E-ISSN 2477-6939 P-ISSN 0216-0749
AQUACULTURA INDONESIANA
An International Journal of Indonesian Aquaculture Society

Substrate Manipulation in Controlled Rearing to Increase The Growth and Survival Rate of Sand Sea Cucumber *Holothuria scabra* Jaeger

Hartinah[1], Ahmad Ghufron Mustofa*[1], Nawawi[1], Yani Narayani[1], Muh. Fahmi Attariq[2] and Warah[2].

[1]*Lecturer of Aquaculture Department, Pangkep State Polytechnic of Agriculture, South Sulawesi,*
[2]*student of Aquaculture Department, Pangkep State Polytechnic of Agriculture, South Sulawesi*

Received: January 6, 2023; Accepted: April 8, 2023

Abstract

The cultivation of the sea cucumber *Holothuria scabra* Jaeger for broodstock and production in captivity at sea with naturally available feed showed that the daily growth rate was slow at 0.14 0.10g day-1. One of the efforts to increase growth is substrate manipulation. Organic material in the form of chicken manure has been applied in this study as a mixed substrate with sand at different percentages. This study used a completely randomized design (CRD) at a 95% confidence level. The research treatments consisted of treatment A (10% organic matter 80% sand), treatment B (20% organic matter 80% sand), treatment C (30% organic matter) 90% sand), D (without organic matter = 100% sand) (100% sand), each treatment was repeated three times. The results showed that the availability of organic matter in the form of chicken manure at different percentages in the sand substrate significantly affected growth (P 0.05), but was not significantly different from the survival rate of sand sea cucumbers. Furthermore, it is known that treatment B (20% percentage of organic matter in the form of chicken manure and 80% sand) per substrate weight has a better effect on growth compared to other treatments.

Keywords: *Holothuria scabra*, nutrition, growth, and survival rate.

Introduction

Sea cucumber production is still caught from the sea (Martoyo et al., 19; Rahantoknam et al., 2021). Furthermore, it is reported that the exploitation is not controlled, so it is feared that it will not guarantee the continuity of the existence of the sand sea cucumber population in the sea. Cultivation is one of the alternatives for the provision of sand sea cucumbers. sand sea cucumber cultivation in Indonesia, including in South Sulawesi is still an enlargement business, the seeds are collected from the sea. The enlargement of sea cucumbers still depends on natural conditions, so it takes 5 - 8 months to reach the consumption size. Furthermore, Jasmadi (2018) reported that the daily growth rate of sea cucumbers was slow at 0.14 0.10g day-1. One of the efforts to trigger the growth of sea cucumbers is by manipulating the substrate. Substrate composition of organic matter is suspected to be related to the growth of sea cucumbers because according to Sutaman (1993), the main food of sand sea cucumbers is detritus, and as additional/complementary food are phytoplankton and zooplankton. Chicken manure is one of the organic materials besides being consumed directly by the sea cucumbers as the main food, it is also expected to grow plankton and bacteria as complementary foods for sand sea cucumbers.

*Corresponding Author: aghufronm@gmail.com

Research Methods

Research Design

This research was implemented using a completely randomized design (CRD), based on Steel, R.G.D. and J.H., Torrie (1980), with four treatments, each consisting of 3 replications. The treatments that were tried were as follows:

- Treatment A = Chicken manure 10% + 90% sand
- Treatment B = 20 % chicken manure + 80 % sand
- Treatment C = Chicken Manure 30% + 70% Sand
- Treatment D = 100% sand.

Research Time and Implementation

The research was carried out for 4 months (mid-May to mid-August) in 2022. The rearing container has a volume of 60 liters with a base surface area of 34 cm. The container is immersed in an iron frame tarpaulin pool with a diameter of 6 meters until it sinks and the remaining 10 cm above the water surface. Each container is aerated. The average weight of sand sea cucumbers is 30 g/individual, as many as 72 sand sea cucumbers with a density of 24 sand sea cucumbers / m^2. Prior to stocking, the sea cucumbers were adapted to the environment and fed in styrofoam containers for 4 hours.

Feed preparation: feed before being given is made in the form of a paste and immersed in the substrate according to a dose of 5% of the biomass. After the spread of the aeration went smoothly and the surface of the plastic tub was covered with blue plastic

The observed variables include:

- he specific growth rate is calculated based on the formula recommended by Zonneveld et al., (1991) and
- he survival rate is determined based on the formula recommended by Effendi (1979).
- As supporting data, analysis of nutrient content (protein, fat, and carbohydrates), substrate organic matter, feed, and water microbial content was also carried out, and several water quality parameters (salinity, temperature, pH, and ammonia).

Results and Discussion

Results

The data on the results of monitoring the main and supporting variables are presented in Table 1. Table 2, Table 3, and Table 4 for Growth and Survival Rate.

Table 1. Average Absolute Growth (grams) of Sand Sea Cucumbers During Experiments at Different Treatments

replication	Absolute Growth Repeat (grams) at Different Treatments			
	A (chicken manure 10 % +90 % sand)	B (chicken manure 20 % +80 % sand)	C (chicken manure 30 % +70 % sand)	D 100 % sand
1	35	50	15	20
2	40	55	10	20
3	40	55	10	20
Average	38.33±2.89[b]	53.33±2.89[a]	11.66±2.89[d]	20±0.00[c]

Description:
Different letter notation indicates that the treatment gives a significantly different response at the level of 0.05.

All treatments had a significantly response, treatment B has a better respons than the other treatments.

Table 2. Specific Growth Rate (%) Average Test Sea Cucumber During Research at Different Treatments

Observation Day	LPS (%) on Different Treatment			
	A (chicken manure 10 % +90 % sand)	B (chicken manure 20 % +80 % sand)	C (chicken manure 30 % +70 % sand)	D (100 % sand)
10	3.662[b]	5.426[a]	0.514[d]	1.542[c]
20	1.764[b]	2,783[a]	0.000d	1.335[c]
30	1.772[a]	0,939[d]	1.472[b]	1.178[c]
40	1.027[a]	1.064[a]	1.283[a]	1.054a

© Copyright by Indonesian Aquaculture Society 2023

Description:
Different letter notation indicates that the treatment gives a significantly different response at the level of 0.05.
During monitoring

All treatments had a significant effect on LPS until day 30, but were not significantly different until day 40.

Table 3. Substrate Nutrient Content % Dry Weight), Total Microbial Water (Cell/ml) and Substrate Organic Matter (%/gram) in Each Treatment

Treatments	Nutrient Content (% Dry weight)			Microbial count	Organic Ingredients (%/gram)	
	Lipid	Protein	Karbohidrat	(Cell/ml water)	Beginning	end
A B C D	0.29	1.00	6.13	25 X 10^6	2.933	1.963
	0.46	1.9	7.55	55 X 10^6	4.445	3.215
	0.94	1.67	7.9	75 X 10^6	5.744	4.875
	0.02	0,92	5.44	1.5X 10^6	1.973	1.022

Description:
Results of Analysis at the Laboratory of Nutrition and Chemistry, Department of Fisheries Cultivation and Microbiology Laboratory, Department of Fishery Products Processing Technology, Politani Pangkep.

Table 4. Commercial Feed Nutrient Content (% Dry Weight), in Each Treatment

Treatment	Nutrient Content (% Dry weight)		
	Lipid	Protein	Karbohidrat
A	0.29	1.00	6.13
B	0.46	1.9	7.55
C	0.94	1.67	7.9
D	0.02	0,92	5.44

Description:
Results of Analysis at the Laboratory of Nutrition and Chemistry, Department of Fisheries Cultivation, POLITANI Pangkep

Table 5. Survival Rate (%) Average Test Sea Cucumber During Research at Different Treatments

replication	Survival Rate (%) at Different Treatments			
	A (chicken manure 10 % +90 % sand)	B (chicken manure 20 % +80 % sand)	C (chicken manure 30 % +70 % sand)	D 100 % sand
1	100	100	100	100
2	100	100	100	100
3	100	100	100	100
Rataan	100±0.00[a]	100±0.00[a]	100±0.00[a]	100±0.00[a]

Note:
The same letter notation in each treatment indicates that the treatment does not give a significantly different response at the 0.05 level.

All treatment does not significantly different response on survival rate

Discussion

Based on the absolute weight growth data of sea cucumbers after being reared for 40 days (Table 1), it is known that treatment B (20% chicken manure + 80% sand) gave higher growth than other treatments (treatments A, C and D). Furthermore, based on the results of the SPPS version 27 analysis of the four treatments tested, there was a significant difference at the 0.05 level. This shows that the maintenance of sea cucumbers on different substrates can affect the growth of the absolute weight of sea cucumbers, this fact can be understoodbecause the different levels of the combination of chicken manure and sand as a rearing substrate cause the conditions of the live media of sand sea cucumbers in each treatment to be different,

© *Copyright by Indonesian Aquaculture Society 2023*

especially the content of organic matter, content of Substrate nutrition, and water microbial content are as shown in Table 5. Substrate in the form of a mixture of sand and organic matter in treatment B (20% organic matter in the form of chicken manure and 80% sand) had a better effect on the absolute weight growth of sand sea cucumbers. Manipulation of the substrate with organic matter content in the form of chicken manure plays a role in supplying nutrients and stimulating the growth of natural food which is a complementary feed for sea cucumbers.

The natural food for sea cucumbers is plankton or bacteria (Sutaman, 1993). In fact, the manipulation of the substrate directly affects the absolute weight growth because sea cucumbers utilize organic matter, bacteria, and plankton as a source of nutrients to support growth. This was presumed because it was evident that too little organic matter as in treatments A and D or too much (treatment C) had a negative effect on growth. The content of organic matter is too much so the water of the maintenance media becomes cloudy interferes with light penetration and has a negative effect on microbes and other natural feeds. Too little organic matter (treatment

The nutritional content of chicken manure is sufficient for growth because it contains protein, fat and crude fiber, respectively 28.7%, 1.7%, and 14.9% (Allen et al., in Simanjuntak and Waluyo, 1982). Yusnaini et al., (1999) reported that sea cucumbers consume the types of food that are around them, then they are digested and absorbed by the intestines before biosynthesis (growth) occurs. Animal waste decomposes in the water so that it stimulates the formation of single proteins such as bacteria and plankton which are used by sea cucumbers as food (Litchfield, 1982).

The high absolute weight growth in treatment B (20% chicken manure and 80% sand) was thought to be because the combination level was sufficient and able to meet the needs of sea cucumbers both in quantity and quality to live and grow optimally. This is presumably because if the substrate organic matter, substrate nutrient content, and water microbial content were increased as seen in treatment C, or reduced in treatment A, the absolute growth of the tested sea cucumbers decreased.

The low absolute growth of the tested sea cucumbers in treatment C (30% chicken manure + 70% sand), even lower than treatment D (100% sand) was thought to be due to a protein deamination process because excess protein in feed can reduce growth because a lot of energy is needed to remove the residual nitrogen metabolism from the excess protein, so that the protein obtained is not used efficiently to produce meat but is converted into energy (Halver, 1972).

The specific growth rate of test sea cucumbers on days 10 to 20 decreased in all treatments. In treatment B the specific growth rate of the tested sea cucumbers increased faster than other treatments, but the specific growth rate in all treatments decreased again on days 30 to 40. This was closely related to the depletion of organic matter content, substrate nutrient content, and water microbial content. due to the process of changing the water which is carried out every day as much as 50%, so it is possible that little by little organic material is wasted. This fact indicates that the condition of the organic matter until day 40 is considered the same because it produces a specific growth rate that is not significantly different from the treatments being tested. This is also reinforced by the data that all the treatments tried tended to decrease until the end of the experiment (40 days). Therefore, it is necessary to rehabilitate the substrate whose period needs further investigation.

Each treatment did not show any dead sea cucumbers. This indicates that the difference in the maintenance substrate did not cause the sea cucumbers to die, thus causing differences in the survival rate of the tested sea cucumbers. A caused the availability of nutrients to be less supportive of the growth of sea cucumbers

Conclusions and Recommendations

Conclusion

1. The combination of chicken manure and sand as a substrate at different levels had a very significant effect on growth but was not significantly different on the survival rate of the tested sea cucumbers.
2. Based on absolute growth and specific growth rate of test sea cucumbers, it was found that treatment B (20% chicken manure + 80% sand) gave a better effect than treatment A (10% chicken manure + 90% sand), treatment C (30% manure) chicken +

© Copyright by Indonesian Aquaculture Society 2023

70% sand) and treatment D (100% sand).

Suggestion

1. To facilitate the management of feeding and shorten the maintenance period of 30 gram sand sea cucumbers, it is recommended in controlled maintenance to use a rearing media substrate consisting of 15% chicken manure and 85% sand.
2. Due to the indication of a decrease in the specific growth rate of the tested sea cucumbers from the beginning to the end of this experiment, it is recommended for further experiments regarding the substrate rehabilitation period. In addition, it is also necessary to investigate the use of other types of organic materials, to avoid dependence on one type of organic material (chicken manure).

Acknowledgement

The authors would like to thank the Director and Chairperson of PPPM Politani Pangkep, for the PNBP funds that have been disbursed, to the manager of the Nutrition and Chemistry Laboratory of the Aquaculture Fisheries Department who has assisted in collecting data on the nutrient content of substrates and commercial feed, so that this research can be carried out.

References

David. J.M., Mills, D.J., N.D.Q. Duy, Marie A. J-M, C.M. Raison and J.M. Zarate· 2012, Overview of sea cucumber aquaculture and sea-ranching research in the South-East Asian region. https://www.researchgate.net/publication/265360339

Effendie, I., 1979. Biologi Perikanan. Fakultas Perikanan IPB.

Eriksson,H, G. Robinson, M.J. Slater, and M. Troell. 2012. Sea Cucumber Aquaculture in the Western Indian Ocean: Challenges for Sustainable Livelihood and Stock Improvement. 10.1007/s13280-011-0195-8, PMCID: PMC3357833, PMID: 22083524

Halver, J.E., 1972. Fish Nutrition. Academic Press, New York London. Amerika Serikat. Jasmadi, 2018.Pertumbuhan dan aspek Biologi Teripang Pasir *Holthuria scabra* pada

Karamba Jaring Tancap di Perairan Lairngangas Maluku Tenggara. Jurnal Ilmu dan Teknologi Kelautan Tropis. Vol:10:2:317-331. ISSN cetak2087-9423, E- Elektonik :2620-309X. DOI:http//dx.doi/10.29244/jitkt.v10i2.24047.

Litchfield, J.H. 1982. Meat, Fish and Poultry Processing Waste. J.Water Pllut. Control-Fed. Martoyo,J.N, Aji dan Winanto.T. 1994. Budidaya Teripang. Penebar Swadaya Jakarta.

Rahantoknam, T.S.P., M.Y.Baruyatmaan, Rahantoknam, M.A., M.K.Oholwutuan., 2021. Pemberdayaan Masyarakat dalam Budidaya teripang (*Holothuria scabra*). Politeknik Negeri Tual, Maluku Utara. Jasintek Vol.2:2:121-125.ISSN 2721-107X:EISSN 2721- 1061.

Simanjuntak dan Waluyo. 1982. Cacing Tanah. Budidaya dan Pemanfaatannya. Penebar Swadaya. Jakarta.

Steel, R.G.D. and J.H., Torrie. 1980. Principle and Procedure of Statistics, Abiometrical Approach. Second Edition. Kagoguso Ltd, Tokyo.

Sutaman. 1993. Petunjuk Praktis Budidaya Teripang. Kanisius Yogyakarta.

Yusnaini, Pangerang U.K. dan Ramli. 1999. Teknik Budidaya Teripang Pasir Holothuria Scabra Jaeger dengan Pemanfaatan Kotoran Hewan dan Tepung Ikan sebagai Pakan. Lembaga Penelitian UNHALU Bekerjasama dengan Proyek Pembinaan Kelembagan Penelitian dan pengembangan Pertanian/ARMP-II Kendari. Sulawesi Tenggara.

Zonneveld, N., E.A. Huisman dan J.H. Boon. 1991. Prinsip-Prinsip Budidaya Ikan. Gramedia Jakarta. Jakarta.

© Copyright by Indonesian Aquaculture Society 2023