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Fisheries and Aquaculture Journal

Research Article

Formulated Feeds for Genetically Improved Farmed Tilapia (GIFT)

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ABSTRACT

Background: The problem in the development of Genetically Improved Tilapia brought about by the protein from the expensive fish feed is the surprising cost of fish feeds. The study's aim is to look for an alternative and cheap fish feed. The research identified Genetically Improved Farmed Tilapia (GIFT) growth and survival rates in the HAPA using formulated sweet potato granules and commercial feeds as the grounds for the development of a Technology Guide. The experiment method has been used in the research.

Results: The findings showed that the three formulated feeds have lower protein (20.33, 19.3, and 19.6) yet with higher fat (24.1, 15.69, and 10.72) than the commercial (24.1%, 3%). The initial and final weight in grams, length in centimeters and width in centimeters were highest on T1 then followed by T2 and T3. It was with the use of T1 which proved to be an effective feed.

Conclusion: The ingredients utilized in the feed formulations are possible substitution of fish feed and the advancement of its usage is commendable.

Keywords: Formulated feeds; Genetically improved farmed Tilapia; Fish feed

Abbreviations: ADB: Asian Development Bank; ANOVA: Analysis of Variance; GIFT: Genetically Improved Farmed Tilapia; FCR: Feed Conversion Ratio; FE: Feed Efficiency

INTRODUCTION

Tilapia farming is a significant factor in this phenomenon in Southeast Asia and has primarily evolved around one species, Nile tilapia. In the 1970s, tilapia agriculture in Asia started to thrive and was followed by regional improvements in hatchery technology and pond husbandry. The genetic aspects of most fish farming, including tilapia farming, were overlooked until the mid-1980s, unlike in land animal farming, where selective breeding is centuries old. By that moment, in stagnating tilapia returns, the effects of this absence of attention to genetics were starting to demonstrate.

According to Pemsl et al. research [1] in the last four decades, the aquaculture industry has witnessed drastic development, particularly in developing nations. Increasing the development of aquaculture is a mixture of area expansion and technological change (increased strains, feed and fertilizer input, and improved management). One instance of such technological change is the selective tilapia breeding attempts launched together with (inter)national partners by the World Fish Center (then ICLARM) in 1988. The result of the selective breeding attempt was a tilapia strain called "GIFT," which was first released in 1993 and the growth levels in on-farm studies were considerably greater. The strain was embraced in the Philippines for the first time, but has since spread to 11 Asian nations. Ex-ante trials showed the potential of the GIFT strain and found that significant effect can be anticipated from strains derived from GIFT and GIFT. The research is an ex-post evaluation of the effect of GIFT on the farm level and how the technology was disseminated and used. The research is based on a survey of 780 tilapia manufacturers in three areas in Luzon, the Philippines, undertaken in 2006/2007.

The study analyzes GIFT strain acceptance rates and compares GIFT vs. non-GIFT strain results and the effect on tilapia returns of various variables. The main results are that the acceptance of pure GIFT strains is very small (6%) based on farmers ' reporting, while nearly half of farmers reported using GIFT strains obtained. In at least 27% of cases, there is

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Received: September 16, 2019; **Accepted:** June 22, 2020; **Published:** June 29, 2020

Citation: Villarino RT (2020) Formulated Feeds for Genetically Improved Farmed Tilapia (GIFT). Fish Aqua J 11:277. doi: 10.35248/2150-3508.20.11.277

uncertainty about the genetic origin of the strains, and questions about the purity of the breed remain even for the GIFT and GIFT-derived strains.

In at least 27% of cases, there is uncertainty about the genetic origin of the strains, and questions about the purity of the breed remain even for the GIFT and GIFT-derived strains. The GIFT and GIFT-derived strains did not perform any better compared to other strains based on the scores of farmers and the recorded manufacturing data. This is probable to be the consequence of bad leadership over the last 15 years of enhanced strains rather than a shortcoming of the initial GIFT technology.

Nutritionists around the globe are constantly looking for sources of dietary protein in which fish will maximize development and boost output in the shortest moment and at the highest price possible. Peelings and leftover materials are one of the cheapest nutrient sources that can decrease the elevated price of fish feed. Many studies were carried out using multiple protein sources such as chicken entrails and formulated Gabate kangkong feeds as quoted by Tabanao [2].

As Ansah et al. [3] quoted in 2014, Tilapias (Family: Cichlidae) is appropriate for multiple aquaculture systems owing to its ease of propagation, handling tolerance, rapid development in both natural and produced feed, tolerance of a broad spectrum of environmental circumstances, and elevated palatability, marketability and nutrient content. Because of their rapid development and brief generation time, tolerance to a broad spectrum of environmental circumstances, resistance to stress and disease, ability to reproduce in captivity, and acceptance of artificial feeds immediately after yolk-sac absorption, they are particularly well suited for culture in developing nations. From 1970 to 2010, global tilapia production in aquaculture risen from 28,000 tons to over 3 million tons. Globally, tilapias were the dominant group of animals caught in inland fisheries between 2000 and 2005 (the tilapias were exceeded by cyprinids in 2005. In terms of aquaculture manufacturing, tilapias accounted for roughly 5% of complete worldwide fish farming, second to carps, which accounted for over 70%.

GIFT's implementation and dissemination has produced important rural income and jobs, contributing to human nutrition, particularly among the poor, as tilapia is a comparatively cheap fish. Tilapia farming offers an appealing livelihood for hatchery operators and fish farmers and GIFT has made an important contribution to job creation, including for poor small-scale farmers [4].

The study has attempted to discover the nearly ideal species that will develop quickly in a feeding, development, and survival setting. The study lastly selected the GIFT or the Genetically Improved Farmed Tilapia after thorough studies.

The ultimate goal of this study is to encourage sustainable development while providing the Filipino people with financial possibilities. "Give a fish to a man; he's going to eat a day. Teach him how to farm fish. He'll feed himself (but may need subsidies for life).Teach him how to use tilapia as his main crop fish. He'll have a tool that will sustain his future development if used wisely."(Adapted from Anonymous and Jérôme Lazard).

METHODS

Research materials

The materials used in the study were the species of Genetically Improved Farmed Tilapia, formulated sweet potato granules, and commercial feeds. There were four HAPAs; and each HAPA was placed with 10 pieces of Genetically Improved Farmed Tilapia post fingerlings at 30 grams each and is randomly mixed with male and female GIFT. The Genetically Improved Farmed Tilapia placed in T_0 were the control group fed with commercial feeds while those of T_1 or the 1.5kg sweet potato peelings (Boniatos)+750 g leftover fish bones of the mackerel scad (*Decapterus macarellus*)+375 ml of Vegetable oil+3 tabs amino acid feed, T_2=1 kg sweet potato peelings (Boniatos)+750 g leftover fish bones of the mackerel scad (*Decapterus macarellus*) +375 ml of Vegetable oil+2 tabs amino acid feed, and T_3=0.5 kg sweet potato peelings (Boniatos)+250 g leftover fish bones of the mackerel scad (*Decapterus macarellus*)+125 ml of Vegetable oil+1 tab amino acid feed. The instrument, apparatus, and equipment used in the study were the HAPA, aerators, meat grinder, ladles, mixing bowl, drying trays, weighing scale, scoop net, and basins.

Gathering and formulation of feeds

Diet formulation is the method of combining the available raw materials to satisfy the established nutrient requirements of Genetically Improved Farmed Tilapia. In this study, the sweet potato peelings were selected as one of the raw materials, which is believed to have the ability to supply nutrients and at the lower cost.

In this procedure, the sweet potato peelings (Boniatos) were the main materials, were first procured and gathered. The peelings were then air dried. Then, all the materials such as the sweet potato peelings (Boniatos)+leftover fish bones of the mackerel scad (*Decapterus macarellus*)+Vegetable oil+amino acid were mixed thoroughly in a mixing bowl.

The mixture was then passed through a meat grinder. Then the extrusion, which looked like granules were dried; after drying, the final product is now ready for use.

Determination of proximate composition of feeds

All tests of formulated and the commercial feeds were broken down in the F.A.S.T. lab for the proximate composition as to moisture, crude protein, fat, ash, energy content, and sodium. Moisture and ash were resolved by the standard strategies for AOAC 1995. Difference determined the total carbohydrates. For sodium determination, the test was processed with nitric acid added with potassium chloride and diluted to know the volume. The test solution was suctioned through AAS set inflame discharge mode for estimation.

The control and experimental groups

There were four treatment groups involved in the study, the T0 the control group, T1 or the 1.5kg sweet potato peelings (Boniatos)+750 g leftover fish bones of the mackerel scad (*Decapterus macarellus*)+375 ml of Vegetable oil+3 tabs amino

acid feed, T2=1 kg sweet potato peelings (Boniatos)+750 g leftover fish bones of the mackerel scad (*Decapterus macarellus*) +375 ml of Vegetable oil+2 tabs amino acid feed, and T3=0.5 kg sweet potato peelings (Boniatos)+250 g leftover fish bones of the mackerel scad (*Decapterus macarellus*)+125 ml of Vegetable oil +1 tab amino acid feed.

The T_0, the control group, was placed with Genetically Improved Farmed Tilapia using commercial feeds and, T_1 or the 1.5kg sweet potato peelings (Boniatos)+750 g leftover fish bones of the mackerel scad (*Decapterus macarellus*)+375 ml of Vegetable oil+3 tabs amino acid feed, T_2=1 kg sweet potato peelings (Boniatos)+750 g leftover fish bones of the mackerel scad (*Decapterus macarellus*)+375 ml of Vegetable oil+2 tabs amino acid feed, and T_3=0.5 kg sweet potato peelings (Boniatos)+250 g leftover fish bones of the mackerel scad (*Decapterus macarellus*) +125 ml of Vegetable oil+1 tab amino acid feed, the experimental groups, were placed with the same species using formulated sweet potato granules. Each aquarium was placed with 10 pieces of GIFT at 30 grams each, and had eight samplings.

The feeding was done twice daily. The daily feeding rate was 3% of the total body weight. One-half of the total feeds for the day were given in the morning between 6 and 8 o'clock and the other half in the afternoon 4 and 6 o'clock. The weights and survival rates of the Genetically Improved Farmed Tilapia were taken and recorded every sampling.

Water quality

The water quality was monitored on a daily basis to decide the impact of formulated feeds on it. The parameter for water quality such as temperature, oxygen, and salinity was checked multiple times daily (twice both toward the beginning of the day and afternoon) using an advanced DO meter. The pH was determined two times every week. The ammonia and nitrate were resolved weekly using the API test pack. The criteria for desired water quality depended on the study of Go, et al., (2018). The ideal extents are as follows: DO (3-5 ppm); temperature (22-35 0 C); pH (6.5-8.5); saltiness (<45 ppt);ammonia (<0.025), nitrate (0.1-4.5); and nitrite (<0.02).

Research gathering techniques

As a comparative study, the investigator had leaned on the effects of formulated sweet potato granules and commercial feeds on the growth and survival rates of Genetically Improved Farmed Tilapia. Sampling of the species was done every weekend and the data were gathered through the daily observations of the researcher. Through observations, the researcher recorded the data and tabulated for analysis and interpretations. The data gathered were arranged and put into tables for illustration of the analysis and interpretations.

Biostatistical treatment

Biostatistical treatment used in the study which the researcher wanted to answer and diagnose carefully the specific problems were: (a) Arithmetic Mean was used to determine the weight, length, and width of the Genetically Improved Farmed Tilapia. (b) To determine the significant difference among growth factors, ANOVA was utilized. (c) To express the total variation that can be attributed to the growth factors, Sum of Squares was used. (d) Tukey Test was employed to determine which treatments were significant.

RESULTS

The crude protein (Table 1) of the formulated feeds indicated that commercial feed contained the highest protein; next is T_1 while T_2 and T_3 had nearly the equivalent amount. Results further uncovered that there were no significant ($p<0.01$) contrasts in the crude protein of the three formulated feeds. Nonetheless, when contrasted with the control feed, their protein substance were significantly ($p<0.01$) lower.

Table 1: Composition of formulated feed.

Parameters	T_0	T_1	T_2	T_3
Crude Protein (%)	$_a$24.1	$_b$20.33	$_b$19.3	$_b$19.6
Carbohydrates (%)	40.2	43.07	45.44	41.16
Crude Fat (%)	$_a$3	$_b$24.1	$_c$15.69	$_d$10.72
Fiber (%)	8.7	7.81	3.55	5.61
Ash (%)	11.5	3.5	2.18	2.44
Moisture (%)	9.9	10.31	10.24	8.5
Sodium,ppm	$_a$0.11	$_b$362.9	$_c$250.1	$_d$430.2

The same superscripts don't significantly differ ($p<0.05$). a,b,c,d are variables.

With respect to carbohydrates compositions of the control and experimental feed, the most noteworthy worth was observed in T_2 and the least worth was in the control feed. Notwithstanding, the carbohydrates content among the four feeds were practically identical as an inconsequential result was got utilizing the trial of Analysis of Variance (ANOVA).

The formulated and control feeds have various amount (Table 1) of crude fat. Among the formulated, Treatment 1 contained significantly higher amount (24.1) followed by T_2 then, at T_3 (10.72). The fat compositions of these feed were significantly higher than the control feed as it had the least fat substance (3.0). The high-fat contents of the formulated feeds compensate for their low protein contrasted with the control feed as the ongoing pattern in fish feeds is to use higher levels of lipids in the eating routine. Although increasing dietary lipids can help lessen the high expenses of eating regimens by incompletely sparing protein in the feed, issues such as excessive fat statement in the liver can decrease the wellbeing and market quality of fish.

The fiber content among the experimental groups uncovered that T_1 acquired the highest percentage. The least amount was seen in T_2. The control feed had the highest fiber substance of

8.7 than the experimental groups. Their fiber compositions did not essentially contrast. As indicated by Go, et.al 2018 that it isn't prescribed for fish to contain fiber substance past 8-12% since these amount would result in the decrease in nature of unusable supplement. In this way, the fiber amount of these feed were in the acceptable range.

Concerning the ash amount of the four groups, the control feed obtained significantly higher amount (11.5) compared to the three experimental feeds (T_1, T_2, T_3) which have ash amount extending from 2.18-3.5. These qualities are not exactly the required content in feeds since according to Khaw, et al. [4] the standard ash content in fish sustains for the most part goes from 7%to 12%. The outcome suggests that formulated feeds contain less minerals analyzed than the control feed. Along these lines, they have to be supplemented with minerals to provide better development execution to angle. On the other hand, the acquired ash of the control feed surpasses as far as possible. In this manner, it may have negative consequences for the fishes, including expanded mortality and reduced growth [5,6].

The sodium content of the formulated feeds was estimated in ppm. The obtained sodium of the four groups is reflected in Table 1. The information demonstrates that the sodium content of the four feeds were significantly unique. T_3 has significantly higher substance followed by T_1 and T_2; the control feed got the least amount.

Growth performance

The growth performance and survival rate of Genetically Improved Farmed Tilapia in a HAPA for 60 days is shown in Table 2.

Table 2: Growth performance and survival rate of Genetically Improved Farmed Tilapia (GIFT).

	T_0			T_1			T_2			T_3		
	Initial	Final	Weight Gain	Initial	Final	Weight Gain	Initial	Final	Weight Gain	Initial	Final	Weight Gain
Total	153	710	556.9	153.2	638	484.9	153	604	451	153.2	540	386.9
Mean	15.3	71	55.69	15.32	63.8	48.49	15.3	60.4	45.1	15.32	54	38.69

Results revealed that T_1 showed better growth execution among the formulated feeds because it had the most amazing weight gain in addition to the control feed and the least value was seen in the examples supported by T_3. This may be anticipated to result in a slightly greater quantity of protein in T_1, but its fat content was the least compared with the other two medicines (T_2 and T_3). Nevertheless, in the Weight Gain and Length Increases of the four medicines, ANOVA Examination showed no critical ($p<0.01$) comparison. Despite the reality that control feed saw the highest ordinary weight gain, the value was practically identical to that of control feed.

Water quality

Table 3: The Effect of treatments on water quality.

Parameter	T0	T1	T2	T3
Dissolved O_2 (mg/dl)	4.5	4.7	4.4	4.5
Temperature (°C)	28.5	28.6	28.6	28.5
ph	7.3	7.3	7.3	7.3
Ammonia	-	-	-	-
Nitrate	-	-	-	-

(-) not detected

Results indicated not significant ($p<0.05$) in all the parameters of the five groups. Moreover, all qualities are inside the scope of standard values. It demonstrated great water quality for the whole time of study. It suggests that the formulated feeds had no antagonistic impact on the water quality that may influence the health and survival of the Genetically Improved Farmed Tilapia (Table 3).

DISCUSSION

Proximate composition of formulated feeds

Protein inclusion is the most costly piece of a fish feed; in this way it is vital to satisfy and match each fish species ' appropriate and least protein requirement and amino acids [7]. The protein requirement of a fish relies on a number of variables, including water temperature and water quality, as well as its hereditary structure and nutritional levels [7]. Providing high quantities of protein in an animal diet is both financially and environmentally ridiculous, since, as stated by Banrie [7], protein parts are one of the very costly nutritional elements, and taking into account excessive proteins also builds the nitrogen excretion of the fish.

The correct amount of carbohydrates should be provided in fish feeds to ensure the highest nutrient usage, growth, and digestion and health results of fish [8]. Protein, fat and sugars are the fundamental components of meals [7]. Protein in fish feed is

used for fish development as long as both fat and sugar are adequate; something else will be used as a source of vitality [7]. It can subsequently be suggested that high-vitality fat supplements can be used as a replacement for protein in feed formulation [7]. Consequently, the latest consolidation of high fat in fish consumes fewer calories.

When appropriate measures of crude fiber are integrated into the fish feed, different health benefits can be attributed that can be shown in the duration and size growth of the species. Indeed, crude fiber assumes an important job in fish health by efficiently removing poisons and waste products as a result of its ability to bind water along these lines helping the animal to also create firmer stools [8]. Moderate fiber inclusions in feeds enhance binding as well as feed section within the feed channel. The development of sodium in the form of salt makes the sustenance increasingly satisfactory and has some benefits for fish diets such as boosting the appetite of the fish and acting as humectants by reducing motion of the water. As mentioned by Towers as quoted by Go, et al. [9] in 2018 promotes consideration of salt in fish to yield important outcomes in the growth and efficiency of fish.

Growth and survival rates of the Genetically Improved Farmed Tilapia (GIFT)

Despite the study of Magondu et al. as cited by Go, et al. [8], the results of the study were that sustaining the fish on detailed eating schemes resulted in a significantly higher mean fish weight gain than that of fish benefiting from unfigured eating schemes on the grounds that the highest weight gain was seen in the fish samples benefiting from commercial feed. Control feed has the lowest Feed Conversion Ratio estimate and the highest Feed Efficiency followed by T_1 while T_3 has the highest Feed Conservation Ratio estimate. It implies a smaller measure of T3 feed is needed to contrast one kilo of fish with T_2 and T_1. On the other side, T_3 shows bad performance in the growth of fish, but it also needs the most amazing feed measure to provide one kilo of fish in contrast to the other two procedures (T_1 and T_2). The estimates of Feed Conversion Ratio collected in this research were smaller than the values of Feed Conversation Ratio collected on tilapia fingerlings by Adewolu [5] maintained weight control plans with distinct protein concentrations. Also, in this research, the values of Feed Conversion Ratio and Feed Efficiency were not within the range of "healthy growth" as they competed with Craig, et al. [7], a healthy growth feed should have an estimated Feed Conversion Ratio of 1.5-2.0 or a Feed Efficiency of half. It indicates that the formulated feeds should be enhanced to guarantee the Genetically Improved Farmed Tilapia (GIFT) is ideally developed [10-23].

Water quality

The superb quality of water maintained throughout the experiment was due to the velocity of momentum generated by winds producing waves that resulted in excellent water trade in all boundaries. As a result, there was no uneaten nutrition loaded on the HAPA and ammonia and nitrate development was avoided.

CONCLUSION

The formulated feeds have the option of adding the commercial feed equal to the development of the Genetically Improved Farmed Tilapia (GIFT). They are also possible in feed formulation to replace fishmeal in order to decrease feed costs. In this way, sweet potato peelings (Boniatos) and the remaining mackerel scad fish bones (Decapterus macarellus) that do not compete with human consumption should be developed for use in the formulation of feed.

DECLARATIONS

Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon request.

Competing interests

The author declares that he has no competing interests of this article.

Funding

The author received no financial support for the research, authorship, and/or publication of this article.

Acknowledgement

The author of this article is grateful to the University President of Cebu Technological University and to the Campus Director of Cebu Technological University – Moalboal Campus.

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