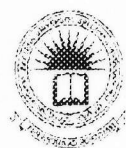



**EFFECTS OF DIETARY REPLACEMENT OF FISHMEAL BY CASSAVA
LEAF MEAL ON GROWTH PERFORMANCE OF RED CARP ORANDA
(*Carassius auratus auratus*) BY DEVELOPING AUTOMATIC FEEDER**



BY

H.A.M.M.AMARATHUNGA



FTC 26

Project Report
Library - EUSL

DEPARTMENT OF BIOSYSTEMS TECHNOLOGY

FACULTY OF TECHNOLOGY

EASTERN UNIVERSITY

SRI LANKA

2022

ABSTRACT

Fishmeal is an exceptional protein source in aqua-feeds due to its high palatability digestibility, and excellent composition of minerals, fatty acids and essential amino acids (Olsen and Hasan 2012). Moreover, in previous three decades' fish meal prices have also increased in real terms and are expected to be increased further with continuous growth in demand. This rapid increase in fish oil and fishmeal prices may have negative effect on the commercial aquaculture projects. Due to the finite supply and rising cost of fishmeal, aquaculture feed industry and research institutions have conducted a large number of studies to reduce dependency of aquaculture industry on fishmeal. Therefore, an experiment was conducted to evaluate cassava leaf meal instead of fishmeal in red cap *oranda* gold fish diet. Young cassava leaves were collected, chopped and sun-dried to prepare cassava leaf meal. The fish feed was prepared with 0%, 5%, 10% and 15% replacement level of cassava leaf meal for fishmeal. A total of hundred red cap *oranda* fish at the age of 28 days were the study population. Ten fish were used per replicate, and two replicates per treatment were allocated in a Completely Randomized Design (CRD). Feed was fed in ad libitum and proper water quality was maintained. The T₂ (10% cassava leaf meal) recorded highest body weight ($0.44\pm 0.02\text{g}$) and the least ($0.28\pm 0.03\text{g}$) was in T₃ (15% cassava leaf meal). The weight gain was greater ($p<0.05$) for T₂ ($0.14\pm 0.00\%$) and MT₀ and T₁ have the same value (0.07 ± 0.00 & 0.07 ± 0.01). There were no significant differences of total length and length gain of fish among the treatments. Highest SGR was obtained in T₂ ($0.33\pm 0.13\%$). Best CF (7.6 ± 0.65) was obtained in T₁ diet. Results indicated that, growth performance and feed utilization values were significantly ($p<0.05$) higher in fish fed with diets

containing 10% cassava leaf meal, whereas lower performance was in fish fed with diets containing 5% cassava leaf meal. The current study shows that cassava leaf meal can replace fishmeal up to 10% substitution level without any adverse effect on Growth and food utilization performance.

On the other hand, automatic fish feeder will be developed. Growth performance will be compared of red cap oranda fish by using both automatic fish feeder and manual method. Highest length gain were obtain from the AT₀ (automatic fish feeding system) (0.42 ± 0.03) and highest weight gain also from the AT₀ (0.15 ± 0.02). Specific growth rate of the manual method and automatic fish feeder was 0.18 ± 0.01 and 0.37 ± 0.06 respectively. Fish can be fed by hand, by automatic feeders, and by demand feeders. Automatic and demand feeders save time, labor, and money, but at the expense of the vigilance that comes with hand-feeding (Steven *et al.*, 2017).

TABLE OF CONTENT

	Page No
ABSTRACT.....	3
ACKNOWLEDGEMENT.....	5
CHAPTER 01.....	14
INTRODUCTION.....	14
CHAPTER 02.....	19
LITERATURE REVIEW.....	19
2.1 Aquaculture.....	19
2.2 Ornamental fishery.....	20
2.3 Ornamental fish production in Sri Lanka.....	21
2.4 Goldfish.....	21
2.5 Goldfish varieties.....	22
2.5.1 Red cap oranda goldfish.....	22
2.6 Nutritional requirements of goldfish.....	23
2.6.1 Protein.....	24
2.6.2 Amino acid.....	24
2.6.3 Lipids.....	25
2.6.4 Carbohydrates.....	25
2.6.5 Vitamins.....	25
2.6.6 Minerals.....	26
2.7 Fishmeal.....	26
2.7.1 Artificial feed.....	26
2.8 Feeding.....	27

2.8.1 Feed efficiency.....	28
2.9 Leaf meal.....	28
2.9.1 Cassava leaf meal as a Protein source (<i>Manihot esculenta</i>).....	29
2.10 Hand feeding (Traditional method).....	29
2.11 Automatic fish feeder.....	30
2.11.1 Feeder mechanism.....	30
CHAPTER 3.....	32
MATERIALS AND METHODS.....	32
3.1 Experimental fish.....	32
3.2 Experimental setup.....	32
3.2.1 Automatic fish feeder establishment.....	32
3.2.2 Tank setup.....	35
3.3 Experimental diet.....	35
3.3.1 Treatments.....	35
3.3.2 Preparation of cassava leaf meal.....	36
3.3.3 Feed preparation.....	37
3.4 Feeding.....	38
3.5 Other maintenance.....	38
3.6 Data collection.....	38
3.7 Growth parameters.....	39
3.7.1 Weight gain.....	39
3.7.2 Length gain.....	39
3.7.3 Percentage weight gain.....	39
3.7.4 Percentage length gain.....	39

3.7.5 Specific growth rate.....	39
3.7.6 Condition factor.....	39
3.7.7 Percentage survival of fish.....	40
3.8 Economic analysis.....	41
3.9 Statistical analysis.....	41
CHAPTER 4.....	42
RESULTS AND DISCUSSION.....	42
4.1 Proximate composition of the experimental diet.....	42
4.2 Cassava leaf meal treatment.....	43
4.2.1 Total length and length gain.....	43
4.2.2 Total body weight and weight gain.....	43
4.2.3 Length gain percentage.....	44
4.2.4 Weight gain percentage.....	45
4.2.5 Condition factor (length weight relationship).....	46
4.2.6 Specific growth rate.....	48
4.2.7 Cost analysis.....	49
4.3 Automatic fish feeder development.....	51
4.3.1 Total length, length gain and length gain percentage.....	51
4.3.2 Total body weight, weight gain and weight gain percentage.....	52
4.2.3 Condition factor.....	53
4.2.4 Specific growth rate.....	53
4.4 Survival rate.....	54
4.5 CHAPTER 05.....	55
CONCLUSION.....	55

REFERENCES.....58

LIST OF TABLES

	Page No
Table 3.1: Five treatments for the experiment.....	36
Table 3.2: Feed formulation of fishmeal replace with four levels of prepared cassava leaf meal in <i>Carassius auratus auratus</i> diet.....	38
Table 4.1: Proximate composition of four experimental diets of <i>Carassius auratus auratus</i>	42
Table 4.2: Total length and length gain of <i>Carassius auratus auratus</i> fed by diets with four levels of cassava leaf meal.....	43
Table 4.3: Body weight and weight gain of <i>Carassius auratus auratus</i> fed by diets with four levels of cassava leaf meal.....	44
Table 4.4: Length gain percentage of <i>Carassius auratus auratus</i> fed by diets with four levels of cassava leaf meal.....	45
Table 4.5: Weight gain percentage of <i>Carassius auratus auratus</i> (at 69 days of growth) fed by diets with four levels of cassava leaf meal.....	46
Table 4.6: Condition factor of <i>Carassius auratus auratus</i> fed by diets with four levels of cassava leaf meal.....	47
Table 4.7: Specific growth rate of <i>Carassius auratus auratus</i> fed by diets with four levels of cassava leaf meal.....	48
Table 4.8: The local market price of ingredients used in the experiment.....	49
Table 4.9: Cost per 1kg of feed and incidence cost for different experimental diets.....	50

Table 4.10: Total length, length gain and length gain percentage of <i>Carassius auratus auratus</i> fed by diets with manual method and automatic fish feeder.....	51
Table 4.11: Body weight and weight gain of <i>Carassius auratus auratus</i> fed by diets with both automatic and manual method.....	52
Table 4.12: Condition factor of <i>Carassius auratus auratus</i> fed by diets with four levels of cassava leaf meal.....	53
Table 4.13: Specific growth rate of <i>Carassius auratus auratus</i> fed by diets with both two feeding methods.....	54

LIST OF PLATES

	Page No
Figure 3.1: Wiring diagram of the automatic fish feeder.....	33
Figure 3.2: Block diagram of the automatic fish feeder.....	33
Figure 3.3: Automatic fish feeder unit setup.....	33
Figure 3.4: Automatic fish feeder	34
Figure 3.5: Cassava leaves.....	35
Figure 3.6: Chopping of cassava leaves.....	35
Figure 3.7: Sun drying of cassava leaves.....	35
Figure 3.8: Cassava laves powder.....	35
Figure 3.9: Fish feed dough before steaming.....	36
Figure 3.10: Steaming of the dough.....	36
Figure 3.11: Squeezing the feed.....	36
Figure 3.12: Prepared fish feed after drying.....	36