathogen agent
Pathogenesis: negative	Contaminant of coliform: negative	Heavy metal: negative

2.3. Parameter of Observation

Observation of parameter were plant height, leaves length, leaves width, total number of leaves, total number of shoots, and time of flowering. Plant height was measured from up of the media until highest plant. Leaves length was measured from leaf base to leaf tip of the biggest leaves. Leaves width was measured from side right of the leaf to side left of the leaf. Total number of leaves were counted number of leaves in one plant. Total number of shoots were counted shoot number in one plant. Time of flowering was counting day to flowering from planting.

2.4. Data Analysis

Data calculated by ANOVA and the means were separated using Duncan's Multiple Range Test by using the program IBM SPSS *Statistics* 19. The data was analysis used SPSS software

3. Result and Discussion

Propagation of anthurium was well growth depend on plant environmental surrounding. The environment were light, humidity, irrigation, temperature and media including fertilizer. In this study, the combination of biofungicide and bio fertilizer in media were observed.

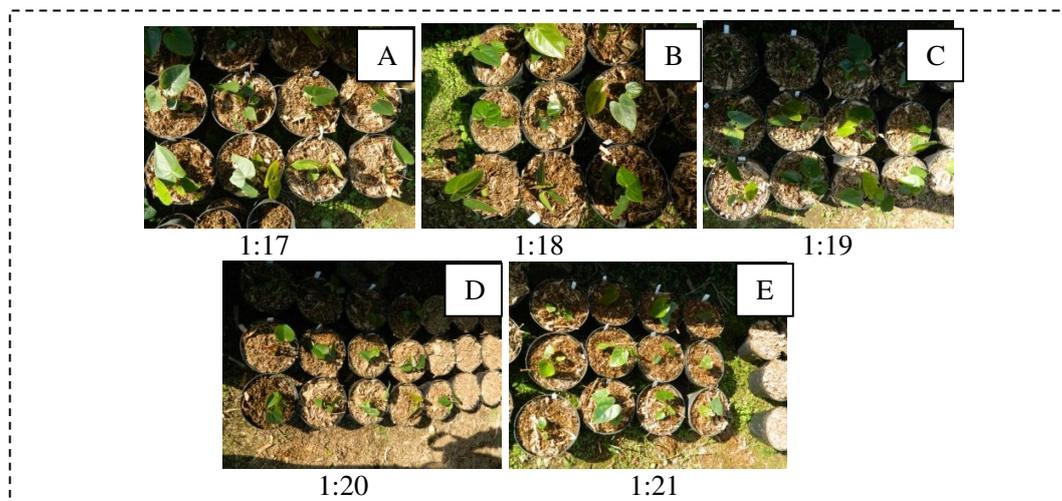


Figure 2. Anthurium clones in media containing of glyocompost. Ratio glyocompost : manure (1:17) (A), Ratio glyocompost : manure (1:18) (B), Ratio glyocompost : manure (1:19) (C), Ratio glyocompost : manure (1:20) (D), Ratio glyocompost : manure (1:21) (E).

Media was added with essential element of cultivation most plants, including anthurium. Usually, media were containing macro and micro elements, without fungicide or fertilizer. Both of fungicide and fertilizer were needed for cultivation. Figure 2 and Table 2 showed that media mix fungicide and fertilizer accelerate of flowering in anthurium clone CC and SQ. Effect of Glyocompost was different on each clone of anthurium. Ratio media : glyocompost (1: 17) induced the highest total of flowering in CC clones, but it was not happen in SQ clone. The highest total number of flowering was obtained in ratio 1:20 and 1: 21. It means that each clones have difference micro and macro element for growth.

Table 2. Percentage of flowering in two anthurium clones (2 months) after application of Glyocompost.

No.	Ratio of Glyocompost in Media	Anthurium Clones	
		CC	SQ
1.	1:17	38.46 %	-
2.	1:18	23.08 %	-
3.	1:19	23.08 %	37.5%
4.	1:20	-	37.5 %
5.	1:21	-	-

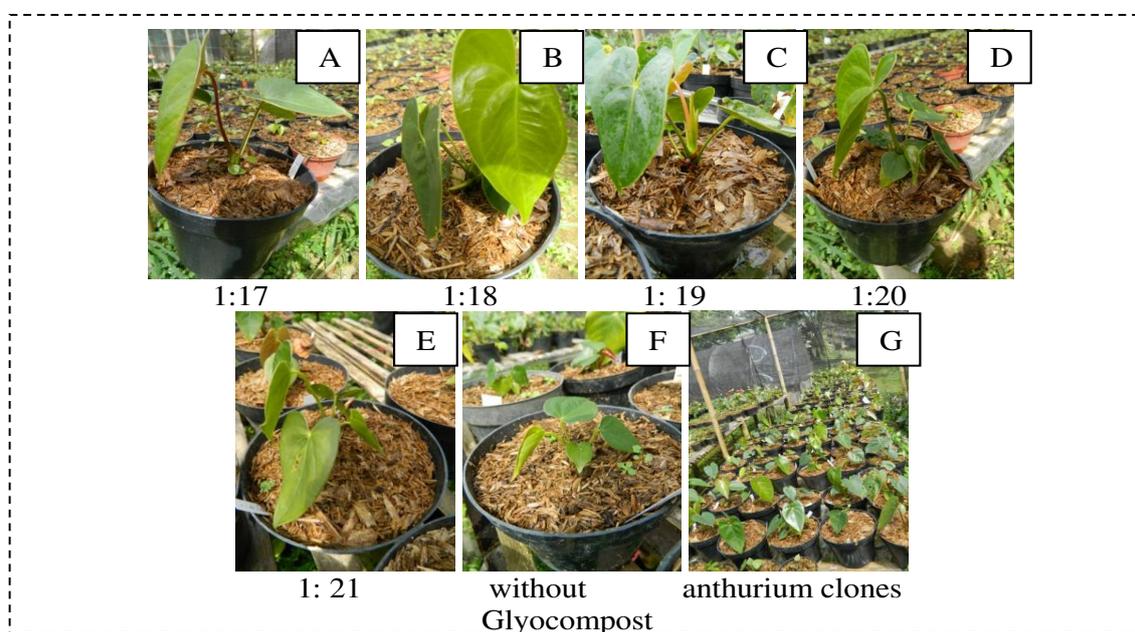


Figure 3. Response of anthurium clones in media containing glycompost (1 month after application of glycompost). Ratio 1:17 (A), Ratio 1:18 (B), Ratio 1:19 (C), Ratio 1:20 (D), Ratio 1:21 (E).

Most of anthurium clones were cultivated in media mix glycompost showed that all plants were growing well (Figure 3). Glycompost promoted of plant growth by increasing the accessibility and supply of major nutrients result in all anthurium clones grew well. Plants roots exude contains many organic compounds that stimulate microbial growth. Microorganism found in plants tissues. The *Azospirillum* spp in Glycompost have ability to fix nitrogen (nitrogen fixation) [11]. It means that *Azospirillum* spp have function as PGPBEs (Plant Growth Promoting Bacterial Endophytes) facilitated plant growth by three interrelated mechanism. There were phytostimulation, bio fertilization and biocontrol. Phytostimulation was direct promotion of plant growth by production of phytohormones. *Azotobacter*, *Pseudomonas* and *Bacillus* in glycompost released enzyme ACC (1-aminocyclopropane-1-carboxylate) deaminase. This enzyme increased plant growth and reduced abiotic stress by balancing level of ethylene production in plant. The elevate ethylene level inhibited cell division, DNA synthesis and root or shoot growth [11].

Table 3. Morphology of Flower Character in Anthurium SQ clone (2 months) application of Glycompost

No.	Ratio of Glycompost in Media	Spathe length (cm)	Spadix length (cm)	Spathe width (cm)	Spadix colour	Spathe colour
1.	1:18 (SQ-3)	3.4	1.6	3.9	Orange 28-B	Red purple 59-A
2.	1:19 (SQ-6)	3.3	2.3	3.3	Yellow 7-A	Red purple 59-A
3.	1:19 (SQ-1)	3.4	1.6	3.9	Orange 28-B	Red purple 59-A
4.	1:19 (SQ-5)	4.5	1.5	4.5	Red 45-A	Green yellow 1-A
5.	1:19 (SQ-6)	3.4	3.0	3.5	Red purple 53-A	Red purple 53-A
6.	1:19 (SQ-3)	3.5	3.5	3.8	Red 53-A	Red 36-A
7.	1:19 (SQ-4)	3.4	2.8	2.9	Red 93-A	Red green 38-C
8.	1:20 (SQ -8)	4.0	1.0	3.7	Red 53-A	Red 42-A
9.	1:20 (SQ-3)	2.8	2.5	2.7	Yellow 11-D	Red purple 59-A

Morphology of flower character were observed used RHS colorchart, there were variation in spadix color from yellow, orange until red in clone SQ. There was no variation in spathe color. Both of spathe and spadix were not affected by glyocompost (Table 3).

Table 4. Percentage of flowering in two anthurium clones (4 months) after application of Glyocompost.

No.	Ratio of Glyocompost in Media	Anthurium Clones	
		CC	SQ
1.	1:17	61.53 %	33.33 %
2.	1:18	38.46 %	-
3.	1:19	30.77 %	100 %
4.	1:20	15.38 %	50 %
5.	1:21	-	-

Best Ratio of glyocompost in SQ anthurium clone was 1:19. This result was similar to banana, lily and others [10]. But it was different result for CC clone. The best ratio for the CC Anthurium clone was 1:17. It was indicated that anthurium growing and development were influence by many factors [8]. It was not only depending on glyocompost but also by the genetically characters [8].

Table 5. Response of anthurium clones in media containing Glyocompost (12 months)

No.	Ratio of Glyocompost in Media	Plant height (cm)	Leaves Length (cm)	Leaves width (cm)	Total number of shoots	Total number of leaves
1.	1:17	3.88 a	5.67 ab	3.41 ab	1.00 b	4.0 a
2.	1:18	4.90 a	5.70 ab	3.43 ab	1.00 b	4.0 a
3.	1:19	5.51 a	7.29 c	4.24 c	0.39 a	4.0 a
4.	1:20	6.00 a	6.59 bc	3.79 bc	0.44 a	4.0 a
5.	1:21	5.68 a	6.14 b	3.57 ab	0.50 ab	4.0 a
6.	Without glyocompost	3.88 a	5.13 a	3.05 a	0.17 a	4.0 a

Means followed by the same letter are not significantly different according to the Duncan's Multiple Range Test at $p < 0.05$.

Application of Glyocompost affected leaves length, and leaves width but not for total number of leaves as shown by the same number of total number of leaves.



Figure 4. Population of anthurium CC using glyocompost media (4 month after application of glyocompost).

Figure 4 indicated that clones were growing well and some of F1 population were blooming. Even though it was not stable yet in the first blooming, but it was stable at the second or third blooming.

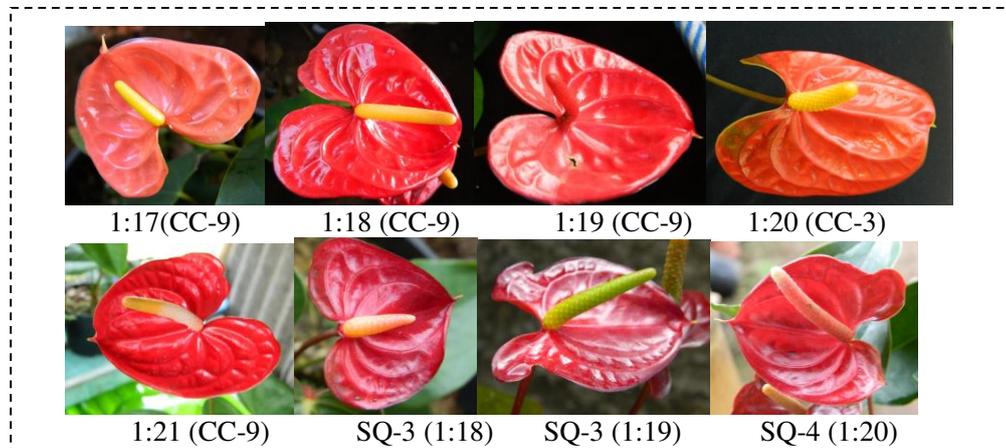


Figure 5. First flowering of CC anthurium in media glyocompost (10 months after application of glyocompost).

Animal pollinators are essential for blooming and sexual reproduction in most plant including Anthurium. Soil fungi and microbe could impact pollinator visitation and reproduction of plants by modifying the quality or magnitude of floral signals [10]. That's way the glyocompost also trigger of flowering in anthurium 4 months after application (Figure 5). Glyocompost is also have function as fertilizer, allocate more nutrients to plant growth and development. Beside the vegetative stadia, it's also accelerate flowering. Earlier studies found that arbuscular mycorrhizal fungi (AMF) provide hosts with soil resources in exchange for photosynthate. Finally its influence floral signal, pollination, seed set and plant size [10].

4. Conclusion

Application of glyocompost have many advantages for anthurium propagation. There were supply major nutrients for growth and development in anthurium, triggered of flowering earlier and protected to soil born pathogen infection.

5. References

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