

Bioenergetics-Based Factorial Model to Determine Feed Requirement and Waste Output of Tilapia Produced under Commercial Conditions

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ABSTRACT

A feed requirement and waste output model for commercial tilapia production was developed using the Fish-PrFEQ bioenergetics factorial approach and by an integration of data from commercial sources and the scientific literature. Different growth models were compared to determine the growth trajectory during three different production stages (nursery, 1–30 g body weight (BW); pre-growout, 30–220 g BW; and growout, >220 g BW) based on data from a commercial tilapia farm in Ecuador. Feed requirement was estimated based on digestible energy requirement (DE_{req}), calculated from the expected energy gain (recovered energy, RE), and estimates of energy losses associated with basal metabolism (HeE), heat increment of feeding (HiE), and urinary and branchial excretion (UE + ZE), all estimated by compiling and analysing data from published studies. The waste outputs were estimated using a nutrient mass balance approach. Feed requirement model simulations were compared with the results from a growth trial carried out under controlled conditions.

The modified TGC models produced a better fit of the growth trajectory of the fish on the commercial farm across production stages compared with other growth models (specific growth rate, linear model). Values predicted for body weight ($r = 0.998$, $P < 0.001$) and feed conversion (FCR, feed:gain) ($r = 0.849$, $P < 0.01$) by the models were highly correlated to the observations from the growth trial. Total solid wastes (TSW) output of tilapia fed according to a realistic production scenario (feeds with 40, 30, 28% CP for nursery, pre-growout and grow out stages, respectively) was estimated at about 331 and 423 kg per tonne of feed fed and per tonne of fish produced, respectively. These results show that this model could be a valuable tool for production and feeding management on commercial tilapia culture operations.