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Application of organic fertilizer originated from pond waste for white shrimp (*Litopenaeus vannamei*) grow-out in the extensive system

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Abstract. This study aims to evaluate the growth of natural feed, growth, survival rate, and production of white shrimp culture in an extensive system. A total of 9 ponds of 500 m^2 were used as research containers. This study used a CRD with 3 treatments each with 3 replications. The treatments tried were: A = pond solid waste as organic fertilizer (2000 kg/ha) + Urea (100 kg/ha) + SP 36 (100 kg/ha), B = KCP PLUS + Urea (100 kg/ha) + SP 36 (100 kg/ha) and C= KM+Urea (100 kg/ha) + SP 36 (100 kg/ha). The test animals' average weight of 0.027 g/ind, stocked at a density of 4 ind/m^2. Supplementary fertilizer was given 10% of the initial dose and given every week. The results showed that the application of pond solid waste organic fertilizer gave a relatively similar response to the use of other commercial fertilizers on the growth of white shrimp. The survival and shrimp production significantly differed from other treatments. The abundance of individual phytoplankton ranging from 565-2588 ind/L and zooplankton ranges from 523-652 ind/L. The plankton diversity index (H') ranges from 1.47-2.12, the uniformity index (E) ranges from 0.52-0.83, and the dominance index (D) ranges from 0.16-0.38.

1 Introduction

Since 2011, super-intensive shrimp farming in ponds of 1000 m^2 with a stocking density of 312-1000 individuals/m^2 [1], stocking density of 658-1602 individuals/m^2 [2], and shrimp farming in concrete ponds of 1000 m^2 with a density of 500-1250 individuals/m^2 [3, 4]. have been developed in Indonesia. This technology has been shown to boost shrimp production; nevertheless, the waste load generated as a byproduct of aquaculture activities has ramifications for aquatic environmental environments. One of the causes of the decline in the quality of the aquatic environment is the dumping of aquaculture waste during operations, which comprises high concentrations of organic matter and nutrients as a result of the

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operations [5].Shrimp pond sediments include a high concentration of nutrients, including 0.67% total N, 4.78% P2O5, 1% K2O, 17.84% Organic C, 6.25 pH, and 15.06% moisture [6]. Shrimp pond solid waste comprises 1.92% organic carbon, 54% total nitrogen, and 1.70% phosphorus [7]. The value of sediment fertilizer from one hectare of tilapia fish production ponds is equivalent to 6.26 tonnes of urea and 1.96 tonnes of TSP; these nutrients have the ability to improve soil quality so that pond trash can be composted and utilized as organic fertilizer [8].

Fertilization, in theory, is the addition of nutrients required by aquatic plants in order to promote the production of natural food, fish, or shrimp; the fertilizers employed are typically inorganic fertilizers like as urea and TSP, or organic fertilizers such as bran and chicken farm waste [9]. Organic and inorganic fertilizers each have advantages and disadvantages, but when used together, they can complement each other. For example, the use of organic fertilizers can increase the activity of microorganisms in the soil, increase organic matter, and increase anion and cation activity, all of which can improve soil quality [10].

In aquaculture activities for both shrimp and fish, fertilization is vital in producing natural food sources such as plankton and dissolved oxygen in water via phytoplankton [11]. Urea, TSP, and organic fertilizers are examples of pond fertilizers. The use of these fertilizers aims to fertilize the soil so that it is suitable for use and contains essential minerals and the main organic acids for the growth of natural feed to support the growth of shrimp and fish. [12].

From the description above, research on the application of pond waste organic fertilizer for growing white shrimp in extensive ponds aims to obtain information about the use of pond waste organic fertilizer for growing white shrimp in ponds while at the same time supporting the development of sustainable aquaculture.

2 Materials and methods of research

The research was carried out in South Sulawesi, Indonesia, at the Research Institute for Brackish water Aquaculture and Fisheries Extension (RIBAFE), Maros Regency.

A total of 9 ponds of 500 m^2 were used as research containers. This study used a completely randomized design (CRD) with 3 treatments each with 3 replications. The treatments tried were: A = pond solid waste as organic fertilizer "POLTASI" (2000 kg/ha) + Urea (100 kg/ha) + SP 36 (100 kg/ha), B = commercial organic fertilizer “KCP PLUS" + Urea (100 kg/ha) + SP 36 (100 kg/ha) and C=Commercial organic fertilizer “KM” + Urea (100 kg/ha) + SP 36 (100 kg/ha) [13], [14].

Preparation of the trial ponds included draining the subgrade to cracks, removal of silt, eradication of pests, liming of the subgrade, and installation of water filters for both incoming and outgoing water. After the pond is completely ready, basic fertilizer is applied according to the treatment and filled with brackish water as high as 50 cm. During the process of growing natural food, the water level is raised to 60 cm [15], [16], then adding water gradually until reaches a depth of 60-70 cm. After the process of growing the natural feed lasted for 3 weeks, then the stocking of the juvenile size white shrimp with average weight was 0.027 g/ind. The stocking density was 4 individuals/m^2 or 40,000 individuals/ha. During the maintenance, no artificial feed was given, only 10% follow-up fertilization of the initial dose was applied every 15 days starting in the second month after stocking. This research lasted for 75 days of maintenance.

The observed variables included the growth, survival rates and production of white shrimp, the species composition and abundance of plankton, as well as biological index such as the plankton diversity index (H'), the uniformity index (E), and the dominance index (D)

[17,18]. Plankton identification was done out to the genus level using the books [19, 20]. he abundance of plankton was determined using a microscope and the Sedgwick rafter counter cell with APHA formula and water quality, including temperature, dissolved oxygen, salinity, pH, alkalinity, TAN, NO_2, NO_3, PO_4 and TOM.

The data on white shrimp growth and survival rate were investigated using analysis of variance (ANOVA) with the SPSS program version 21.00, followed by a Tukey test with a 95% level of confidence. Plankton composition and abundance, biological indices such as the plankton diversity index (H'), uniformity index (E), and dominance index (D), and water quality data were all descriptively evaluated.

3 Results

The growth of white shrimp obtained for 75 days of rearing in ponds increased in line with the rearing time. Shrimp growth performance from three different treatments can be seen in Figure 1.

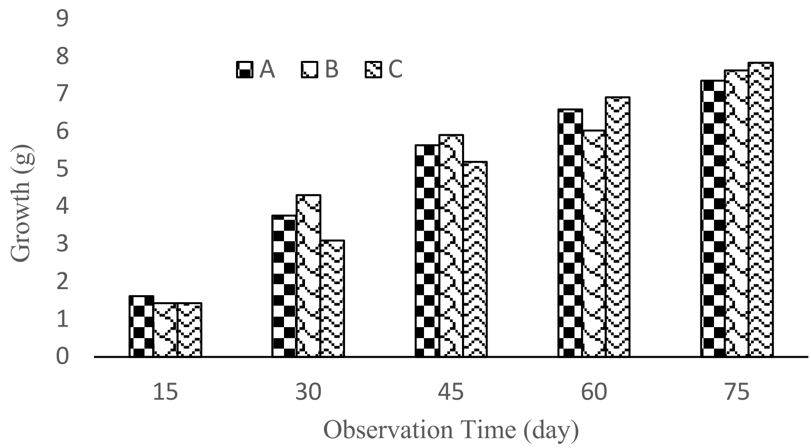

Fig. 1. Growth performance of white shrimp during the 75-day rearing period in extensive pond

The growth chart above shows that the growth of the white shrimp obtained increases along with the length of maintenance. Based on the graph above, in the first sampling, the growth of shrimp in treatment A was higher than that of the other treatments and tended to increase along with the length of time they were reared. We can also see an increase in growth in treatment C along with the length of maintenance, but the growth value is lower when compared to treatments A and B in the first to third sampling and has a higher growth value compared to the other treatments in the fourth sampling. Even though the shrimp growth value in treatment B was higher than the other treatments in the second and third samplings, in the fourth sampling there was a decrease in weight of 0.11 g. Statistical test results showed that the growth of the final weight of the shrimp did not show a significantly effect (P>0.05) between the treatments tested. This means that shrimp pond solid waste that has been processed into organic fertilizer has a quality value that is no different from other commercial organic fertilizers. Data on the average final shrimp weight growth for 75 days of rearing presented in Table 1

Table 1. Growth performance of white shrimp (*L. vannamei*), survival rate and production for 75 days of rearing periods

Variable	Treatment		
	A	**B**	**C**
Pond size (m^2)	500	500	500
Stocking density (ind/pond)	2000	2000	2000
Rearing period (days)	75	75	75
Initial weight (g)	0.027±0.008	0.027±0.008	0.027±0,008
Final weight (g)	7.36±2.03^a	7.62±2.45^a	7.84±1.89^a
Absolute wight (g)	7.333±2.03^a	7.593±2.45^a	7.813±1.89^a
Spesific growth rate (%)	9.34±0.01^a	9.40±0.02^a	9.45±0.01^a
Survival rate (%)	17.63±0.38^a	5.33±0.19^c	12.74±0.10^b
Production (g)	7830±6.65^a	886±583.3^c	2000±871.7^b

The increase in white shrimp biomass obtained from each treatment A = 7.33 g, treatment B = 7.59 g and treatment C = 7.81 g for 75 days of maintenance. The growth rate obtained in this study averaged 9.34% -9.45%. The growth rate value of white shrimp obtained in this study not significant when compared to the results of research by [21] who obtained the daily growth rate of white shrimp in traditional plus rearing with densities of 4, 6 and 8 fish, respectively 9.23; 9.19 and 9.05%/day. Daily growth rate of white shrimp ranging from 9.48-9.52%/day for 100 days of maintenance [22]. When compared again with the results obtained by [23] who obtained a daily growth rate of simple white shrimp for 60 days of rearing of 14%/day, This study's growth rate of white shrimp was likewise rated as lower. The difference in specific growth rate of white shrimp obtained between the research results and some previous research results is due to differences in final weight obtained, which is strongly related to differences in research containers (ponds), container area, length of cultivation, level of technology, stocking density used, and response to feed used during rearing.

The survival rates of white shrimp obtained at the end of the study were plot A of 17.63%, plot B of 5.33% and plot C of 12.74%. The survival rate of the shrimp obtained in this study was low, this was due to the research activities being attacked by WSSV (*White Spot Syndrome Virus*) at the age of 50-60 days resulting in mass mortality as shown in the bacterial sampling data in soil and water media (Table 3 and Table 4). Several factors, including abiotic and biotic factors, can affect survival in white shrimp culture during maintenance. Abiotic variables include the physical and chemical properties of water in awater, which is also known as the water quality factor. Good water quality allows physiological processes in the shrimp's body to function properly, promoting shrimp development and survival [24].

Production is the resultant of shrimp growth and survival obtained at the end of the study. Shrimp production obtained in this study is presented in Table 2. Based on the table above it appears that white shrimp production was obtained in the ponds of treatment A = 7830 g then treatment B = 886 g and treatment C = 2000 g. The low production value obtained in this study was caused by research activities being attacked by WSSV at the age of 57 days of maintenance. Decreased production in shrimp farming can be caused by various causes, one of which is the death of shrimp caused by *Vibrio* sp. or by viruses (*White Spote Baculo Virus*, *White Spote Syndrome Virus*, *Yellow Head Virus*, and *Hepato Pancreatic parvo-like Virus*) and various other cause [25].

Differences in the use of fertilizers in each treatment will provide different amounts and types of plankton. are microscopic organisms that live in the waters. These organisms provide a vital role, one of which is as a natural food source for other species living at a higher trophic level in water. Plankton is classified into two major groups: phytoplankton and zooplankton [26]. Composition and number of species and plankton diversity index values for 75 days of shrimp rearing. Based on the composition of plankton species, were obtained compared to zooplankton which were only obtained (7 species). The composition of plankton species in each treatment is presented in Table 2.

Table 2. Species composition and abundance (ind/L) of plankton in extensive pond

Plankton type	Treatment		
	A	B	C
Phytoplankton			
-*Navicula* sp.	38	42	72
-*Oscillatoria* sp.	50	1852	65
-*Coscinodescus* sp.	5	3	0
-*Nitzchia* sp.	7	21	29
-*Chaetoceros* sp.	21	0	0
-*Gyrodinium* sp.	18	37	37
-*Plurosigma* sp.	1	3	4
-*Prorosentrum* sp.	635	407	305
-*Gyrosigma* sp.	9	211	14
- *Melosira* sp.	2	3	0
-*Protoperidium* sp.	30	9	39
Total	816	2588	565
Zooplankton			
-*Copepoda* sp.	211	160	171
-*Brachionus* sp.	139	129	109
-*Tartanus* sp.	0	15	20
-*Euplotes* sp.	169	5	0
-*Acartia* sp.	34	31	37
-*Apocyclops* sp.	98	182	187
-*Tintinopsis* sp.	1	1	0
Total	652	523	524

Based on the number of individuals of each species, it appears that the phytoplankton in each treatment is rather small (Table 2). This is because phytoplankton are preyed upon by zooplankton on the water's surface during the photosynthesis process. The abundance of phytoplankton and zooplankton obtained in each treatment did not have a positive correlation with the weight and growth rate of the white shrimp obtained; this was most likely due to a combination of factors, particularly the shrimp's health, which was known to be infected with diseases that affected the shrimp's appetite and led to death.

The abundance of plankton genera in waters varies depending on the season; some plankton genera are plentiful during the dry season, while others are abundant during the rainy season. Temperature, pH, nutritional content, light, weather, and disease all have an impact on these changes. Fish and zooplankton predation, species competition, and algal toxins [27]. Factors supporting phytoplankton growth are extremely complex and interact with each other between physico-chemical factors such as light intensity, dissolved oxygen, temperature stratification, and the availability of nitrogen and phosphorus nutrients, while biological aspects include animal predation, natural mortality, and decomposition [28]. Temperature, light intensity, salinity, pH, and pollutants in awater all have vital roles in determining the quantity of plankton species. While biotic factors like as feed availability, predator abundance, and the presence of competition can all influence species composition,. [29].

The plankton diversity index provides an overview of pond water conditions on the amount and type of plankton obtained during rearing. The plankton diversity index values obtained for each treatment are presented in Figure 2. In the figure it appears that the highest diversity index values obtained were obtained in treatment C which was 2.1212, followed by treatment A = 1.8568, and the lowest in treatment B = which was 1.5283.

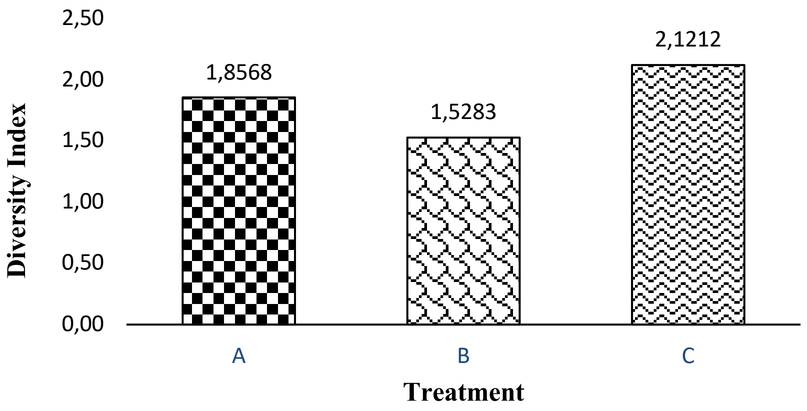

Fig. 2. Plankton Diversity Index obtained for 75 days of rearing in extensive ponds

The variety index values that fluctuate between observations are impacted by water quality parameters such as organic matter, as well as nutrient availability and utilization that differ between individuals [30]. With an H'1-3 value, the plankton diversity index values obtained in each treatment fall into the medium category, moderate distribution, and moderate stability [31]. The condition of the waters at the time of maintenance is revealed by this value. If H' is less than one, the biota community is unstable; if H' is between one and three, the biota community's stability is moderate; and if H' is greater than three, the biota community is stable [18].

The plankton uniformity index shows the distribution conditions and types of plankton obtained in a particular waters. The uniformity index (E) value of the plankton obtained until the end of the study is presented in Figure 3. The highest uniformity index value was obtained in treatment C, namely 0.8038, treatment A 0.6424 and the lowest in treatment B, namely 0.5394. 11 plankton species were discovered based on the results of plankton identification, particularly phytoplankton. According to the results of plankton identification, one of the 11 plankton species dominated the seas, specifically the type of Oscillatoria sp. The results are anticipated to result in a low plankton uniformity index value in treatment B.

The uniformity index (E) of plankton obtained in treatments C and A shows that water conditions can be categorized as high with a value > 0.6 according to the presence of plankton species *Oscillatoria* sp in each observation in treatment B in large quantities which can affect the balance of plankton populations in the community. There is a difference between the diversity (H') and uniformity (E) index values of plankton that varies in a water due to physical and chemical factors of the water as well as the availability of nutrients (phosphate and nitrate) and the utilization of nutrients that are different from each individual as well as the ability to adapt. Each phytoplankton kind adjusts to the current environmental conditions. [32].

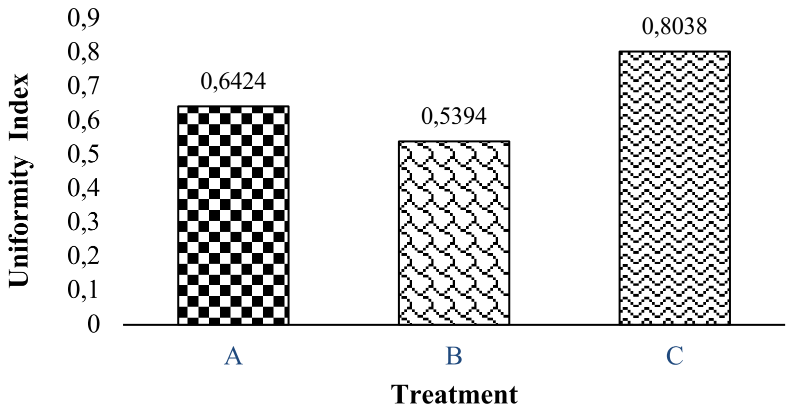

Fig. 3. Plankton uniformity index obtained for 75 days of rearing in extensive ponds

The dominance index (D) of a water illustrates whether or not a specific type or group of plankton dominates the water. The dominance index values (D) obtained in this study were consecutive, namely pond A was 0.237; B = 0.357 and C = 0.157, according [17]. the plankton index value was 0< D <0.5 is included in the low category (good). Thus, based on the plankton dominance index value obtained in this study, it is included in the good category.

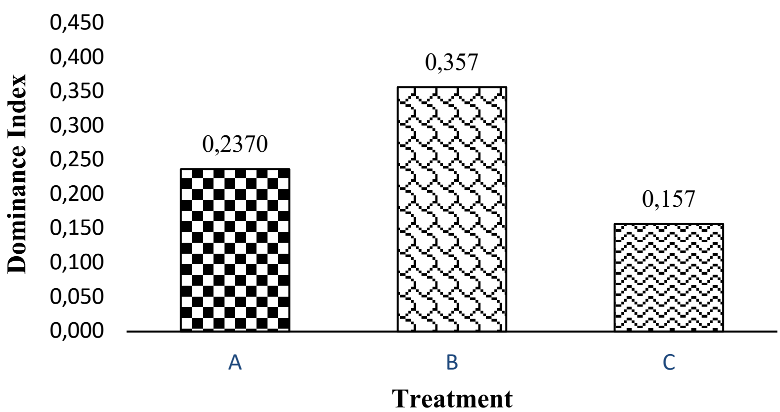

Fig. 4. Plankton dominance index obtained during 75 days of rearing in extensive ponds

Dominance index values close to zero in the community structure suggest that the observed biota lacks a dominant genus. The dominance index value is near to one, indicating that there are genera in the reported biota community structure that dominate other genera in extreme ways. The destruction of natural ecosystems, such as the transformation of mangrove land into ponds or other uses, chemical and other organic pollutants, and climate change are the key variables impacting the quantity of organisms, species homogeneity, and dominance. [18].

Based on the results of observations of bacteriological developments every 15 days, observations showed that total bacteria (CFU/mL) in pond water and inlet tended to increase with increasing rearing time in all treatments. Vibrio bacteria population data from soil samples (Table 3) shows that treatment A bacterial growth from sampling 1 aged 15 days to sampling 3 aged 45 days is included in the safe category for shrimp growth, whereas in the 4th sampling shrimp aged 60 days the TBV/TPC ratio was starting >10, namely A1 = 12%, (TBV 2.15x10^{5} and TPC 3.57x10^{6}), A2 = 10.12% (TBV 1.48x10^{5} and TPC 1.75x10^{6}) and at 75 days the ratio of TBV / TPC treatment A1 and A2 remained in unsafe conditions for shrimp growth, namely 12.5% TBV 1.05x10^{5}, TPC 8.4x10^{5} and 10.12% TBV 1.24x10^{5,}TPC 1.22x10^{6} respectively. Treatment B total bacteria in sampling 4 and 5 also had a TBV and TPC ratio value exceeding the safe value for bacteria (> 10%) while treatment C the results of examining soil bacteria in sampling 4 and 5 also obtained TBV values of 3.91x10^{5} and TPC 1.75x105 so that the value of the ratio of TBV and TPC (> 10) namely C3 value of 15.05% while in sampling 5 the total value of C3 soil bacteria TBV 1.78x10^{5} and TPC 1.18x10^{6}.

Table 3. Total value of Vibrio Bacteria, Total Plate Count and TBV/TPC Ratio in Soil ponds

Pond Code	Sampling I			Sampling II			Sampling III			Sampling IV			Sampling V		
	TBV	TPC	%	TBV	TPC	%	TBV	TPC	%	TBV	TPC	%	TBV	TPC	%
A1	4.04	5.16	7.57	4.57	5.47	12.7	4.70	6.29	2.60	5.34	6.55	12.5	5.02	5.92	12.5
A2	2.90	4.58	2.09	3.94	5.96	0.94	4.32	5.95	2.32	5.17	6.20	10.1	5.09	6.09	10.1
A3	3.10	5.52	0.38	3.42	6.38	0.11	3.82	6.03	0.60	5.42	5.53	2.45	4.51	6.12	2.45
Average	**3.35**	**5.08**	**3.35**	**3.97**	**5.93**	**4.57**	**4.28**	**6.09**	**1.84**	**5.31**	**6.09**	**8.36**	**4.88**	**6.05**	**8.36**
B1	3.65	4.56	4.79	4.52	6.16	2.26	5.02	5.92	12.65	5.12	5.85	10.8	5.16	6.12	10.8
B2	4.23	5.52	5.12	3.84	6.21	0.43	5.06	6.17	7.76	5.06	6.52	9.91	5.05	6.05	9.91
B3	3.34	5.27	1.17	3.68	6.31	0.24	4.03	6.07	0.91	4.46	5.77	2.54	4.41	6.01	2.54
Average	**3.74**	**5.12**	**3.69**	**4.02**	**6.23**	**0.98**	**4.70**	**6.05**	**7.11**	**4.88**	**6.05**	**7.73**	**4.87**	**6.06**	**7.73**
C1	4.11	5.44	4.61	3.91	7.56	0.02	4.73	6.33	2.47	4.50	6.17	6.97	5.07	6.23	6.97
C2	2.81	5.40	0.26	3.55	6.12	0.27	3.61	6.07	0.34	4.12	6.00	2.68	4.41	5.98	2.68
C3	3.49	5.37	1.32	3.83	6.00	0.69	4.64	6.10	3.45	4.59	5.85	15.05	5.25	6.07	15.1
Average	**3.47**	**5.41**	**2.06**	**3.76**	**6.56**	**0.33**	**4.32**	**6.17**	**2.09**	**4.40**	**6.01**	**8.23**	**4.91**	**6.09**	**8.23**

Table 4. Value of Total Vibrio Bacteria, Total Plate Count and and the TBV/TPC Ratio in water during rearing in extensive ponds

Pond Code	Sampling I			Sampling II			Sampling III			Sampling IV			Sampling V		
	TBV	TPC	%	TBV	TPC	%	TBV	TPC	%	TBV	TPC	%	TBV	TPC	%
A1	4.01	5.15	7.27	3.52	5.47	3.43	2.86	4.34	3.30	3.26	4.77	6.11	2.85	4.43	2.60
A2	3.38	5.20	1.51	2.92	5.96	5.50	2.58	3.65	8.44	2.89	4.07	6.66	2.95	4.17	6.05
A3	3.43	5.35	1.20	3.02	6.38	1.91	2.45	4.20	1.81	2.32	4.21	1.28	2.35	3.65	12.5
Average	**3.61**	**5.23**	**3.33**	**3.15**	**5.93**	**3.61**	**2.63**	**4.06**	**4.52**	**2.82**	**4.35**	**4.68**	**2.72**	**4.08**	**7.05**
B1	3.67	5.12	3.56	3.28	6.16	13.0	2.72	4.15	3.73	2.60	3.78	6.58	2.90	5.21	0.48
B2	3.41	4.48	8.64	2.55	6.21	1.99	2.41	4.52	0.77	2.21	4.11	1.25	2.88	6.02	0.07
B3	3.37	4.48	7.80	2.77	6.31	1.04	2.95	4.41	3.46	2.79	5.11	0.48	2.60	4.40	1.56
Average	**3.49**	**4.69**	**6.67**	**2.86**	**6.23**	**5.35**	**2.69**	**4.36**	**2.66**	**2.53**	**4.33**	**2.77**	**2.79**	**5.21**	**0.71**
C1	4.16	4.82	22.3	2.35	7.56	0.93	3.16	4.65	3.25	3.02	4.37	4.52	3.14	4.54	3.97
C2	2.90	4.44	2.34	2.58	6.12	3.51	2.15	4.34	0.65	2.08	3.88	1.60	2.27	4.41	0.72
C3	3.46	4.40	11.4	3.25	6.00	10.5	2.24	3.95	1.94	3.09	3.78	20.4	3.17	4.65	3.32
Average	**3.51**	**4.55**	**12.0**	**2.72**	**6.56**	**4.97**	**2.52**	**4.31**	**1.95**	**2.73**	**4.01**	**8.84**	**2.86**	**4.53**	**2.67**

The results of measuring total bacteria in water were carried out from the first sampling to the fifth sampling as shown in Table 4. In general, the bacterial values for all treatments were still at a safe value for shrimp growth, except for one plot in treatment A3 where the total TBV bacteria was 5.02X10^2 cfu/ml TPC was 4.5x10^3 CFU/mL so that the ratio value obtained at 75 days of TBV /TPC is in the unsafe category for shrimp life, namely 12.50% in the fifth sampling. The content of *Vibrio harveyi* bacteria in pond water at a density of 10^3 CFU/mL can cause tiger shrimp that are kept to be attacked by disease (Muliani et al ,2000) Meanwhile, if the population density of *Vibrio* sp. in water exceeding 10^3 cfu/mL and in sediment 10^4 cfu/mL can trigger outbreaks of WSSV attacks. The value of the ratio of TBV and TPC total bacteria that are safe for the growth of shrimp reared is <10% [33].

Water quality is critical to the survival and growth of vannamei shrimp. Temperature, salinity, pH, dissolved oxygen, ammonia, nitrite, nitrate, phosphate, and BOT levels were measured in all treatments during the study and the results are given in Table 5.

Table 5. The average value of water quality variables obtained during 75 days of maintenance

Variable	Treatment			Canal
	A	B	C	
Temperature (°C)	29.30-32.20	29.7-32.6	28.8-32.8	30.27
	30.54	30.85	30.67	
DO (mg/L)	3.12-5.67	2.86-7.49	3.02-5.25	4.04
	3.84	4.60	4.03	
pH	7.50-8.50	7.5-8.5	7.5-8.5	7.7
	7.82	8.04	7.94	
Salinity (ppt)	13.00-29.00	13.0-29.00	15.00-29.00	21.25
	20.5	20.75	20.17	
Alkanility (mg/L)	118.90-164.00	114.8-164	106.6-190.2	132.23
	142.81	133.68	146	
Ammonia (mg/L)	0.05-2.14	0.004-2.64	0.046-2.64	0.56
	0.72	0.63	0.81	
PO_4 (mg/L)	0.01-0.51	0.004-0.26	0.009-0.33	0.084
	0.21	0.09	0.09	
NO_2(mg/L)	0.001-0.9	0.001-0.117	0.002-0.211	0.01
	0.01	0.021	0,032	
NO_3(mg/L)	0.04-0.68	0.03-0.84	0.001-0.96	0.27
	0.15	0.23	0.19	
BOT (mg/L)	9.50-70.88	8.06-72.57	7.94-85.34	46.7
	50.93	47.49	54.21	

Except for the high ammonia level, the water quality during the investigation was nevertheless suitable for the growth and survival of vannamei shrimp, and the test animals tolerated it during maintenance. Decent water quality for white shrimp farming is optimum salinity 10-25 ppt (tolerance 50 ppt), water temperature 28-31 °C (tolerance 16-36 °C), dissolved oxygen > 4 mg/L (minimum tolerance 0.8 mg/L), pH 7.5-8.2, alkalinity 120-150 mg/L, ammonia <0.1 mg/L, Phosphate 0.5-1 mg/L and H_2S <0.003 mg/L [34].

The average temperature of the water obtained during the study was 30.5-30.85°C and the average dissolved oxygen was 3.84-6.03 mg/L. The ideal temperature and dissolved oxygen levels for vaname shrimp cultivation are 27 - 32 °C and > 3 mg/L, respectively, and can endure temperatures of up to 10°C [35]. Water temperature influences shrimp activity as well as that of other aquatic species. The ideal temperature for vannamei shrimp growth is between 26 and 32°C [36].

Several other water quality variables are thought to have an effect on the growth rate of cultivated shrimp. The salinity of pond water during the study ranged from 13-29 ppt. The optimum salinity for vannamei shrimp growth was 15-25 ppt [35]. The growth of vaname shrimp at a salinity of 5-15 ppt was significantly higher than at a salinity of 49 ppt [37]. Vannamei shrimp can tolerate salinities ranging from 0.5 to 45 ppt [38]. The pH range for extensive vannamei shrimp farming water is 7.4 - 8.9, with an ideal value of 8.0 [39].

Ammonia is one of the by-products of the decomposition process of organic matter in water which can be toxic. Ammonia toxicity increases with decreasing dissolved oxygen levels. The concentration of ammonia in this study reached between 0.004-2.640 mg/L. The high concentration of ammonia obtained in this study is thought to be caused by the accumulation of organic matter due to fertilization which causes ammonia to increase. The toxicity of the water quality variable does not work independently, meaning that even if the ammonia level exceeds the threshold for life, the other variables are still at optimal levels, so it will not kill the shrimp. Penaeus sp. may tolerate NH3 concentrations as low as 0.1 mg/L [40]. Ammonia LC50 values for juvenile vannamei shrimp at 24, 48, 72, and 96 hours of immersion and 35 ppt salinity were 2.78, 2.18, 1.82, and 1.60 mg/L, respectively [41]. The best nitrite range for vaname shrimp cultivation is 0.01 - 0.05 mg/L, while the optimal total organic matter range for vannamei shrimp production is 55 mg/L [42]. The ideal nitrate concentration for vannamei shrimp is between 0.4 and 0.8 mg/L [43].

4 Conclusions

The application of organic fertilizer from solid waste superintensive shrimp pond provides a growth response, the daily growth rate of vannamei shrimp is extensive system relatively the same response compared to other commercial organic fertilizers. The low of survival rate and production was caused by WSSV disease during rearing period. The abundance of individual phytoplankton ranging from 565-2588 ind/L and zooplankton ranges from 523-652 ind/L. The plankton diversity index (H') ranges from 1.47-2.12, the uniformity index (E) ranges from 0.52-0.83, and the dominance index (D) ranges from 0.16-0.38.

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