RUMPHIUS PATTIMURA BIOLOGICAL JOURNAL
2020, 2 (1): 25-31
E-ISSN : 2684-804X

SOATTING OF UREA FERTILIZER AND CONCENTRATION LEVEL OF SEAWEED CARRAGINAN *Eucheuma cottonii*

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Received: 19 February 2020 Accepted: 12 march 2020 Published: 25 March 2020

ABSTRACT

Euchema cottonii seaweed as carrageenan-producing, growth and development is in need of the quality of light and nutrients such as nitrogen, such as urea. This study aims to determine the combination of long soaking and urea concentration levels that are effective in improving the content of Euchema cottonii. This research method uses long immersion urea treatment 2 hours, 4 hours, 6 hours and without immersion (control) and urea concentration of 1 gram, 1.5 gram, 2 gram and without of urea fertilizer (control), repeat 3 times. The content of carrageenan in each treatment will be analyzed using ANOVA, followed by HSD test at 95% significance level. The results showed that the best carrageenan content (66.52%) in the treatment of long soaking 2 hours with 2 grams of urea concentration and the lowest carrageenan content (51.33%) obtained in the treatment of long immersion 6 hours with 1 gram of urea concentration. Carrageenan seaweed Eucheuma cottonii on research generally meets the standards of quality carrageenan for maximum moisture content of 35% (SNI Indonesia), and ash content of 15-40% (FAO, FCC), a maximum of 35% (EEC).

Keywords: *carrageenan, concentration, seaweed, urea fertilizer.*

To cite this article:
Rijoly, S., Killay, A., Rupilu, J. 2020. Soatting of urea fertilizer and concentration level of seaweed carraginan *eucheuma cottonii. Rumphius Pattimura Biological Journal.* 2 (1): 25-31. DOI https://doi.org/10.30598/rumphiusv2i1p025-031

INTRODUCTION

Indonesia as an archipelagic country consists of 13,667 islands which have a coastline of more than 81,000 km and has considerable potential for seaweed. Of the 782 species of Indonesian seaweed, only 18 species from 5 genera (clans) have been traded, and of the 5 genera only the Euchema and Gracilaria genera have been cultivated (Anggadiredja et al, 2006). Seaweed is a source of foreign exchange and a source of income for coastal communities. Seaweed commodity is one of the main commodities of the fisheries and marine sector which is very strategic to develop. It is considered strategic because apart from its relatively short planting period, which is approximately 2 months, this commodity also absorbs a large number of workers, promises local and regional markets and competitive selling prices. In Indonesia alone, seaweed production has increased significantly with an increase of 78.4% from 5.2 million wet tons of seaweed in 2011 to 9.2 million tons in 2013 (Aluman, 2016; Munadi, 2015). Seaweed has many benefits, especially as a raw material for the food, pharmaceutical, cosmetic,

fertilizer, textile, medical and organic fertilizer industries. In addition, it can guarantee the environmental sustainability of fishery resources and create new jobs for coastal communities (Latif, 2008).

Eucheuma cottonii seaweed can be processed into handicrafts that have high economic value. Carrageenan is a hydrocolloid compound which is a long chain polysaccharide compound and is extracted from carrageenan-producing seaweed. Carrageenan is the latex of seaweed obtained from the extraction of red seaweed using hot water or an alkaline solution at high temperatures. Carrageenan is also the name given to a family of linear polysaccharides which are obtained from red algae and are important for food. Carrageenan is distinguished based on its sulfate content into two fractions, namely kappa carrageenan which contains less than 28% sulfate and iota carrageenan if it contains more than 30%. Furthermore, carrageenan can be divided into 3 fractions based on their constituent units, namely kappa, iota and lambda carrageenan. Kappa carrageenan is produced from Eucheuma spinosum, and lambda carrageenan is produced from Chondrus crispus. In industry, carrageenan is used as a stabilizer, thickener, gelling agent, emulsifier, binder and prevents crystallization in the food or beverage, pharmaceutical, cosmetic and other industries (Hudha, 2012).

Seaweed can be influenced by several parameters, one of which is nutrients. Nutrients are nutrients needed by plants as a source of energy to construct various cell components during the process of growth and development. The nutrients used in the growth of seaweed are nitrogen nutrients which are sourced from fertilizers. Nitrogen as an alternative to maintain the fertility of seaweed because it can make plants more fresh and is one of the constituent elements of chlorophyll (Budiyani, 2012). Seaweed (Eucheuma cottonii sp) as a plant that lives in waters also requires a number of adequate and balanced nutrients to achieve optimal production. For this reason, fertilization treatment of this commodity is very necessary so that seaweed production can be increased from seaweed production which is usually produced in natural conditions. The average use of urea fertilizer can increase seaweed production compared to no fertilization treatment (Silea, 2007). Seaweed growth occurs with fertilization treatment is not known with certainty. For this reason, it is necessary to conduct research on the application of fertilizer, namely urea fertilizer with carrageenan content from this type of Eucheuma seaweed. So that seaweed farmers can increase the seaweed cultivation business.

METHOD

This research is an experiment consisting of two stages, namely field research and followed by laboratory analysis. Field research was carried out at the seaweed cultivation location in Nuruwe Village, carrageenan extraction and measurement of seaweed quality were carried out at the Basic Chemistry Laboratory and Fisheries Product Technology and Marine Science Laboratory, Pattimura University.

Materials

buoy, 6 mm nylon rope for rises, 15 mm nylon rope for main rope, knife, boat, anchor or weight, plastic basin, bucket, mercury thermometer, pH meter, salinometer, digital scale, blender, 250 ml Erlenmeyer, paper strainer, spatula, stir bar, funnel, 250 ml measuring cup, petri dish, porcelain dish, desiccator, furnace, oven and stationery. The main materials used in this study were seaweed seeds of Eucheuma cottonii and Urea fertilizer, as well as 96% isopropyl alcohol, 0.1 M NaOH and distilled water for the manufacture of Eucheuma cottonii seaweed extraction.

Research design

This study used a completely randomized design (CRD) factorial pattern with 2 main factors, namely soaking time with 4 levels of fertilizer and concentration of fertilizer with 4 levels. Each treatment was repeated 3 (three) times with the number of experimental units observed being 4x4x3 = 48 units. Four levels of immersion time factor (A) namely control (A0), 2 hours (A1), 4 hours (A2) and 6 hours (A3). Four levels of fertilizer concentration factor (B) consist of control/fertilizer concentration of 0 grams (A0), 1 gram (B1), 1.5 grams (B2) and 2 grams (B3). $Yij = \mu + A_i + B_j + AB_{ij} + \epsilon_{ij}$

Data analysis

The data in this study were analyzed using analysis of variance (ANOVA) at a significant level of 5% ($\alpha = 0.05$). If the results of the analysis show that the soaking time and the level of fertilizer concentration affect the carrageenan content of Eucheuma cottonii, then a further test will be carried out using the Tukey test.

DISCUSSION RESULT

Based on observations during five weeks of planting, the growth of *Eucheuma cottonii* showed varying results. The average growth of seaweed can be seen in table 1.

Table 1. Average Seaweed Growth (Wet Weight) and Carrageenan Content of Eucheuma cottonii

Treatment		mean weight (gram) ($\bar{x}$)	mean Karaginan (%)
Immersion (Jam)	**pupuk Urea (gram)**		($\bar{x}$)
Control (0)	Control (0)	139,06	54,63
	1	129,55	52,24
	1,5	126,63	54,43
	2	122,04	55,78
2	0	124,73	55,06
	1	119,73	58,02
	1,5	136,27	55,69
	2	120,57	66,52
4	0	135,94	57,05
	1	124,83	59,85
	1,5	145,91	57,52
	2	120,21	55,21
6	0	122,26	53,55
	1	126,81	51,33
	1,5	141,33	54,85
	2	137,36	54,16

The highest seaweed growth during the study was found in the 4-hour soaking treatment with 1.5 grams of urea fertilizer concentration, followed by a 6-hour soaking treatment with 1.5 grams of urea fertilizer. This was followed by a 6-hour soaking treatment with 2 grams of urea fertilizer concentration and a 2-hour soaking treatment with 1.5 grams of urea fertilizer. The lowest growth of seaweed was found in the 2-hour soaking treatment with 1 gram of urea fertilizer concentration, followed by the 4-hour soaking treatment with 2 grams of urea fertilizer concentration. After that, soaking for 2 hours with a concentration of 2 grams of urea and 4 hours of immersion with a concentration of 1 gram of urea. This situation indicates that seaweed soaked in urea fertilizer with a concentration of 1.5 grams showed better growth when compared to urea fertilizer concentrations of 1 gram and 2 grams. As for the immersion time, it can be seen that immersion time of 4 hours to 6 hours gives better growth when compared to 2 hours of immersion time.

Carrageenan Content in Eucheuma cottonii Seaweed

Based on the average laboratory analysis results, the carrageenan content in each treatment ranged from 51.33 to 66.52%. The highest concentration of carrageenan content was found in the 2-hour soaking treatment with 2 grams of urea fertilizer concentration, namely 66.52%. Meanwhile, the lowest concentration of carrageenan content was obtained in the 6-hour long soaking treatment with 1 gram of urea fertilizer, namely 51.33%. The results of laboratory analysis also showed that there were fluctuations in the average carrageenan content in each treatment given during the five weeks of observation. If associated with the growth of seaweed, it appears that the growth of seaweed that is not high increases the concentration of carrageenan content. Because the growth of seaweed at 2 hours of soaking time with 2 grams of fertilizer concentration was low (120.57), but the average percentage of carrageenan was very high (66.52%).

The results of the analysis of variance regarding the effect of soaking time and the level of fertilizer concentration on the carrageenan content of Eucheuma cottonii are presented in table 2.

Table 2. Results of analysis of variance on the effect of soaking time and fertilizer concentration on carrageenan content of Eucheuma cottonii.

Source of Diversity	Derajat Free (DB)	number Kuadrat	Kuadrat mean	F Hitung 5% (0,05) (JK)	F Tabel (KT)
Soaking time (A)	3	61,08	20,36	77,3 4,15*	3,325
Fertilizer Concentration (B)	3	231,90	29,33	15,74*	
Combination (AB)	9	263,94	4,91	5,97*	
Galat	32	157,07			
Total	47	713,99			
KK=25%					

The data in table shows that the calculated F value > F table. This means that the soaking time with different levels of fertilizer concentration has a significant effect on the carrageenan content of Eucheuma cottonii seaweed.

Table 3. BNJ Test Results Effect of Urea Fertilizer Concentration on Carrageenan Content

Treatment	Karaginan (%)	Control	1 gram	1,5 gram	2 gram
Control	55,07	-	-	-	-
1 gram	55,36	0,29^{tn}	-	-	-
1,5 gram	55,62	0,55^{tn}	0,26^{tn}	-	-
2 gram	57,92	2,85*	2,56*	2,3*	-
BNJ 0,05 = 1,97					

Treatment	Mean	Control	2 jam	4 jam	6 jam
Control	54,27	-	-	-	-
2 jam	58,82	4,55*	-	-	-
4 jam	57,41	3,14*	1,41^{tn}	-	-
6 jam	53,48	0,79^{tn}	3,76*	2,35*	-
BNJ 0,05 = 1,97					

^{tn} = no significant (α = 0,05). * = different (α = 0,05).

It is known that all types of plants really need nutrients, both macro nutrients and micro nutrients. In urea fertilizer there are as many as twenty one nutrient elements (macro and micro) which these elements are needed for plant growth. During plant growth requires 16 essential nutrients (macro and micro). If one of the elements is not available, it can cause plant growth and development and its productivity to be hampered (Sutejo, 1990). The highest growth was obtained from the 4 hour long soaking treatment in 1.5 gram urea fertilizer concentration. While the lowest growth was obtained from the treatment of 1 gram of fertilizer concentration with 2 hours of soaking time. The higher the concentration of urea, the higher the weight of the seaweed obtained (Silea, 2007). This is due to the longer time and the higher the concentration of urea fertilizer in the immersion solution, the higher the absorption capacity of seaweed seedlings to fertilizer. Therefore, there is a tendency for seaweed seedlings to perform better and faster growth activities (Silea, 2007). Plant needs for nutrients vary depending on age, type of plant, and the needs of the plant itself. During the vegetative period, plants need more N, because very vital for plant growth because this element is most needed by plants. This element's main function is to synthesize chlorophyll which is used by plants in carrying out the process of photosynthesis. Plants

cannot absorb nutrients in a singular form, but plants absorb these nutrients in ionic form, such as N nutrients that can be absorbed by plants in the form of NH4 and NO3- as well as other elements that are also absorbed by plants in ionic form, which is often referred to as the form available to plants. . However, the problem is that if the element N is given in excessive amounts it can actually result in decreased plant production, this is because the provision of element N in large quantities exceeds the needs of plants can result in a longer plant vegetative phase. As a result, apart from decreasing productivity, the resulting quality also decreases (Purwadi, 2011).

This can be seen in the treatment with a concentration of 1.5 grams of fertilizer with a soaking time of 4 hours where this treatment gave the best growth response compared to other treatments. The treatment with a concentration of 1 gram of fertilizer did not give optimal results, thought to be caused by the nutrients absorbed by the seaweed being very small, and the treatment with a concentration of 2 grams of fertilizer also did not give optimal results, allegedly because the nutrients absorbed by the seaweed became excessive, thus inhibiting growth. from the seaweed itself (Ruhnayat, 2007). The availability of a number of nutrients in the urea fertilizer solution which is absorbed by the seaweed seedlings will help with the lack of nutrients provided by the waters as their natural growing environment. The availability and balance of nutrients really helps the process of plant growth and development. With sufficient nutrient content, it can be used as a chlorophyll-forming element in the photosynthesis process (Silea, 2007).

Carrageenan is very important for the resilience of seaweed in an environment with high salinity because it plays a role in maintaining ion balance in a cell. The carrageenan content in Eucheuma cottonii is formed as a result of the photosynthesis process. Photosynthetic activity also affects the growth rate of Eucheuma cottonii. Algae growth is related to the process of cell formation and division in the thallus. The process of forming the thallus affects the metabolism of the cell wall and the formation of an increased cell wall causes the material that makes up the cell wall to also increase (Zainuddin, 2018). Carrageenan is present in the cell walls of seaweed or its intracellular matrix and carrageenan is a major component of the dry weight of seaweed compared to other components (Samsuria, 2006). The carrageenan content of *Eucheuma cottonii* seaweed in each treatment ranged from 51.33 – 66.52 grams. In the 2-hour soaking treatment, the average carrageenan content was greater than the 4-hour, 6-hour soaking treatment and the control. This can be seen from the highest presentation of carrageenan found in the 2-hour soaking time with 2 grams of fertilizer concentration. This is due to the long soaking conditions of 2 hours with a concentration level of 2 grams of fertilizer, Eucheuma seaweed absorbs Nitrogen (N) in the form of nitrate from fertilizer properly so that there is no shortage or excess of these nutrients. In contrast to the 6 hour long soaking treatment with 1 gram fertilizer concentration which produced the lowest carrageenan presentation, this was due to the longer soaking time, the more nitrogen (N) was absorbed resulting in an excess of N element which affected the growth of seaweed because seaweed became more susceptible to disease, more watery and aborted thallus. This causes a reduction in the carrageenan content of the seaweed (Ruhnayat, 2007).

Seaweed is an organism that obtains food through the flow of water that passes through it. Sufficient water movement will also bring sufficient nutrients and at the same time wash the dirt attached to the thallus. The ideal current speed is between 15-50 cm/s. Current velocity during the study ranged from 22-48 cm/sec. Water movement affects weight, thallus shape and production of Eucheuma hydrocolloid materials. Thus, the current velocity during the study was good enough for the growth of Eucheuma cottonii. Strong currents and waves can cause damage to plants such as broken or detached from the straps or the substrate. In addition, the absorption of nutrients is not optimal because the seaweed has not had time to be absorbed and has been brought back by the currents. The slow current speed can cause the dirt attached to the thallus not to be completely cleaned and the supply of nutrients is increasingly hampered due to sub-optimal water movement.

CONCLUSION

The results of the analysis of variance for soaking time and fertilizer concentration levels were significantly different from the carrageenan content of Eucheuma cottonii seaweed. The best seaweed content was obtained from the 2-hour soaking time and the concentration level of 2 grams of fertilizer with a carrageenan content of 66.52%. Meanwhile, the lowest carrageenan content was obtained at 6 hours of soaking time and 1 gram of fertilizer concentration, namely 51.33%. The quality of Eucheuma cottonii seaweed carrageenan in this study generally met the carrageenan quality standards set by FAO, FCC, EEC and SNI Indonesia, namely for a maximum water content of 35% (SNI Indonesia) and an ash content of 15-40% (FAO and FCC). with a maximum level of 35% (EEC).

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