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GROWTH OF *Caulerpa* sp. IN THE CULTIVATION OF BASIC PATCH SYSTEM IN ROMPO VILLAGE, LANGGUDU DISTRICT

Pertumbuhan *Caulerpa* sp. Dalam Budidaya Sistem Dasar Patch di Desa Rompo Kecamatan Langgudu

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ABSTRACT

Caulerpa sp. is a type of sea grape from the green algae group that can be used as food. In Indonesia there are still very few people who can cultivate it and its current availability comes from harvesting it in nature. The aim of this research was to analyze the effect of different seed weights on the growth and antioxidant content of Caulerpa sp. cultivated using the basic stake method. The research was carried out in Rompo Village, Langgudu District, Bima Regency. Cultivation of *Caulerpa* sp. carried out for 30 days. The research used the Completely Randomized Design (CRD) method which consisted of 5 treatments, namely; A : 100 grams (20 g / 5 points), B : 125 grams (25 g / 5 points), C : 150 grams (30 g / 5 points), D : 175 grams (35 g / 5 points), and E : 200 grams (40 g / 5 points). The research results explained that the highest absolute growth was in treatment E (69.8 grams). The highest specific growth was in treatment A (1.395% / day). Number of dots of *Caulerpa* sp. The most were found in treatment E (414 dots). Antioxidant value of *Caulerpa* sp. The highest was in treatment A (87.15%). The conclusion of this research is that different seed weights have an influence on absolute, relative growth, number of dots and antioxidant content. A seedling weight of 200 grams (Treatment E) gave the best absolute growth and increase in the number of dots, namely 69.8 grams and 414 dots. A seed weight of 100 grams (A) provides the best specific growth and amount of antioxidants, namely 1.395% / day and 87.15%.

ABSTRAK

Caulerpa sp. merupakan salah satu jenis anggur laut dari kelompok alga hijau yang dapat dimanfaatkan sebagai makanan. Di Indonesia masih sangat sedikit masyarakat yang bisa membudidayakannya dan ketersediaannya saat ini berasal dari pemanenan di alam. Tujuan penelitian ini adalah menganalisis pengaruh perbedaan bobot biji terhadap pertumbuhan dan kandungan antioksidan *Caulerpa* sp. dibudidayakan dengan metode pancang dasar. Penelitian dilaksanakan di Desa Rompo, Kecamatan Langgudu, Kabupaten

Bima. Budidaya *Caulerpa* sp. dilaksanakan selama 30 hari. Penelitian menggunakan metode Rancangan Acak Lengkap (RAL) yang terdiri dari 5 perlakuan yaitu; A : 100 gram (20 g / 5 poin), B : 125 gram (25 g / 5 poin), C : 150 gram (30 g / 5 poin), D : 175 gram (35 g / 5 poin), dan E : 200 gram (40 g / 5 butir). Hasil penelitian menjelaskan pertumbuhan absolut tertinggi terdapat pada perlakuan E (69,8 gram). Pertumbuhan spesifik tertinggi terdapat pada perlakuan A (1,395%/hari). Jumlah titik *Caulerpa* sp. Jumlah terbanyak terdapat pada perlakuan E (414 titik). Nilai antioksidan Caulerpa sp. Tertinggi pada perlakuan A (87,15%). Kesimpulan dari penelitian ini adalah berat benih yang berbeda memberikan pengaruh terhadap pertumbuhan absolut, pertumbuhan relatif, jumlah titik dan kandungan antioksidan. Berat bibit 200 gram (Perlakuan E) memberikan pertumbuhan mutlak dan pertambahan jumlah titik terbaik yaitu 69,8 gram dan 414 titik. Biji dengan berat 100 gram (A) memberikan pertumbuhan spesifik dan jumlah antioksidan terbaik yaitu 1,395%/hari dan 87,15%.

Kata Kunci	*Rumput laut, anggur laut, berat biji, antioksidan, budidaya*
Keywords	*Seaweed, sea grapes, seed weight, antioxidants, cultivation*
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INTRODUCTION

Indonesia has an area of water that can be utilized for seaweed cultivation, around 14,000 ha (Susilowati, 2017). Seaweed is one of the superior commodities that has potential as a functional food. Rich seaweed of fiber and is a source of natural antioxidants that are easily obtained and available in quite abundant quantities. One type of potential seaweed is sea grapes (*Caulerpa* sp.).

Caulerpa sp. grows on sand substrates mixed with fragments of mollusk shells (gravel) and coral fragments. Lives together with other algae such as padina and seagrass. (Palulalu, 2016). According to Sunaryo, (2015) this plant lives attached to the bottom substrate of waters such as: coral fragments, sand and mud. Caulerpa sp. often found in protected places with clear water. The water flow is not too strong and the bottom is smooth due to sedimentation. Diversity of Caulerpa sp. It is highest in the tropics, namely in the culitoral zone and decreases in the inner zone. In the sublittoral zone of Caulerpa sp. grows attached to coral or creeps under the coral canopy (Prod'homme Van Reine and Trono, 2011) in (Saptasari, 2010).

Distribution of Caulerpa sp. quite widespread, especially in tropical climates because this type requires sunlight for its photosynthesis process. The Caulerpa sp type is found in most parts of Asia, namely; Indonesia, Thailand, Malaysia, Japan, China, Philippines, Korea, and other locations around Asia. The distribution of Caulerpa sp species is also found on small islands in Indonesia. This type spreads to eastern Indonesia,

the waters of Maluku and its surroundings, and Nusa Tengara (Oedjoe et al., 2019 in Razai, 2019).

Sea grapes contain antioxidants which are very good for body health. C. racemosa contains phenolic compounds as non-nutritional components. This component is thought to function as an antioxidant. Caulerpa racemosa, which originates from Indonesia and Japan, does not contain catechins or their isomers, which are phenolic compounds. The polyphenol component contained in Caulerpa racemosa is catechol (Ridhowati, 2016).

There are still few people who can cultivate sea grapes (Caulerpa sp) in Indonesia and the stock on the market comes from natural harvests. One of the areas in Indonesia that has cultivated Caulerpa sp. namely in Takalar, South Sulawesi which uses ponds as a place for cultivation. Market potential for Caulerpa sp. very open because it is a food that is good for health. However, in NTB no one has cultivated Caulerpa sp. itself. This is because this cultivation is still relatively new among society. To produce good production results, several factors are needed, namely choosing the right location for cultivation, using seeds that meet the criteria, the type of cultivation technology applied, and control during the production process. Different seed weights greatly influence sea grapes. This is closely related to the competition between each individual sea grape in obtaining nutrients as food. According to (Iskandar, 2015), biomass is one of the technical factors that greatly influences the growth of seaweed because it is related to the absorption of nutrients. Therefore, it is necessary to cultivate Caulerpa sp seaweed. to determine the effect of different seed weights on the cultivation of Caulerpa sp. with the basic benchmark method.

RESEARCH METHODS

This activity was carried out for 30 days. Located in Rompo Village, Langgudu District, Bima Regency. Antioxidant analysis was carried out at the Analytical Chemistry Laboratory, Faculty of Mathematics and Natural Sciences, Mataram University.

The tools and materials used in this research are scales, stationery, thermometer, pH meter, refractometer, bamboo/wood, raffia rope, baskets, Caulerpa sp., plastic, rope, buoys, stones, fruit nets, buckets, distilled water, tissue.

The research method that will be used is an experimental method using a Completely Randomized Design (CRD) consisting of 5 treatments with different stocking densities. Each treatment was repeated 4 times to obtain 20 experimental units. Caulerpa sp. attached to a plastic basket with a basket area of 1,750 cm^2.

Table 1. Treatment applied to research activities

Perlakuan	Keterangan
A	*Caulerpa* sp seeds weighing 100 g
B	*Caulerpa* sp seeds weighing 125 g
C	*Caulerpa* sp seeds weighing 150 g
D	*Caulerpa* sp seeds weighing 175 g
E	*Caulerpa* sp seeds weighing 200 g

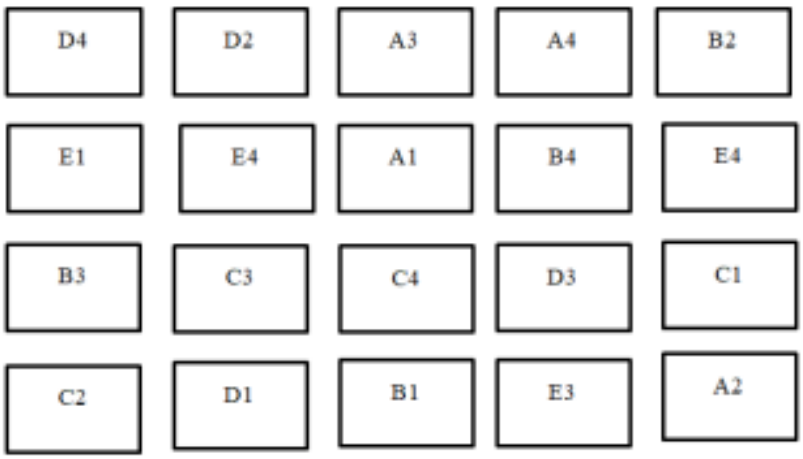

Figure 1. Layout of the Experimental Unit

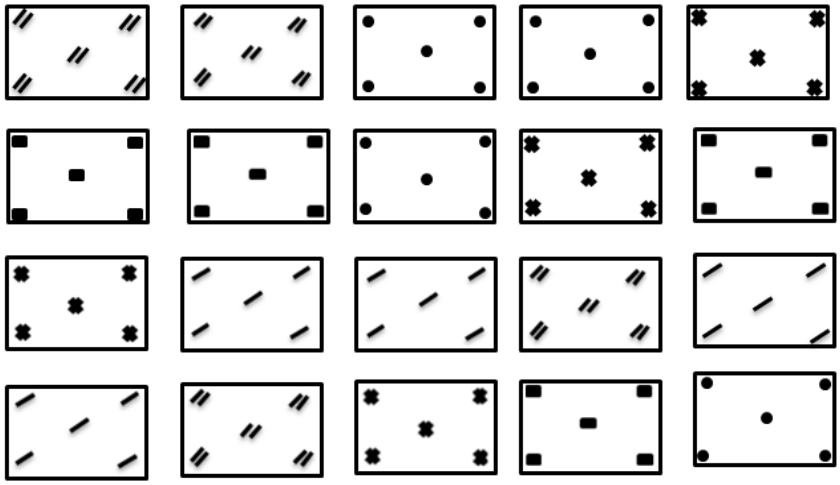

Figure 2. Seedling Attachment Point in Plastic Basket

Information: ● = Treatment A with a weight of 100 grams (20 g / 5 points)
✱ = Treatment B with a weight of 125 grams (25 g / 5 points)
/ = Treatment C with a weight of 150 grams (30 g / 5 points)
// = Treatment D with a weight of 175 grams (35 g / 5 points)
▬ = Treatment E with a weight of 200 grams (40 g / 5 points)

The research stage carried out is the basic stake preparation stage by preparing the tools and materials that will be used to make the basic stakes and preparation. Cultivation buildings are made using fruit basket lids that have holes. Prepare bamboo and ris rope to tie at each corner of the fruit basket lid. Peg the lid of the fruit basket to the bottom of the water. *Caulerpa* sp seed preparation stage, namely *Caulerpa* sp seeds. The seeds used are seeds taken directly from nature, then the seeds are sorted to separate them from dirt or mud that sticks to the sea grapes. Apart from that, look to see if there are any white thalus. *Caulerpa* sp. The initial weight was weighed with each different weight, namely 100 g, 125 g, 150 g, 175 g, and 200 g. Tie the seeds to the cultivation medium using raffia rope. In each cultivation medium, *Caulerpa* sp seeds. stocked with different stocking

densities, namely 100 g, 125 g, 150 g, 175 g, and 200 g. Caulerpa sp. Planting Stage. Namely by taking Caulerpa sp seeds. as much as 100 g, 125 g, 150 g, 175 g, and 200 g. Tied Caulerpa sp seeds. on cultivation media measuring 50 x 35 cm using raffia rope with different densities on each cultivation medium. Tied Caulerpa sp seeds. at 5 binding points that have been determined for each cultivation medium, namely in treatment A, namely 20 g / 5 points, treatment B, namely 25 g / 5 points, treatment C, namely 30 g / 5 points, treatment D, namely 35 g / 5 points, and treatment E, namely 40 g / 5 points. Planting was carried out in the morning at 9 am. *Caulerpa* sp. maintenance stage. namely during Caulerpa sp. are in the cultivation media, various activities are carried out such as cleaning Caulerpa sp. from adhering dirt, checking thallus, and checking water quality. The growth observation stage is by taking samples of *Caulerpa* sp. in each treatment, namely in treatments A1, B1, C1, D1 and E1. *Caulerpa* sp. was weighed. in each treatment at predetermined times on days 0, 10, 20 and 30. Antioxidant tests were carried out on *Caulerpa* sp.

The parameters used to test research results include:

1. Absolute Growth Rate

According to Kasim et al., (2017), absolute growth can be measured using the absolute growth formula as follows:

$$G = Wt - Wo$$

Information:

G = Average absolute growth (gr)
Wt = Seedling weight at the end of the study (gr)
Wo = Seedling weight at the start of the study (gr)

2. Specific Growth Rate

According to Kasim et al., (2017), specific growth can be measured using the specific growth formula as follows:

$$SGR = \frac{(Ln\,Wt - Ln\,Wo)}{t} x\ 100\%$$

Information:

SGR = Specific daily growth rate (%/day)
Wt = Average weight of fish at the end of the study (gr/head)
Wo = Average weight of fish at the start of the study (gr/head)
t = Time (maintenance length)

3. Number of Thalus Circles

To count the number of dots on Caulerpa sp. This is done by counting the number of dots in the thalus at a predetermined time, namely on days 0, 10, 20 and 30.

4. Water Quality

Water quality data is supporting data which includes temperature, salinity, pH, current speed, nitrate, phosphate and dissolved oxygen (DO). Water quality sampling is carried out once every 10 days in the morning.

5. Antioxidant Analysis

According to (Molyneux, 2004 in Rahmawati, 2016) the antioxidant activity of a sample is determined by the amount of DPPH radical absorption inhibition by calculating the percentage (%) of DPPH absorption inhibition using the following formula:

$$\%\ inhibisi = \frac{(Absorban\ blanko - Absorban\ sampel)}{Absorban\ blanko} x\ 100\%$$

Information:

% Inhibition = Inhibition level
Absorbent blank = Uptake of DPPH radicals
Sample absorbance = Sample uptake in DPPH radicals

The data from the results of this research are absolute growth data and relative growth as well as analysis of antioxidant content. To determine the effect of the treatment given using analysis of variance (ANNOVA), then Duncan's multiple area test was carried out to determine the differences between each treatment.

RESULTS AND DISCUSSION

1. Absolute Weight Growth

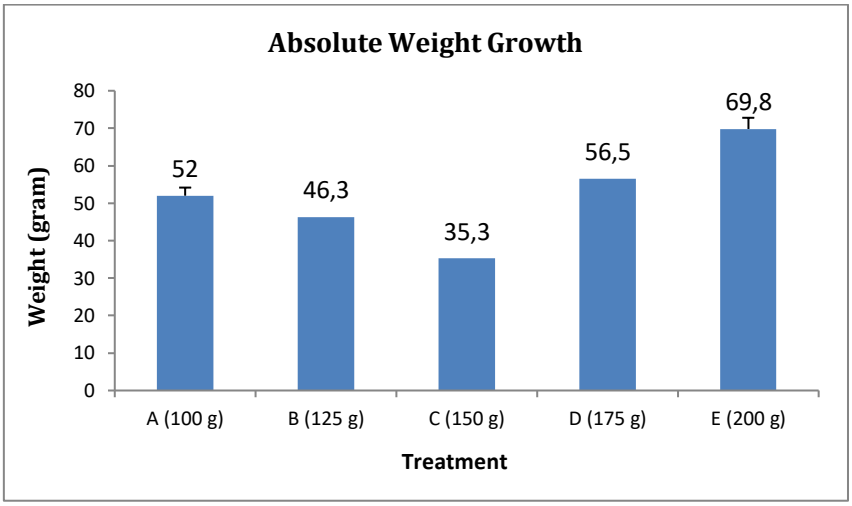

Figure 3. Absolute Weight Growth

2. Specific Weight Growth

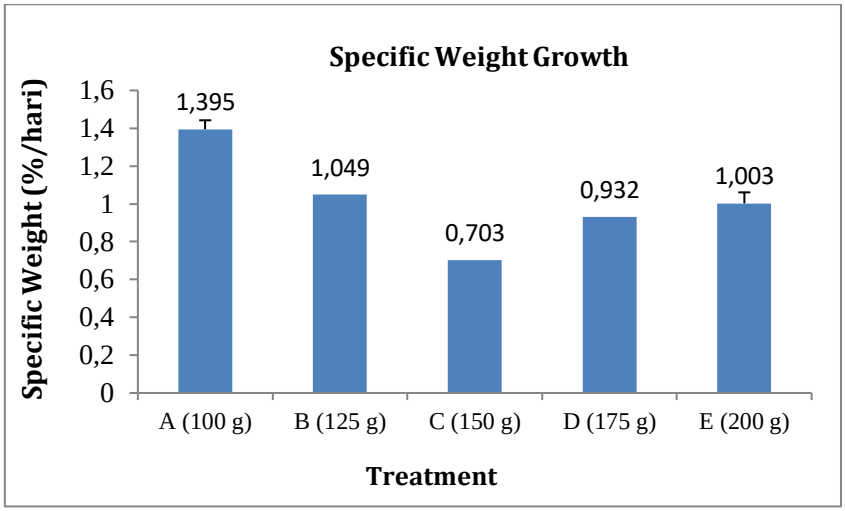

Figure 4. Specific Weight Growth

3. Number of Added Thalus Circles

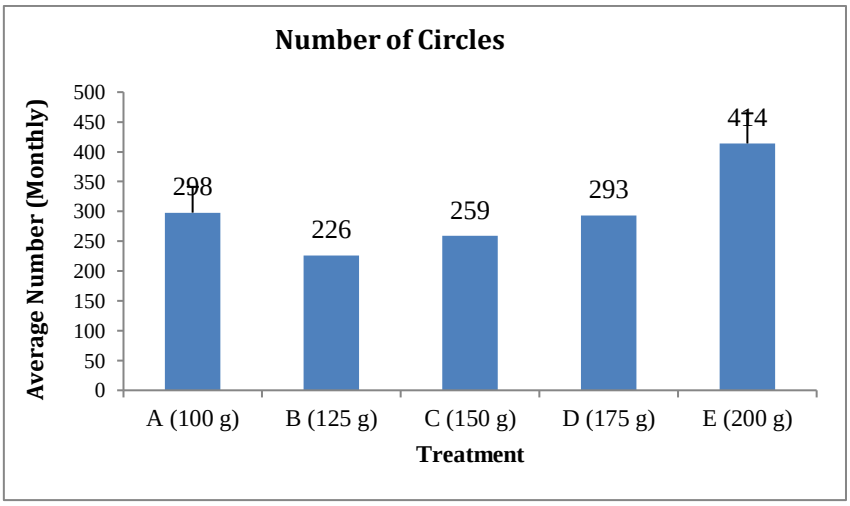

Figure 5. Number of Added Thalus Circles

4. Antioxidant Analysis

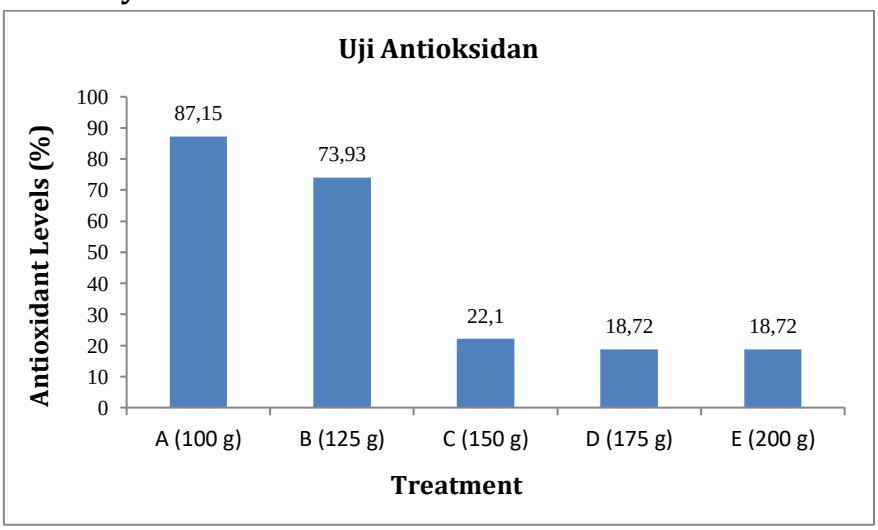

Figure 6. Antioxidant content

1. Absolute Weight Growth and Specific Weight Growth

Cultivation of sea grapes with seed weight in treatments A and E provided good absolute growth rates and specific growth of sea grapes (*Caulerpa* sp.) compared to treatments B, C, and D (Figures 4 and 5). It is suspected that the weight of the seeds in experiment E was very high, causing them to grow very much and also have sufficient nutrients. According to Akmal (2017), seaweed takes nutrients and nutrients from its surroundings by diffusion through the walls of its thallus. If seaweed gets little nutrition and nutrients, the growth of sea grapes can be hampered.

The highest absolute growth was in treatment E with an absolute growth value of 69.8 g. The high absolute weight growth value in treatment E (200 g) is thought to be due to the large number of thallus, so that sea grapes have a large surface area to absorb nutrients in the waters. Absorption of nutrients can accelerate branch growth. According to Akmal (2017), seaweed takes nutrients and nutrients from its surroundings by diffusion through the walls of its tallus. If seaweed gets little nutrition and nutrients, the growth of sea grapes can be hampered.

In terms of specific weight growth, the seed weight gives the best results for the growth of sea grapes (*Caulerpa* sp.), namely treatment A (100 g), where at a seed weight of 100 g, the number of thallus is less and there is a larger growing space so that it can accelerate branching. new. This is confirmed by Subarsono (2018) who stated that the initial biomass of seeds greatly influences the growth rate of seaweed. Low seed weight has a small number of thalus and has more growing space so that it can accelerate the growth of new branches.

2. Number of Increased Thalus Circles

Based on the results of counting thalus dots in treatment E, the weight of the seedlings was the highest compared to treatments A, B, C, and D (Figure 6) so that the number of dots produced was large. The higher the weight of the seeds used, the greater the number of thallus dots produced by sea grapes. The thalus circle has the function of absorbing food in the water using the cells found in the thalus circle. This is in accordance with the opinion of Kurniawan (2018), stating that seaweed has a thallus as a replacement for the role of leaves, stems and roots, which functions as a food absorber through the cells in the thallus.

Figure 7. Caulerpa sp. thallus spheres

3. Antioxidant Analysis

Antioxidants can be interpreted as components that can fight the oxidation process. Antioxidants also have a function, namely to protect fat from peroxidation by free radicals. Antioxidants can work effectively because antioxidants can donate an electron to free radicals. Free radicals will lose their ability to attack cells and the chain of oxidation reactions will be broken if the free radicals get electrons from antioxidants. Antioxidants will turn into free radicals after donating their electrons. In this phase, antioxidants are not harmful because antioxidants have the ability to adjust to changes in electrons, turning themselves into reactive ones (Ridhowati, 2016).

Based on the results of the antioxidant test in this study, it can be seen in Figure 6 that the antioxidant value in sea grapes is highest in treatment A compared to treatments B, C, D, and E. This is because the seed weight is 100 g. The antioxidant content value is higher due to the seed weight being 100 g. g there is no competition for nutrients or nutrients in the waters, such as the supply of sunlight needed for photosynthesis and also when taking samples of sea grapes, different branches/thallus are used for further testing in the laboratory which can later determine whether the antioxidant content is high or low. According to Illustrimo et al,. (2013), stated that the seaweed growth process itself is very dependent on the intensity of sunlight to carry out the photosynthesis process, where through this process the seaweed cells can absorb nutrients so as to stimulate the daily growth of seaweed through cell division activities and will affect the quality seaweed antioxidants.

4. Water Quality

Temperature values during cultivation range from 27.4 – 27.5°C. This temperature value is optimal and suitable for the growth of sea grapes. This water temperature is good for the growth of Caulerpa. According to (Tomascik et.al., 1997 in Darmawati, 2016) the optimal water temperature around seaweed plants (Caulerpa sp) ranges from 26 - 30°C.

The pH value obtained during cultivation of Caulerpa sp. ranges from 7.7 – 7.8. According to Susilowati, (2017), the optimum pH for seaweed cultivation ranges from 6.8 – 8.2. The salinity value obtained was 28 – 29 ppt, where this value is good salinity for the growth of Caulerpa sp. This is in accordance with Ardiansyah's statement, (2020) that Caulerpa lentilifera seaweed can survive at a salinity of 20 – 50 ppt.

The phosphate value obtained in cultivating Caulerpa sp. namely 0.1 mg/l, this is a good phosphate value for the growth of Caulerpa sp. According to Darmawati (2016), if there is a minimum of 0.01 mg/l phosphate in seawater, then the growth rate of most aquatic biota will not be hampered.

The current speed value obtained was 2.31 – 3.70 m/s. According to Anggariredja et al. (2008) in Novianti (2015) stated that the good current range for seaweed cultivation is 20 ± 40 cm/s.

The nitrate value obtained was 10 mg/l, where this nitrate concentration is high for the growth of sea grapes and seaweed. According to Pong-Masak (2015), states that in general the nitrate range for optimum growth of seaweed is 0.95 – 3.5 mg/L.

The nitrite value obtained was 0.05 mg/l. The values obtained include optimal values for sea grape growth. According to Darmawati (2016), the optimum nitrite value for seaweed growth is <0.05 mg/l.

CONCLUSION

The conclusions obtained in this research are as follows:

1. Cultivation of Caulerpa sp. Using different seed weights with the basic stake method had a significant effect on the growth of sea grapes. Seedling weight of 200 grams (E) provides the best absolute growth and number of spheres, namely 69.8 grams and 414 spheres. A seed weight of 100 grams (A) provides specific growth and the best amount of antioxidants, namely 1.395%/day and 87.15%.
2. Treatment A contains more antioxidants (87.15%) compared to the other treatments. This is because treatment A uses a low seed weight, namely 100 grams, so that the substances needed by Caulerpa sp. easily absorbed.

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