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The Effect of Cultivation Age on The Carginan Content of Seaweed (*Kappaphycus alvarezii*) in Beach of Ekas, Lombok Timur District

Pengaruh Umur Budidaya Terhadap Kandungan Karaginan Rumput Laut *(Kappaphycus Alvarezii)* Di Perairan Teluk Ekas Kabupaten Lombok Timur

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ABSTRACT

West Nusa Tenggara Province has potential seaweed resources. This study aims to analyze the yield of carrageenan at different cultivation ages. West nusa tenggara province has an area for seaweed cultivation of 25,206.6 ha. The area is spread over the districts of East Lombok, west Lombok, central Lombok, Sumbawa, Dompu, Bima, the city of Mataram, the city of Bima, west Sumbawa and north Lombok. Seaweed is a chlorophyll plant and is classified as a low-level plant that has no true roots, stems or leaves, but only resembles a stem called a thalus. This research was conducted in Ekas Bay, Ekas Buana Village, Jerowaru District, East Lombok, and West Nusa Tenggara. This study used a completely randomized design (CRD) with 4 treatments: P1: 15 days, P2: 25 days, P3: 35 days, and P4: 45 days. The yield of *K. alvarezii* carrageenan obtained the highest score in treatment (P4), which was 53.4%. The chlorophyll content of *K. alvarezii* seaweed obtained the highest value in treatment (P4), namely 5.1 mg/L. Based on the results of research data analysis, it was found that the different cultivation ages of *Kappaphycus alvarezii* had a significant effect on absolute growth, specific growth and no significant effect on carrageenan content. In this study, the P4 treatment (45 days) obtained an absolute growth of 149 g, a specific growth of 5.46%, and a carrageenan content of 53.4%, and the best chlorophyll content value was 5.1 mg/L. The conclusion of this study is the best maintenance in this study, namely treatment P4 (45 days) obtained absolute growth of 149 grams, specific growth of 5.46%, and carrageenan content of 53.4%, and the best value of chlorophyll content is 5.1 mg /l.

ABSTRAK

Provinsi Nusa Tenggara Barat memiliki sumberdaya rumput laut yang potensial. Provinsi Nusa Tenggara Barat memiliki areal untuk budidaya rumput laut seluas 25.206,6 ha. Areal tersebut tersebar pada daerah Kabupaten Lombok Timur, Lombok Barat, Lombok Tengah, Sumbawa, Dompu, Bima, Kota Mataram, Kota Bima, Sumbawa Barat, dan Lombok Utara. Rumput laut merupakan tumbuhan berklorofil dan digolongkan sebagai tanaman tingkat rendah yang tidak memiliki akar, batang maupun daun sejati, melainkan hanya menyerupai batang yang disebut thallus. Penelitian ini bertujuan untuk menganalisa

rendemen karaginan pada umur budidaya yang berbeda. Penelitian ini dilaksanakan di Teluk Ekas Desa Ekas Buana Kecamatan Jerowaru Lombok Timur Nusa Tenggara Barat. Penelitian ini menggunakan rancangan acak lengkap (RAL) dengan 4 perlakuan yaitu: P1: 15 hari, P2: 25 hari, P3: 35 hari, P4: 45 hari. Rendemen karaginan *K. alvarezii* yang diperoleh nilai paling tinggi pada perlakuan (P4) yaitu sebesar 53,4%. Kandungan klorofil terhadap rumput laut *K. alvarezii* diperoleh nilai paling tinggi pada perlakuan (P4) yaitu 5,1 mg/L. Berdasarkan hasil analisis data penelitian diperoleh bahwa umur budidaya *Kappaphycus alvarezii* yang berbeda memberikan pengaruh nyata terhadap pertumbuhan mutlak, pertumbuhan spesifik dan pengaruh tidak nyata terhadap kandungan karaginan. Pada penelitian ini, perlakuan P4 (45 hari) didapatkan pertumbuhan mutlak yaitu 149 g, pertumbuhan spesifik sebesar 5,46 %, dan kandungan karaginan sebesar 53,4 %, serta nilai kandungan klorofil terbaik adalah 5,1 mg/L. Kesimpulan penelitian ini adalah pemeliharaan terbaik dalam penelitian ini yaitu perlakuan P4 (45 hari) didapatkan pertumbuhan mutlak yaitu 149 gram, pertumbuhan spesifik sebesar 5,46 %, dan kandungan karaginan sebesar 53,4 % ,serta nilai kandungan klorofil terbaik adalah 5,1 mg/L.

Kata Kunci	*K. alvarezii, budidaya, karaginan, rumput laut, klorofil*
Keywords	*K. alvarezii, aquaculture, carrageenan, seaweed, chlorophyll*
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INTRODUCTION

West Nusa Tenggara Province has seaweed that grows rapidly in West Nusa Tenggara. Seaweed cultivation is a type of cultivation that is easy to cultivate and does not require too much investment capital. Kappaphycus alvarezii is a type of seaweed that produces carrageenan. Carrageenan has an important role in supporting human needs such as toothpaste, medicine, paint and other needs. Carrageenan also has other roles, namely as a stabilizer (balance regulator), thickener (thickening agent), gelling agent, emulsifier, protective colloid, coagulating agent and preventing crystallisation. This property is highly utilized in the food industry, medicine, cosmetics, textiles and other industries (Tamaheang, 2017).

In various places in NTB, especially in the waters of Ekas Bay, East Lombok, this is one location that has the potential to carry out seaweed cultivation because Ekas Bay is a fisheries cultivation center. Teluk Ekas, Jerowaru District, East Lombok Regency, has met the criteria for carrying out seaweed cultivation, which can be measured by parameters, namely the number of students conducting research in the area. Based on research by (Hulpa et al, 2021) water quality is still within the optimal range. The water quality in Ekas Bay is 28-310c. pH 7.8-8.2. Dissolved oxygen (mg/l) 5.4-7.4. Salinity (ppt) 30-31. Current speed (m/s) 1-6. Nitrate (mg/l) 10-12.5. And phosphate (mg/l) 0.03-0.1.

Seaweed is a plant that contains chlorophyll and is classified as a low-level plant that does not have true roots, stems or leaves, but only resembles a stem called a thallus. K. alvarezii seaweed is a type of seaweed that produces carrageenan. Carrageenan has an important role in supporting human needs such as toothpaste, medicine, paint and other needs. Carrageenan also has other roles, namely as a stabilizer (balance regulator), thickener (thickening agent), gelling agent, emulsifier, protective colloid, coagulating

agent and preventing crystallization. This property is highly utilized in the food industry, medicine, cosmetics, textiles and other industries.

Carrageenan is a compound extracted from seaweed from the Rhodophyceae family such as K. alvarezii seaweed which consists of sulfated polyglycan chains with a molecular mass of approximately more than 100,000 and is hydrocolloid. The characteristics and quality of carrageenan from seaweed in Indonesia can be observed based on its physical and chemical properties which include yield, water content, ash content, viscosity and gel strength. Based on previous research, there are still several parameters that do not meet the established quality standards. This cannot be separated from the factors that influence the quality of carrageenan, including the processing process to obtain carrageenan from seaweed, which consists of a soaking process, extraction, separation of carrageenan with a solvent (using an alkaline solvent), then drying the carrageenan. Apart from that, the characteristics of carrageenan are also influenced by the type of seaweed, type and concentration of solvent, and the age at which the seaweed is harvested (Asikin and Kusumaningrum, 2019).

In general, a good seaweed harvest age for carrageenan quality is 35-45 days compared to 15-25 days. It can be determined that the water content value of carrageenan is influenced by the seaweed harvest age, where previous research results show that the optimum harvest age is 30-40 days. According to (Wenno et al., 2012) the increase in water content in carrageenan is caused by an increase in the harvest age of seaweed due to the hydraulic properties of seaweed. The research aims to analyze the amount of carrageenan content in Kappaphycus alvarezii seaweed at different cultivation ages.

METHODS

This research was carried out for 45 days, located in Ekas Bay, Ekas Buana Village, Jerowaru District, East Lombok, West Nusa Tenggara. This study used a completely randomized design (CRD) with treatments namely: P1: 15 days, P2: 25 days, P3: 35 days, P4: 45 days. The parameters measured include absolute weight growth, specific weight growth, relative weight growth and carrageenan.

Absolute Growth

Absolute growth can be calculated using a formula (Sahabati, 2016).

$$\Delta W = Wt - W0$$

Information:
ΔW = Absolute growth (g)
Wt = Average weight of test seaweed at the end of the experiment (g)
W0 = Average weight of test seaweed at the start of the experiment (g)

Specific Growth Rate

The specific growth rate of seaweed uses the following formula (Kasim *et al,* 2017).

$$\text{SGR} = \frac{LnWt - LnWo}{t} \times 100\%$$

Calculation of Yield Percentage

Calculating the percentage yield of carrageenan uses the following formula (Ainsworthe and Blanshard, 1980; Prastyowati et al., 2008; Majid et al., 2018).

$$\boldsymbol{R = \frac{BK}{BRL} \times 100\%}$$

R : Rendemen (%)

BK : Carrageenan Weight (g)
BRL : Seaweed Weight (g)

RESULT AND DISCUSSION

Absolute Growth

The results of the absolute growth analysis based on the results of research carried out for 45 days can be seen in Figure 1. Based on Figure 1, it shows that the treatment had a real effect on the absolute growth of K. alvarezii. Based on One-Way Anova statistical analysis, it shows that the absolute weight growth of K. alvarezii seaweed is significantly different ($p<0.05\%$), the results of further tests using Duncan show that treatment (P4) is the best result, significantly different from the treatment P3, P2, and P1. Results of analysis of data on the growth of absolute weight of seaweed on the length of maintenance.

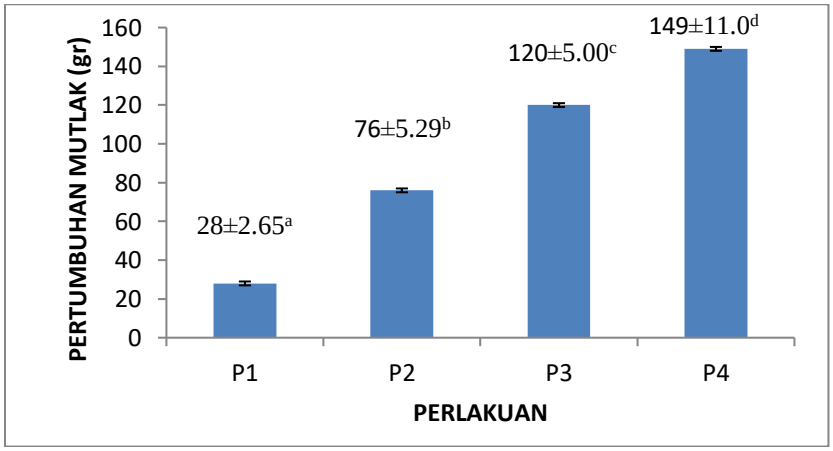

Figure 1. Absolute Growth Chart

The best absolute growth data for seaweed was obtained in treatment (P4) with an average value of 149 grams, while the lowest result obtained in P1 was 28 grams. This is thought to occur due to differences in maintenance time/length which have a real influence on each treatment. So the growth process of K. alvarezii seaweed regarding the absorption of nutrients will be different.

The high absolute growth in P4 is thought to occur because seaweed growing at 45 days absorbs nutrients and nutrients in greater quantities, so that it can produce a fairly high absolute weight. According to Marseno et al., (2010), maintenance of 45 days is better than the lowest or highest harvest age. It can be seen that the harvest age of 45 days can produce a high weight of seaweed, on the other hand, the age of 45 days also produces better quality seaweed compared to the lowest harvest age.

The absolute growth rate of P1 with a weight of 28 grams is thought to be lower because it is too fast to harvest so that the nutrients and nutrients have not been processed optimally which can cause the P1 value to be low. According to Widowati et al. (2015) the growth rate of seaweed is influenced by one important factor, including differences in the intensity of light received by the seaweed which will affect the expanse of new cell walls which almost does not change when the expansion of the seaweed's growth capacity is inhibited by light.

The results of this research are in line with research conducted by Moi Daa (2020), with an average value of absolute weight growth maintained for 45 days of 251 g. Research conducted by Cokrowati (2020), with the absolute weight growth value

maintained for 45 days was 451.43 g. Meanwhile, research conducted by Mahrus Ali (2016) lasted 15 days with an absolute weight of 53 g. Meanwhile, research was conducted in Ekas Bay, East Lombok for 45 days with an average absolute weight of 249 g and for 15 days with an absolute weight of 28 g.

Specific Growth

The highest specific growth value was in treatment P4, namely 5.46% and the lowest value was in P1, namely 4.76%.

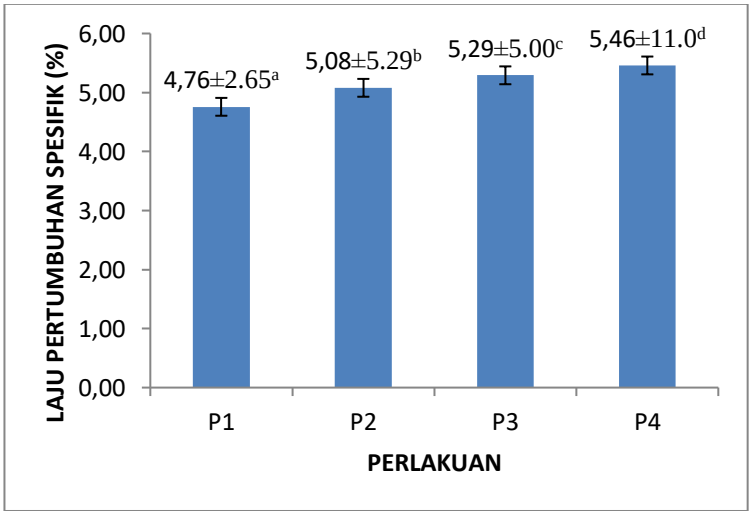

Figure 2. Specific growth graph

The research results showed that the specific growth of treated seaweed (P4) was higher, with an average value of 5.46%, followed by treatment (P3) at 5.29%, P2 at 5.08%, and P1 at 4.76%. According to Gultom et al. (2019) that there are several external and internal factors that influence the specific growth rate of seaweed. One of the internal factors is the species, there are several species of seaweed that have a specific fast growth rate (Kappaphycus alvarezii, Gracilaria, Sargassum sp.), the use of seeds in accordance with the criteria of not being infected by disease, the thallus being elastic, not broken and not slimy. , while one of the external factors is the cultivation method.

The high specific growth rate at P4 of 5.46% is thought to occur because seaweed growth is faster due to harvest time and greater nutrient availability because the ideal age of seaweed is 45 days at P4. Meanwhile, the low specific growth value P1 of 4.76% is thought to be due to the faster harvest time so that the thalus formation process is not optimal, which causes the P1 value to be low. This is in accordance with what was stated by Hayashi & Paula (2007) that the sufficient intensity of sunlight received by seaweed greatly determines the speed of seaweed to meet nutrient needs such as carbon (C), nitrogen (N) and phosphorus (P) for its growth and development.

The results of this research are in line with research conducted by Lutfiati (2022), namely the specific growth rate maintained for 45 days, the value obtained was 4.06%/day – 3.93%/day. Research conducted by Darmawati (2013), namely the specific growth rate maintained for 45 days, the value obtained was 4.75%/day. Meanwhile, research that was conducted in Ekas Bay, East Lombok for 45 days was 5.46%/day.

Carrageenan Content

The carrageenan content of K. alvarezii seaweed obtained from the results of this study can be seen in Figure 3. The carrageenan content of K. alvarezii obtained by the

highest value in treatment (P4) was 53.4%. This shows that at the age of 45 days, the carrageenan content can reach its maximum value.

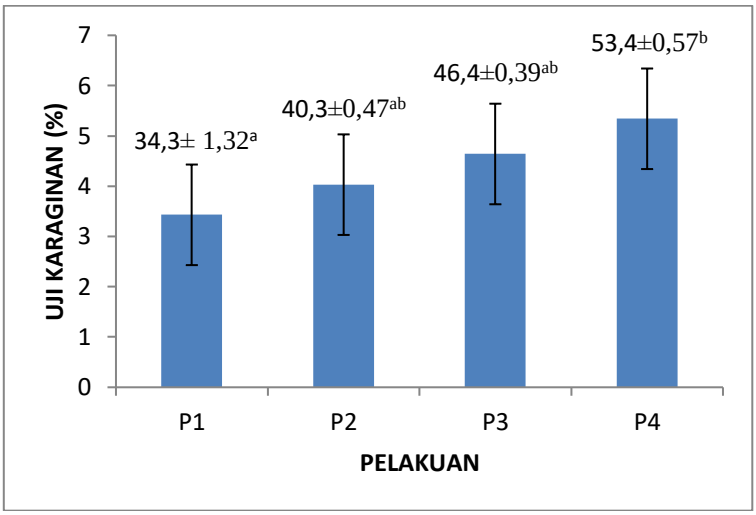

Figure 3. Carrageenan Chart

Based on the results of the K. alvarezii carrageenan test, the highest carrageenan content was obtained in treatment (P4) with a value of 5.34 g, followed by P3 at 4.64 g, P2 at 4.03 g and the lowest at P1 with a value of 3.43 g. This is thought to occur due to the harvest time factor, the older the seaweed, the more carrageenan it contains and other factors including sunlight, currents and nutrients. The carrageenan content according to Marseno et al., (2010), namely the harvest age of 45 days and 60 days is higher compared to the harvest age of 30 days due to changes in the chemical composition that make up the tissue and the plant's physiological response to the need for carrageenan as a compound that makes up the tissue occurs continuously. , even though the increase is not real. This can be seen in Syamsuar's (2006) statement that the longer the harvest, the higher the polysaccharide production.

Research data on the carrageenan content test showed that the highest carrageenan content was found in P4, namely 53.4%. The yield produced in this research has met the standard carrageenan yield requirements set by the Ministry of Trade and Industry, namely a minimum of 25% (Syamsuar, 2006). Even though the highest value is P4, P3, P2 and P1 are included in the established standards, namely with values ranging from 46.4% to 40.3% and 34.3%. Based on Widyastuti's statement (2010), the photosynthesis process that occurs over a long period of time/harvest period can result in a high increase in carrageenan in seaweed thalus. Furthermore, Marseno et al. (2010) stated that the increase in carrageenan yield was due to changes in the chemical composition that makes up the tissue and physiological responses that occur with increasing harvest age and the influence of conditions where seaweed grows.

If we look at the average value of carrageenan content obtained in this study, it ranges from 34.3% - 53.4%. The carrageenan value of K. alvarezii seaweed is relatively good. From the results of previous research, the average seaweed carrageenan yield value has met the standards set by FAO, namely >25%.

CONCLUSSION

Different cultivation ages of Kappaphycus alvarezii seaweed had a significant influence on absolute growth, specific growth and no significant influence on carrageenan

content. The best cultivation age in this study, namely treatment P4 (45 days), obtained absolute growth of 149 grams, specific growth of 5.46%, and carrageenan content of 53.4%, and the best chlorophyll content value was 5.1 mg/L.

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