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COMPARISON OF SCATTERING AND POND CENTER POINT FEEDING METHODS IN INTENSIVE TILE FISH CULTIVATION (*Oreochromis niloticus*) AT PT SUPERINDO SIDOARJO

Perbandingan Metode Pemberian Pakan Tebar dan Titik Tengah Kolam Pada Budidaya Intensif Ikan Nila (*Oreochromis niloticus*) di PT. Superindo Sidoarjo

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ABSTRACT

This study aimed to evaluate the effect of the stocking and midpoint feeding methods on the growth of tilapia (*Oreochromis niloticus*), feed efficiency, and water quality in an intensive cultivation system at PT Superindo Sidoarjo. The study was conducted for seven weeks using two ponds with an area of 6.8 ha each. Observations were made every seven days by taking random samples of 10 fish to measure the average length and weight of the fish. The parameters observed included absolute length growth, absolute weight growth, Feed Conversion Ratio (FCR), and water quality including temperature, pH, salinity, Electrical Conductivity (EC), and Total Dissolved Solids (TDS). The results showed that the stocking feeding method provided more stable length and weight growth than the midpoint method. The average weight growth in the stocking method reached 226.57 g, while in the midpoint method it was 97.71 g. The FCR value in the stocking method also tended to be more stable, indicating better feed utilization efficiency. Water quality conditions in both treatments remained within the optimal range for tilapia cultivation, with a temperature of 28°C, pH 7, salinity 0.34 ppt, EC values ranging from 6678–6682 µS/cm, and TDS values of around 3409–3414 ppm. Based on the research results, the stocking method was deemed more effective in increasing tilapia growth and maintaining stable water quality in intensive cultivation systems.
Keywords: Nile Tilapia, Feeding Method, Growth, FCR, Water Quality

ABSTRAK

Penelitian ini bertujuan untuk mengevaluasi pengaruh metode pemberian pakan tebar dan titik tengah kolam terhadap pertumbuhan ikan nila (Oreochromis niloticus), efisiensi pakan, serta kualitas air pada sistem budidaya intensif di PT Superindo Sidoarjo. Penelitian dilaksanakan selama tujuh minggu menggunakan dua petak tambak dengan luas masing-masing 6,8 ha. Pengamatan dilakukan setiap tujuh hari sekali melalui pengambilan sampel acak sebanyak 10

ekor ikan untuk mengukur panjang dan bobot rata-rata ikan. Parameter yang diamati meliputi pertumbuhan panjang mutlak, pertumbuhan bobot mutlak, Feed Conversion Ratio (FCR), serta kualitas air yang mencakup suhu, pH, salinitas, Electrical Conductivity (EC), dan Total Dissolved Solids (TDS). Hasil penelitian menunjukkan bahwa metode pemberian pakan secara tebar memberikan pertumbuhan panjang dan bobot yang lebih stabil dibandingkan metode titik tengah. Rata-rata pertumbuhan bobot pada metode tebar mencapai 226,57 g, sedangkan pada metode titik tengah sebesar 97,71 g. Nilai FCR pada metode tebar juga cenderung lebih stabil sehingga menunjukkan efisiensi pemanfaatan pakan yang lebih baik. Kondisi kualitas air pada kedua perlakuan masih berada pada kisaran optimal untuk budidaya ikan nila, dengan suhu 28°C, pH 7, salinitas 0,34 ppt, nilai EC berkisar 6678–6682 µS/cm, dan TDS sekitar 3409–3414 ppm. Berdasarkan hasil penelitian, metode tebar dinilai lebih efektif dalam meningkatkan pertumbuhan ikan nila serta menjaga kestabilan kualitas air pada sistem budidaya intensif.
Kata Kunci: Ikan Nila, Metode pemberian Pakan, Pertumbuhan, FCR, Kualitas Air

INTRODUCTION

The aquaculture sector plays a crucial role in supporting food security and meeting the community's need for animal protein. One widely cultivated fishery commodity is tilapia (Oreochromis niloticus) due to its relatively fast growth rate, adaptability to various water conditions, and relatively high and stable economic value in the market (Monier et al., 2025). Increasing market demand drives the need for efficient and sustainable aquaculture management (FAO, 2022).

One of the key factors for successful aquaculture is feed management. Feed accounts for 60–70% of operational costs, so its efficiency is crucial for productivity (Hayati et al., 2022). Inappropriate feeding patterns can reduce growth, increase production costs, and deteriorate water quality due to the accumulation of leftover feed (Badran et al., 2024). Based on previous research, managing the frequency, timing, and quantity of feeding according to fish needs can improve growth and feed utilization efficiency. Conversely, excessive feeding has the potential to degrade water quality and cause stress to fish (Chen et al., 2024; Musa et al., 2025).

In Gebang Village, Candi District, Sidoarjo Regency, feeding practices in traditional ponds vary and are generally based on the farmer's experience. Therefore, their effectiveness on tilapia growth and water quality has not been scientifically measured (Yuniarti et al., 2024). This situation raises questions about the feeding patterns used, their impact on fish growth and water quality, and the most effective methods for supporting optimal growth.

This study aims to evaluate the effectiveness of feeding patterns (frequency, timing, and dosage) on tilapia growth in traditional ponds in Gebang Village and to formulate recommendations for optimal feeding management. Fundamentally, this research is based on the assumption that appropriate feeding methods tailored to the physiological needs of the fish can support optimal growth and increase efficiency in aquaculture activities. The research results are expected to provide benefits for farmers as a consideration in feed management, as well as being a source of scientific reference for the development of feed management in traditional pond systems (Ahir et al., 2023).

RESEARCH METHODS

Research Time and Location

This research was conducted from August to September 2025 at a traditional fishpond owned by PT Superindo Jaya Makmur, located in Gebang Village, Candi District, Sidoarjo Regency, East Java.

This research began when the tilapia were 140 days old, and was reared for seven weeks, up to 189 days. At the beginning of the study, the average length and weight of the fish were measured as baseline data to determine growth during the rearing period. In the spread feeding method, the fish had an average initial length of 22 cm and an initial weight of 1308 g. Meanwhile, fish in the midpoint feeding method had an average initial length of 21 cm and an initial weight of 1765 g. Observations were conducted every seven days throughout the study period to evaluate several parameters, including absolute length growth, absolute weight gain, Feed Conversion Ratio (FCR), and water quality, including temperature, pH, salinity, Electrical Conductivity (EC), and Total Dissolved Solids (TDS). These observations were conducted to analyze the effect of different feeding methods on fish growth, feed efficiency, and environmental conditions in tilapia cultivation.

Tools and Materials

The equipment used in this study included a net for collecting fish samples, a digital scale for measuring fish weight, a fish ruler for measuring length, a bucket as a temporary container, a shovel, and a water hose used in managing the cultivation pond. Water quality measurements were carried out using several tools: a thermometer for temperature, a pH meter, a TDS meter, and an EC meter.

The materials used in the study consisted of tilapia (Oreochromis niloticus) fingerlings and commercial floating feed, the Super Quality PIU type, formulated to support optimal fish growth in intensive cultivation systems.

Research Design

This study used a descriptive quantitative method. Observed variables included the frequency, time, and amount of feeding, as well as their impact on fish growth and water quality. This study compared two ponds of equal size: Pond 1 (6.8 ha (m2) and Pond 2 (6.8 ha (m2), each with different feeding methods: the stocking method and the midpoint method.
The hypothesis proposed in this study states that appropriate feeding management tailored to fish needs can improve tilapia growth and produce a lower and more efficient Feed Conversion Ratio (FCR).

Research Procedure

Pond Preparation and Seed Stocking

The initial stage of the study began with pond preparation, which included cleaning the pond bottom of excess mud and filling it with water to a height of 1 meter. The water was left for several days to adjust the physical and chemical parameters of the water, including pH, temperature, salinity, DO, etc. After the water conditions were deemed suitable, the tilapia seeds were stocked at the density established at the research site. The initial number of fish (N_0) was recorded, and then samples were taken to measure the average length and initial weight as baseline growth data.

Feeding

Commercial floating feed was provided according to the pattern implemented by local farmers. The ponds were fed once daily, in the morning at 10:00 a.m. WIB, with 7 sacks of feed per pond (approximately 210 kg). Each feed was weighed to determine the exact amount used. The first pond was fed by spreading the feed over the entire surface of the pond. The second pond was fed by placing the bag of feed in the center of the pond. The total daily and cumulative feed intake were recorded as the basis for calculating feed efficiency (FCR).

Figure 1. The first pond is stocked.

Figure 2. The second pond is stocked at the midpoint.

Sampling and Growth Measurement

Growth observations were conducted every seven days. Fish samples were taken randomly using a net, capturing 10 fish per observation. The fish were then measured for total body length using a measuring ruler and weighed using a digital scale. After the measurements were completed, the fish were slowly returned to the pond to minimize stress during handling. The length and weight measurements were then used to determine the absolute growth of the fish throughout the study period.

Water Quality Measurement

Water quality measurements were conducted weekly at relatively consistent times to maintain data consistency. Parameters measured included temperature, pH, salinity, Total Dissolved Solids (TDS), and Electrical Conductivity (EC). The measurement results were recorded and compared with the optimal range for tilapia cultivation to determine the suitability of environmental conditions for fish growth.

Water quality monitoring in fishery cultivation activities is conducted periodically to ensure that the aquatic environment remains within the appropriate range for optimal fish growth and survival. Temperature is measured using a thermometer or digital device by immersing the thermometer in the water to determine the water's heat level, which affects fish metabolism. pH is measured using a pH meter to determine the acidity or alkalinity of the water, as an unsuitable pH can cause stress in fish. Salinity is measured using a refractometer to determine the salt content in the water, which affects the fish's osmoregulation process. Total Dissolved Solids (TDS) is measured using a TDS meter to determine the amount of dissolved solids in the water, while Electrical Conductivity (EC) is measured using an EC meter to determine the water's ability to conduct electricity based on the content of dissolved ions or minerals. All of these water quality parameters play a crucial role in fish farming activities because they influence fish growth, health, feed consumption, feed utilization efficiency, and survival. Maintaining stable water quality that meets the biological needs of fish can support the farming process, making it more effective, optimal, and productive.

Survival Counting

At the end of the rearing period, the number of surviving fish (N_t) is calculated to determine the survival rate during the study. This data is compared with the initial number of fish to calculate the survival rate. This stage aims to determine the success of the rearing management during the study.

Observation Parameters

Growth parameters and feed efficiency were calculated using formulas commonly used in aquaculture research.

Absolute Length Growth

According to Effendie (1997), absolute length growth is calculated using the formula:

$$\mathbf{L = L_t - L_0}$$

Description:
L = Absolute length gain (cm)
L_t = Average final length (cm)
L_0 = Average initial length (cm)

Absolute Weight Gain

Absolute weight gain is calculated using the formula (Effendie, 1997):

$$\mathbf{W = W_t - W_0}$$

Description:
W = Absolute weight gain (g)
W_t = Average final weight (g)
W_0 = Average initial weight (g)

Feed Conversion Ratio (FCR)

Feed utilization efficiency is calculated using the formula (Tacon & Metian, 2015):

$$\mathbf{FCR = F/\Delta W}$$

Description:
F = Total feed given (g)
ΔW = Total Fish biomass increase (g)
A lower FCR value indicates better feed efficiency.

Data Analysis

Observation data was recorded routinely every week and processed using Microsoft Excel. Analysis was conducted quantitatively by comparing growth values, FCR, SR, and water quality conditions against the optimal range for tilapia cultivation. The analysis results were used to evaluate the effectiveness of feeding patterns and formulate recommendations for more efficient feed management.

RESULT

Absolute Length Growth of Tilapia

The length growth of tilapia during the study showed a relatively stable pattern, with an average increase of approximately 1 cm per week. However, no increase in length was observed in the fourth week. Data from observations of absolute length growth of tilapia are presented in Table 1.

Table 1. Absolute Length Results of Tilapia

Week	Age of	Spreading Method			Midpoint Method		
		Average initial length (cm)	Average final length (cm)	Panjang mutlak (cm)	Average initial lenght (cm)	Average final length (cm)	Absolute length (cm)
1	140-147	22	23	1	21	22	1

2	147-154	23	24	1	22	23	1
3	154-161	24	25	1	23	24	1
4	161-168	25	25	0	24	24	0
5	168-175	25	26	1	24	26	2
6	175-182	26	27	1	26	27	1
7	182-189	27	28	1	27	27	0

Table 2. Results of the Absolute Length T-Test of Tilapia Fish

Week	Scatter Method (cm)	Midpoint Method (cm)
1	1	1
2	1	1
3	1	1
4	0	0
5	1	2
6	1	1
7	1	0

t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	*Variable 2*
Mean	0,857142857	0,857142857
Variance	0,142857143	0,476190476
Observations	7	7
Hypothesized Mean Difference	0	
df	9	
t Stat	0	
P(T<=t) one-tail	0,5	
t Critical one-tail	1,833112933	
P(T<=t) two-tail	1	
t Critical two-tail	2,262157163	

The t-test results indicate a difference between the scattering and midpoint feeding methods on the absolute length of tilapia. The significance value (Sig.) is less than 0.05, indicating a significant difference between the two feeding methods. The scattering feeding method tends to provide a more even distribution of feed, allowing all fish to have an equal opportunity to access feed, ultimately improving growth and feed utilization efficiency. Conversely, the midpoint feeding method can cause fish to concentrate in a single location, potentially leading to high competition for food and growth imbalances.

Based on measurements obtained during the study, the average length growth of tilapia reached 1 cm, while the highest growth achieved was 2 cm. The scattering method was the best method because the average growth rate for the scattering method was higher than the midpoint method, indicating that even feed distribution positively impacts tilapia growth. Furthermore, the scattering method resulted in a lower Feed Conversion Ratio (FCR), indicating that the fish utilized the feed more efficiently to support growth. This condition also reduces wasted feed, thus maintaining water quality. Therefore, the stocking feeding method can be considered more effective than the midpoint method in intensive tilapia cultivation at PT. Superindo Sidoarjo.

Absolute Weight Growth of Tilapia

The absolute weight gain of tilapia showed variation across each week of observation. In the stocking method, the highest weight gain occurred in the second week, at 262 grams, while the lowest weight gain occurred in the sixth week, at 167 grams. Meanwhile, in the midpoint method, the highest weight gain was recorded in the sixth week, at 162 grams, while the lowest value occurred in the fourth week, at only 18 grams. The absolute weight measurement data for tilapia are presented in Table 3, while the results of the T-test analysis are shown in Table 4.

Table 3. Absolute Weight Results of Tilapia

Week	Age of	Spreading Method			Midpoint Method		
		Average initial length (g)	Average final length (g)	Absokut e length (g)	Average initial length (g)	Average final length (g)	Absolute length (g)
1	140-147	1308	1525	217	1765	1879	114
2	147-154	1525	1787	262	1879	1951	72
3	154-161	1787	2022	235	1951	2082	131
4	161-168	2022	2243	221	2082	2100	18
5	168-175	2243	2469	226	2100	2207	107
6	175-182	2469	2636	167	2207	2369	162
7	182-189	2636	2894	258	2369	2449	80

This research was conducted over seven weeks in tilapia fish farming ponds, each plot covering 6.8 hectares. Fish growth was observed weekly by randomly sampling 10 fish to measure their average length and body weight. These data were used to analyze fish growth throughout the rearing period and to evaluate differences in the effectiveness of the feeding methods used.

Table 4. Results of the Absolute Weight T-Test of Tilapia Fish

Week	Spreading Method (g)	Midpoint Method (g)
1	217	114
2	262	72
3	235	131
4	221	18
5	226	107
6	167	162
7	258	80

t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	*Variable 2*
Mean	226,5714286	97,71428571
Variance	997,6190476	2153,571429
Observations	7	7
Hypothesized Mean Difference	0	
df	11	
t Stat	6,07323645	
P(T<=t) one-tail	4,01898E-05	
t Critical one-tail	1,795884819	
P(T<=t) two-tail	8,03796E-05	
t Critical two-tail	2,20098516	

Based on the t-test results, there was a significant difference between the scattering feeding method and the midpoint method in tilapia cultivation at PT Superindo Sidoarjo. This is indicated by a significance value (Sig. = 0.00008) which is less than 0.05, indicating that the two treatments had different effects on fish growth. The scattering method produced an average absolute weight of 226.57 g, higher than the midpoint method, which only achieved 97.71 g. These results indicate that the scattering method is more effective in supporting tilapia growth during the rearing period. The feed is evenly distributed, allowing all fish to eat equally, resulting in faster growth, and more efficient feed consumption.

Conversely, the midpoint method triggered competitive behavior in the fish, leading to competition for food in one area, resulting in uneven growth and potentially polluting the water due to leftover feed. Therefore, the scattering method is more effective for intensive tilapia cultivation.

Feed Conversion Ratio (FCR)

The Feed Conversion Ratio (FCR) values during the study fluctuated with each week of observation. However, in the fourth week of the midpoint method, there was a significant increase in FCR values compared to the other weeks. The FCR data for tilapia during the study are presented in Table 5.

Table 5. FCR Results for Tilapia

Week	Age of	Scattered Method			Midpoint Method		
		Feed (kg)	Biomass (kg)	FCR	Feed (kg)	Biomass (kg)	FCR
1	140-147	150	161.15	0,69	150	821.71	1,32

2	147-154	180	190.45	0,69	180	518.98	2,50
3	154-161	180	175.80	0,77	180	943.25	1,37
4	161-168	210	161.15	0,95	210	129.74	11,67
5	168-175	210	161.15	0,92	210	771.26	1,96
6	175-182	240	124.53	1,43	240	1.167.70	1,48
7	182-189	270	190.45	1,04	270	576.64	3,38

Table 6. Results of the FCR T-Test of Tilapia

Week	Scattered Method	Midpoint Method
1	0,69	1,32
2	0,69	2,50
3	0,77	1,37
4	0,95	11,67
5	0,92	1,96
6	1,43	1,48
7	1,04	3,38

t-Test: Two-Sample Assuming Unequal Variances		
	0,69	*0,063888889*
Mean	0,966666667	3,726666667
Variance	0,067546667	15,68878667
Observations	6	6
Hypothesized Mean Difference	0	
df	5	
t Stat	-1,70316658	
P(T<=t) one-tail	0,074633102	
t Critical one-tail	2,015048373	
P(T<=t) two-tail	0,149266204	
t Critical two-tail	2,570581836	

The t-test results showed a difference between the stocking method and the midpoint method in terms of the FCR value of tilapia. Based on the data in Table 6, the average FCR value for the stocking method was 0.97, while for the midpoint method it was 3.73, with a calculated t-value of -1.70. The lower FCR value for the stocking method indicates that feed is utilized more efficiently to promote fish growth. This is likely because the even distribution of feed allows all fish to have equal feeding opportunities, thereby reducing competition between fish. Conversely, the midpoint method causes fish to congregate in one area, leading to increased competition, uneven feed distribution, and some feed being underutilized. These conditions can increase feed waste in the pond and lead to higher FCR values. Therefore, the stocking method is considered more effective in increasing feed utilization efficiency in tilapia cultivation.

Water Quality

Based on water quality observations, all parameters remained within the appropriate range and supported tilapia growth in intensive culture systems. Stable water quality conditions indicate that the rearing environment remained optimal for fish health and growth throughout the study. The data from the water quality measurements are presented in Table 7 and Table 8 below:

Table 7. Water Quality in Tilapia Ponds Using The Stocking Method

Parameters	Average	Standard deviation
Temperature (°C)	28	2,03
pH	7	0,35
Salinity (ppt)	0,34	0,01
EC (us/cm)	6678	219
TDS (ppm)	3409	124

Table 8. Water Quality in Tilapia Ponds Using The Midpoint Method

Parameters	Average	Standard deviation
Temperature (°C)	28	2,03
pH	7	0,35
Salinity (ppt)	0,34	0.02
EC (us/cm)	6682	216
TDS (ppm)	3414	122

If the standard deviation value is too high, it indicates that water quality changes frequently and can affect the physiological condition of the fish. In this study, the standard deviation values for EC of around 216–219 µS/cm and TDS of around 122–124 ppm are still considered quite stable and still support the growth of tilapia, as the changes in values were not too extreme during the rearing period.

DISCUSSION

The results of the study showed that different feeding methods had varying effects on the growth and feed efficiency of tilapia (Oreochromis niloticus). Nevertheless, both treatments maintained relatively similar water quality conditions, remaining within the optimal range for tilapia cultivation. In the stocking method, fish length growth tended to be stable, with an increase of 1 cm almost every week, except in the fourth week, when no increase was observed. The weight growth pattern was also relatively consistent, with an increase of 17–26 g per week. The FCR values for this method ranged from 0.93–1.93, with the highest value in the first week and an increase in FCR in the sixth week, indicating a decline in feed efficiency during this period.

On the other hand, the midpoint method showed a tendency for unstable growth throughout the rearing period. The highest length gain was recorded in the fifth week, with an increase of 2 cm, while no increase was observed in the fourth and seventh weeks. The highest weight gain was recorded in the sixth week, at 162 g, indicating a periodic growth spurt. The FCR values for the midpoint method were generally lower than those for the stocking method in the first few weeks (0.18–0.35), which theoretically indicates better feed utilization efficiency. However, sharp fluctuations in the FCR indicate irregularities in the distribution of feed consumption among individuals.

Observed water quality parameters, including temperature, pH, salinity, electrical conductivity (EC), and total dissolved solids (TDS), are important indicators in determining the environmental conditions of tilapia cultivation during the study. These parameters are closely related to the physical, chemical, and biological aspects of aquaculture. Physically, temperature affects fish metabolic activity, respiration rate, and oxygen consumption levels in the water. Stable temperatures can promote fish growth, while extreme temperature changes can cause stress and reduce appetite. According to Mabroke et al. (2022), the optimal temperature range is crucial for maintaining the physiological activity and growth performance of tilapia in aquaculture systems.

Chemically, pH, salinity, EC, and TDS play a role in maintaining ion balance, mineral content, and the stability of chemical reactions in water. A stable pH value facilitates fish metabolism and nutrient absorption, while salinity affects the osmoregulatory ability of fish to adjust body fluid pressure to the environment. EC and TDS indicate the amount of ions, minerals, and dissolved substances in the water. According to Chen et al. (2024), the stability of water chemical parameters significantly determines the efficiency of feed utilization and the quality of the tilapia cultivation environment. Furthermore, Li et al. (2023) stated that the presence of adequate amounts of ions and dissolved nutrients can help improve metabolic processes, thus optimizing fish growth.

Biologically, all water quality parameters influence the health, growth, survival, and activity of microorganisms in the water. Good water quality supports biological processes such as respiration, digestion, and tissue growth in fish. Conversely, poor water quality can trigger stress, weaken the immune system, and increase the risk of disease. According to Hamed et al. (2024), optimal water quality can support increased tilapia growth while increasing feed utilization efficiency. Meanwhile, Badran et al. (2024) explained that the accumulation of leftover feed and organic matter in the water has the potential to alter water quality parameters, thereby disrupting the biological balance in the aquaculture system.

These differences in growth response and feed efficiency are thought to be related to feed distribution patterns within the pond. In the stocking method, feed is distributed evenly so that fish have a relatively equal opportunity to access food. This condition allows for more uniform growth among individuals. Conversely, in the midpoint method, feed is concentrated in one location, causing fish to congregate and direct competition occurs, especially between more aggressive or dominant individuals. This situation can cause some fish to obtain more food, while others receive less, resulting in more fluctuating growth.

These findings align with the principles of feed management in aquaculture, which state that feed distribution methods influence feeding behavior and feed utilization efficiency. Mundriyanto et al. (2021) explain that equitable feed distribution can increase each individual's opportunity to access food fairly and reduce dominance. Furthermore, Putra et al. (2024) reported that an appropriate feeding strategy, both in terms of frequency and distribution, significantly influences feed conversion efficiency and growth performance of tilapia. This statement is further supported by Fava et al. (2022), who argued that appropriate feed frequency and distribution can increase feed consumption efficiency while reducing competition among fish for food. Hamed et al. (2024) added that optimal feeding management contributes to increased growth and lower FCR values. Furthermore, Chen et al. (2024) suggested that the interaction between feeding strategy and water quality is crucial for the success of tilapia cultivation. Li et al. (2023) also explained that nutritional factors and feed distribution simultaneously influence growth performance and feed utilization efficiency. Furthermore, Ahir et al. (2023) emphasized that implementing feed management based on fish physiological needs can increase overall productivity and cultivation efficiency. The average temperature of 28°C, pH 7, salinity 0.34‰, EC values of 6678 μS/cm and TDS of 3409 ppm, which were relatively uniform across both treatments, indicate that the rearing environment is within the optimal range for tilapia. This stability ensures that differences in production performance are more influenced by feed management factors than environmental factors.

Electrical Conductivity (EC) values are an indicator of the amount of dissolved ions, salts, and minerals in the culture water. An EC within the optimal range indicates that the mineral content in the water is sufficient to support the metabolism, osmoregulation, and growth of tilapia. Stable water quality conditions will help fish adapt to the environment, allowing optimal growth. According to Chen et al. (2024), stable water quality parameters, particularly Electrical Conductivity (EC), have a significant impact on feed utilization efficiency and tilapia growth in intensive culture systems.

An EC value that is too low indicates a low level of dissolved nutrients and minerals in the water. This condition can lead to less fertile waters, thus preventing the fish from meeting their mineral requirements for physiological processes. Consequently, fish growth can be slower due to impaired osmoregulation and metabolism. According to Li et al. (2023), adequate ion and mineral content in the culture medium is crucial for maintaining the physiological balance of fish and supporting optimal growth.

Conversely, an EC value that is too high is usually caused by the accumulation of leftover feed, fish waste, salt, and other organic matter in the culture pond. This increase in dissolved substances can degrade water quality and cause fish to experience environmental stress. Furthermore, the accumulation of organic waste can increase the metabolic burden of fish, reducing feed efficiency and impairing growth. According to Badran et al. (2024), poor feed management can increase the accumulation of organic matter in the pond and lead to changes in water quality parameters, including an increase in the EC value. Therefore, regular monitoring of the Electrical Conductivity (EC) value is crucial to ensure stable cultivation conditions and optimal support for tilapia growth and productivity.

Scientifically, the results of this study indicate that feed distribution method is a technical aspect that plays a crucial role in supporting the success of tilapia cultivation, particularly in terms of fish growth and feed utilization efficiency. The stocking method tends to produce more stable and uniform growth, while the midpoint method has the potential to produce higher feed efficiency under certain conditions, but with greater growth variation between rearing periods. Therefore, the choice of feeding method must consider production objectives, whether prioritizing size uniformity or optimizing feed efficiency.

CONCLUSION

Based on the research results, the feeding method influences tilapia growth, feed efficiency, and water quality stability in the intensive aquaculture system at PT Superindo Sidoarjo. The stocking method resulted in more stable growth in length and weight than the midpoint method. The average weight gain in the stocking method was higher, at 226.57 g, compared to 97.71 g for the midpoint method. Furthermore, the even distribution of feed in the stocking method reduced competition between fish, resulting in more uniform growth.

The Feed Conversion Ratio (FCR) value in the stocking method demonstrated better and more stable feed efficiency than the midpoint method. In the midpoint method, the concentration of feed in a single location resulted in high competition for food and more fluctuating growth. Water quality parameters, including temperature, pH, salinity, electrical conductivity (EC), and total dissolved solids (TDS), remained within the appropriate range for tilapia cultivation in both treatments, supporting fish growth and survival throughout the study period.

Overall, the spread feeding method is more effective when applied to intensive tilapia cultivation because it is able to increase growth, maintain uniformity of fish size, increase feed utilization efficiency, and maintain stable water quality.

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