Original Research Article

Effect of Combination of Trash Fish Meal and Wild Taro Leaves Flour on Growth Performance and Physical Characteristic of Juvenile Tilapia (*Oreochromis niloticus*) Feeds.

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ABSTRACT

The research aims to analyze the effect of the combination of trash fish meal and taro leaves flour on juvenile tilapia (*Oreochromis niloticus*) growth performance, the sinking rate of the pellets, and the best ratio of combination feeds that can increase juvenile tilapia growth performance. Juvenile tilapia with a length of 5-8 cm and weight of 7.27 ± 2.12 g were reared for 42 days in the aquarium 25 L with a stocking density of ten fishes. The experiment used was a completed random design consisting of 4 treatments and four replications. Treatment A (control), B (15% taro leaf flour), C (substitution of fish meal by 50% trash fish meal) in combination with 20% taro leaf flour, and D (substitution fish meal by 100% trash fish meal) in combination with 25% of taro leaf flour. The results showed that a combination feed of trash fish meal and wild taro flour as a source of protein juvenile tilapia significantly different (P = 0.05) on the tilapia growth performance and the sinking rate of fish feed. Treatment C has the highest SGR (1.01 ± 0.55 g) with a feed sinking rate of 1.95 cms^{-1}. So that the combination can reduce the level of use of fish meal and soybean meal.

Keywords: Growth Performance; Sinking rate; Taro Leaves; Tilapia; Trash Fish

1. INTRODUCTION

Tilapia (*Oreochromis niloticus*) is a freshwater fish that Indonesian people favorite. It has a savory taste, thick flesh, and high protein content. It can use as a source of protein for humans. Besides the nutritional content and the like, tilapia cultivation has good potential for further development [1]. Based on this opinion, market demand has increased and spurred tilapia aquaculture production. Statistical data [2] show that tilapia aquaculture production in 2018 was 1.2 million tons. In 2019 increased to 1.3 million tons, but in 2020 declined to 364 thousand tons due to the Covid-19 pandemic.

One of the factors needed in aquaculture is the availability of good quality feed because the requirement for diet during cultivation can spend 60-70% of the total production cost [3]. The raw feed materials on the market are dominated by an imported fish meal made from anchovies, herring, or menhaden with better quality and maintenance. Still, the price is relatively high, leading to high fish feed prices. Based on these conditions, it is necessary to develop alternative feeds made from local protein sources that are easy to obtain, cheap, and have appropriate nutritional content to reduce dependence on imported raw materials [4].

Omnivorous fish such as tilapia eat all kinds of food from both plant and animal origin, so protein sources that must be required are animal and vegetable protein. The ratio of animal and vegetable protein sources in omnivorous fish food is 40:60 [5]. Animal protein sources

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have a high level of digestibility which can facilitate the absorption of nutrients. It contrasts some vegetable protein sources' low digestibility levels due to their high fiber content and anti-nutritional substances [6]. Antinutrients are substances in food ingredients that can interfere with utilizing nutrients in the digestive tract. Fish still needs sources of vegetable protein in feed, but sources of vegetable protein that have high fiber and anti-nutritional content should be limited. If vegetable protein and animal protein sources were given simultaneously, they would complement each other [7]. Using local alternative raw materials is one way for cultivators to reduce production costs. Imported raw feed materials commonly used are fish meal and soybean meal, so the alternative is to use local raw materials sourced from animal and vegetable origin from fishery and agricultural waste. They are no longer appropriately used but still have high nutritional content and are used by the community as feed, including trash fish and taro leaves.

Trash fish is a by-product of catching fish traditionally used as fish or other animal feed, so it has low economic value. Trash fish has a high nutritional content, but because the condition of the fish is not hygienic and consists of several types of fish, trash fish is easily damaged, and the quality is not stable. The fresh trash fish had a chemical composition of ash 27.89%, crude fat 6.54%, crude fiber 1.64%, and crude protein 58.97% [8].

The leaves of the taro plant are rarely used by humans and tend to become agricultural waste. In the utilization of the trash, the leaves of taro can be used as an alternative feed for fish. Taro leaves have high nutrients. There is a composition of the protein content of 25.7%, ash 10.6%, and fiber of 11.2% [9], gross energy of 3,821 cal/g [10]. So, combining trash fish and wild taro leaves (*Colocasia esculenta*) can be used as raw material for fish feed. It hopes that the combine can optimize the growth performance of juvenile tilapia and the sinking rate of the pellets and decrease the use of fish meals and soybean meals.

2. MATERIAL AND METHODS

The research was carried out from March 1, 2022, to July 14, 2022, starting from the manufacture of feed until the last maintenance at the Aquaculture Laboratory, Building 4, Faculty of Fisheries and Marine Sciences, Padjadjaran University. The tools used in this research are an aquarium (25 L), flour machine, flour filter, pelleting machine, oven, digital scale, aeration installation, heater, basin, and measuring cup. The materials used were juvenile tilapia measuring 5-8 cm with a weight of 7.27 ± 2.12 g, an animal protein source (fish and trash fish meal), a vegetable protein source (soybean, taro leaf, and rice bran flour), tapioca flour, topmix, and fish oil. The composition of the raw materials used is arranged according to the ratio of animal and vegetable protein sources to omnivorous feed, which is 40:60

Table 1. Formulation Diets

Raw material	Treatment				
	A	B	C	D	
Trash fish meal	0	0	10	20	
Fish meal	20	20	10	0	
Taro leaf flour	0	15	20	25	
Soybean meal	45	30	25	20	
Rice bran flour	20	20	20	20	
Tapioca flour	8	8	8	8	
Topmix	5	5	5	5	
Fish oil	2	2	2	2	
Total	100	100	100	100	Standard

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Total Protein (%)	29,29	28,98	28,52	28,19	25-30 [11]
Total fat (%)	14,66	12,17	11,30	10,45	6-10 [11]
Total fiber (%)	5,70	8,11	8,68	9,13	3-5 [12]

The experiment used was a completed random design consisting of 4 treatments and four replications, with a stocking density of 1 fish/2 L [13]. The feeding rate of juvenile tilapia is two times a day, as much as 3% of the biomass. The combined dose of treatment feed in research where the trash fish meal substitutes fish meal and taro leaf flour as an addition from the total ingredients used is as follows:

A: 0% trash fish meal and taro leaf flour (control)

B: 15% taro leaf flour without the combination of trash fish meal

C: 50% trash fish meal substitutes fish meal and combination with 20% taro leaf flour

D: 100% trash fish meal substitutes fish meal and combination with 25% taro leaf flour

2.1 Test Feed

The preparation of the test feed started with washing trash fish dominated by *petek* (*Leiognathus equulus*) fish and then drying under the sun for seven days and then drying again using an oven at 60^{o}C for 6 hours, after that the fish were mashed with a flour machine. Taro leaf flour was made by drying the taro leaves that have been separated from the bone leaves under the sun for three days. After that, they are mashed using a blender. The trash fish meal and taro leaf flour are sieved to separate the coarse flour. The feed raw materials that have been weighed as needed are mixed and added with sufficient water, and then enter the feed mixture into the pelleting machine. The feed was dried at 60^{o}C for 18 hours.

2.2 Observation Parameters

2.2.1 Spesific Growth Rate (SGR)

The formula for calculating the specific growth rate is the following equation [14]:

$$\boldsymbol{SGR = \frac{(lnWt - lnW0)}{t} x\ 100\%}$$

Information:

SGR = Specific growth rate (% day^{-1})

W0 = Initial weight (g)

Wt = final weight (g)

T = Rearing period (days).

2.2.2 Physical Characteristic Feed

The feed sinking rate test is the distance divided by the time it takes the feed to reach the bottom of the measuring cup. This test was carried out by dropping 5 grains of feed into a 500 ml measuring cup filled with water as high as 20 cm. The time is calculated from the time the feed touches the water surface until the feed touches the water bottom [15]. The palatability of fish feed test by observing each aquarium that was fed 2 g pellets. After that, comparing how much diet was left in each aquarium [16]

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3. RESULTS AND DISCUSSION

3.1 Spesific Growth Rate

Based on the data that showed in Fig. 1 that feeding with a combination of trash fish meal and taro leaf flour in the feed showed that the feed given had a significant effect on the specific growth rate of tilapia seeds, which ranged from 0.77% - 1.01%.

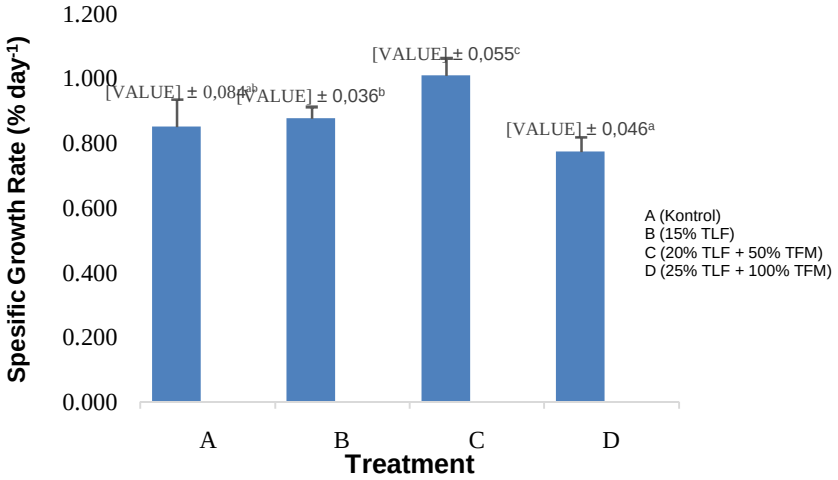

Fig. 1. Diagram of Juvenile Tilapia Spesific Growth Rate

The specific growth rate is the percentage of daily juvenile tilapia weight gain. The difference in the value of the specific growth rate occurs because the fish used to have different types, weights, and doses of feed combinations, so the resulting growth rates are different [17]. The specific growth rate in treatment feed A (control) was not significantly different from treatment feed B and D. It was significantly different from treatment feed C. The quality of imported fish meal used is not the same as the trash fish meal produced. However, it has almost the same protein content, and the amino acid levels in imported and trash fish meals are different. Based on research [18] regarding artificial feed using *petek* fish meal, the more use of *petek* fish meal used, the more protein broke into peptides to amino acids, so the growth will be higher because the amino acids are absorbed by the fish body more and more. This means that the higher the protein sourced from animal protein, the higher the amino acid produced so that it can affect growth.

Based on the data, the highest specific growth rate was the treatment feed C (1,008%), and the lowest was the treatment feed D (0,773%). This was due to the high fiber content. Fish can consume feed with crude fiber content ranging from 3-5% [10], but some fish can tolerate crude fiber content up to 8-12% but tend to reduce growth [19]. The fiber can reduce the absorption rate of feed nutrients because the plant cell walls in the feed will limit the diffusion or absorption of nutrients and retain nutrients available in intestinal fluids and digestive enzymes so that the nutrients absorbed are not absorbed. Meet the needs of fish for growth. Feeds containing high fiber can also reduce fish appetite because the complex carbohydrate composition can make fish feel full easily and decrease feed consumption [20].

The use of taro leaf flour of as much as 20% is the optimal dose that can increase growth performance (SGR 2.07%), and a dose of 25% can reduce the growth of tilapia (SGR

1.86%) [21]. The use of forage flour, such as Indigofera leaf, can reduce growth if the dose level exceeds 20% [22]. This is due to the high crude fiber and the presence of anti-nutritional substances that can inhibit the digestion of tilapia so that the feed consumed by fish is not absorbed optimally, resulting in low growth.

3.2 Physical Characteristic Feeds

Based on the physical characteristics of the observed feed, namely feed sinking rate and feed palatability. The sinking speed of the feed on the given feed treatment showed that the ability of the feed to reach the bottom of the rearing media slowed down with the addition of taro leaf flour and trash fish. Fig. 2 shows the treated feed's sinking speed to reach the water's bottom.

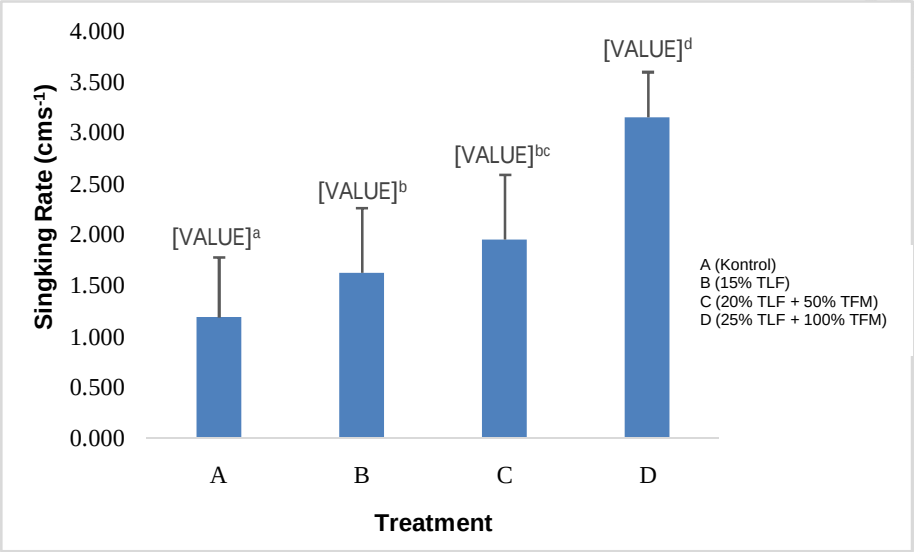

Fig. 2. Feed Sinking Rate

feed sinking rate was tested to observe how long it took the feed to reach the bottom of the water since it was stocked on the surface. The research results show that the time it takes for feed to reach the bottom is getting longer with the addition of taro leaves. This is supposed to be because, with the increase in trash fish meal and taro leaf flour, there is less soybean meal, where the particle size is small, and the density is heavier when compared to taro leaves. The greater the feed's density when compared to the water's density, the faster the feed will sink [23]. The sinking speed of the feed will be faster if the specific gravity level is higher with a smaller particle size [16].

The palatability of fish feed to the treatment given showed that with the addition of taro leaf flour and trash fish, the attractiveness of fish to the feed decreased. Table 2 shows the level of palatability of fish to the treatment feed given during the rearing period.

Table 2. Feed Palatability

Treatment	Replications			
	1	2	3	4
A	+++	+++	+++	+++
B	+++	+++	+++	+++
C	+++	++	+++	++
D	++	++	++	+++

The palatability test on feed was carried out to find which feed was preferred by fish because fish were more interested in consuming a meal with a distinctive aroma. The appetite in fish is influenced by the smell of the diet (attractant) [24]. Based on the results of research, with the addition of trash fish meal, the smell of the fish gets stronger, but because it is accompanied by the addition of more and more taro leaf flour, it also increases the aroma produced by the leaves. This resulted in a decrease in the level of palatability in fish with the addition of taro leaf flour. The aroma released from forage feeds was less favored by fish [25].

4. CONCLUSION

The combination of trash fish meal and taro leaf flour significantly affected growth and feed sinking rate. The best combination feed ratio of trash fish meal and taro leaf flour (*Colocasia esculenta*) was 50% trash fish meal substitutes fish meal and combination with 20% taro leaf flour with a specific growth rate of 1.01% and feed sinking rate of 1.95 cms^{-1}. So that the combination can reduce the level of use of fish meal and soybean meal.

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