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Effect of Bamboo Basket Container Type and Plastic Basket on the Growth of Sea Grape *(Caulerpa racemosa)* With Longline System in a Controlled Tub

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Abstract

This study aims to determine the effect of the type of cultivation container in the form of bamboo baskets and plastic baskets on the growth of sea grapes (Caulerpa racemosa) cultivated using a longline system in a controlled tub. The research was conducted for 35 days at SMK Negeri 1 Southeast Maluku, using an experimental method with a random design. The main parameters observed were thalus weight growth and absolute weight growth. The results showed that the use of bamboo basket containers resulted in higher thalus growth compared to plastic and control baskets. Statistical analysis using ANOVA showed a significant difference (p<0.05) between treatments. The improved growth in bamboo baskets is thought to be due to the physical characteristics of bamboo that resemble natural substrates, such as rough surfaces that favor rhizoid attachment. Environmental factors such as depth, light intensity, and water quality (temperature, pH, salinity, and dissolved oxygen) are also in the optimal range for C. racemosa growth. These results recommend the use of bamboo baskets as an effective medium in controlled marine grape cultivation.

Keywords: *Caulerpa racemosa*; bamboo shell; *Longline system*; *Plastic shell;* type of container

Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh jenis wadah budidaya berupa keranjang bambu dan keranjang plastik terhadap pertumbuhan anggur laut (Caulerpa racemosa) yang dibudidayakan menggunakan sistem longline dalam bak terkontrol. Penelitian dilakukan selama 35 hari di SMK Negeri 1 Maluku Tenggara, menggunakan metode eksperimental dengan rancangan acak. Parameter utama yang diamati adalah pertumbuhan berat thalus dan pertumbuhan berat mutlak. Hasil penelitian menunjukkan bahwa penggunaan wadah keranjang bambu menghasilkan pertumbuhan thalus yang lebih tinggi dibandingkan keranjang plastik dan kontrol. Analisis statistik menggunakan ANOVA menunjukkan perbedaan yang signifikan (p<0,05) antar perlakuan. Pertumbuhan yang lebih baik pada keranjang bambu diduga disebabkan oleh karakteristik fisik bambu yang menyerupai substrat alami, seperti permukaan kasar yang mendukung perlekatan rizoid. Faktor lingkungan seperti kedalaman, intensitas cahaya, dan kualitas air (suhu, pH, salinitas, dan oksigen terlarut) juga berada pada kisaran optimal untuk pertumbuhan C. racemosa. Hasil ini merekomendasikan penggunaan keranjang bambu sebagai media efektif dalam budidaya anggur laut secara terkontrol.

***Kata Kunci**: Caulerpa racemosa*; jenis wadah; kerangjang bambu; *kerangjang plastic; sistem Longline*

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INTRODUCTION

Seaweed is a potential commodity to be developed, because cultivation techniques are relatively easy and cheap with high productivity. Its spread is wide in Indonesian waters. One well-known and potential type of seaweed is the sea grape (Caulerpa racemosa). This type is known by several local names such as Lat (Southeast Maluku and Tual City), Latoh (Java), Bulung Boni (Bali), Lawi-Lawi (Sulawesi), and in Japan it is called Umi Budo. The mention of sea grapes is due to the morphology of ramuli or the shape of the thallus. C. racemosa resembles sea grapes, (Yudasmara, 2014).

Sea grapes come from the group of green algae that belong to feather seaweed. Feather seaweed is reported as an edible macroalgae, has bioactive substances such as anti-bacterial, anti-fungal, anti-tumor and can be used for the therapy of high blood pressure and goiter (Septianingrum, C. racemosa sea grape is safe to consume directly and has been used by some coastal communities as a fresh vegetable or plant. Caulerpa sp. is a nutritious food in Japan, Korea, and Southeast Asia (Antara, 2022). In addition, this sea grape has many benefits, including its high protein content (Glorens et al., 2015), a natural source of antioxidants (Indarkasi et al., 2023; Belkacemi et al., 2020). C. racemosa is also rich in fiber, a source of protein and as a nutrient that is good for growth such as, vitamins, minerals, fiber, protein, iron, calcium, and vitamin B complex. The proximate content of C. racemossa has protein of 10.390%, fat of 3.072%, carbohydrate of 32.092% and fiber of 10.057% (Da Conceicao et al., 2020). Serpara et al., (2013) stated that 75% C. racemosa extract can be used as a preservative medium for flying fish (Decapterus sp.) and is able to suppress the change in pH value for 20 days from 6.04 to 6.25.

In Southeast Maluku Regency and Tual City, there are only two types of sea grapes that are directly consumed by the community, namely C. lentifera and C. racemosa. This type of algae is consumed as a plant, a vegetable that is in great demand by the community and has become a typical menu of the Southeast Maluku region. In addition, it has been developed into juices and various processed food ingredients. So far, C. racemosa in the area has been widely exploited. One of them is in Letman Village, Southeast Maluku Regency, where more stock in the market is taken from nature so that it has an impact on the continuity of production. Therefore, cultivation businesses are needed so that they are expected to be able to meet the needs of demand both in quantity and quality.

One of the cultivation techniques of sea grapes that can be used is the use of bags. Dewi and Suryaningtyas, (2020) stated that the growth of seaweed in the treatment using bags is better than the growth of grass in the treatment without using the bag. Yudasmara (2014) stated that the rigid quadrant nets method made of bamboo for C. racemosa cultivation carried out in a fiber glass tub was effective and efficient in terms of quality and quantity and the average yield was 2159.85 g. Currently, the use of other techniques with other materials has not been widely used.

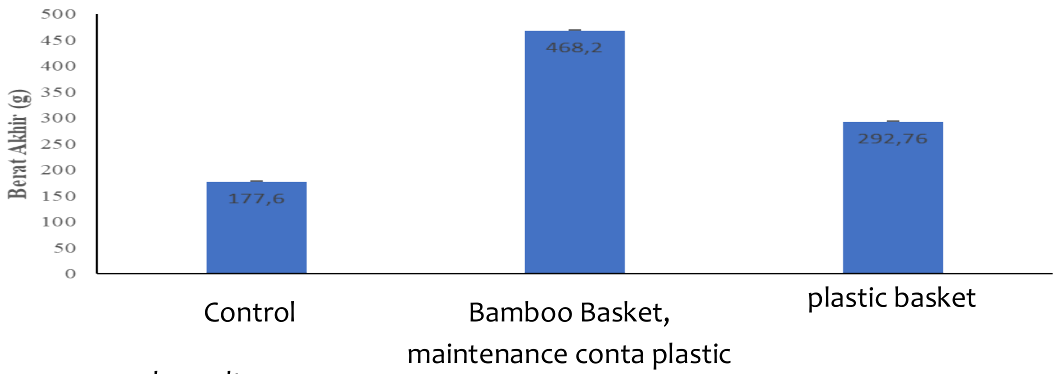
METHOD

This research was carried out at SMK Negeri 1 Southeast Maluku in the period from March 4 to April 15, 2025. The materials and tools used include bamboo baskets and plastic baskets as maintenance containers, ropes, controlled tubs, hi-blowers, hoses and aeration stones, as well as measurement instruments in the form of thermometers, salinometers, lux meters, and analytical scales. The experimental design was carried out by observing the growth *of the Caulerpa racemosa sea grape* through thalus weight measurement using a digital scale, where samples were released from the strap on the basket using a live node that could be opened and weighed, then weighed at the beginning and end of the study for each treatment and control, as is common practice in seaweed cultivation research (Effendi, 2003; Trono, 2018). Absolute growth is calculated based on the difference between the final weight and the initial weight of biomass with the formula G = Wt – Wo which is commonly used in the study of the growth of aquatic organisms (Effendi, 2003; Dawes, 2019). The observation data were statistically analyzed using multiple fingerprint analysis or the F test at a 95 percent confidence level with the help of SPSS software, and if there were significant differences between treatments, it was followed by the Duncan test to identify the differences between treatments in more detail, according to experimental analysis procedures in the fisheries and marine fields, (Gomez & Gomez, 2010; Steel et al., 2019).

RESULT AND DISCUSSION

Results of measurement of the weight of sea grape thalus C. *racemosa* for 35 days of maintenance can be seen in Figure 4.1 below. When compared to controls, sea wine C. *Racemosa* raised in bamboo basket containers had a higher thalus weight of 468.2 g and followed in plastic basket containers with a value of 292.76 g.

Figure 1:
Weight of thalasday sea grapes C. *racemosa* at the end of observation

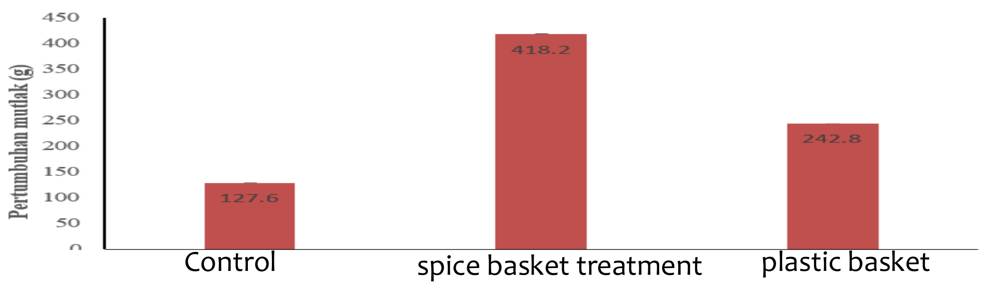


Source: research results

The results of the fingerprint analysis showed that the type of bamboo basket container and plastic basket influenced the weight gain of marine grape thalus C. *racemosa* after 35 days of maintenance.

The results of the calculation of the absolute weight growth of sea grapes C. *racemosa* for 35 days of maintenance can be seen in Figure 4.2 below. When compared to controls, sea wine C. *Racemosa* reared in bamboo basket containers had a higher absolute weight growth of 418.2 g and followed in plastic basket containers with a value of 242.8 g. Furthermore, the data could be processed using multiple fingerprint analysis because it was homogeneous.

Figure 2:
Absolute weight growth of sea grapes C. *Racemosa*



Source: research results

The results of the fingerprint analysis in Table 2 show that the type of bamboo basket container and plastic basket influence the absolute weight growth of sea grape *C. racemosa*.

Based on the results of the study, bamboo basket containers have a higher thalus weight than plastic baskets and controls. This is in line with Yudasmara (2014) who stated that the media or planting container is the place where sea wine is attached. Bamboo containers are classified as good in affecting the weight of thalus due to the physical properties of bamboo, including its rather rough and rigid surface. This makes it easier for the rhizoids of sea grapes to stick and develop so that they can grow densely and cause weight gain. In natural conditions, C. racemosa is attached to rocks or a rather rough substrate for its life. Thus, cultivation efforts can use bamboo basket containers that have the same properties as substrates in natural conditions.

Another factor that can cause the difference in thalus weight is depth. Atmadja et al. (1998) stated that depth is closely related to light penetration, and nutrients. Darmawati (2013) stated that the seaweed growth process itself is highly dependent on the intensity of sunlight to carry out the photosynthesis process, where through this process seaweed cells can absorb nutrients to spur the daily growth of seaweed through cell division activities. The same opinion is also expressed by Anam (2010) that seaweed needs sunlight to carry out the process of photosynthesis. Da Conceicao et al. (2020) and Genara et al. (2022) stated that the planting depth treatment of 30 cm provided the highest daily specific growth results. In this study, the depth used was 35 cm. This is almost in line with the above research and leads to a good absolute growth in the treatment.

This is because a depth of 30 cm is the optimal depth for *C. lentillifera* to photosynthesize and obtain nutrients. This condition is in accordance with the statement of Hayashi et al, (2007) who stated that different rates of photosynthesis can affect the growth of the talus, and the adequacy of sunlight greatly determines the speed of seaweed to meet the needs of nutrients such as carbon (C), nitrogen (N), and Phosphorus (P) for cell growth and division. In addition to depth, the factor that affects growth is the planting distance. Arisqia *et al.*, (2023) stated that a planting distance of 30 cm can lead to good distribution of nutrients so that it affects its growth. In this study, the planting distance used was 30 cm between different containers. Another thing that affects the growth of C*. racemosa sea* grapes is the quality of the water. Water quality includes temperature, pH, salinity, and DO. This is in line with the statement of Iskandar et al. (2015) The optimal temperature for the growth *of* C. racemosa ranges from 25°C-31°C.

Based on the value obtained of 28.54 °C, it means that it is still optimal for C *growth. Racemosa.* The pH value measured was 7.12 and was considered optimal for *C growth. racemosa*. This is supported by the research of Khatimah et al. (2016) that pH is optimal for C *growth. racemosa* is 5-8. Furthermore, for salinity of 30 ppt and in accordance with the research of Nur et al. (2016) that the good salinity range for seaweed is ranging from 15-35 ppt. The measured DO value is 5.28 mg/L and in accordance with Ardiansyah's (2020) research, the standard value of DO quality for seaweed is more than 5 mg/l. According to Sunaryo (2015), the minimum dissolved oxygen content is 2 mg/l under normal conditions and is not polluted by toxic compounds.

CONCLUSION

Based on the results of the study, it can be concluded that the type of cultivation container in the form of bamboo baskets and plastic baskets has a significant effect on the growth of Caulerpa *racemosa sea grapes* which are cultivated using a *longline system* in a controlled tub. Differences in container materials affect the conditions of the microhabitats around thalus, especially related to water circulation, light penetration, and the availability of dissolved oxygen which plays an important role in the process of photosynthesis and biomass accumulation. The treatment using bamboo baskets showed better growth than plastic baskets, which is thought to be due to the more open and natural nature of bamboo allowing water and nutrient exchange to take place more optimally. In contrast, plastic baskets tend to have more enclosed characteristics so they have the potential to limit the flow of water and light, which ultimately affects the growth rate of sea grapes. These findings confirm that container selection is a crucial technical factor in *C. racemosa cultivation*, especially in controlled systems, and has practical implications for increasing productivity and sustainability of sea grape cultivation, where the use of bamboo baskets can be recommended as a more effective, environmentally friendly, and applicative container alternative.

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