Research Application Summary

Combined effect of selected technologies on growth, survival and water quality of improved strain of *Oreochromis shiranus* in earthen ponds of Dowa district, Malawi

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Abstract

The study to evaluate the combined effect of feed, feeding trays and clear plastic pond sheeting technique on the growth, survival and water quality of the improved strain of *Oreochromis shiranus* was conducted in Dowa District, Malawi, from February to June 2012. The experiment was a factorial conducted in a Complete Randomised Design. Three treatments (feed, feeding trays and clear plastic pond sheeting) were tested and data on fish weights collected at 21 day intervals for the 4 month period. Yields, FCR and survival rate were calculated at the end of the research period. Results from the study suggest that the treatment which had all the three technologies had the highest weight gain and survival rate of above 98% at 95 % confidence level.

Key words: Aquaculture, fish feed, fish feeding, ponds, tilapia

Résumé

L'étude visant à évaluer l'effet combiné de l'alimentation, des mangeoires et de la technique de couvrir les étangs par des bâches en plastique clair sur la croissance, la survie et la qualité de l'eau de la souche améliorée de *Oreochromis shiranus* a été menée dans le district de Dowa au Malawi, de Février à Juin 2012. L'expérience fut un factoriel réalisé dans une conception randomisée complète. Trois traitements (alimentation, mangeoires et bâches en plastique clair de l'étang) ont été testés et les données sur le poids des poissons prélevées à intervalles de 21 jours pour la période de 4 mois. Les rendements, le FCR et le taux de survie ont été calculés à la fin de la période de recherche. Les résultats de l'étude suggèrent que le traitement qui avait toutes les trois technologies a eu le plus grand gain de poids et le taux de survie de plus de 98% au niveau de confiance de 95%.

Mots clés: Aquaculture, aliments pour poissons, alimentation des poissons, étangs, tilapia

Background

Oreochromis shiranus is the most preferred fish species to be kept under culture by small scale farmers in Malawi due to its high water quality and temperature tolerance. The species however is known to exhibit poor growth rates due to early reproduction. This has generated interest to genetically improve this fish species through selective breeding, improve its growth rate by manipulating temperature environment and supply of better quality feed. Thus, the World Fish Centre and National Aquaculture Centre in Malawi introduced a selective breeding programme (National Tilapia Breeding Program) to develop an improved strain of *O. Shiranus*, which is said to have resulted in 30% improved growth rate. With the exception of the lakeshore region, temperature in most areas in Malawi range between 14 - 24^{o}C. Therefore measures to boost pond temperatures were sought as earlier studies had shown that higher temperatures were necessary for higher growth of this species. In their study to boost tilapia production using a low cost technology, Kaunda *et al.* (2007) investigated the effect of using a clear plastic sheeting on the growth of *Tilapia rendalli*. Results showed that covering 80 % of fish ponds using clear plastic sheeting resulted into a growth increase of *T. rendalli* by more than 50 % (Specific Growth Rate (SGR) = 0.84) while covering 80% of the ponds with the same sheets increased yields by between 36% to 50%.

Project C-FISH, 2010 formulated a diet (in combination with manure) which proved to improve fish growth and profitability of fish farming enterprise in Chingale, Zomba, Malawi. This diet is also cheap and thus would reduce the costs of producing fish in ponds and increase profitability of the fish rearing enterprises in Malawi. This study therefore was conducted to assess the combined effect of using C-FISH feed, feeding trays and pond plastic sheeting on growth r and survival of the improved strain of *O. shiranus*.

Literature Summary

Tilapias are among the most important warm water fishes used for aquaculture production and originate from Africa and the Middle East (Fryer and Iles, 1972). These are farmed in more than 140 countries. Although, principally herbivorous in nature, *O. shiranus* can feed on a wide variety of natural food organisms found in organically fertilised ponds (Yashouv and Chervinski, 1961) as well as on artificial feeds. Due to the high cost of fish feeds (Liti *et al*., 2005) and limited protein sources, most farmers cannot afford supplementary feeds. Therefore, whereas commercial tilapia farms report yields of 10 000- 15

000 kg/ha/yr, small-scale tilapia farms with fertilised earthen ponds, report yields of approximately 500kg/ha/yr (Machena and Moehl, 2001).

Study Description

The study is being carried out in the central region of Malawi, in Dowa District. Earthen ponds of between 200m^2 and 300m^2 with average water depth of 0.7m were used. Treatments used comprised of different combinations of the C-FISH formula 2 diet (65% maize bran, 30% low fat soya and 5% wheat bran), maize bran (control), submersible trays (0.3m^2), feed broadcasting method (control), 80% plastic pond cover and 0% cover (control). Fingerlings weighing 9±2g obtained from the National Aquaculture Centre (NAC) were stocked at a rate of 5 fish/ m^2 and were fed twice daily at 5% of fish body weight/ day for fingerlings of 10-60g and at 3% of fish body weight/ day for fish larger than 60g. In total there were eight treatments. These were: 1: control; 2: plastic cover, no feed, no tray; 3: tray, no feed, no plastic cover; 4: tray, plastic cover, no feed; 5: feed, no tray, no plastic cover; 6: feed, plastic cover, no tray; 7: feed, tray, no plastic cover; and 8: feed, tray and plastic cover. Poultry manure was used to fertilise the ponds f, at 10kg per 200m^2 per week. This was applied either evenly over the pond surface or put in sacks submerged in the pond waters.Thirty fish were sampled every 21 days by seining. Specific growth rate, body weight gain and feed conversion ratio were then calculated. Fish ponds were totally harvested at the end of the experimental period to determine fish survival and final of fish weight.

The following model was used to analyse data:

$$Y_{ijklm} = \mu + f_i + p_j + t_k + (f*p)_{ij} + (f*t)_{ik} + (p+t)_{jk} + (f*p*t)_{ijkl} + e_{ijkl}$$

Where:

Y_{ijkl} = The observed weight gain (g) of the mth fish within the ith feed, the jth plastic cover, the kth tray and the lth block
μ = Overall mean
f_i = fixed effect of the ith feed
p_j = fixed effect of the jth plastic cover
t_k = fixed effect of the kth tray
$(f*p)_{ij}$ = effect of interaction between feed and plastic cover
$(f*t)_{ik}$ = effect of interaction between feed and tray
$(p*t)_{jk}$ = effect of interaction between plastic and tray

$(f*p*t)_{ijk}$ = effect of the interaction between feed, cover and tray

e_{ijkl} = is the random deviation of the l^{th} fish from the average of the feed, cover, tray subclass.

Genstat statistical package edition 13 was used for analysis to generate table of means and correlations of some selected traits.

Research Application

Preliminary results of the experiment showed that the highest fish growth rate was obtained in treatment 8, which was made up of a combination of all the three technologies – feed, feeding trays and plastic pond sheeting (Fig 1). This was highly significantly different from the other treatments at 5% confidence level recording average weights of 39g after 12 weeks. This was higher than weights recorded after the same time in other treatments (27g).

These results are very promising given that local farmers can cheaply produce high weight fish from locally made earthen ponds.

Fish weights after 84 days of culture

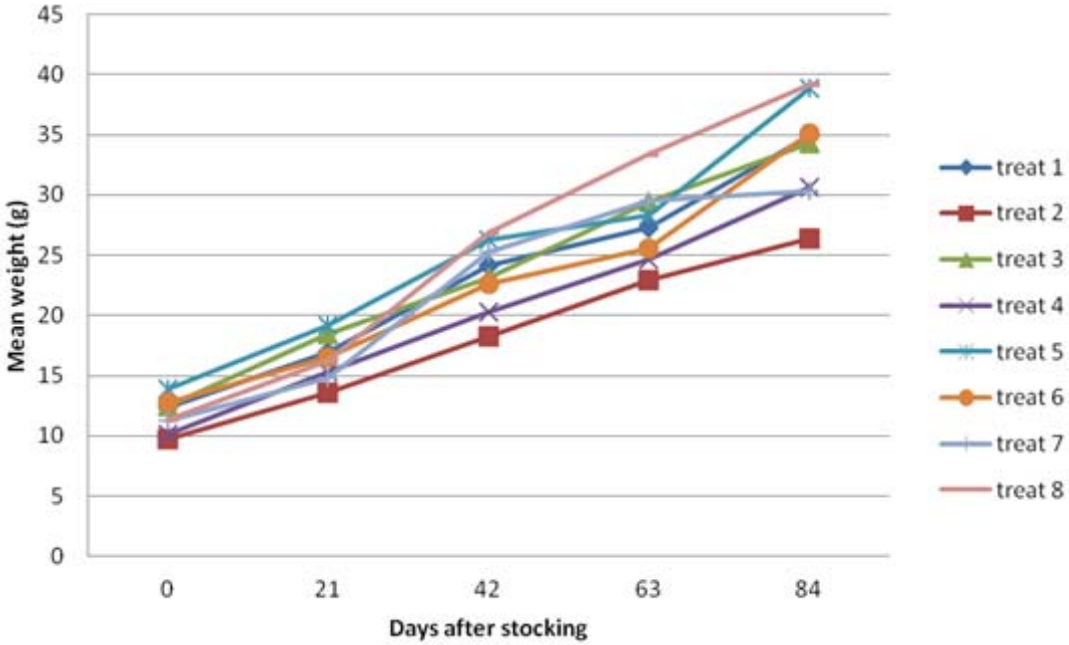

Figure 1. Mean weights of fish raised in earthen ponds under different feeding regimes in open or covered ponds with feed supplied on submersible trays or evenly scattered on the water surface.

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