

WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

Batch #18

1. SUBJECT CLASSIFICATION	A. PRIMARY Agriculture	AM40-0000-0000
	B. SECONDARY Aquatic biology	

2. TITLE AND SUBTITLE
Relationship between rate of feeding, rate of growth, and rate of conversion in feeding trials with 2 species of Tilapia: T.mossambica Peters and T.nilotica Linneaus

3. AUTHOR(S)
Shell, E.W.

4. DOCUMENT DATE 1968	5. NUMBER OF PAGES 6p.	6. ARC NUMBER ARC
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7. REFERENCE ORGANIZATION NAME AND ADDRESS
Auburn

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)
(In FAO fisheries rpt.44,v.3:III/E-9,p.411-415)

9. ABSTRACT

10. CONTROL NUMBER PN-RAA-990	11. PRICE OF DOCUMENT
12. DESCRIPTORS Food consumption Growth Tests Tilapia Weight	13. PROJECT NUMBER
	14. CONTRACT NUMBER CSD-1581 GTS
	15. TYPE OF DOCUMENT

RELATIONSHIP BETWEEN RATE OF FEEDING, RATE OF GROWTH AND RATE
OF CONVERSION IN FEEDING TRIALS WITH TWO SPECIES OF TILAPIA,
TILAPIA MOSSAMBICA PETERS AND TILAPIA NILOTICA LINNEAUS

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Reprinted From
Proceedings of the World Symposium
On Warm-Water Pond Fish Culture, Rome, Italy
May 18-25, 1966
FAO Fisheries Report 44, Vol. 3: III/E-9, p. 411-415
1968

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Abstract

An experiment was conducted to determine the relationship between feeding rate, growth rate and conversion in two species of tilapia. In Tilapia mossambica Peters growth rate increased four-fold when the feeding rate was increased from 1 to 2 percent. There was little increase in growth rate when the feeding rate was increased with increases in feeding rate from 1 to 4 percent. The best conversion rate was obtained at the 2 percent feeding rate with T. mossambica and at the 1 percent feeding rate with T. nilotica. Most economical rates of feeding were lower than the rates giving maximum growth.

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RAPPORTS ENTRE LA RATION ALIMENTAIRE, LE TAUX DE CROISSANCE ET LE TAUX
DE CONVERSION CONSTATES AU COURS D'ESSAIS D'ALIMENTATION AVEC DEUX
ESPECES DE TILAPIA, T. MOSSAMBICA PETERS ET TILAPIA NILOTICA
LINNAEUS

Résumé

Des expériences ont été faites pour déterminer les rapports entre la ration alimentaire, le taux de croissance et le taux de conversion chez deux espèces de Tilapia. Avec Tilapia mossambica Peters, le taux de croissance quadruple lorsque la ration alimentaire est portée de 1 à 2 pour cent. Par contre, le taux de croissance n'augmente guère lorsque la ration passe à 3 et 4 pour cent. Le meilleur taux de conversion a été obtenu avec une ration alimentaire de 2 pour cent pour T. mossambica et une ration de 1 pour cent pour T. nilotica.

Les rations alimentaires les plus économiques sont inférieures aux rations donnant le maximum de croissance.

RELACION ENTRE LOS INDICES DE ALIMENTACION, CRECIMIENTO Y TRANSPORTE EN LOS
ENSAYOS DE ALIMENTACION CON DOS ESPECIES DE TILAPIA, T. MOSSAMBICA PE-
TERS Y TILAPIA NILOTICA LINNAEUS

Extracto

Se llevó a cabo un experimento para determinar la relación entre los índices de alimentación, de crecimiento y de conservación en dos especies de tilapia. En Tilapia mossambica Peters el ritmo de crecimiento aumentó al cuádruplo al elevarse la proporción de alimentación del 1 al 2%. Se registró poco incremento en el índice de crecimiento cuando la proporción de alimentación se aumentó con incrementos en la tasa de alimentación del 1 al 4 por ciento. El mejor índice de conversión o transformación de los alimentos se obtuvo a la tasa de alimentación del 2 por ciento con T. mossambica y a la del 1 por ciento con T. nilotica. Las tasas de alimentación más económica fueron más bajas que las tasas que daban el máximo crecimiento.

1 INTRODUCTION

The relationship between rate of feeding and rate of conversion is very important in fish culture. If fish are fed at too high a rate, much of the food is wasted, and, even though growth may be excellent the cost of production is excessive. Further, in some cases uneaten food decaying in the water may be detrimental to fish growth. If the feeding rate is too low, approaching the rate required for maintenance, growth is very slow, and the rate of conversion very high. In this case the amount of food fed is low, is largely wasted, and there is no growth.

The relationship between feeding rate and conversion rate is dependent on the species of fish, size of fish, quality of food and water temperature. The research reported here was conducted to determine the relationship between rate of feeding, rate of growth and conversion in feeding trials involving Tilapia mossambica Peters (Java tilapia) and T. nilotica Linnaeus (Nile tilapia).

2 EXPERIMENTAL PROCEDURE

Tilapia being wintered in troughs in the Fisheries Laboratory were used in these experiments. The 16 troughs of tilapia, eight troughs of Java tilapia and eight troughs of Nile tilapia were fed a percentage (1, 2, 3 or 4 percent) of their body weight each day for six days per week for four weeks (11 March 1959 to 7 April 1959). Each feeding rate was replicated in two troughs for each species. The amount to be fed each day was calculated on the basis of total weight of fish in each trough at the beginning of the experimental period. At the end of two weeks the fish in each trough were weighed, and the amount fed was adjusted to the gain in weight of the fish during that 14-day period.

Troughs with Java tilapia contained an average of 9.44 kg of fish at the beginning of the experiment. Troughs with Nile tilapia contained an average of 14.74 kg of fish.

The diet used in these experiments consisted of 80 percent Auburn No.2 meal (35 percent peanut meal, 35 percent soybean meal, 15 percent fish meal, 15 percent distiller's dry solubles) and 20 percent finely ground beef liver. The diet was prepared by mixing liver with water to form a heavy slush. This slush was then added to the meal and mixed until the resulting product was about the consistency of wet sawdust. It was found necessary to add the liver to water before adding it to the meal. Finely ground liver added directly to the meal resulted in a product that could not be evenly mixed.

The diet was mixed each morning and weighed into plastic cups. The fish were fed a day's ration in two to four daily portions. The fish receiving 1 percent of their body weight per day were usually fed twice. Fish receiving 4 percent were fed four or even five times per day. This was necessary because of the relatively small stomach capacity of the tilapia. If too much feed was added to the trough at one time, the fish quickly became gorged, leaving feed on the bottom of the trough. Utilization of feed on the trough bottom was usually poor in troughs being fed at the higher rates.

The troughs were partially cleaned each day. Troughs in which fish were being fed at lower rates (1 or 2 percent) could be cleaned by washing the space behind the retaining board. Apparently because of activity of the fish, the small amount of waste feed and faeces present in these troughs was washed under the board. In troughs in which fish were being fed at the 3 or 4 percent rate, the sweeping action of the fish was not sufficient to keep the troughs clean. These troughs were cleaned either by draining to a low level and sweeping out the wastes, or by using a siphon hose to remove the collected faeces and waste feed. Water was added to the troughs continuously at a rate sufficient to provide about one change of water per hour.

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3 RESULTS OF FEEDING TRIALS WITH JAVA TILAPIA

The gains in weight of fish receiving the different levels of feeding are expressed as a percentage of the initial weight of fish. These are termed growth rate throughout this paper. The growth rate data resulting from the feeding trials with Java tilapia are as follows:

<u>Percent fed</u>	<u>Growth rate</u>	<u>Conversion</u>
1	5.8	4.1
2	19.9	2.5
3	20.6	3.6
4	18.0	5.6

Each value represents the average growth rate of the two troughs of fish receiving the same feeding rate.

The foregoing data indicate that an increase in feeding rate from 1 to 2 percent was sufficient to provide enough feed to raise the growth rate of the fish from just above maintenance to almost maximum; increase to 3 percent in the feeding rate resulted in only a small increase in growth rate. There is some suggestion in these data that feeding 4 percent per day brought about a reduction in growth when compared with feeding rates of 2 and 3 percent. This is probably a result of excessive accumulation of waste products of metabolism and some unused feed in troughs fed at this higher rate.

The table presents data obtained on the relationship between feeding rate and conversion rate in feeding trials with the Java tilapia. Each value represents the average conversion rate (grams of feed required to produce a gram of fish) for two troughs of fish receiving the same rate of feeding. The data on the conversion rates presented in the table indicate that at the lowest rate of feeding the amount of feed given was just enough for maintenance with very little left for growth. In this situation the conversion rate was high. At the highest rate of feeding more feed was presented to the fish than could be eaten or utilized. In this case the conversion of feed into fish was also poor, and a high conversion rate was obtained.

Since both low and high feeding rates produced unfavourable conversion rates, it is apparent that maximum efficiency for converting feed into fish flesh is obtained at some intermediate rate of feeding. These data suggest that the optimum feeding rate for Java tilapia under conditions of this experiment was a little above 2 percent of body weight per day.

4 RESULTS OF FEEDING TRIALS WITH NILE TILAPIA

Growth rate data resulting from the feeding trials with Nile tilapia are presented in the following table. Each value represents the average growth rate of two troughs of fish receiving the same rate of feeding.

<u>Percent fed</u>	<u>Growth rate</u>	<u>Conversion</u>
1	8.9	2.8
2	12.3	4.0
3	13.8	5.4
4	16.1	6.0

These data indicate that the growth rate of Nile tilapia increased slightly with increases in the amount of feed presented to the fish at all levels of feeding. These results are contrary to those obtained in the feeding trials with the Java tilapia. With that species increasing the feeding rate above 2 percent did not result in increasing the growth rate. The cause of the difference in response in growth rate between the two species is not known.

The above table also contains data obtained on the relationship between feeding rate and conversion rate in feeding trials with the Nile tilapia. Each value represents the average conversion rate for two troughs of fish. Conversion rates obtained with Nile tilapia increased steadily with increases in the feeding rate. These data suggest that the feeding rate producing the most efficient conversion with the feed used may be below 1 percent per day. These results are different from those obtained with Java tilapia. With the Java tilapia the feeding rate for the most efficient conversion was about 2 percent. This difference probably represents the effect that quality, formulation and physical consistency of feed had on feed intake and utilization in different species of fish.

The results obtained in the feeding trials with both species indicate that maximum growth rate does not necessarily accompany maximum efficiency of feed utilization. With both species increases in growth rate were obtained above feeding rates giving the best conversion rates. This is probably a result of the mechanics of feeding the fish. If the fish could be provided with exactly the amount of feed for maximum growth without any waste, maximum efficiency and maximum rate of growth would probably be obtained at the same feeding rate. However, when the fish are fed the entire ration for the day in two or three portions some waste is probably inevitable. This wastage is increased as the rate of feeding is increased.

CONCLUSIONS

A study of the relationship between rate of feeding, rate of growth, and rate of conversion by Java tilapia and Nile tilapia yields the following conclusions: (i) With the Java tilapia growth rate was increased four-fold by increasing the feeding rate from approximately 1 to 2 percent. Further increases in the feeding rate resulted in only a slight increase in growth rate. There was some indication that the highest rate of feeding (4 percent) resulted in reduced growth. Growth rates of Nile tilapia increased slightly with all increases in the feeding rate. (ii) With the Java tilapia the best conversion rate was obtained at the 2 percent feeding rate. Feeding rates above and below resulted in poorer conversions. With the Nile tilapia, the best conversion was obtained at the 1 percent feeding rate. Conversion rates increased at feeding rates above 1 percent. (iii) With both species optimum conversion rates were obtained at feeding rates lower than those providing maximum growth rates. This resulted probably from the mechanics of feeding or from the frequency of feeding.
