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The Effect of Cocopeat Addition in Plant Media on The Quality and Quantity of Papaya Seeds (*Carica papaya* L.var.calina)

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Abstract. Papaya (*Carica papaya* L.) is one of the agricultural commodities that is widely cultivated by farmers in almost all parts of Indonesia. This plant is widely cultivated because varied consumption of papaya by the community makes the demand for fresh papaya fruit in the market always increase. Therefore, the cultivation of this plant is very important to be applied properly. Cocopeat is a powder which is a waste of coconut coir processing. Our previous research has shown that cocopeat is an organic material that has a positive role in the growth of patchouli seedlings. This study aimed to examine how the effect of the addition of cocopeat on the quality and quantity of growth of papaya seedlings (*Carica papaya* L.var.calina) on experimental land within the Universitas Negeri Manado (Unima) campus in Tondano. Experimental research was carried out with one factor, the concentration of cocopeat, with 5 levels 10, 20, 30, 40 and 50%. The control used was an organic media compounded by the analysis without using cocopeat. Each treatment and control was repeated 30 times so that the number of experimental units was 180 experimental units. Randomization was carried out by placing 10 rows and 18 columns at the Unima Patchouli Nursery Installation. The quantity parameter is the number of days the seeds germinated and the number of seeds that were successfully germinated in each treatment and control. Quality parameters include seedling height at the age of 2 months after germination (first germination); number of leaves, leaf size, wet weight and dry weight at 2 months of age. Based on the results, it can be concluded that the use of organic media with the addition of cocopeat at a concentration of 10-50% had a significant effect on leaf number, leaf size, plant height, stem diameter, wet weight, and dry weight of papaya plants in the early growth period. The addition of cocopeat concentration in the growing media will have an increasing effect on the observed parameters. Especially for the parameter of the number of days of germination after planting did not show a significant difference between all treatments.

Keywords: *Carica papaya*; cocopeat; seed; growth parameters

I. INTRODUCTION

Papaya plant (*Carica papaya* L.) is one of the agricultural commodities that is widely cultivated by farmers in almost all parts of Indonesia. Cultivation of this plant is widely cultivated because the market prospects promise good results. Market demand for papaya never goes down and is evenly distributed throughout the year [1]. Regular and diverse consumption of papaya by the community makes the demand for fresh papaya fruit on the market always increase [2]. Therefore the cultivation of this plant is very important to be understood and to be applied properly [3].

In nurseries, roots are a very important initial factor related to germination. Seedlings that have good root growth and have the ability to grow better. One of the factors that can affect root formation is the seedling medium. Nursery media is a place to germinate seeds. Seedling media for germination must meet the

requirements, including crumb structure, namely the ratio of micro and macro pores, must be balanced so that it does not inhibit root growth and is able to bind water and nutrients needed for plant growth [4]. Several types of media can be used as germination media. Each type of media has different characteristics, so it is necessary to find a good and suitable growing medium for a particular type of plant [5].

The composition of the planting medium commonly used by farmers for papaya nurseries is a mixture of soil, sand and manure [6, 7]. However, it is necessary to study further the composition of the planting medium which is lighter but still guarantees optimal growth of papaya seedlings and considering that not all areas have the potential to produce manure. For this reason, modifications are needed regarding the planting media so that farmers have other alternatives if there is no manure media mixture available.

Organic materials that can be used as nursery media are compost, husk charcoal, cocopeat and sawdust. The mixture of these materials is expected to be an alternative planting medium for papaya seedlings and modifications to the composition of the planting media are expected to produce a lightweight nursery medium that can provide optimal papaya seedling growth results. The criteria for quality seeds include, among others, healthy seeds and free from the threat of pathogens, as well as originating from mother plants with high yield potential.

The success of papaya cultivation begins with the use of high quality seeds that are expected to produce high quality fruit. The development and growth of seedlings is influenced by the type of planting medium. A good planting medium must be able to support the availability of nutrients for plants and the humidity of the root area and have sufficient air circulation [8]. A research used rice husk charcoal as a mixture for planting media will provide good aeration and drainage [9].

Beside organic fertilizer component commonly used by farmers, another beneficial organic material for papaya cultivation is cocopeat. Cocopeat is a powder which is a waste of coconut coir processing [10]. In our previous research, cocopeat, an organic material, plays a positive role in the growth of patchouli seedlings. This research was conducted to examine the effect of adding cocopeat on the growth of papaya (*Carica papaya* L.var.calina) seedlings in an experimental field on the Unima campus, Tondano.

This research was conducted with the aim of scientifically examining how the effect of adding cocopeat organic matter on the quality and quantity of the early growth of papaya (*Carica papaya* L.var.calina). This needs to be disclosed because the commodity of papaya has flourished and is widely cultivated by farmers in North Sulawesi. Meanwhile, there is potential for cocopeat organic matter which can be used as an additional organic fertilizer in papaya growing media.

The benefits that are expected to be obtained from this research are the proven positive effect of adding cocopeat organic matter in the planting media substrate on the quantity and quality of the early growth of papaya (*Carica papaya* L.var.calina) plants in experimental gardens at the Unima campus in Tondano. The results of this study will make a positive contribution to the cultivation of (*Carica papaya* L.var.calina) which is being actively cultivated by farmers in North Sulawesi. The results of this study can also be used by agricultural extension workers and related government officials. In addition, the results of this study can also be used as reference material for students, lecturers, practitioners and various parties who need them.

II. METHODS

The series of all activities in this study were carried out for 6 months where the experiment was carried out for 2-3 months effectively. Experimental activities were carried out entirely at the Unima Patchouli Nursery Installation because at that location there were ideal facilities for experimenting with the effect of adding cocopeat to papaya (*Carica papaya* L.var.calina) growth media.

The experimental design implemented in this study used a Completely Randomized Design because the environmental conditions in the patchouli nursery installation in Unima were relatively homogeneous and partly controllable. The nursery installation used a paranet roof with a light filter of 70-90% and is evenly distributed throughout the research location. The method used was an experiment with only one factor (the concentration of cocopeat) and one test plant, papaya (*Carica papaya* L.var.calina).

Experimental research was carried out with one factor, namely the concentration of cocopeat with 5 levels as a treatment, namely 10%, 20%, 30%, 40% and 50%. The

control used in the experiment this time was an organic media compounded by the analysis without using cocopeat. Each treatment and control was repeated 30 times so that the number of experimental units was 6x30=180 experimental units.

Randomization was carried out by placing 10 rows and 18 columns at the Unima Patchouli Nursery Installation. The quantity parameter is the number of days the seeds germinated and the number of seeds that were successfully germinated in each treatment and control [11]. Quality parameters include seedling height at the age of 2 months after germination (first germination); number of leaves, leaf size, wet weight and dry weight at 2 months of age.

Research Procedure

Preparation of planting media compounding was carried out before the experiment was carried out. The planting medium that is prepared consists of a mixture of soil (top soil), sand, manure in the form of chicken manure and rice husk. This media composition is called basic media and is also used for control in this experiment. The initial treatment to break dormancy on papaya seeds (*Carica papaya* L.var.calina) was used. The source of the seeds is from the Center for the Study of Tropical Fruits IPB Bogor. This initial treatment was the same for all experimental units and seeds that had relatively the same breakdown of dormancy were selected.

The mixture experimental media consisted of basic media added with 10%, 20%, 30%, 40% and 50% cocopeat. The media was mixed homogeneously and then put into a 15x30 cm polybag with the number of experimental units 30 for each treatment. The placement of 180 experimental units in experimental locations was according to complete randomization with the positions of 10 rows and 18 columns with the same distance. Other treatments such as watering and weeding or other treatments for all experimental units were tried to be the same as possible.

Observations were made every day and differences in germination time used units of amount/day. Variations within one day were ignored in this experiment. Parameters for plant height, number of leaves, leaf size, wet weight and dry weight were carried out at the end of the experimental period. Weighing the wet weight used an analytical balance, drying the sample in an oven at 150°C for 2x24 hours. The stem was halved first before drying.

Data analysis was performed using the SPSS application with the type of analysis of variance (ANOVA) to determine the significance of the differences between all the treatments used in this experiment. If the ANOVA results showed a significant difference then were proceed with DMRT analysis [12].

III. RESULTS AND DISCUSSION

Results

The formulation of the planting media was consisted of a mixture of top soil, sand, manure in the form of chicken manure and rice husks. This media composition was called the control and then the media was mixed with the addition of cocopeat at concentration levels of 10, 20, 30, 40 and 50%. Compounding the planting medium was carried out in April 2021. The papaya seeds used were Papaya Calina seeds produced by the Center for Tropical Horticultural Studies or PKHT at Bogor Agricultural University with the Decree of Release of variety number 2106/KPTS/ SR12C/5/2010. The seeds obtained were given the same treatment at the preparation stage, namely soaking in warm water for 24 hours. After that it was planted in polybags according to the treatment with 30 replications each. The planting was carried out on April 9 2021. The experimental and control units totaled 180 polybags containing seeds. For all subsequent treatments and controls, they were given the same treatment, namely a cover made of transparent plastic to facilitate observation during the experiment.

Seed Germination Time

Seed germination observations were carried out every day to calculate how many germinated. The results of observing this parameter are in the form of the average number of days after planting or HST where all the seeds germinate are listed in Table 1.

Plant Height

Observation of plant height was carried out at the end of the observation period in the second month after planting. Plant height was measured in each sample in all treatments. The results of observing this parameter are the average plant height at the end of the observation period listed in Table 2.

TABLE 1
SEED GERMINATION TIME
(DAYS AFTER PLANTING = HST)

Number	Treatment	Average HST
1	Control	21.5
2	10 %	18.5
3	20 %	18.0
4	30 %	17.5
5	40 %	18.0
6	50 %	18.0

TABLE 2
PAPAYA PLANT HEIGHT AT THE AGE
OF 2 MONTHS AFTER PLANTING

Number	Treatment	Average Plant Height
1	Control	20.5
2	10 %	26.5
3	20 %	28.5
4	30 %	29.0
5	40 %	29.0
6	50 %	29.5

Number of Leaves

Observation of the number of leaves was carried out at the end of the observation period in the second month after planting. The number of plant leaves was counted for each sample in all treatments. The results of the observation of this parameter in the form of the average plant height at the end of the observation period are listed in Table 3.

TABLE 3
THE NUMBER OF PAPAYA LEAVES
AT THE AGE OF 2 MONTHS AFTER PLANTING

Number	Treatment	Average Number of Leaves
1	Control	4.0
2	10 %	6,5
3	20 %	7.0
4	30 %	7.0
5	40 %	8.0
6	50 %	8.0

Leaf Size

Observation of leaf size including leaf length and leaf blade width was carried out at the end of the observation period in the second month after planting. Leaf size was measured in each sample in all treatments. The results of observing the average leaf size at the end of the observation period are listed in Table 4.

TABLE 4
THE SIZE OF PAPAYA PLANT LEAVES
AT THE AGE OF 2 MONTHS

Number	Treatment	Average Leaf Size
1	Control	20.0x15.5cm
2	10 %	22.5x17.5 cm
3	20 %	23.0x17.5cm
4	30 %	24.0x18.0cm
5	40 %	24.5x19.0 cm
6	50 %	25.5x21cm

Stem Diameter

Observation of plant stem diameter was carried out at the end of the observation period in the second month after planting. Plant stem diameter was measured in each sample in all treatments. The results of observations of this parameter in the form of the average diameter of plant stems at the end of the observation are listed in Table 5.

TABLE 5
THE STEM DIAMETER OF PAPAYA PLANTS
AT THE AGE OF 2 MONTHS

Number	Treatment	Average Stem Diameter
1	Control	89.10mm
2	10 %	112.5mm
3	20 %	114.0mm
4	30 %	115.5mm
5	40 %	117.5mm
6	50 %	118.0mm

Gross Weight

Plant wet weight observations were carried out at the end of the observation period in the second month after planting. Plant wet weight was weighed with an analytical balance in each sample for all treatments. The results of the observation of this parameter in the form of the average wet weight of plants are listed in Table 6.

TABLE 6
THE WET WEIGHT OF PAPAYA PLANTS
AT THE AGE OF 2 MONTHS

Number	Treatment	Average Plant Wet Weight
1	Control	0.95 Kg
2	10 %	1.2 Kg
3	20 %	1.35 Kg
4	30 %	1.4 Kg
5	40 %	1.55 Kg
6	50 %	1.65 Kg

Dry Weight

Plant dry weight observations were carried out at the end of the observation period in the second month after planting. Plant dry weight was measured for each sample in all treatments. The results of this parameter observationaretheaverageplantdryweightattheendof the observation period listed in Table 7. Drying is carried out in the laboratory using an oven with a stable temperature so that the sample is completely dry but not crushed.

The quantity parameter is the number of days the seeds germinated and the number of seeds that were successfully germinated in each treatment and control. Quality parameters included seedling height at 2 months after germination (first germination), stem diameter, number of leaves, leaf size, wet and dry weight at 2 months of age. Observation of wet and dry weight was carried out at the end of the study period because the wet and dry weight were measured after the plants were removed from the polybags and weighed in the laboratory.

TABLE 7
THE DRY WEIGHT OF PAPAYA PLANTS
AT THE AGE OF 2 MONTHS

Number	Treatment	Average Plant Dry Weight
1	Control	0.35 Kg
2	10 %	0.45 Kg
3	20 %	0.55 Kg
4	30 %	0.55 Kg
5	40 %	0.65 Kg
6	50 %	0.75 Kg

Discussion

The use of cocopeat in growing media with increasing concentrations in this research results did not show a significant effect. The germination process of papaya seeds was actually more influenced by the internal conditions of the seeds, but the temperature and humidity of the surrounding environment also affect the speed of germination. The addition of cocopeat with increasing concentration will also affect soil texture and structure which is related to soil temperature and moisture. These two factors affect the germination rate of papaya seeds.

Nowadays, cocopeat has been used as soilless planting media widely [13]. Cocopeat is an ideal planting media for nurseries because of their low bulk density, low shrinkage, slow degradation and also high total pores [14]. The relatively large porosity of cocopeat will affect plant productivity [15].

The higher the concentration of cocopeat added to the planting medium will certainly have a higher effect on the physical environmental factors on the planting medium used. However, the addition of cocopeat at a concentration of 10% had an effect that was not significantly different from the effect of adding cocopeat at concentrations of 20, 30, 40 and 50%. This means that the addition of 10% cocopeat is enough to have an optimal impact on the germination rate of California papaya seeds. Adding cocopeat with a concentration of more than 10%, although it will have a better impact on soil texture and structure, is not necessary because of efficiency and effectiveness considerations in the California papaya cultivation business.

The observed plant height parameters showed that papaya plants growing on soil media as a control averaged 20 cm. If cocopeat was added to the planting medium at a concentration of 10%, the average plant height increased sharply to 26.5 cm. The ratio of the increase in plant height between the seeds planted in the soil medium (control) and the media added with 10% cocopeat increased sharply to 26.5 cm or increased as high as 6.5 cm when compared to the seeds planted in the soil medium. This result was similar with the effect of cocopeat on rubber (*Hevea brasiliensis* Müll. Arg.) which significantly increased plant height [13].

The increase in the height of the papaya plant seedlings is due to the addition of cocopeat which will have a direct impact on soil texture. Good soil texture will provide better opportunities for root growth because the texture of the media will be looser and the pores of the soil mixed with cocopeat are better. The content of oxygen, ground water and other dissolved compounds will be better and allow plant roots to grow properly to penetrate the soil and function more optimally in absorbing water and other nutrients.

Another factor is changes in soil structure due to the fast decomposition process in cocopeat because of the shape of small granules which are easily decomposed. The results of the decomposition process improve soil structure because it is rich in organic matter. However, the administration of cocopeat at a higher concentration did not have a significant effect with the addition of 10% cocopeat.

The observed results for the parameter number of leaves of papaya plant seeds grown on soil media (control) were lower when compared to papaya plant seeds grown on media with the addition of 10% cocopeat, giving an average difference of 2.5 leaves from all samples. The number of different leaves of approximately 3 for papaya plant seeds will actually have a chain effect for all growth parameters.

The number of leaves contained in the ripe seed embryo is characteristic of the species, so it is influenced by the genotype and also by the environment. The speed of growth of papaya stem diameter is influenced by the availability of N and P nutrients, irrigation, and temperature. Seedlings with larger stem diameters will have better strength so they can face unfavorable field conditions [16].

The growth of papaya seeds in this research was positively correlated with the rate of photosynthesis because the more leaves on papaya plant seeds, the higher the rate of photosynthetic intensity and will produce higher carbohydrate compounds and will have a direct impact on tertiary secondary synthesis and so on which will appear as a form of growth (leaf size, stem diameter, wet and dry weight). Therefore, the patterns of differences in data for all parameters are more or less not significantly different for all parameters.

The results of observations in Table 1-7 tend to show that the administration of cocopeat would have a positive impact on all indicators of the initial growth of papaya seedlings. Especially for germination time (HST) did not show a significant difference because the actual germination process is more determined by the internal factors (properties) of the papaya seeds used. External factors also contributed to the acceleration of the germination process but the addition of cocopeat did not show a significant difference.

Cocopeat is an organic hydroponic growing medium, because it is made from coconut fiber powder. Cocopeat has a pH between 5.0 to 6.8 so it is very good for the growth of any plant. Cocopeat is easy to absorb and store water. It also has pores, which facilitate the exchange of air, and the entry of sunlight. The content of Trichoderma molds, a type of enzyme from fungi, can reduce disease in the soil. Thus, cocopeat can keep the soil loose and fertile [17].

IV. CONCLUSION

The use of organic media with the addition of cocopeat at a concentration of 10-50% has a significant effect on leaf number, leaf size, plant height, stem diameter, wet weight and dry weight of papaya plants in the early growth period. The addition of cocopeat concentration in the planting medium will have an increasing effect on the observed parameters. Especially for the parameter number of days germination after planting did not show a significant difference between all treatments.

V. RECOMMENDATION

It is recommended that further research be carried out to find out how the effect of adding cocopeat in the growing media for California papaya (*Carica papaya* L.var.calina) has on plant growth and productivity. Follow-up research can also be carried out to determine the effect of organic media on the level of ripeness of the fruit, the texture of the fruit flesh and the taste of the fruit flesh.

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