Identification of Optimized Quantity of Methyl-Testosterone Incorporated Feed for Sex Reversal of Nile Tilapia

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Introduction

Tilapia is likely to be the most important aquaculture fish species in the 21 century (Fitzsimmons, 2000). Tilapia has certain favourable characteristics for aquaculture such as more tolerant to adverse environmental conditions; survive at low dissolve oxygen, relatively fast growth and efficient food conversion (Yi et al., 1996; Penna Mendoza, 2005). One of the main impediments in tilapia grow out production at commercial scale is its rapid reproduction rate. It attains sexual maturity at an early age and reproduces after every 4-6 weeks in the ponds and start to reproduce in culture ponds resulting a low production. This can be controlled by stocking ponds with all male tilapia produced with mono-sex production technique. Tilapia has sexual growth dimorphism in which males grow faster and show more standard size than females (Mair and Little, 1991). Manual process by visual examination, hybridization, gene manipulation and masculinisation via steroid hormone are commonly used techniques for production of mono-sex tilapia.

Use of the hormone17α-Methyl Testosterone (MT) to induce sex reversal in farmed tilapias has become a common practice in many parts of the world. MT is a simple and reliable way to produce all-male tilapia stocks, which consistently grow to a larger/more uniform size than mixed sex or all-female stocks. MT treatment could still be perceived as hazardous to tilapia consumers if MT is applied at higher than the recommended dosages, or is used for longer periods. Moreover, there is no evidence that higher dosages or longer treatment periods improve the sex reversal effectiveness of MT. In fact research findings indicate that MT is actually less effective if the recommended dosage and duration of treatment are exceeded (Yoshikawa and Oguri, 1978). Hence, identification of minimal quantity of methyl testosterone incorporated feed for sex reversal of tilapia is more critical for the fish farmers. It helps to minimize the cost that needs to bear for hormone and feed. Lower usage of hormone treated feed will lower the accumulation it into the natural environment as well.

Methodology

The study was carried out at the Aquaculture Development Center (AQDC) in Polonnaruwa. The selected sample size was 3750 tilapia individuals on fry stage and twelve tanks were used for the study. All tanks were cleaned through the scrubbing of algae and allowed to dry for three days. The water was filtered through sand and gravel filter media and pumped into the tanks. The outlet pipes were sealed with plastic caps. Tilapia fry was taken from the Polonnaruwa Aquaculture Development Center (AQDC) from the same spawning. Fry were quarantined for 2 to 3 days. The quarantined fry with average body weight of 0.02 ± 0.001 g were randomly stocked in twelve tanks at the rate of 250 fry per tank. Each tank was covered with small mesh net material to block the entrance of predators. In order to take 60 mgMT/kg, 0.5g of testosterone powder was measured using an electronic analytical balance (Model: FA1004N) with 0.1 mg accuracy and dissolved in one litter of 95% "Methyl Alcohol" solution. 120 ml was taken and spread over 1 kg of powder form commercial tropical fish feed (FF 00) and kept at room temperature for one day to evaporate the excess methanol solution. Fifty individuals from each tank were weighed after blotting with paper towel. Based on data

obtained mean body weight was calculated. Under treatment 01, all tilapia fry was given 3% of their mean body weight. Respectively, 6% for treatment 02, 9% for treatment 03 and finally 12% for treatment 04 were continued up to two weeks.

After two weeks, fifty individuals were randomly taken from each tank and body weight was measured and mean body weight for each tank was calculated separately. Using same methodology individual weights was measured at every other week until the end of research period and mean body was calculated. The amount of hormone incorporated feed for the individual and total amount of hormone utilized were calculated for each treatment according to the mean body weight and fed with those new values.

After four weeks, tilapia fingerlings were fed with usual commercial tropical fish feed (FF 01) for another three weeks and at the eighth week, the amount of male, female was recorded by observing the genital papilla of the advance fingerlings using methylene blue. The results were analysed using Minitab 16 statistical software. Survival rates and percentage male production were analysed using analysis of variance (ANOVA) in order to determine the differences among treatments at 95% significance level.

Results and Discussion

In all treatments survival rates of experimental fish was 100%, which showed that 17-α- MT did not affect the survival rate of fish, which may be due to rapid hormonal excretion in fish via faeces and gills (Cravedi et al., 1993).

There was a significant difference ($p<0.05$) in male percentages observed among the four treatments. Lowest male percentage observed in the T1 treatment while highest was found in the T4 treatment which was fed with 12% of fish body weight (Table 1). According to the Tukey's test results, this was confirmed and moreover it shows that no significant difference between T3 and T4 treatments (Table 2). However it required 129.80 g and 70.88 g of hormone incorporated feed for T4 and T3 treatments respectively (Table 1). Furthermore the total amount of hormone required for preparation of feed is high in treatment 04 than treatment 03. According to the results obtained from cost analysis it required additional 17.68 LKR for treatment 04 compared to treatment 03.

Table 1. Effect of different treatments on percentage production of male Thilapia and hormone and feed amount used and cost.

Treatment	Feeding amount (% body weight)	Male %	Total Hormone amount	Total hormone feed amount given	Cost (Rs)
T1	3%	56.6	1.242 mg	20.69 g	6.21
T2	6%	61.7	2.684 mg	44.73 g	13.42
T3	9%	94.0	4.253 mg	70.88 g	21.27
T4	12%	95.6	7.788 mg	129.80 g	38.95

Table 2. Comparison of mean value of male tilapia production

TR	Mean	Grouping
3%	56.6±2.053	C
6%	61.7±2.344	B
9%	94.0±0.800	A
12%	95.6±1.058	A

According to the study, there was a higher effect of 17α-Methyl Testosterone (MT) on sex reversal of tilapia spp. Results have suggested that the best treatment was Treatment 03, because even though treatment 04 had a highest male percentage, there was no big difference between

treatment 03 and 04. But, the feed and hormone amount required for treatment 04 is greater than the treatment 03. Same way, the cost that needs to bear for treatment 04 is comparatively greater than treatment 03. So that treatment 03can be identified as the best treatment which gives significantly high male percentages while utilising the comparatively low amount of feed and hormone. Moreover this treatment is the cost effective treatment with significant results.

Conclusions

Based on the results obtained, treatment 03 that individuals were fed 17α-Methyl Testosterone incorporated feed with 9% of their mean body weight can be identified as cost effective treatment which gives significantly high rate of all male tilapia

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