Growth Performance of *Eucheuma cotonii* by Immersing in Several Macroalgae Extract

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Abstract

Nunik Cokrowati, Dewi Nur'Aeni Setyowati, and Rina Kurnianingsih. 2017. Growth Performance of Eucheuma cotonii by Immersing in Several Macroalgae Extract. Aquacultura Indonesiana, 18 (1): 26-29. Macro algae in West Nusa Tenggara are potential in types and quantities. One of the types that have only been economically used is seaweed, such as Eucheuma cottonii, Eucheuma spinosum, Eucheuma striatum and Gracillaria sp. In general, all macro algae can be used for various purposes such as pharmacy, agriculture, livestock, and food ingredient. Macro algae commonly have the growth hormones and contain primary and secondary metabolites. The growth hormones in macro algae are called cytokinin, auxin and absicic acids. The objective of this study was to determine the effect of macro algae extracts to the growth of Eucheuma cottonii. This study was carried out in Ekas Bay, Ekas Buana Village, Jerowaru District, of East Lombok, West Nusa Tenggara, between May to September 2016. Eucheuma cottonii was cultivated on the 8 m X 8 m size of longline and 40 ris of load. Spacing between ris was 1 m and distance between clumps was 25 cm. Cultivation was carried out by using Eucheuma cottonii seed with average weight of 100 g and weighing was carried out every 7 days. Macro algae used as extract included Sargassum aquifolium, Ulva sp. and Turbinaria sp. Extracts were put into immersion at 5% concentration. The parameters measured were the absolute growth and Specific Growth Rate of Eucheuma cottonii, and the water quality. The results showed that the addition of macro alga extracts significantly affected the growth of Eucheuma cottonii.

Keywords: Absolute growth; Aquaculture; Longline; Specific Growth Rate; Water quality

Introduction

Macro algae in Nusa Tenggara Barat are quite potential both in their types and quantity. They have been utilized economically, especially seaweeds (as being marketable) such as Eucheuma Eucheuma cottonii, spinosum, Eucheuma striatum and Gracillaria sp. In general, any marine plants are usable for various purposes such as pharmacy, agriculture, livestock and food ingredients. Types of marine plants in Nusa Tenggara Barat waters area include Sargassum, Ulva and Turbinaria. In the last three years, Sargassum has been utilized as raw material for rice wrapping paper. In Nusa Tenggara Barat, it is only sold in dried form to be sent to paper industry in Surabaya. Ulva and Turbinaria wildly grow in coastal water area and have not been utilized.

Commonly, macro algae have growth hormones and produce primary and secondary metabolites. The growth hormones in marine plants include cytokinin, auxin, and absicic acids. Adhi *et al.* (2016) explains that *Sargassum* produces various secondary metabolites with bioactivities such as anti-bacteria, antioxidant, cytotoxic and antivirus. The primary metabolite produced by *Sargassum* is alginate. Sedayu *et al.*, (2014) explains that *Ulva* contains cytokinin that plays important role in the plant growth especially to support cell division. Cytokinin is also proven to improve the land-plant resistance to severe environment. According to Basmal (2009), *Turbinaria* can be used as biological fertilizer or biofertilizer because it is rich with growth booster substance (ZPT) such as auxsin, cytokinin and gibberellin, and abisat acids, as well as ethylene.

Growth hormone content in *Sargassum*, *Ulva* and *Turbinaria* can be utilized to increase the growth of *Eucheuma cottoni*. It can be used to cope with the problems in *Eucheuma cottonii* cultivation such as poor quality of seeds, decreasing growth, decreasing production and diseases. Thus, the objective of this study was to identify the influence of the immersing *E. cotonii* in macroalgae extract on the growth of *E. cottonii*.

Materials and Methods

The study was conducted in May-September 2016 at Ekas Bay, Ekas Buana Village, Jerowaru District East Lombok, West Nusa Tenggara Province, Indonesia.

Preparation of marine plant extract

The extracts of *Sargassum*, *Ulva* and *Turbinaria* were made by mashing all parts of the plants using grinder or blender to make them to become smooth. Then, sea water was added in 1:1 ratio. The solution was then diluted by using sea water to reach 5% concentration.

Preparation of Eucheuma cottonii seed

The cultivation of *Eucheuma cottonii* was carried out in 8 m x 8 m size of floating raft made from bamboo. The *Eucheuma cottonii* seed with average weight of 100 g was tied in ris rope by 25 cm space between the ropes. Each unit of the bamboo raft consisted of 15 ropes. The seed tied in the rope was immersed in the marine plant extract solvent. The duration of immersion is 2 hours. Immersed seed of *E. cottonii* was then cultivated on the bamboo raft.

Research Design

This study used the Complete Random Design that consisted of 3 treatments with 5 repetitions.

- P0 : without extract (control)
- P1 : Sargassum Extract
- P2 : Ulva Extract

P3 : *Turbinaria* Extract

Research Parameters

Observed parameters included the absolute growth of Eucheuma Cottonii, Specific Growth Rate of Eucheuma cottonii and water quality.

Absolute Growth

According to Dawes (1994) in Yudasmara (2014), the absolute growth is measure under the following formula :

Where :

G = Average Absolute Growth (g);

 W_t = weight of the seed at the end of the research (g);

 $G = W_t - W_0$

 W_0 = weight of the seed at the beginning of the research (g).

Specific Growth Rate

According to Nelson *et al.* (1980) in Yudasmara (2014), the specific growth can be calculated under the following formula :

$$LPS = \frac{Ln Wt - Ln Wo}{t} X 100 \%$$

Where :

LPS = specific growth rate (% per day);

Wt = weight at t (weight at 45 days) (g);

W0 = initial weight (g);

t = observation period (days).

Water quality

Measured water quality parameters consisted of temperature,water current speed, depth, salinity, clearness, dissolved oxygen (DO), and acidity level (pH).

Statistical analysis

Data of *Eucheuma cottonii* growth was tabulated by using Microsoft excel. Then, Spesific growth rate and absolute growth rate was analyzed by using ANOVA (Analysis of Variance) and continued with advanced test of BNT (smallest significant difference) when there was significant influence (significant difference) of every treatment.

Result and Discussion

Based on the result of ANOVA analysis, given with *Sargassum*, *Ulva* and *Turbinaria* extracts, it showed significant influence to the absolute and specific growth of *Eucheuma cottonii* as presented on Table 1.

Table 1. The Growth Performance of Eucheumacottoniiby immersing in several macroalgae extract.

Extract	Absolute	Specific Growth			
Exilaci	Growth (g)	(%)			
Control	235.42 ^a	3.16 ^a			
<i>Ulva</i> sp.	341.75 ^b	5.4005 ^b			
Sargassum	270.733 ^a	3.4285 ^a			
Turbinaria	249.3 ^a	3.332 ^a			

Ulva sp. extract could give higher absolute growth and specific growth than Sargassum and Turbinaria. Ulva sp. extracts is a macro algae with cytokinin, auxin and Giberlin. Taiz and Zeiger (1991) explains that Cytokinin in plants can be from two sources: from the plant itself (endogenous cytokinin) which plays important role in the plant growth especially to support cell division; and from exogenous cytokinin which is intentionally given to the plant due to its capability to improve the plant resistance in poor environment. Sedayu et al. (2014) mentions that the content of cytokinin in several types of green algae such as Ulva pertusa, Enteromopha compressa, and Monostroma sp. are around 0.02–0.45 ppm.

The immersion of *Eucheuma cottonii* by using the *Sargassum* and *Turbinaria* extracts did not show significant difference either in the absolute growth or specific growth. *Sargassum aquifolium* is the brown algae living in coral reefs. According to Adhi *et al.* (2016), color pigment is found in *Sargassum* consisted of

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chlorophyll a, chlorophyll c, β -carotene, and fukosantin. The brown color in Sargassum is due to the domination of fukosantin pigment to other pigments as the main component in Sargassum that can increase the growth rate such as the growth hormones. However, there has not been any previous study on the growth hormone content in Sargassum. It can produce secondary metabolite due to the activities of anti-bacteria, anti-fungus, antioxidant, cytotoxic and enzyme inhibitor. Antioxidant is a compound preventing the oxidation process due to its reactive oxygen and free radicals. Meanwhile, cytotoxic is a compound that can hamper or even kill certain cells. Thus, the result of secondary metabolite was absorbed by K. alvarezii that thallus would be healthier to support the optimum growth.

Turbinaria has not been commonly utilized by the people of Indonesia. In Filipina, it has been used as food ingredient such as soup. The addition of *Turbinaria* sp. extract can improve the growth of *Eucheuma cottonii* but not as significant as the additions of *Ulva* sp. extract that there has not been any previous study on it. Aslan (1998) explains that *Turbinaria* sp. has alginate iodine content. Truus *et al.* (2001) in Wibowo *et al.* (2011) explains that alginate is found in the cell wall of brown seaweed in the form of crystals in parallel composition on the cellulose fine threads and cell fluid. *Turbinaria* sp. has alginate content which is one of the polysaccharide groups established in the brown seaweed with 40% content of the dried weight and played important role in sustaining the cell network structure. Chemically, alginate is a long linear polymer composed from two units of monomeric, which are β -D-mannuronat acid and α -Lguluronat acid.

Water quality is a factor supporting the growth of *Eucheuma cottonii*, however in this study, the parameter value of water quality tended to be stable and suitable to the required condition for the cultivation of *Eucheuma cottonii*. The following is the result of water quality observation:

Parameter	Observation week number					Requirement for seaweed cultivation	
	1	2	3	4	5	6	(Kepmen No. 1/MENKLH/2004)
Temperature (°C)	30.4	32.6	31.5	29.6	30.4	32.4	27-30
DO (mg/L)	7.29	5.84	7.29	7.29	7.29	5.84	▶ 4
Salinity (ppt)	29	32	34	30	32	29	28-34
pH	7	7.2	7.1	8.1	7.3	7.4	6.5-8.5
clearness (m)	3.8	4.1	3.5	3.8	3.8	4.1	>5
current (cm/second)	33.33	30.55	30.33	40	30.55	35.00	20-30

Table 2. Water quality at the command area

The parameter value of water quality in overall was suitable to the required value for seaweeds cultivation. The temperature ranged between 29.6°C and 32.6°C. Such temperature was higher than the requirement for cultivation. Further more, temperature range for maintenance photosynthetic activity of *Kappaphycus* sp. was 22–33 °C (Lideman et al., 2013), so, the temperature in cultivation area was in ranged for maintenance photosynthetic activity of Eucheuma denticulatum and *Kappapycus* sp. When this study took pace, the air was quite hot and during dry season. Temperature is related to the seaweed metabolism. When the temperature was too high, thallus would become white and broken. Temperature has direct impact to the plant physiological process or indirect effect to the surrounding environment. Clearness ranged between 3.8 m to 4.1.m. Water was slightly dirtier

due the clay mixture. Such condition consequently prevented sunlight penetration and covered the plant surface that would cause thallus and holdfast become fragile and holfast.

The current range can be classified as higher, which was 30.33 to 40 cm/second, than the requirement for cultivation. *Eucheuma cottonii* would have maximum growth within the moving water (current). Water movement was useful for cleaning thallus, generating new nutrient, removing the metabolism residue, helping oxygen diffusion to the waters, stimulating growth through hydraulic force and preventing significant water temperature fluctuation. Salinity ranged between 29 ppt to 34 ppt. *Eucheuma cottonii* relatively could not resist wide range of salinity. The maximum growth of *Eucheuma cottonii* reached within the salinity tended to approach sea salinity which was 32-35 ppt. In order to obtain the salinity, it is suggested that the location cultivation not to be near to river estuary or other freshwater source.

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Conclussion

E. cottonii immersed in macroalgae extract has effect on its growth and *Ulva sp* extract can provide higher absolute growth and higher spesific growth.

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