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THE EFFECT OF PROVIDING BOOSTER GROTOP IN COMMERCIAL FEED ON THE GROWTH AND SURVIVAL OF TILAPIA FISH SEEDS *(Oreochromis niloticus)* IN A RECIRCULATING AQUACULTURE SYSTEM (RAS)

Pengaruh Pemberian Boster Grotop dalam Pakan Komersil Terhadap Pertumbuhan dan Kelangsungan Hidup Benih Ikan Nila *(Oreochromis niloticus)* pada Sistem Budidaya Resirkulasi (RAS)

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ABSTRACT

Tilapia is a high-value aquaculture commodity with increasing market demand. To meet this growing need, alternative approaches in cultivation are required, particularly in feed management. Feed plays a crucial role in supporting fish growth and represents the largest cost component in aquaculture operations. As a solution, the use of Grotop booster has been introduced to enhance appetite, improve immunity, and increase feed efficiency. This study aims to evaluate the effects of adding Grotop booster to commercial feed on the growth performance and survival rate of tilapia fry (*Oreochromis niloticus*) cultured in a closed Recirculating Aquaculture System (RAS). The research was conducted over 28 days using a completely randomized design with four levels of Grotop booster supplementation (0, 15, 30, and 45 g/kg of feed), each with three replications. Observed parameters included absolute weight and length gain, specific growth rate (SGR), survival rate (SR), feed efficiency (FE), feed conversion ratio (FCR), and water quality. The results showed that Grotop booster supplementation had a significant effect ($P<0.05$) on all observed parameters, with the 15 g/kg feed dosage yielding the most optimal results in terms of growth and feed efficiency. It can be concluded that the addition of Grotop booster to commercial feed can improve the growth performance of tilapia in a RAS environment.

Keywords: Tilapia, Grotop Booster, Growth, Survival Rate, RAS

ABSTRAK

Ikan nila merupakan salah satu komoditas perikanan dengan nilai ekonomi tinggi yang mengalami peningkatan permintaan dari waktu ke waktu. Untuk mendukung kebutuhan tersebut, diperlukan pendekatan alternatif dalam sistem budidaya, khususnya pada aspek pakan. Pakan memiliki peranan krusial dalam menunjang pertumbuhan ikan, sekaligus menjadi komponen biaya terbesar dalam operasional budidaya. Sebagai solusi, penggunaan boster grotop diperkenalkan untuk meningkatkan nafsu makan, daya tahan tubuh ikan, serta efisiensi penggunaan pakan. Penelitian ini bertujuan untuk mengkaji pengaruh penambahan boster grotop ke dalam pakan komersial terhadap pertumbuhan dan tingkat kelangsungan hidup benih ikan nila (*Oreochromis niloticus*) dalam sistem budidaya tertutup Recirculating Aquaculture System (RAS). Penelitian dilakukan selama 28 hari menggunakan rancangan acak lengkap dengan empat perlakuan dosis boster grotop (0, 15, 30, dan 45 g/kg pakan) dan tiga kali ulangan. Parameter yang diamati meliputi pertambahan bobot dan panjang mutlak, laju pertumbuhan spesifik (LPS), tingkat kelulushidupan (SR), efisiensi pakan (EP), rasio konversi pakan (FCR), serta kualitas air. Hasil penelitian menunjukkan bahwa penambahan boster grotop memberikan pengaruh yang signifikan ($P<0,05$) terhadap seluruh parameter yang diuji, di mana dosis 15 g/kg pakan memberikan hasil paling optimal pada hampir seluruh aspek pertumbuhan dan efisiensi pakan. Berdasarkan temuan ini, dapat disimpulkan bahwa penambahan boster grotop pada pakan komersial dapat meningkatkan performa pertumbuhan ikan nila dalam sistem RAS.

Kata kunci: Ikan nila, Boster Grotop, Pertumbuhan, Kelulushidupan, Sistem RAS

INTRODUCTION

Tilapia is a freshwater fish consumed by many Indonesians (Handayani *et al.,* 2024). With population growth and increasing awareness of the importance of animal protein consumption, demand for this fish continues to rise, necessitating intensification of cultivation efforts, particularly during the grow-out phase (Salsabila & Suprapto, 2019). With its high and relatively stable economic value, tilapia has good prospects for development as a leading commodity. A determining factor in successful cultivation is optimal and consistent feed provision, considering that feed contributes approximately 50 to 70 percent of total production costs and is the primary source of energy and nutrients for fish growth and survival (Faizati *et al.,* 2021). The main challenge in tilapia cultivation is its relatively slow growth, therefore strategies are needed to increase feed efficiency to accelerate growth rates. Several previous studies have suggested that slow tilapia growth can be overcome through more efficient and effective feed utilization (Khotimah *et al.,* 2023).

Commercial feeds used in fish farming are generally designed to meet nutritional needs, the development of vital organs, and the activity of enzymes that play a crucial role in the seeding stage. However, the high price of commercial feeds does not always equate to the quality provided. Therefore, innovation is needed to improve feed quality to support optimal cultivation results. One widely used approach is the addition of supplements in the form of grotop boosters. These supplements are known to stimulate appetite, improve the immune system, optimize digestive enzyme function, and accelerate fish growth. Grotop boosters can be applied through the water or mixed directly into the feed, but administration through the feed is considered more effective in improving nutritional quality and absorption by fish. The use of grotop boosters in feed formulations is also believed to have a positive impact on cultivation performance, particularly in recirculating systems (RAS). Research by Amal et al. (2021) showed that the addition of grotop boosters can improve the growth and survival rate of catfish in peat swamp environments. Similar results were also found by Gea *et al.,* (2023) on gourami (*Osphronemus gouramy*) seeds, where there was a significant increase in growth and survival at various doses of the booster application.

RESEARCH METHODS

Place and Time

The research was conducted in April-May 2025 for 28 days at the UPTD BBI, Padang Panjang City, East Padang Panjang District, West Sumatra Province.

Tools and Materials

The materials used are 5-8 cm tilapia seeds, commercial PF-500 feed, a grotop booster, and potassium permaganate (PK) to sterilize the container. The tools used include Styrofoam and tarpaulin, a drum, a water pump, dacron, a tank, a basin, a ruler, a scale, a pH meter, a DO meter, and a camera.

Research Design

The study was designed using 12 aquariums as maintenance containers, filled with 12 fish fry. Before use, the aquariums were sterilized using a potassium permanganate (PK) solution to remove residual dirt and potential pathogen contamination. The initial stages of feed preparation began with measuring the initial length and weight of the fish to obtain an average value, which was later used to calculate daily feed requirements during the maintenance period. Next, commercial feed was mixed with a grotop booster according to the dosage specified for each treatment. The feed was then weighed according to the fish's daily requirements, packaged in separate plastic bags for each feeding session, and labeled according to the treatment. This procedure was intended to facilitate feed distribution based on treatment. Feed was provided three times daily, namely at 8:00, 1:00, and 18:00 WIB. Fish sampling was carried out weekly to evaluate absolute weight gain, absolute length, and specific growth rate (SGR).

Test Feed Preparation

The feed used was commercial PF 500 feed, which is suitable for the mouth opening size of tilapia fry. This feed was then enriched with Grotop booster based on the predetermined treatment dosages, namely 0, 15, 30, and 45 g/kg of feed. The amount of feed (1 kg) and Grotop booster was measured accurately for each treatment and replication as needed. Before the mixing process, the length and weight of the fish were measured first to obtain an average used in calculating daily feed requirements during the rearing period. Mixing was carried out by weighing the feed and booster according to the dosage, then Grotop was gradually dissolved in 125 ml of clean water while stirring for 5-10 minutes until the solution was homogeneous. The mixture was then sprayed evenly onto the feed pellets, then dried at low temperature until the moisture content was stable. Once dry, the feed was stored in a closed plastic container until feeding time.

Research Parameters

The calculation of each parameter observed in the study refers to (Effendi et al. 2013), namely:

1. Absolute Weight Gain

$$W = Wt - Wo$$

Information:

W = Absolute weight gain (g)
Wo = Initial average weight of the study (g)
Wt = Final average weight of the study (g)

2. Absolute Length Growth

$$L = Lt - Lo$$

Information:
L = Absolute length growth (cm)
Lo = Average length of initial research (cm)
Lt = Average length of the final study (cm)

3. Specific Growth Rate (LPS)

$$\propto = \frac{ln\ Wt - ln\ Wo}{t} \times 100\ \%$$

Information:
α = Specific growth rate (%)
Wo = Initial average weight of the study (g)
Wt = Final average weight of the study (g)
t = Maintenance period (days)

4. Survival Rate (SR)

$$SR = \frac{NT}{NO}\text{x}100\%$$

Information:
SR = Survival rate (%)
Nt = Number of fish at the end of maintenance (tails)
No = Initial number of fish for maintenance (tails)

5. Feed Efficiency (EP)

$$EP\ = \frac{(Wt + Wd) - Wo}{f} \times 100\ \%$$

Information:
EP = Feed efficiency value (%)
Wt = Final fish biomass weight of the study (g)
Wd = Biomass weight of dead test fish (g)
Wo = Initial fish biomass weight of the study (g)
f = Weight of feed consumed by test fish (g)

6. Feed Conversion Ratio (FCR)

$$FCR = \frac{F}{(Wt + d) - Wo}$$

Information:
FCR = Feed conversion ratio value (%)
F = Amount of feed consumed by test animals (g)
Wt = Final test fish biomass weight of the research (g)
d = Total weight of test fish that died during the study (g)
Wo = Initial biomass weight of the study (g)

Data collection technique

The method used is an experimental method using a Completely Randomized Design (CRD) with 3 replications and 4 treatments.:

1. Treatment A: 0 g/kg (as control)
2. Treatment B: 15 g/kg of Booster Grotop per kg of feed
3. Treatment C: 30 g/kg of Booster Grotop per kg of feed
4. Treatment D: 45 g/kg of Booster Grotop per kg of feed

The design model refers to research (Amal *et al.,* 2021), as follows:

$$Y_{ij} = \mu + \tau i + \Sigma\ ij$$

Information:
Y_{ij}= Growth and survival of fish in the i-th treatment and j-th replication
μ = The general average dose of booster grotop
τi = The effect of treatment i
Σij = Effect of the first treatment on the jth replication
i = A, B, C, D and E (Treatment)
j = 1,2 ,3 and 4 (replication)

Data Analysis

Data on growth, SR, FCR, EP, and water quality parameters were analyzed descriptively and tested for homogeneity. If the assumptions were met, the analysis was continued with ANOVA at a 95% confidence level ($P<0.05$). To determine the best treatment, a further Student Newman-Keuls (SNK) test was conducted based on the results obtained. This analysis refers to the method of Amal *et al*., (2021).

RESULT

1. Absolute Weight Gain

The absolute weight growth of tilapia fry is presented in Table 1 below:

Table 1. Absolute Weight Growth

Grotop Dosage (g/kg feed)	Beginning (g)	End (g)	Absolute weight (g)
0	4,00	7,92	3,91 ± 0,21
15	4,73	11,54	7,20 ± 0,15
30	4,69	9,87	5,17 ± 0,80
45	4,14	9,72	5,58 ± 0,38

Based on the results of data analysis, treatment with a Grotop dose of 15 g/kg feed produced the highest absolute weight with a value of 7.20 ± 0.15 g. ANOVA conducted at a significance level of 5% ($P <0.05$) showed that differences in Grotop dosage variations had a significant effect on the growth of absolute weight of tilapia fry, with H_0 rejected and H_1 accepted. Further tests using the Student Newman-Keuls method confirmed that treatment at a dose of 15 g/kg feed produced a statistically more significant increase in weight compared to other dosage treatments. From the results, it was concluded that variations in Grotop dosage in feed significantly affected the absolute growth of tilapia fry.

2. Absolute Length Growth

The absolute length growth of tilapia fry during the rearing period can be seen in Table 2.

Table 2. Absolute Length Growth

Grotop Dosage (g/kg feed)	Beginning (g)	End (g)	Absolute Length (cm)
0	5,53	7,25	1,72 ± 0,29
15	5,70	8,75	3,05 ± 0,12
30	5,72	8,26	2,54 ± 0,56
45	5,87	7,78	1,91 ± 0,13

Based on observations, a Grotop dose of 15 g/kg feed resulted in the highest absolute length growth, namely 3.05 ± 0.12 cm. The results of the analysis of variance (ANOVA) with a 95% confidence level ($P < 0.05$) showed that variations in Grotop doses significantly affected the increase in length of fish seeds. From these results, it can be stated that H_0 is rejected and H_1 is accepted. Further tests can be stated that a dose of 15 g/kg feed resulted in a statistically higher increase in length compared to other treatments. These findings indicate that the use of Grotop at certain doses, especially 15 g/kg, can significantly optimize the length growth of tilapia fish.

3. Specific Growth Rate (LPS / SGR)

The specific growth rate of tilapia fry is shown in Table 3.

Table 3. Specific growth rate (SGR)

Grotop Dosage (g/kg feed)	Beginning (g)	End (g)	SGR %
0	4	3,91	13,9 ± 0,72
15	4,73	11,54	25,7 ± 0,39
30	4,69	9,87	18,4 ± 2,82
45	4,14	9,72	19,9 ± 1,39

According to the analysis results, a Grotop dose of 15 g/kg feed obtained a high specific growth rate with a value of 25.70 ± 0.39%, which is consistently more significant compared to other doses. The results of the ANOVA test at a significance level of 5% ($P < 0.05$) showed that variations in Grotop doses had a significant effect on the SGR value of tilapia fry, which was proven by the hypothesis H_1 being accepted and H_0 being rejected. Further tests using the Student Newman-Keuls method revealed that a dose of 15 g/kg feed statistically resulted in a higher SGR increase compared to other dose treatments. This finding explains that the addition of Grotop to the feed will increase the efficiency of optimal fish fry growth.

4. Survival Rate (SR)

The survival rate (SR) during the maintenance period is shown in Table 4.

Table 4. Survival Rate (SR)

Grotop Dosage (g/kg feed)	Beginning (g)	End (g)	SR %
0	12	10,33	86,10 ± 4,80
15	12	11,33	94,44 ± 4,81
30	12	11,00	91,66 ± 8,33
45	12	10,66	88,88 ± 4,81

Based on observations, the highest survival rate was achieved with a Grotop dose of 15 g/kg feed, at 94.44 ± 4.81%. This increase is thought to be related to the vitamin C content in the Grotop booster, which functions as an antioxidant, thus helping strengthen the fish's immune system and increasing their resistance to stress and disease.

5. Feed Efficiency (EP)

The feed efficiency of tilapia fry during the research period is shown in Table 5.

Table 5. Feed Efficiency (EP)

Grotop Dosage (g/kg feed)	Feed	Beginning (g)	End (g)	Dead (g)	Feed efficiency %
0	10,36	46,41	95,03	9,46	17,6 ± 1,00
15	14,93	56,76	143,13	3,56	18,2 ± 1,60
30	12,73	55,68	118,46	5,6	17,2 ± 1,71
45	11,91	53,01	115,6	5,9	16,3 ± 1,50

Based on the analysis, a Grotop dose of 15 g/kg feed provided the highest feed efficiency value, namely 18.2 ± 1.60%. Conversely, a dose of 45 g/kg feed was recorded as producing the lowest feed efficiency, namely 16.3 ± 1.50%. However, the results of the ANOVA test showed a significant value at 0.05 ($P>0.05$), which explains that variations in Grotop doses do not significantly affect the feed efficiency of tilapia fry in a recirculation cultivation system (RAS).

6. Feed Conversion Ratio (FCR)

The feed conversion ratio (FCR) of tilapia fry during the fish rearing period can be seen in Table 6.

Table 6. Feed conversion ratio (FCR)

Grotop Dosage (g/kg feed)	Feed (g)	Beginning (g)	End (g)	Dead (g)	Feed Conversion
0	10,36	46,41	95,03	9,46	0,178 ±0,42
15	14,93	60,1	143,13	3,56	0,172 ± 0,40
30	12,73	53,34	121,5	5,6	0,173 ±0,56
45	11,91	53,01	115,6	5,9	0,174 ± 0,58

Based on the research results, the Grotop dose of 15 g/kg feed produced the most efficient (lowest) FCR value, which was 0.172 ± 0.40. Meanwhile, the control group (0 g/kg feed) recorded the highest FCR value, which was 0.178 ± 0.42, which indicated the lowest efficiency. However, despite this, the results of the ANOVA statistical test showed a P value> 0.05, which indicated that variations in the Grotop dose had no significant effect on the feed conversion ratio of tilapia fry in the recirculation cultivation system (RAS).

7. Water Quality

Water quality parameters showed consistent conditions with a temperature of 26–27 °C and a pH of 7.91–7.96. These results indicate that the addition of boosters to the feed did not significantly impact water quality changes, as these values were still within the optimal tolerance threshold for tilapia growth. In general, tilapia can adapt well to waters with a pH between 5 and 11.

DISCUSSION

1. Absolute Weight Gain

Administering Grotop booster at a dose of 15 g/kg of feed resulted in the highest absolute weight gain in tilapia fry, at 7.2 ± 0.15 g, significantly higher than the control group, which only achieved 3.91 ± 0.21 g. This increase is likely influenced by the vitamins B1, B2, and C in Grotop, which play a crucial role in optimizing energy metabolism and aiding the formation and regeneration of fish tissues. The combination of vitamin C with other vitamins is also believed to strengthen the fish's immune system, which in turn accelerates growth and improves feed utilization efficiency.

This finding aligns with research by Amal *et al.,* (2021) and Gea *et al.,* (2023) which found that Grotop supplementation can accelerate the growth of fry, although the optimal dose varies between species—50 g/kg for gourami and 40 g/kg for catfish. This positive effect is attributed to the multivitamin content in Grotop, which can boost immunity and accelerate metabolism, thus supporting significant weight gain. Furthermore, adequate feed intake plays a role in accelerating fish adaptation to the culture environment and supporting accelerated growth (Mutia *et al.,* 2018; Lembang & Kuing, 2022). Over time, increased fish body weight also indicates that Grotop-enriched feed can provide essential enzymes and nutrients that support optimal growth (Ririhena & Palinussa, 2021).

2. Absolute Length Growth

The highest results for absolute length growth were achieved in the treatment with the addition of 15 g/kg of Grotop feed, amounting to 3.05 ± 0.12 cm. Conversely, the lowest value was found in the control group without Grotop supplementation, with a length of only 1.72 ± 0.29 cm. The 15 g/kg dose was considered the most effective in promoting fish length growth, likely due to the multivitamin content in Grotop, particularly vitamin B2, vitamin C, amino acids, and protease enzymes that support body elongation.

According to research conducted by Amal *et al.* (2021), vitamin B2 plays a crucial role in increasing metabolic activity that supports length growth, while vitamin C functions to accelerate tissue repair and strengthen the fish's skeletal system. Furthermore, amino acids are key structural elements in the formation of body tissue, thus directly contributing to body elongation. Protease enzymes also play a role in improving protein digestion, ultimately supporting overall physical growth.

Determining the optimal dosage must consider the growth rate and uniformity of the individual fish, so that cultivation results are more stable and efficient. The balance between protein and energy content in the feed also significantly influences the success of fish growth. Saifuddin *et al.,* (2020) stated that adding Grotop booster to the feed can increase the protein content of the feed, which is the main energy source in supporting maximum fish growth.

3. Specific Growth Rate (LPS/SGR)

The highest specific growth rate (SGR) was achieved in the treatment with a dose of 15 g/kg grotop booster, at 25.7 ± 0.39%. The lowest value was recorded in the treatment without grotop supplementation (0 g/kg), with an SGR of 13.9 ± 0.72%. This finding indicates that the 15 g/kg dose is the most effective dose level in increasing SGR. This is likely due to the multivitamin content, particularly vitamins B1 and B2, contained in the grotop booster, which supports increased daily growth rates. Adequate nutritional intake allows fish to experience a more significant daily increase in body weight compared to their initial weight, thus contributing to an increase in daily growth percentage.

This finding is consistent with the results reported by Gea *et al.,* (2023) and Kursistiyanto et al. (2013), which confirmed the important role of vitamins in grotop booster in increasing fish growth rates. Vitamin B1 functions as an appetite stimulant, increasing feed intake, and accelerating weight gain, while Vitamin B2 contributes to efficient daily weight gain, which then has a direct impact on increasing the SGR value. Variations in booster doses can trigger different physiological responses in fish, thus affecting growth rate. Furthermore, according to

Muchdar *et al.,* (2020), good feed quality and protease enzyme activity that meets the needs of fry are crucial factors in supporting increased fish growth rates.

4. Survival Rate (SR)

The highest SR was achieved at a dose of 15 g/kg, at 94.44 ± 4.81%, while the lowest was at a control dose of 0 g/kg feed, at 86.1 ± 4.80%. This is due to the multivitamin content, particularly Vitamin C, in the grotop booster, which has antioxidant properties, plays a role in protecting cells from stress and stimulating the immune system, thereby increasing the fish's resistance to stress and disease. Conversely, at doses without boosters, fish experienced nutritional deficiencies and digestive disorders, leading to a decreased survival rate. These findings align with Amal *et al.,* (2021) statement that Vitamin C can strengthen the fish's immune system and protect against stress and disease. A similar study on catfish also showed consistent results, with the lowest survival rate recorded at a dose of 0 g/kg, which is associated with decreased nutrient intake. Therefore, the SR of tilapia fry is strongly influenced by feed quality and environmental conditions.

Rina and Elrifadah (2015) stated that different dosages of feed used in tilapia cultivation using a recirculation system did not significantly affect fish survival rates. The main factors influencing fish survival are increasing the fish's resistance to stress, monitoring water quality parameters in the culture medium, and providing feed that meets quality and quantity standards. Furthermore, the amount of feed consumed and environmental conditions also play a significant role in determining tilapia survival. Zainul *et al.,* (2020) also added that fish survival is highly dependent on environmental quality and the adequacy of the feed provided.

5. Feed Efficiency (EP)

The highest feed efficiency (EP) was recorded at a Grotop dosage of 15 g/kg, at 18.2 ± 1.60%, while the 45 g/kg dosage produced the lowest EP, at 16.3 ± 1.50%. This is due to the multivitamin content in Grotop, such as Vitamin B1, which supports enzyme activity and the digestive process, which in turn helps convert feed into fish body weight. Amino acids play a direct role in increasing feed conversion into body tissue, while Protease accelerates nutrient absorption from feed, preventing wastage and increasing feed efficiency.

Amal *et al.,* (2021) and Gea *et al.,* (2023) also revealed that increased feed efficiency can be achieved through the use of multivitamins in Grotop. Vitamin B1, Amino Acids, and Protease work synergistically to increase metabolism, nutrient absorption, and reduce excessive feed requirements, ultimately optimizing fish growth and increasing feed efficiency in fish farming. Hendrik (2010) added that providing additional supplements does not always have a significant impact on feed efficiency, because this is very dependent on environmental conditions, the quality of the basic feed, and the adaptability of the fish.

6. Feed Conversion Ratio (FCR)

The lowest FCR value was recorded at a dose of 15 g/kg feed, with a value of 0.172 ± 0.40, while the highest FCR was found in the treatment without grotop supplementation (0 g/kg), with a value of 0.178 ± 0.42. The low FCR at a dose of 15 g/kg indicates that the use of grotop boosters can improve the efficiency of feed utilization by fish. The vitamin B1 content in the booster plays a role in increasing energy production required for growth, while protease enzymes facilitate more effective protein digestion, allowing optimal utilization of feed nutrients for building body mass in fish. This contributes to increased growth efficiency while reducing the FCR value.

These results align with those of Amal *et al.* (2021), Rina & Elrifadah (2015), and Gea *et al.* (2023), who revealed that the multivitamins in grotop boosters, particularly vitamin B1, amino acids, and protease enzymes, play a role in increasing the efficiency of metabolism and feed digestion. This has an impact on accelerating fish growth and reducing the amount of feed required for each gram of body weight gain, thus causing a decrease in the FCR value. Furthermore, Zulkifli *et al.,* (2023) added that the protein content in feed significantly influences the FCR value, where the ideal protein content can increase the efficiency of feed utilization, especially if the feed is adjusted to the fish's needs.

7. Water Quality

In fish farming, water temperature and pH are crucial parameters that influence fish growth and survival. During the study period, the water temperature was recorded at 26–27°C, well within the optimal tolerance threshold for tilapia (Mantayborbir *et al.,* 2023).

Meanwhile, the water pH was between 7.91–7.96, indicating stable water conditions and within the ideal pH range for tilapia, which is between 5 and 11. This pH stability is crucial for maintaining the fish's physiological balance and supporting effective metabolism and growth. (Rizky *et al.,* 2024).

CONCLUSION

1. Treatment with a dose of 15 g/kg booster grotop has proven to be an effective dose in supporting the growth and feed efficiency of tilapia. At this dose, the fish showed an absolute weight of 7.2 g, an absolute length of 3.05 cm, a specific growth rate (SGR) of 25.7%, a survival rate (SR) of 94.44%, a feed efficiency (EP) of 18.22%, and a feed conversion ratio (FCR) of 0.172.
2. This increased growth rate is thought to be due to the multivitamin and protease enzyme content in booster grotop, which can improve digestive efficiency, nutrient absorption, and metabolism in tilapia. However, administering a high dose of 45 g/kg actually tends to reduce growth, likely due to metabolic stress on the fish.
3. During the research, water quality remained within the optimal range, so that the increase in fish growth rate was more influenced by feed quality than fluctuations in environmental parameters.

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