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Effect of *Sargassum* sp. Cultivation on Laboratory Scale with Different Substrates

Pengaruh Budidaya Rumput Laut *Sargassum* sp. Dengan Substrat Yang Berbeda di Skala Laboratorium

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ABSTRACT

Sargassum sp. is a brown algae containing alginate and iodine ingredients used in the food, pharmaceutical, cosmetic and textile industries. The purpose of this study was to analyze the effect of substrate type on the growth of Sargassum sp and to determine the type of substrate that is good in Sargassum sp. This research was conducted from December 2022 to January 2023, at the Fish Production and Reproduction Laboratory, Aquaculture Study Program, Faculty of Agriculture, University of Mataram. This research was conducted using experimental methods and using substrate difference treatment. The experimental design used in this study was a completely randomized design consisting of 5 treatments and 3 repeats. The treatment is treatment A (without substrate), B (white sand), C (white sand and coral), D (black sand), E (volcanic rock). The results showed that treatment C showed the highest growth yield with the measured growth parameters being absolute growth, relative growth, specific growth rate. This study concluded that the type of substrate did not have a significant effect (not significantly different) on the growth of Sargassum sp. which are cultivated on a laboratory scale. Nevertheless, Sargassum sp. Those cultivated using a mixture of white sand and coral (C) substrates tend to have higher growth values compared to no substrate (A), white sand (B), black sand (D), and volcanic rock (E) with an absolute growth value for 35 days of 22.0 g, relative growth of 73.3%, and a specific growth rate of 1.6%. Alginate content of Sargassum sp. In the white sand substrate treatment tends to be higher than the other four treatments with an alginate percentage of 56.5%.

ABSTRAK

Sargassum sp. adalah alga coklat yang mengandung bahan alginat dan yodium yang digunakan dalam industri makanan, farmasi, kosmetik dan tekstil. Tujuan penelitian ini adalah menganalisis pengaruh jenis substrat terhadap pertumbuhan Sargassum sp dan

mengetahui jenis substrat yang baik pada Sargassum sp. Penelitian ini dilaksanakan pada bulan Desember 2022 sampai dengan Januari 2023, di Laboratorium Produksi dan Reproduksi Ikan, Program Studi Budidaya Perairan, Fakultas Pertanian Universitas Mataram. Penelitian ini dilakukan dengan menggunakan metode eksperimen dan menggunakan perlakuan perbedaan substrat. Rancangan percobaan yang digunakan dalam penelitian ini adalah rancangan acak lengkap yang terdiri dari 5 perlakuan dan 3 kali ulangan. Perlakuannya adalah perlakuan A (tanpa substrat), B (pasir putih), C (pasir putih dan koral), D (pasir hitam), E (batuan vulkanik). Hasil penelitian menunjukkan bahwa perlakuan C menunjukkan hasil pertumbuhan tertinggi dengan parameter pertumbuhan yang diukur yaitu pertumbuhan absolut, pertumbuhan relatif, laju pertumbuhan spesifik. Penelitian ini menyimpulkan bahwa jenis substrat tidak memberikan pengaruh nyata (tidak berbeda nyata) terhadap pertumbuhan Sargassum sp. yang dibudidayakan dalam skala laboratorium. Meskipun demikian, Sargassum sp. Tanaman yang dibudidayakan dengan campuran substrat pasir putih dan karang (C) cenderung memiliki nilai pertumbuhan lebih tinggi dibandingkan tanpa substrat (A), pasir putih (B), pasir hitam (D), dan batuan vulkanik (E) dengan pertumbuhan absolut. nilai selama 35 hari sebesar 22,0 g, pertumbuhan relatif 73,3%, dan tingkat pertumbuhan spesifik 1,6%. Kandungan alginat Sargassum sp. Pada perlakuan substrat pasir putih cenderung lebih tinggi dibandingkan keempat perlakuan lainnya dengan persentase alginat sebesar 56,5%.

Kata Kunci	*Algae coklat, akuakultur, Substrat, rumput laut, Alginat*
Keywords	*Brown Algae, Aquaculture, Substrate, Seaweed, Alginate*
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INTRODUCTION

Indonesia is a maritime country that has a wealth of seaweed that has great potential for development. Some seaweed in Indonesian waters grows naturally and some has begun to be cultivated. One component of biota which is a marine biological resource is macroalgae. Macroalgae which are commonly found in the sea are also known as seaweed.

One type of seaweed that has the potential to be cultivated in Indonesia is Sargassum sp. This type of seaweed has high economic value because it contains alginate and iodine which are used in the food, pharmaceutical, cosmetic and textile industries. Apart from that, Sargassum sp. contains active compounds such as steroids, alkaloids, phenols and triterpenoids which function as antibacterial, antiviral and anti-fungal (Pakidi et al., 2017).

Substrate is an important component that plays a role in the growth and existence of seaweed species. Differences in bottom substrate in waters will influence seaweed density (Ain et al., 2014). Amalia, (2013) stated that the best type of substrate for the growth of marine algae is a mixture of sand, coral and coral fragments. However, in soft water substrate

types such as sand and mud, many types of marine algae are found such as Halimeda sp., Caulerpa sp., and Gracilaria sp. (Alawiah, 2022).

The type of substrate is one of the factors that can influence the growth of biota or plants. Sargassum sp. It grows by attaching to various substrates ranging from sandy substrates, coral fragments, dead coral or seagrass areas in the waters so that it can influence its growth.

Sargassum requires a substrate to attach the holdfast to. Cultivation of Sargassum seaweed on a laboratory scale with different substrates has not been widely carried out, so this research is new. Therefore, it is very important to carry out research on the cultivation of Sargassum sp. laboratory scale. It is hoped that this research can provide information and knowledge for cultivators who cultivate Sargassum. The aim of this research is to analyze the effect of substrate type on the growth of Sargassum sp and to determine the type of substrate that is good for Sargassum sp.

RESEARCH METHODS

This research was carried out from December 2022 to January 2023, at the Fish Production and Reproduction Laboratory, Aquaculture Study Program, Faculty of Agriculture, University of Mataram. The materials and tools used were Sargassum sp., jars, white sand, black sand, coral fragments, volcanic rock, scales, camera, thermometer, refractometer, pH meter, DO meter and lux meter. This research was carried out using experimental methods and using different treatments for cultivation substrates of Sargassum sp. Cultivation was carried out for 35 days. The experimental design used in this research was a Completely Randomized Design (CRD) which consisted of 5 treatments and 4 replications, so that 20 experimental units were obtained. These treatments are treatment A (no substrate), treatment B (white sand), treatment C (white sand and coral), treatment D (black sand), and treatment E (volcanic rock). Cultivation of Sargassum sp. with the first stage being the preparation of the cultivation site, namely the preparation of jars filled with water to a height of 14 cm from the surface of the substrate or around 18 cm from the bottom of the container or with a volume of around 5 liters per container. The second is the preparation of Sargassum sp seeds. The seeds used were taken from the waters of Batu Layar beach, West Lombok Regency. The third stage is planting Sargassum sp seeds. on the provided substrate. The fourth stage is growth observation, carried out every day and water changes are carried out every 10 days. In this research, the parameters that are the object of research are:

Absolute Growth

Absolute growth can be calculated using the formula of Kasim et al. (2017)

$$G = Wt - W_0$$

Information:
G : Average absolute growth (g)
Wt: Weight of seedlings at the end of the study (g)
W0: Seedling weight at the start of the study (g)

Relative Growth

Relative growth measurement is calculated based on the Effandi (1997) formula:

$$RGR = \frac{W_t - W_0}{W_0} \times 100\%$$

Information:
RGR : Relative Growth Rate (% / day)
Wt : Weight of test biota at the end of the research
W0 : Weight of test biota at the start of the study
T: Time (maintenance length)

Specific Growth Rate

Specific growth rate can be measured using the formula of Mukhlis et al. (2017)

$$SGR = ((Wt / W_0)^{1/t} - 1) \times 100\%$$

Information:
SGR: Specific daily growth rate (%/day)
Wt: Average weight of biota at the end of the study (g)
W0: Average weight of biota at the start of the study (g)
t : Time (length of maintenance)

Alginate Soak

The weight of the alginate obtained was calculated using the method of Widyartini et al. (2015), with the formula:

$$\text{Rendemen alginate (\%)} = \frac{\text{The final product (g)}}{\text{Raw material (g)}} \text{ X } 100\%$$

RESULT AND DUSCUSSION

Absolute Growth

The highest absolute growth of seaweed was treatment C (mixed sand and coral substrate) with a value of 22.0 and the lowest was in the control treatment Treatment A (without substrate) which was 18.7g

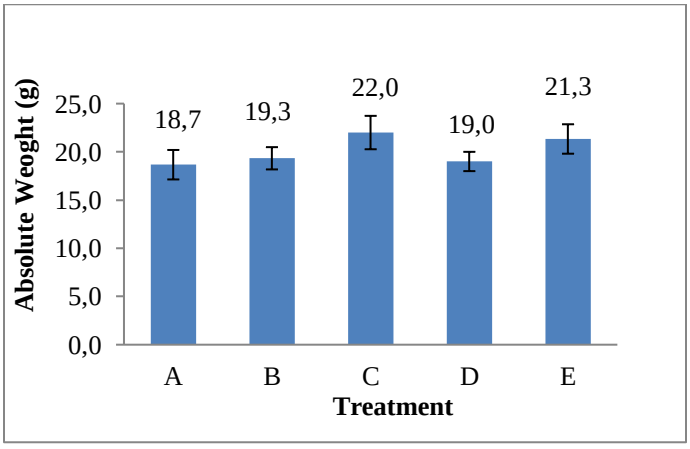

Figure 1. Absolte Weight (g) *Sargassum* sp.

Relative Growth

The highest relative growth of seaweed was treatment C (mixed sand and coral substrate) with a value of 73.3% and the lowest was in the control treatment Treatment A (without substrate), namely 62.2%.

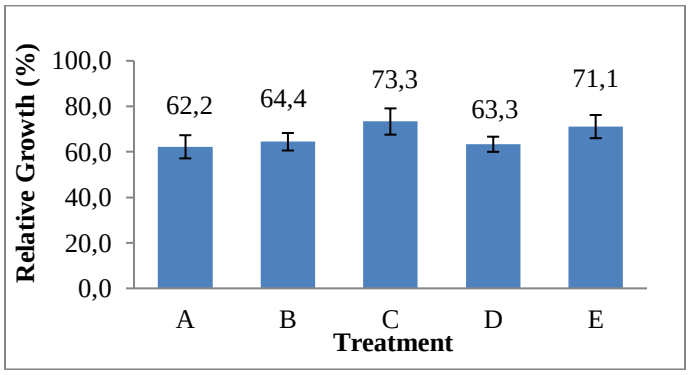

Figure 2. Relative Growth (%) *Sargassum* sp.

Specific Growth Rate

The highest specific growth rate of seaweed was treatment C (mixed sand and coral substrate) with a value of 1.58%/day and the lowest was in the control treatment Treatment A (without substrate), namely 1.39%/day.

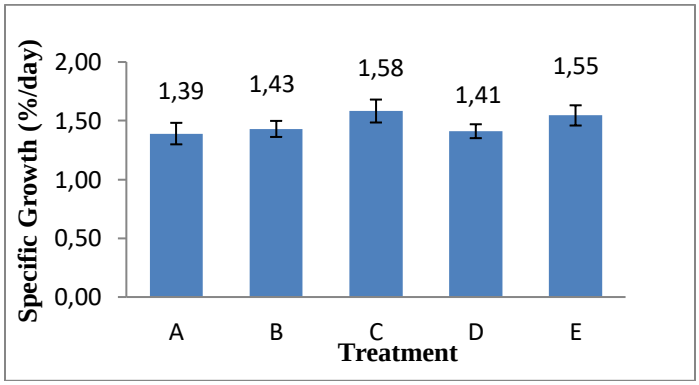

Figure 3. Specific Growth Rate (%/day) *Sargassum* sp.

Alginate Soak

The highest alginate yield content was found in the white sand substrate treatment (Treatment B) with a value of 56.5% and the lowest was in the volcanic rock treatment (treatment E) with a value of 49%.

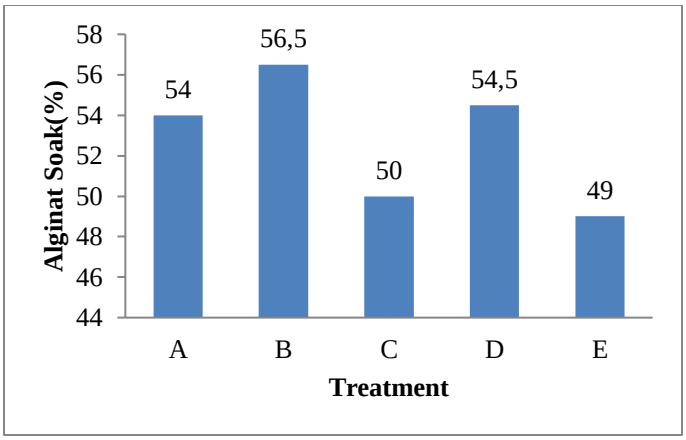

Figure 4. Alginat Soak(%) Seaweed is cultivated for 35 days

Water quality

The results of measuring water quality parameters during the Sargassum sp maintenance period are presented in Table 1.

Table 1. Water quality during the study

Parameter	Observation Result	References
Temperature	28-30	(Astuti *et al.,* 2021)
pH	7-8	Ichwanul (2020)
Salinity	32-33	Ichwanul (2020)
DO	7,2-7,4	Priono (2013)
Light intensity	1353-1471	Prastowo *et al.,* (2019)
Phosphate	0,12-0,68	Asni (2015)
Nitrate	0,10-0,28	Firda (2022)

Discussion

Growth of Sargassum sp.

Based on the results of the research conducted, the types of substrate tested did not have a significant effect on the growth of Sargassum sp. both in terms of absolute growth parameters, relative growth and specific growth rates, although the mixed white sand and coral substrate (Treatment C) showed the highest growth values in all parameters compared to the other 4 (four) treatments. The absence of a significant effect is thought to be because the types of substrates tested were natural substrates of Sargassum sp. Handayani et al. (2020) explained that Sargassum sp. can grow on certain substrates based on its morphological characteristics. Alawiah (2022) also explained that Sargassum sp. grows attached to substrates of varying types ranging from sandy, muddy, coral fragments, dead coral or seagrass areas in the waters. Even though the types of substrate tested had different characteristics, the results of this study showed that these differences had no effect on growth. Apart from the substrate, there are several environmental factors that can easily influence growth, such as salinity, temperature, pH, current speed, nitrate and phosphate (Fauziah, 2017). However, these parameters are relatively homogeneous in all treatments so that their influence on research results can be ignored.

The relative growth rate is the amount of increase in the percentage of maintenance weight of Sargassum sp. for 35 days. The research results showed that the highest value was obtained in the sand and coral substrate treatment (Treatment C), namely 73.3% and the lowest in the treatment without substrate (Treatment A), namely 62.2%. However, the results obtained show values that are not significant or not significantly different, this is because the substrate used is not much different from the substrate in the natural habitat. According to Alawiyah (2022), Sargassum should be cultivated on hard substrates such as dead coral, gravel and mollusc shells.

The specific growth rate describes the ability of Sargassum sp. to grow specifically in a certain period of time. Differences in different substrates can influence the specific growth rate of seaweed Sargassum sp. However, the research results showed that the results obtained were not significant or not significantly different. During 35 days of maintenance, specific growth rates showed that the tilapia ranged from the treatment without substrate (A), which was 1.39%/day, the white sand treatment (B), which was 1.43%/day, the sand and coral substrate treatment (C), which was 1.58%/day. , black sand treatment (D) is 1.41%/day, and volcanic rock treatment (E) is 1.55%/day. The growth rate value obtained is low when compared with the statement of Edy et al. (2017) that the growth rate of seaweed is considered quite good and profitable if daily growth is above 2% / day, whereas according to Majid et al. (2018) that the specific growth rate of seaweed that is considered quite profitable is above 3% weight gain per day. According to Runtuboy et al. (2018), seaweed growth and reproduction are closely related to the process of photosynthesis.

Alginat Soak

Based on the results of alginate content analysis, Sargassum sp. those cultivated on white sand substrate (B) tend to have higher alginate content values compared to other treatments with a percentage value of 56.5%. Pasaribu et al. (2020) explained that alginate content can also be influenced by the production process, as well as type, harvest season and cultivation location. Apart from that, factors that influence the yield of alginate content of Sargassum sp. depending on the environment where Sargassum sp. grows. Rasyid (2001) in Ode (2014), explains that the alginate content of seaweed Sargasum sp. influenced by the characteristics of the waters where the seaweed grows.

Water Quality

Based on the results of temperature measurements during the research, values were obtained ranging between 28-30 oC. The value obtained is still considered good for Sargassum sp cultivation activities. Water temperature affects the rate of growth and photosynthesis, so that in cultivation activities the temperature should not be too high and not too low. According to Firda et al., (2022) a good water temperature for seaweed cultivation is 20-31 oC.

The degree of acidity or pH at the cultivation location ranges from 7-8. The pH value obtained above is considered good for the survival of biota. According to Ichwanul (2020), the appropriate water pH value for Sargassum sp. ranges from 6.9-8.

The salinity values obtained at the research location ranged from 30-31 ppt. The range of salinity measured during the study is still within the tolerable range. According to Ichwanul (2020), the salinity is suitable for cultivating Sargassum sp. is in the range of 32-33.5 ppt.

The light intensity in the research container is greatly influenced by the light intensity entering the water. The light intensity value found during the research was 1235-1463 lux. According to Prastowo et al. (2019). The optimum light intensity ranges from 1300.6-4160.5 lux.

The nutrient needed by seaweed is also nitrate. The nitrate value obtained during the research was 0.10-0.40 mg/l. This value is considered not good because the value is relatively high. According to Firda et al. (2022), in their research stated that the appropriate nitrate value for cultivated organisms is in the range of 0.10-1.68 mg/L.

The phosphate values obtained during the research ranged from 0.1 – 0.25 mg/L. based on BSN (2011) the appropriate phosphate level for cultivation is > 0.1 ppm. If the phosphate level is >2.0, it shows that the phosphate level is high and can cause eutrophication. This value is good for supporting the growth and survival of seaweed and is supported by research by Asni (2015), which states that to support the growth of seaweed, a phosphate value ranging from 0.1 – 3.5 ppm is an optimal value.

CONCLUSION AND SUGGESTION

Based on the results of this research, it can be concluded that the type of substrate does not have a significant influence (not significantly different) on the growth of Sargassum sp. cultivated on a laboratory scale. However, Sargassum sp. those cultivated using a mixed substrate of white sand and coral (C) tend to have higher growth values compared to those without substrate (A), white sand (B), black sand (D), and volcanic rock (E) with absolute growth values during 35 days, namely 22.0 g, relative growth of 73.3%, and specific growth rate of 1.6%.

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