



## The Culture Performance of 17- $\alpha$ -methyltestosterone Treated Tilapia (*Oreochromis niloticus*) in Fertilized Ponds

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**Abstract:** Tilapia is the leading farmed species in all over the world due to its taste and the consumer preference. One of the main constraints in Tilapia culture is its early maturation. The objectives of this study were to determine the effect of different doses of 17- $\alpha$ -methyltestosterone on the growth of *Oreochromis niloticus*. For this study, the experiment expanded over a period of 166 days in four earthen ponds. Fertilization of all the ponds was done with cowdung at the rate of 0.1g N/100 g wet fish body weight daily. The supplementary feed (rice polish) was given at the rate of 2% fish body weight daily. One pond was designated as control pond in which Tilapia was added which was not sex reversed by 17- $\alpha$ -methyltestosterone. In the treated ponds, 17- $\alpha$ -methyltestosterone was applied at the rate of 50, 70, and 90 mg/kg feed. The net fish production was calculated as 850.48, 1026.94, 1117.92 and 1277.17 kg/ha/year with 0, 50, 70, and 90 mg 17- $\alpha$ -methyltestosterone/kg feed pond, respectively. The overall results indicated that the sex-reversed *Oreochromis niloticus* showed markedly increased growth than in control ponds. However, maximum fish growth and production were observed with 90 mg/kg 17- $\alpha$ -methyltestosterone while minimum decrease in fish production was recorded with 50 mg/kg 17- $\alpha$ -methyltestosterone. The Tilapia which was produced through sex reversal had a capability to grow more as compared to normal Tilapia.

**Keywords:** Culture performance, Tilapia, sex reversed, 17- $\alpha$ -methyltestosterone

### 1. INTRODUCTION

Tilapias have become one of the most abundantly produced fish in aquaculture, it is now recognized as the “new white fish” accordingly, Tilapias rank as the second fish being cultured solely for food in the world, after carp. Tilapia, *Oreochromis mossambicus* was introduced in Pakistan during 1950, while *Oreochromis aureus* and *Oreochromis niloticus* were imported in 1985 for aquaculture in saline waters of the country [1]. However, they have become nuisance for fish farmers and are considered as pest, due to which although Tilapia is the most popular fish and widely cultured throughout the world but has many constraints of its culture in Pakistan. The constraints are lack of

control on its prolific breeding and non-availability of quality fish seed.

Pakistan has vast areas of salt waters which can be best utilized for culturing tilapia species, as this fish is very hardy and quite suitable for these environments. They are also disease resistant, reproduce easily, feed efficiently and can tolerate poor water condition. The production rate of tilapia is 85000 tons per year in Thailand, Taiwan, China, Philippines, Belgium and USA [2]. Methyltestosterone is the most commonly used androgen to direct the sex of tilapia. Sex reversal by oral administration of feed incorporated with methyltestosterone is probably the most effective and practical method for the production of all

male Tilapia. Various protocols regarding dose rate and treatment duration have been evaluated. All depend on hormonal treatment with sexually undifferentiated fry. When fish are treated from the beginning to end of the gonadal differentiation period with a proper dose of androgen the resultant fish population will be highly skewed to males. The use of hormones to alter the sex ratios of fish was first demonstrated in species other than Tilapia [3].

Sex reversed tilapia fry production through administration of androgen (17- $\alpha$ -methyltestosterone) is considered to be the efficient and economically feasible method for obtaining all male Tilapia populations [4]. In a previous study, different doses of 17- $\alpha$ -methyltestosterone hormone (MT) used as a growth promoter was administered to Nile tilapia; *Oreochromis niloticus* in fishmeal based pelleted diet for 90 days. The applied doses were 0.5, 1.0, 2.5, 5, 10, 20 and 40 mg MT/kg feed. The obtained results showed that only the dose of 5 mg/kg was the optimum effective dose in promoting significant final weight, weight gain and SGR of Nile tilapia [5]. Dan and Little [6] compared the culture performance of different species of strains of *Oreochromis niloticus* found that, methyltestosterone treatment resulted a final size of fish 10.7 % larger than the mixed sex fish. Hence, this investigation aimed to evaluate culture performance of Tilapia (*Oreochromis niloticus*) treated with 17- $\alpha$ -methyltestosterone in fertilized earthen ponds.

## 2. MATERIALS AND METHODS

The experiment was conducted over a period of 166 days during the month of May to October in four earthen ponds, each measuring 25m x 8m x 1.5m at the Fisheries Research Farms, Department of Zoology and Fisheries, University of Agriculture, Faisalabad, Pakistan. Fertilization of all the ponds was done with cow dung at the rate of 0.1 g N/100 g wet fish body weight daily [7]. 130 Tilapia were stocked in each pond. The supplementary feed (Rice polish) was given at the rate of 2% fish

body weight daily. One pond was kept as control in which Tilapia was added which was not sex-reversed by 17- $\alpha$ -methyltestosterone while in pond 1, pond 2 and pond 3, 17- $\alpha$ -methyltestosterone were applied at the rate of 50, 70, and 90 mg/kg feed, respectively. Fish growth was measured in terms of increase in body weight by random capturing of 20 fish samples from each pond on each fortnight. After obtaining the data, the fish were released back into their respective ponds. The data of growth parameters was subjected to statistical analysis through microcomputer using MSTATC packages following [8].

## 3. RESULTS

After 166 days of rearing, all Tilapia were harvested from all the ponds. Survival rate for all the fish species was found to be 100% throughout the experimental period. The initial average body weights of Tilapia were 20.2, 22.1, 22.3 and 24.0g while the final were 79.0, 93.1, 103.6 and 112.3 g in control, 50, 70, and 90 mg 17- $\alpha$ -methyltestosterone/kg feed, respectively. There were net gains of 58.8, 71.0, 81.3 and 88.3g. The gross fish production was found to be 1142.65, 1346.59, 1498.46 and 1624.30 kg/ha/year while the net production was 850.48, 1026.94, 1179.2 and 1277.17 kg/ha/year in control, 50, 70, and 90 mg 17- $\alpha$ -methyltestosterone/kg feed, respectively (Fig. 1). However, pond-3 (which was treated with 90 mg/kg feed 17- $\alpha$ -methyltestosterone) showed the best in overall weight gain. Fish body weight varied significantly with treatments as well as over the fortnights ( $P \leq 0.05$ ) The water was taken from the tube well of the Fisheries Research Farms. Mean pH ranged from 7.5-8.8 were within the suitable values for fish culture [9]. Dissolved oxygen (DO) concentrations ranged from 4.73-8.5 mg L<sup>-1</sup> in the morning and 5.03-7.2 mg L<sup>-1</sup> in the afternoon. Temperature was 23.9-28.1°C (morning) and 26.9-29.2°C (afternoon). According to Phelps and Popma [10] DO concentrations should remain above 4 mg L<sup>-1</sup> and the optimum temperature between 26–28 °C for ideal fish culture system.

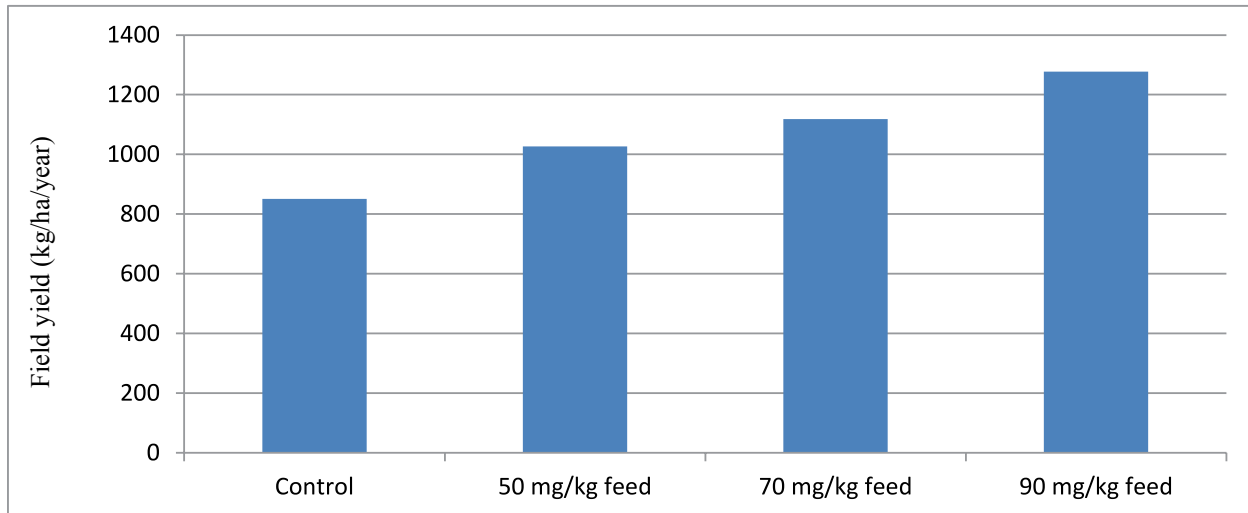


Fig. 1. Net fish production kg/ha/year of tilapia with various dosage of 17- $\alpha$ -methyltestosterone in the fish ponds.

#### 4. DISCUSSION

The results of the present research showed that different dose rates of methyltestosterone affected the growth of *Oreochromis niloticus* significantly ( $P < 0.05$ ). All the treatments which received methyltestosterone, showed more average body weight and gain in body weight of *Oreochromis niloticus* than the control (Table 1). This was due to 17- $\alpha$ -methyltestosterone, which was orally administered in their feed. The same results were observed by Ridha and Lone [11] who observed that treated groups with 17- $\alpha$ -methyltestosterone showed significance increases in weight than control pond. These results are in line with the findings regarding anabolic effect of 17- $\alpha$ -methyltestosterone in fish and all male culture of tilapia by different authors. Hanson et al [12] reported that 10-60 ppm methyltestosterone treatment showed the best growth than control. Varadaraj et al [13] observed faster growth in *O. mossambicus* when fed 17- $\alpha$ -methyltestosterone. These results are also in line with Dan and Little [6] who compared the culture performance of different strains of *O. niloticus* and found that considering all strains, methyltestosterone treatment resulted in a final size of fish 10.7 % larger than mixed sex fish. In the present experiment, it was observed that in treated pond, the maximum growth was observed in pond 3 in which 17- $\alpha$ -methyltestosterone

given at the rate of 90 mg than 50, and 70 mg of 17- $\alpha$ -methyltestosterone and this was in accordance with Carvalho and Foresti [14] who gave the different level of treatment Tilapia with 30, 50 or 100 mg of 17- $\alpha$ -methyltestosterone. The highest growth rate was recorded in pond, which received 100 mg of 17- $\alpha$ -methyltestosterone than other treated pond. Semi-intensive production in ponds using fertilizers and supplementary feeding (rice polish) is a mean of producing low cost tilapia in developing countries like Pakistan. The advantages of such culture are widely recognized for rural food supply. It can provide an opportunity to balance the use of supplementary feeding in correlation with the natural food availability and hence reduce the production cost. The reduced growth in control pond which was not sex reversed may be due further propagation of tilapia resulted in higher densities in the system leading to competition for food and space. These results are in line with David et al [15] who reported that limitations of feed availability in the fertilized, semi-intensive system may have exacerbated the relatively poorer growth of larger, older seeds, but these conditions are typical of those used by farmers in many developing countries. Maximum weight gain in ponds was noted during optimum temperature while the lowest weight gain was observed during low temperature. The same results were obtained by Varadaraj [13] as some

**Table 1.** Fortnightly average body weight and weight gain in control and experimental ponds.

No. of Fortnights	Control		(50 mg17- $\alpha$ -methyltestosterone / kg feed)		(70 mg17- $\alpha$ -methyltestosterone / kg feed)		(90 mg17- $\alpha$ -methyltestosterone / kg feed)	
	Average weight (g)	Weight gain (g)	Average weight (g)	Weight gain (g)	Average weight (g)	Weight gain (g)	Average weight (g)	Weight gain (g)
1	20.2 $\pm$ 1.50	-	22.1 $\pm$ 2.10	-	22.3 $\pm$ 1.10	-	24.0 $\pm$ 2.20	-
2	29.9 $\pm$ 1.30	9.7	33.0 $\pm$ 2.20	11.8	34.2 $\pm$ 2.11	11.9	36.1 $\pm$ 2.15	12.1
3	38.2 $\pm$ 2.10	8.3	44.5 $\pm$ 2.30	10.6	45.0 $\pm$ 1.14	10.8	47.7 $\pm$ 2.11	11.6
4	45.7 $\pm$ 2.15	7.5	54.5 $\pm$ 2.20	10.0	55.3 $\pm$ 1.18	10.3	58.4 $\pm$ 2.13	10.7
5	52.4 $\pm$ 2.25	6.7	69.2 $\pm$ 2.30	9.7	65.3 $\pm$ 2.10	9.9	68.1 $\pm$ 2.24	9.7
6	58.5 $\pm$ 2.15	6.1	71.4 $\pm$ 2.20	7.2	73.6 $\pm$ 2.30	8.3	76.6 $\pm$ 2.30	8.5
7	63.6 $\pm$ 3.25	5.1	77.7 $\pm$ 2.10	6.3	81.0 $\pm$ 1.50	7.4	84.1 $\pm$ 2.20	7.5
8	67.9 $\pm$ 3.05	4.3	81.9 $\pm$ 2.15	4.2	87.3 $\pm$ 1.80	6.3	90.9 $\pm$ 2.15	6.8
9	71.5 $\pm$ 2.50	3.6	85.4 $\pm$ 3.10	3.5	92.6 $\pm$ 2.40	5.3	97.7 $\pm$ 2.25	6.8
10	74.0 $\pm$ 2.30	3.0	88.5 $\pm$ 3.20	3.1	96.7 $\pm$ 2.30	4.1	103.8 $\pm$ 1.90	8.1
11	76.7 $\pm$ 2.20	2.7	90.9 $\pm$ 3.15	2.4	100.2 $\pm$ 2.10	3.5	107.4 $\pm$ 1.95	3.6
12	79.0 $\pm$ 2.10	2.3	93.1 $\pm$ 3.20	2.2	103.6 $\pm$ 2.10	3.4	112.3 $\pm$ 2.20	4.9

factors like temperature affected the sex reversal of fry which increase the growth rate and survival of Tilapia. Smith and Phelps [16] also reported that fish activities including growth, development and metabolism highly depend upon temperature. There were prominent seasonal fluctuations but even then, water temperature remained favourable for fish growth. The water temperature remained lower than air temperature these results are in accordance with Mahboob et al [17].

## 5. CONCLUSIONS

The sex-reversed Tilapia exhibited maximum growth with the application of 90 mg/kg 17-alpha methyltestosterone. The Tilapia which produced through sex reversal has a capability to grow more as compared to un-treated Tilapia. It is suggested that future studies may consider using higher rates

of the hormone dosage to evaluate the growth potential of sex reversed Tilapia.

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