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Application of CPPU Growth Regulator (N-(2-Chloro-4-pyridyl)-N'-phenylurea) and Planting Media Modification on the Growth of Porang (*Amorphophallus muelleri* Blume) Madiun Variety 1: Morphological Responses

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***Abstract*: The porang plant (*Amorphophallus muelleri* Blume) is a tuber plant that is widely cultivated because it has the potential to be an alternative food source. Apart from using bulbils, porang plants can be propagated using stem tubers. One of the obstacles faced in cultivating porang plants is the dormancy period which lasts 7-8 months and the short active growth period of 4-5 months each year. This makes it difficult to increase the productivity of porang plants. Porang plants grow well in light-textured, loose and fertile planting media. The planting medium consisting of a mixture of top soil, compost and husk charcoal has characteristics that are suitable for porang planting media. The research aims to determine the growth of porang stem tubers as morphological respon given Plant Growth Regulators (PGRs) CPPU and modification planting medium. The research design used a Completely Randomized Design (CRD) with two factorials. The first factor is CPPU concentration and the second factor is modification of the planting media. Based on the results of the ANOVA test, it was found that the interaction of CPPU and modification of the planting media had an effect on the time of shoot emergence and number of shoots. Meanwhile, CPPU PGRs influence shoot height. Tuber weight was not influenced by CPPU PGRs and planting media modification. The time of emergence of the first shoots in the C1P1 treatment with an average time of shoot emergence 7 days after planting. The highest number of shoots was found in the C0P4 treatment with an average number of shoots of 13 for each tuber. The best shoot height was found in the C0P2 treatment with an average shoot height of 1.8 cm. The best tuber wet weight was found in the C1P4 treatment with an average increase in tuber weight of 4.6 grams.**

***Keywords*: *Amorphophallus muelleri* Blume, CPPU, Planting media modification, Plant growth regulators.**

1. Introduction

The problem with cultivating the porang plant is that its growth depends on the season. Porang shoot growth occurs at the beginning of the rainy season until the end of the rainy season. In the dry season, porang plants will experience a period of dormancy. Therefore, growth regulators are needed to break the dormancy of porang stem tubers and to stimulate the growth of porang plant seeds.

Dormancy is divided into three types according to the process in which it occurs, namely endodormancy, paradormancy and ecodormancy. The right time to apply the dormancy breaking agent will provide an effective response to the plant. The right time to apply a dormancy breaking agent is when the dormant buds are sensitive to conditions in the external environment [1]. Generally, this sensitive period occurs at the time of ecodormancy. Efforts to break dormancy and stimulate plant growth are generally carried out by applying growth regulators from the cytokinin group, one of which is CPPU (N-(2-Chloro-4-pyridnyl)-N'-Phenylurea). CPPU is a synthetic cytokinin which is known to be effective in stimulating growth by breaking dormancy so that plants can immediately sprout and grow well until they can produce optimally [2].

Porang plants require planting media that is light, loose and fertile. Porang plants also need planting media that has a high enough organic material content and is not waterlogged because porang plants need good air aeration. Several types of planting media that are generally used for seedlings are topsoil, compost, and husk charcoal. Plant nurseries generally use top soil as a medium for seedling growth [3]. The top soil layer is where most of the organic material collects and decomposes, which makes the soil in this layer composed of mineral and organic material which is good for plant growth. The addition of compost and husk charcoal is used as an additional source of nutrients and to improve the quality of the planting medium [4].

A Planting media that has been added with improving ingredients is known to be able to improve the quality of the planting media which can improve the quality of the seeds. The results of previous research show that the addition of compost can increase the content of organic matter and nutrients in the planting media [4]. The addition of husk charcoal to the planting media can also increase the organic material content in the media and can increase soil porosity [5]. Therefore, research regarding the application of CPPU growth regulators

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and manipulation of planting media on the growth of porang plant stem tubers needs to be carried out.

2. Material and Methods

A. Planting Media Preparation

The planting medium consists of top soil, husk charcoal and compost. Each polybag weighs 3 kg. Comparison of top soil:husk charcoal: compost at planting media used:

C0P1: (CPPU 0 ppm and planting media 1: 1: 1)
C0P2: (CPPU 0 ppm and planting media 2: 1: 1)
C0P3:(CPPU 0 ppm and planting media 1: 2: 1)
C0P4: (CPPU 0 ppm and planting media 1: 1: 2)
C1P1: (CPPU 20 ppm and planting media 1: 1: 1)
C1P2: (CPPU 20 ppm and planting media 2: 1: 1
C1P3: (CPPU 20 ppm and planting media 1: 2: 1)
C1P4: (CPPU 20 ppm and planting media 1: 1: 2
C2P1: (CPPU 40 ppm and planting media 1: 1: 1)
C2P2: (CPPU 40 ppm and planting media 1: 1: 1)
C2P3: (CPPU 40 ppm and planting media 1: 2: 1)
C2P4: (CPPU 40 ppm and planting media 1: 1: 2)

B. Preparation of CPPU Solution Concentration

The CPPU stock solution used is 1000 ppm. Meanwhile, the variations in CPPU concentration used as treatment were 20 ppm and 40 ppm with each volume of 1000 mL. To obtain this concentration, use the dilution formula as follows:

V1XM1=V2XM2

Information:
V1 = Volume of solution before dilution
M1 = Solution concentration before dilution
V2 = Volume of solution after dilution
M2 = Concentration of solution after dilution.

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V2 = Volume of solution after dilution
M2 = Concentration of solution after dilution

C. Planting Porang Stem Tubers in Planting Media

A total of 20 tubers were soaked in 20 PPm and 40 PPm CPPU PGRs. Soaking is done for 30 minutes. The stem tubers that have been soaked in CPPU are then planted in planting media according to the treatment given.

D. Planting Porang Stem Tubers in Planting Media

Plant maintenance is carried out for 120 days which includes watering the plants with a water dose of 50 ml/polybag and CPPU (according to treatment) 10 ml/polybag every morning. Apart from that, manual weeding and pest control are carried out.

E. Observation

Observations made included the day the shoots appeared (day 1), the number of shoots, the height of the shoots (cm), and the wet weight of the stem tubers before planting and after the planting period (g).

F. Research Design

The research used a completely randomized design (CRD) with a factorial pattern consisting of two factors, namely the composition of the planting media and the concentration of CPPU. Each treatment was repeated 5 times. Observation data were analyzed using two-factor Analysis of Variance at a confidence level of 95%. If the ANOVA test results show that there is a significant effect (Sig. value ≤ 0.05), then continue with the Tukey test with a confidence level of 95% (α=0.05%).

3. Results and Discussion

A. Time of Emergence of Shoots

Based on the results of the Two-Way ANOVA test, it is known that the interaction of PGRs CPPU with the planting medium modification has a significant influence on the day of shoot emergence. Application of CPPU PGRs and modification of planting media on the average days of emergence of *Amorphophallus muelleri* Blume shoots is shown in Figure 1.

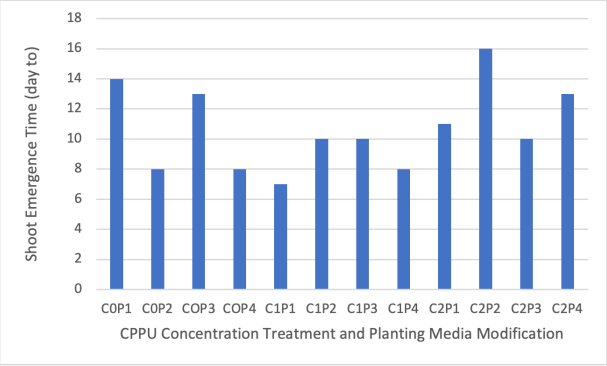

Fig. 1. Average time for *Amorphophallus muelleri* Blume shoots to appear in each treatment after 16 weeks of planting: **C0P1:** (CPPU 0 ppm and planting media 1: 1: 1);**C0P2**: (CPPU 0 ppm and planting media 2: 1: 1); **C0P3**:(CPPU 0 ppm and planting media 1: 2: 1); **C0P4:** (CPPU 0 ppm and planting media 1: 1: 2); **C1P1**: (CPPU 20 ppm and planting media 1: 1: 1); **C1P2**: (CPPU 20 ppm and planting media 2: 1: 1); **C1P3:** (CPPU 20 ppm and planting media 1: 2: 1); **C1P4**: (CPPU 20 ppm and planting media 1: 1: 2); **C2P1**: (CPPU 40 ppm and planting media 1: 1: 1); **C2P2:** (CPPU 40 ppm and planting media 1: 1: 1); **C2P3**: (CPPU 40 ppm and planting media 1: 2: 1); **C2P4**: (CPPU 40 ppm and planting media 1: 1: 2)

The C1P1 treatment showed the fastest shoot emergence. This shows that exogenous cytokinins can act as dormancy breaking substances because they can increase cell division, growth and development in plants [6]. The growth rate is determined by the concentration of exogenous cytokinin administered. The appropriate concentration given will really help plant growth [7]. Apart from that, in the C1P1 treatment,

seed tubers are planted in a planting medium consisting of top soil, husk charcoal and compost in a ratio of (1:1:1), which is known to be able to speed up the emergence of shoots on *Amorphophallus muelleri* Blume tubers. This is thought to be because the composition of the planting medium used is sufficient for the nutrients needed by the tubers. Top soil has a high organic material content which can support plant growth [8]. The addition of husk charcoal can create good aeration and drainage in the planting medium [9]. Compost fertilizer in the planting media mixture used plays a role in increasing soil fertility.

B. Number of Shoots

Based on the results of the ANOVA test, it is known that the interaction factor of PGRs CPPU with the planting medium has a significant influence on the number of shoots. The application of CPPU PGRs and planting media modification on the average number of *Amorphophallus muelleri* Blume shoots produced is shown in Figure 2.

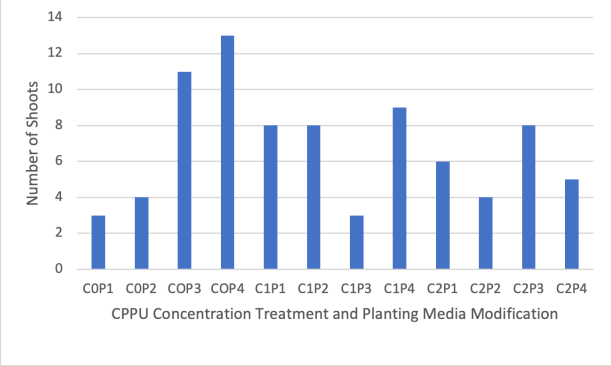

Fig. 2. Average number of shoots for Amorphophallus to appear in each treatment after 16 weeks of planting: **C0P1:** (CPPU 0 ppm and planting media 1: 1: 1);**C0P2**: (CPPU 0 ppm and planting media 2: 1: 1); **C0P3**:(CPPU 0 ppm and planting media 1: 2: 1); **C0P4:** (CPPU 0 ppm and planting media 1: 1: 2); **C1P1**: (CPPU 20 ppm and planting media 1: 1: 1); **C1P2**: (CPPU 20 ppm and planting media 2: 1: 1); **C1P3:** (CPPU 20 ppm and planting media 1: 2: 1); **C1P4**: (CPPU 20 ppm and planting media 1: 1: 2); **C2P1**: (CPPU 40 ppm and planting media 1: 1: 1); **C2P2:** (CPPU 40 ppm and planting media 1: 1: 1); **C2P3**: (CPPU 40 ppm and planting media 1: 2: 1); **C2P4**: (CPPU 40 ppm and planting media 1: 1: 2)

The C0P4 treatment had the highest average number of *Amorphophallus muelleri* Blume tuber shoots compared to other treatments. The increase in the number of shoots is more influenced by endogenous hormones. The application of exogenous hormones causes an increase in the cytokinin hormone so that it can inhibit the increase in the number of shoots [10]. The addition of compost as an organic fertilizer can provide nutrients for the plants themselves. One of the important elements in compost is nitrogen (N). If plants do not get enough of this element, then it is likely that the plant will grow more slowly compared to plants that get more N [11].

C. Shoot Height

Based on the results of the Two-way ANOVA test, it is known that the application of PGRs CPPU has a significant influence on shoot height. The average shoot height of *Amorphophallus muelleri* Blume stem tubers is shown in Figure 3.

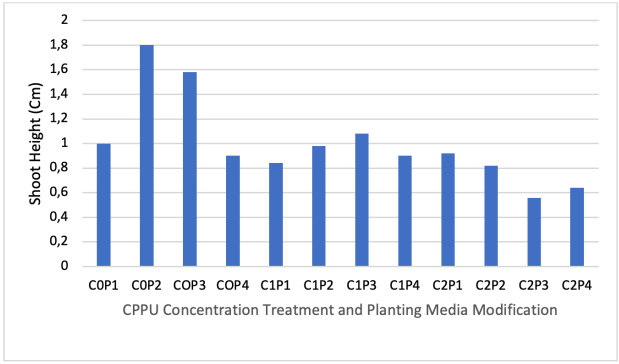

Fig. 3. Average shoot height of *Amorphophallus muelleri* Blume in each treatment after 16 weeks of planting: **C0P1:** (CPPU 0 ppm and planting media 1: 1: 1);**C0P2**: (CPPU 0 ppm and planting media 2: 1: 1); **C0P3**:(CPPU 0 ppm and planting media 1: 2: 1); **C0P4:** (CPPU 0 ppm and planting media 1: 1: 2); **C1P1**: (CPPU 20 ppm and planting media 1: 1: 1); **C1P2**: (CPPU 20 ppm and planting media 2: 1: 1); **C1P3:** (CPPU 20 ppm and planting media 1: 2: 1); **C1P4**: (CPPU 20 ppm and planting media 1: 1: 2); **C2P1**: (CPPU 40 ppm and planting media 1: 1: 1); **C2P2:** (CPPU 40 ppm and planting media 1: 1: 1); **C2P3**: (CPPU 40 ppm and planting media 1: 2: 1); **C2P4**: (CPPU 40 ppm and planting media 1: 1: 2)

The C0P2 treatment had the highest average shoot height of 1.8 cm. The difference in height of each shoot shows that there is a difference in growth speed for each tuber [12]. Overall, the treatment that was given the application of the CPPU growth regulator had a lower average shoot height when compared to the treatment without the CPPU growth regulator. It is suspected that the administration of exogenous cytokinins causes an increase in hormone concentrations which has an impact on phytohormone imbalance [13]. If the concentration level given is too high it will cause death of the plant and inhibit the formation of shoots [14]. Therefore, administration of exogenous cytokinin requires attention to its concentration.

Shoots in the C2P3 treatment were shoots with the lowest average shoot height, namely 0.56 cm. This is thought to be because the addition of excess husk charcoal can inhibit growth. Husk charcoal has high porosity properties. Planting media that is too dense will make it difficult for plants to bind water or nutrients so that growth is not optimal [15]. Husk charcoal also contains lignin which can inhibit growth if there is too much of it in the planting medium. Lignin has the property of being difficult to decompose so it is unable to provide unfavorable or excessive growing environmental conditions [16].

D. Tuber Wet Weight

Based on the results of the Two-Way ANOVA test, it is known that the PGRs CPPU application factors, planting media modification factors and their interactions do not have a significant influence on tuber weight. The average weight of *Amorphophallus muelleri* Blume stem tubers before and after the planting period is shown in Figure 4.

The most significant reduction in tuber weight occurred in the C1P3 treatment. Reduction in tuber weight can be caused by loss of water during the transpiration process and evaporation of gases resulting from the breakdown of glucose into carbohydrates during the respiration process during the planting period [17]. The provision of growth regulators plays

a more or less role in determining the increase and decrease in tuber weight after the planting period. Based on the results obtained, the administration of exogenous cytokinin was not able to show a real effect on tuber weight parameters. Treatment with a mixture of planting media composition consisting of top soil, husk charcoal and compost also had no effect on the weight of the tubers after planting. This is thought to be due to the presence of husk charcoal in the planting medium. Husk charcoal has a high C/N content so it will attract the presence of microbes (bacteria or fungi) to compete for the nutrients in the soil (Fazlini, 2014). High levels of organic compost fertilizer in the planting media can increase the nutrient content in the soil so that can be used for plant growth. Apart from that, compost also acts as a better soil amendment compared to artificial soil amendments.

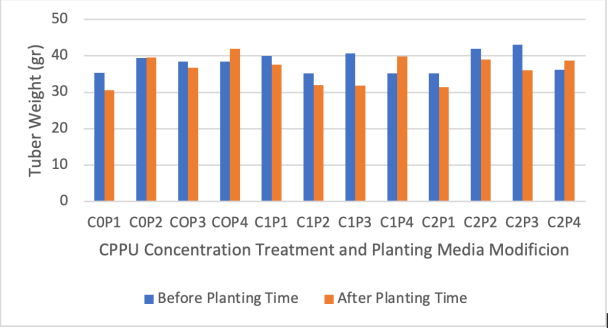

Fig. 4. Comparison of the wet weight of Amorphophallus muelleri Blume tubers before and after the 16 week planting periode: **C0P1:** (CPPU 0 ppm and planting media 1: 1: 1);**C0P2**: (CPPU 0 ppm and planting media 2: 1: 1); **C0P3**:(CPPU 0 ppm and planting media 1: 2: 1); **C0P4:** (CPPU 0 ppm and planting media 1: 1: 2); **C1P1**: (CPPU 20 ppm and planting media 1: 1: 1); **C1P2**: (CPPU 20 ppm and planting media 2: 1: 1); **C1P3:** (CPPU 20 ppm and planting media 1: 2: 1); **C1P4**: (CPPU 20 ppm and planting media 1: 1: 2); **C2P1**: (CPPU 40 ppm and planting media 1: 1: 1); **C2P2:** (CPPU 40 ppm and planting media 1: 1: 1); **C2P3**: (CPPU 40 ppm and planting media 1: 2: 1); **C2P4**: (CPPU 40 ppm and planting media 1: 1: 2)

4. Conclusion

The fastest first shoot emergence time was in the C1P1 treatment with an average shoot emergence time of 7 days after planting. The highest number of shoots was found in the C0P4 treatment with an average number of 13 tuna for each tuber. The best shoot height was found in the C0P2 treatment with an average shoot height of 1.8 cm. The best tuber wet weight was found in the C1P4 treatment with an average increase in tuber weight of 4.6 grams.

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