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Feeding Chart for Semi-intensive Pond Production of Nile Tilapia (Oreochromis niloticus) Fed on a Plant-based Diet and Economic Performance

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Abstract
This study investigated feeding charts for semi-intensive pond production of Nile tilapia fed on a plant-based diet and the economic performance. In Experiment I, the performance of Nile tilapia fed on a plant-based diet comprising agricultural bi-products using three different experimental feeding charts (Feeding charts 1, 2 or 3) was investigated for 180 days. Each tested feeding chart constituted a treatment. Fish were grown in 9 happas each 2 m long×2 m wide×1.5 m high with mesh size 13 mm installed in a fertilized pond of 20×25 m^3 with water temperature ranging from 23.0-30.6 ^oC. Each treatment was replicated in 3 happas. The final fish weight (FW), daily growth coefficient (DCG), percentage (%) weight gain (% WG), condition factor (CF), feed conversion ratio (FCR) and % fish survival (% survival) were calculated. The length-weight relationship of the fish was also determined using the power regression. In Experiment II, the cost-effectiveness of rearing Nile tilapia fed on a plant-based diet using an identified feeding chart in Experiment I was evaluated in a semi-intensive fertilized pond of 70 m^3 stocked with 13.6 g fish at a density of 3.4 fish/m^3. The results in Experiment I indicated that fish fed following feeding chart 2 had significantly higher somatic growth than those fed using feeding charts 1 or 3. The DCG, % WG, CF, FCR and % survival were similar among the treatments. The fish exhibited isometric growth when fed using feeding chart 1 or 2. It was cost-effective to grow Nile tilapia using feeding chart 2 (Experiment II) under semi-intensive pond production at water temperature ranging from 20.8-26.2 ^oC.
Keywords: feeding charts, tilapia, plant-based diet, ponds, semi-intensive, cost-effective

1. Introduction

The important role played by fish feed in influencing fish growth is well recognized in aquaculture (Rust, 2003). The feed that does not meet the nutritional requirement of the cultured fish species makes the fish not grow to their optimal potential while under feeding impairs growth and survival, and over feeding leads to feed wastage and poor water quality (Okorie *et al*., 2013). Given that feed accounts for over 50 % of aquaculture production costs, strategies to minimize feed costs by using low-cost efficient ingredients are being evaluated (Khan *et al*., 2009), amongst which is the use of cheaper plant-based ingredients derived from agricultural residues, especially for herbivorous fish species like Nile tilapia (Adebayo *et al*., 2004; Munguti *et al*., 2012). Agricultural residues from grains and seeds are not directly used as human food but can be used to feed fish and other farmed animals. This helps in minimizing competition for food crops between humans and domestic animals (Munguti *et al*., 2012; Troella *et al*., 2014). In addition, with changes in climate patterns over the years, characterized by unpredictable long dry spells in the tropics, which affects crop yields and human food supplies (Worldfish Center 2012-18 report), use of agricultural residues for feeding animals helps farmers to reserve food crops mainly for human consumption (Troella *et al*., 2014). Farmers especially in developing countries find it cheaper to make their own fish feed on-farm (Hasan and New, 2013; Troella *et al*., 2014; Ng *et al*., 2013). In our previous research (Aanyu *et al*., 2012), a plant-based diet comprising cotton and sunflower seed cakes as the main protein sources with other ingredients including maize bran, wheat pollard, blood meal and soya bean, was identified for Nile tilapia production in semi-intensive pond culture. However, the appropriate feeding regime for Nile tilapia was not developed for this diet, for different climatic conditions, characterized by different temperature ranges (Aanyu *et al*., 2012). It is known that fish reared at different temperatures utilize nutrients differently and this has an implication on their growth rate and feed cost, with over feeding leading to feed wastage and low profits (Rust, 2003; Okorie *et al*., 2013; El-sherif and El-feky, 2009; Santos *et al*., 2013). Although feeding tables/charts do exist for feeding Nile tilapia, the feeding charts are developed using specific feed ingredients and conditions, therefore they cannot be generalized for all types of formulated diets and fish rearing conditions (Okumu and Mazlum, 2002; FAO, 2016).

Pond production of Nile tilapia is commonly practiced in the tropics where tilapia can be grown out-door all year around given the higher temperatures experienced compared to temperate areas (Modadugu and Acosta, 2004; Ng and Romano, 2013). In ponds, fish feeding is commonly based on feeding response, but when the water is turbid, the swimming activity of fish is difficult to see leading to under or over feeding the fish (Tucker *et al*., 2008). However, pre-determined feeding charts can help minimize these negative effects though there is still need to carefully observe feeding response (Abdelghany and Ahmad, 2002). For instance, on a cold day fish often feed on less feed than what's predicted in feeding charts. In Uganda, there are feeding charts developed in the central/western regions for pond production of Nile tilapia using diets formulated with mainly conventional foodstuffs (USAID fish project 2005-2008 and unpublished ARDC data). There is none for eastern and Northern Uganda, specifically for diets based on plant/animal-based agricultural residues. Moreover the highest average monthly temperature ranges differ for northern, central and eastern Uganda, specifically, 28-33 ^{o}C, 24-28 ^{o}C and 27-29 ^{o}C respectively (UBOS, 2015), making fish growth rates different for each region and requiring different feeding charts.

In addition to proper fish feeding, there is need to assess the profitability of a fish farming venture to ensure cost-effectiveness of the enterprise and identify areas/issues for improvement (Engle and Neira, 2005). Therefore in this study, performance of Nile tilapia in eastern Uganda using three different experimental feeding charts was evaluated and the profitability of pond production of Nile tilapia using the feeding chart with the best growth performance of Nile tilapia was investigated. These results can be applied in any part of the world with climatic conditions similar to those described in this study.

2. Materials and methods

2.1 Study area and duration

This study was carried out in Uganda. Two separate experiments (Experiment I and II) were carried out using Nile tilapia obtained from Rock Spring Fish Farm (N00.66142^{o}, E034.18140^{o}) in Eastern Uganda. In Experiment I, the aim was to identify a suitable feeding chart for rearing Nile tilapia in eastern Uganda using a plant-based diet from agricultural bi-products. Eastern Uganda was selected as the study location because it produces large quantities of agricultural bi-products used in this study and many fish farmers make their own fish feed. Experiment I was carried out for 6 months (180 days). Experiment II evaluated the cost-effectiveness of pond production of Nile tilapia fed on plant-based diet from agricultural bi-products using the identified feeding chart in Experiment I. Experiment II was carried out for 5 months (150 days).

2.2 Experimental feed and fish feeding

The experimental feeds were formulated to contain 25 % crude protein using WinPas feed formulation software. The proportions of feed ingredients in the experimental diets and their analyzed proximate compositions are presented in Table 1.

Table 1 Feed ingredients in the experimental diets used in Experiment I and II and analyzed proximate composition of the diets.

Feed ingredient	Experiment I diet %	Experiment II diet %
Cotton	20	20
Sunflower	15	15
soya bean	4	10
blood meal	10	7
maize bran	5	7
mineral and vitamin premix	2	2
Salt	0.4	0.4
wheat pollard	40.1	34.1
wheat flour	2	2.5
sunflower oil	1.5	2
Analysed composition	**%**	**%**
dry matter	90.8	90.3
moisture	9.2	9.7
crude protein	25.6	25.8
crude lipid	3.3	3.5
crude ash	7.0	6.2
crude fiber	12.8	13.0

In Experiment I, the fish were fed by hand following three different trial feeding charts in order to identify one with the best fish performance. The trial feeding charts are attached in Annex 1. They included:

a) an existing feeding chart for Nile tilapia generated during USAID Fish Project (2005-2008) in central/western Uganda using commercial sinking pellets containing 28 % crude protein (treatment 2)
b) an adjusted feeding chart with a lower feed ratio than the one in a) above (treatment 1)
a) an adjusted feeding chart with a higher ratio than the one in a) above (treatment 3).

Feeding response was also observed in order to minimize feed wastage especially on occasions when the fish would not feed actively. In Experiment II, the fish were fed following the feeding chart identified to result into the best somatic growth in Experiment I. Before making fish pellets cotton seed cake and soya beans were subjected to a temperature of about 60 °C to de-activate anti-nutritional factors.

2.3 Experimental design

In Experiment I, the fish were grown in 9 nylon happas, each measuring 2m long × 2m wide × 1.5 m high, installed in a pond measuring 20 × 25 meters using vertically placed wooden poles as shown in Figure 1.

Figure 1 Set-up of nine experimental happas in a fertilized earthen pond.

The mesh size of the happas was about 13 mm to allow sufficient water exchange. The top of each happa was covered using gill nets of 3-5 mm to prevent entry of predators. The treatments were distributed following a complete randomized design and each treatment was replicated in three experimental happas.

In Experiment II, fish were reared in a pond of 70 m^3. In both Experiments I and II, the ponds were fertilized using chicken droppings at a rate of 10 kg / 100 m^3 pond per week and the fertilizer rate was monitored to maintain 30 cms water transparency. Water was flashed out incase it got over fertilized (> 30cm transparency). In Experiment I, each happa was stocked with 200 fish of average weight 7.6 ± 0.1 g (± standard error) and 241 fish of average weight 13.6 ± 1.2 g (± standard deviation) were stocked in Experiment II at a rate of 3.4 fish per cubic meter. In both experiments, before stocking the fish, they were weighed individually to select those with no size variation between treatments/happas.

2.4 Data collection

After every month (30 days), fish were weighed to assess growth and to adjust feed ratio based on the feeding charts. In Experiment I, 100 fish were randomly picked from each happa using a scoop net and their individual weights (g) and lengths (cms) were measured. In Experiment II, the water in the pond was lowered and 100 fish were randomly picked and measured. Weights were measured using a digital weighing scale (precision 0.00 g) and total length taken using a wooden board with a meter ruler attached. Water quality parameters within the ponds were monitored and regulated throughout the study in order to maintain the water quality within the range for Nile tilapia growth. Water temperature and dissolved oxygen concentrations were measured daily before feeding the fish and between 12 noon and 2:00 pm, using an electrode probe, model HQ 40d multi sensor from Hach Lange. The measurements were done 30 cm below the water surface. Twice a week, pH and ammonia nitrogen were measured inside each happa (Experiment I) and at set reference points in the open pond (Experiment II). The water parameters recorded during Experiments I and II are presented in Table 2.

Table 2 Water quality parameters measured during Experiments I and II.

Parameter	Experiment I	Experiment II
Dissolved oxygen (mg per liter)	0.9 - 5.0	0.8 - 3.8
Water temperature (°C)	23.0 - 30.6	20.8 - 26.2 °C
pH	6.2 - 7.3	6.0 - 7.0
Ammonia-nitrogen (mg per liter)	< 0.2	< 0.2

The lower values for dissolved oxygen and water temperature were obtained between 8:00 and 9:00 am and higher values from 12 noon to 2:00 pm. The higher values are attributed to more sunshine and photosynthetic activity after 9:00 am resulting into warmer conditions and more oxygen released by the algae into the water, respectively. Experiment I was carried out during most of the dry months of the year and

Experiment II largely during a rainy time of the year. At the end of Experiment I, the total number of fish in each "happa" was recorded to determine percentage fish survival. In Experiment II, the total number of a live fish in the pond was also recorded.

2.5 Laboratory analysis
Proximate composition analysis (Crude protein, lipid, ash, fiber, dry matter, moisture) of the experimental diets was carried out following the methods described by the Association of American Chemists (AOAC, 1990).

2.6 Calculations
At the end of the study, final average fish weight (FW), daily growth coefficient (DCG), percentage (%) weight gain (% WG), condition factor (CF), feed conversion ratio (FCR) and % fish survival were calculated as follows:

$$FW\ (g) = \frac{\text{total fish biomass per treatment (g)}}{\text{number of a live fish}}$$

$$DCG = \frac{(\text{final fish weight}^{\wedge 0.333} - \text{initial fish weight}^{\wedge 0.333}}{\text{experiment duration (days)}} \times 100$$

$$\%\ WG = \frac{\text{final fish weight (g) - initial fish weight (g)}}{\text{initial fish weight (g)}} \times 100$$

$$CF = \frac{\text{fish weight}}{\text{fish total length}^{\wedge 3}} \times 100$$

$$FCR = \frac{\text{Total amount of feed eaten (g)}}{\text{Weight gain (g)}}$$

$$\%\ \text{fish survival} = \frac{\text{final number of a live fish at end of experiment}}{\text{number of stocked fish}}$$

In addition, graphs indicating the growth trend of the fish during both experiments were generated. In Experiment I, the length-weight relationship (LWR) of the fish in each treatment was also determined to predict the body structure/form of the fish from the different treatments. This was done by making scatter plot diagrams of total length and weight of the fish and using the power regression line equation $W = aL^b$ based on the cube root law to predict the body structure (Froese, 2006). Whereby:
W is the weight of the fish (g)
L is the total length of the fish (cm)
a is the intercept that indicates the rate at which that weight changes with the total length
b is the slope of the power regression line of weight and total length that depicts the weight of the fish at unit total length

According to the cube root law, most fish exhibiting isometric growth (body structure) have a value of exponent 'b' equal to 3 (Froese, 2006). Values of 'b' greater than 3 indicate positive allometric fish and those less than 3 indicate negative allometric fish growth. In Experiment II, an enterprise budget for the production of Nile tilapia under a semi-intensive system in a fertilized pond and fed on a plant-based diet composed of agricultural bi-products was generated. This was done using production costs and returns.

2.7 Statistical analysis
Data calculated on growth performance indicators FW, DCG, % WG, CF, and FCR in Experiment I were analysed using SPSS software (Landau and Everitt, 2004). Data on FW was subjected to normality of distribution test using Kolmogorov-Smirnov`s test and transformed using square root transformation while data on DCG, % WG, CF, and FCR was transformed using arcsine square root. This was followed by Levene `s test for homogeneity of variance between the treatments (for each of the performance indicators). To determine differences in the means between treatments, Turkey's multiple comparison test was performed on the data. When the data did not show homogeneity of variance between treatments, Welch's test was carried out followed by Game-Howell's test. Data are presented as means ± standard error. Significant differences between treatments were determined at $P < 0.05$.

3.0 Results and Discussion
3.1 Performance of Nile tilapia in Experiment I
Table 3 shows the growth performance of Nile tilapia fed based on feed ratios from three different feeding charts (1, 2 or 3) for 6 months.

Table 3 Performance of Nile tilapia fed using three different feeding charts for 6 months.

Performance indicator	Feeding chart 1	Feeding chart 2	Feeding chart 3	P valve
Initial fish weight (g)	7.6 ± 0.1	7.6 ± 0.1	7.6 ± 0.1	NS
Final fish weight (g)	55.5 ± 0.6[a]	58.2 ± 0.5[b]	56.0 ± 0.6[a]	< 0.001
Daily growth coefficient ($g.d^{-1}$)	1.0 ± 0.1	1.1 ± 0.0	1.0 ± 0.1	NS
% weight gain	619.7 ± 57.1	661.8 ± 13.9	637.3 ± 58.9	NS
Condition factor	1.9 ± 0.1	1.8 ± 0.0	1.8 ± 0.0	NS
% fish survival	98.0 ± 0.8	99.0 ± 0.0	99.0 ± 0.0	NS
Feed conversion ratio	3.0 ± 0.1	3.2 ± 0.5	3.7 ± 0.4	NS

Mean values with different superscript in the same row are significantly different from each other. NS are not significantly different values. For final fish weight for each treatment, N = number of fish surviving at the end of the experiment and N = 3 for daily growth coefficient, % weight gain, condition factor, % fish survival and feed conversion ratio.

The fish fed using feeding chart 2 (median ratio) had significantly higher final FW than those fed following feeding chart 1 (lower ratio) and 3 (higher ratio). There was no significant different in the final weight of fish fed following feeding charts 1 and 3. Figure 2 shows the growth trend of the fish during Experiment I.

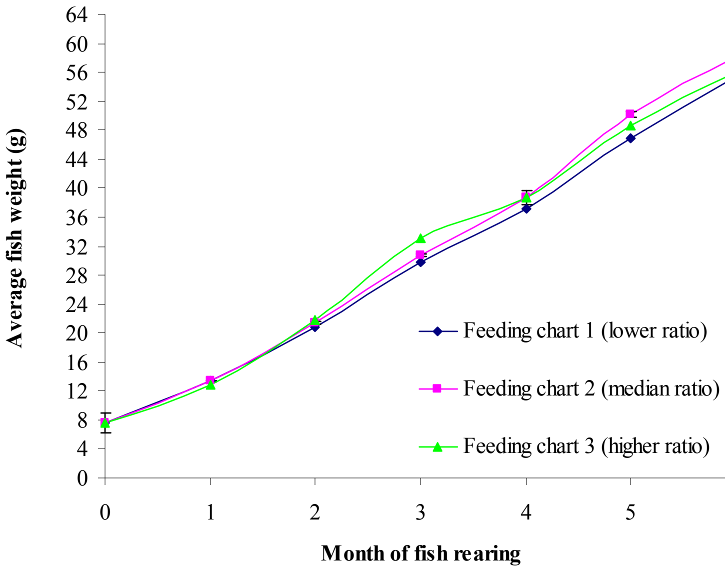

Figure 2 Growth trend of Nile tilapia fed following three different feeding charts over a period of 6 months.

The results generally suggested that as the feed ratio increased beyond that in feeding chart 2 (median ratio), somatic growth of the fish was reduced. This is probably because as the feed ratio increased (feeding chart 3), the quantity of fiber consumed in the diet increased thereby possibly reducing digestibility of the diets and fish growth because maize bran, cotton and sunflower seed cakes, and wheat pollard generally contain high fiber content (Munguti *et al*., 2012).

Figure 3 shows the length-weight relationship of the fish at the start and end of the experiment after feeding using feeding charts 1, 2 or 3.

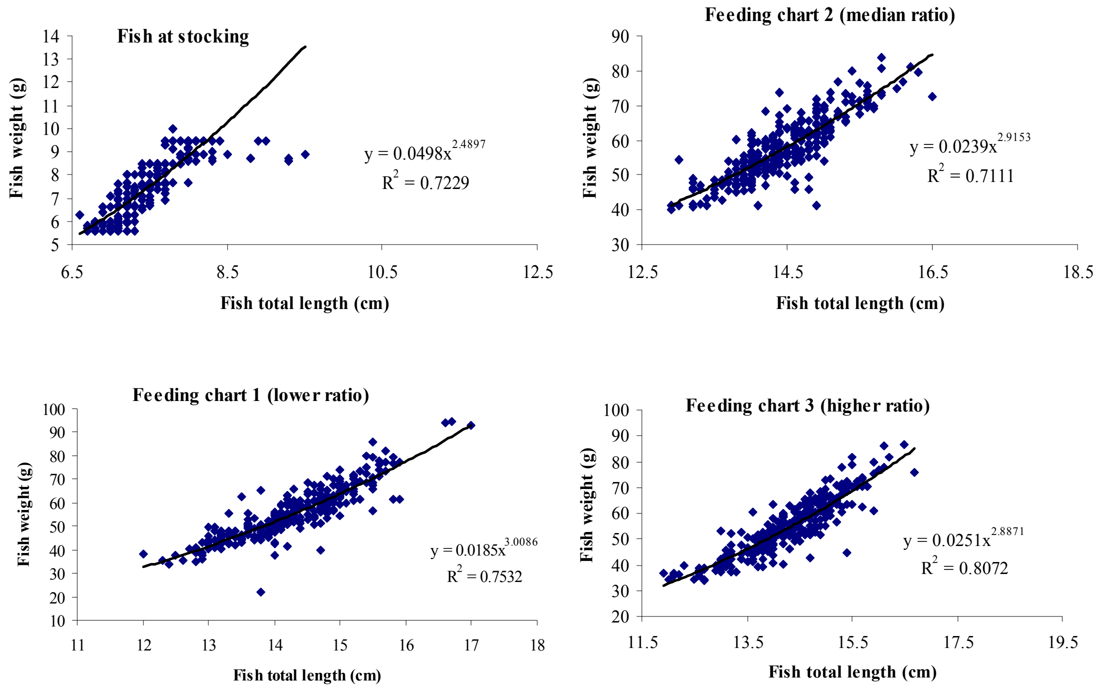

Figure 3 Length-weight relationship of Nile tilapia at the start of the experiment and 6 months after feeding using feeding charts 1, 2 or 3.

The results of the LWR indicated that at the start of Experiment I, the fish had a 'b' value of 2.4897. After feeding of the fish on the experimental diets, following either feeding chart I, 2 or 3, the 'b' values increased with the fish fed using feeding chart 1 having the highest 'b' value of 3.0086 followed by 2.9153 with feeding chart 2 and lastly 2.8871 with feeding chart 3. Nile tilapia has critical 'b' values ranging from 2.92 to 3.0 with the mean value as 2.96 (Froese, 2006). This suggests that at the start of the experiment, the fish exhibited negative allometric but after feeding on the experimental diet using feeding chart 1 or 2, they attained isometric growth (3.00 and 2.92 respectively) associated with fish growing proportionally in weight and length (Froese, 2006). As the feeding ratio increased (Feeding chart 3), the fish fed the highest ration (feeding chart 3) reverted to negative isometric growth. It is noted that fish farmers and fish consumers who buy whole fish tend to prefer fish that exhibit isometric growth (Ighwela *et al*., 2011).

3.2 Performance of Nile tilapia in Experiment II

3.2.1 Growth performance

In Experiment II, the fish were reared on-farm in a grow-out pond under semi-intensive production and fed using feeding chart 2 that demonstrated the best somatic fish growth in Experiment I. Figure 4 shows the growth trend of the fish over a period of 5 months.

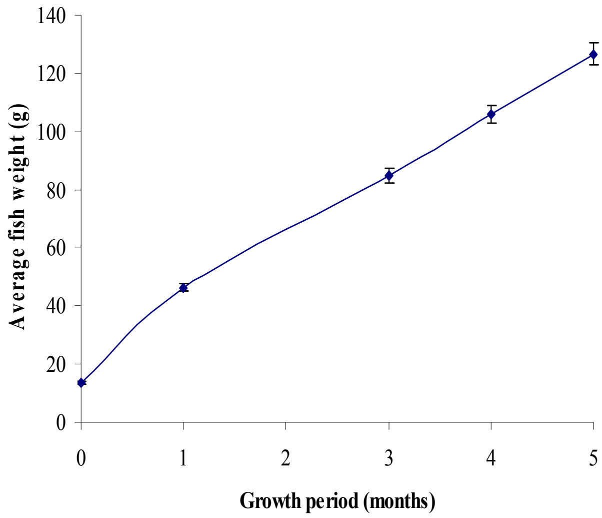

Figure 4 Growth trend of Nile tilapia fed on plant-based diet under semi-intensive open pond production. The values are means ± standard deviation.

The growth curve was still straight (exponential stage), not sigmoid, by the time the experiment was terminated indicating that the fish still had potential to gain more weight (Higgins *et al*., 2015). The fish grew from 13.6 ± 1.2 g at stocking to 126.5 ± 15.1 g after 5 months. This was a higher final average weight (in absolute values) than when the fish were grown in happas in Experiment I. This is attributed to a more confined environment in the happas, limiting fish growth rate. Overall, the results in experiment II support that Nile tilapia can grow bigger when grown directly in the pond and fed on the tested diet and feeding chart 2.

3.2.2 Economic performance

The cost-effectiveness of growing Nile tilapia in a semi-intensive fertilized pond and fed on a plant-based diet comprising agricultural bi-products using a pre-determined feeding chart is presented in Table 4. The enterprise budget (Table 4) indicates a pond yield of 25.8 kg accrued after rearing the fish from 13.6 g to 126.5 g over a period of 5 month. The fish harvest was valued at 103 USD using the price per kilogram of fish in Uganda at the time the experiment of terminated. Total variable costs were estimated as USD 31 with a net income over variable cost as USD 72 and a break-even price of USD 1. But when the fixed costs of USD 120 were amortized over a period of 10 years, which was the period that a well constructed pond was estimated to depreciate, the net income was USD 60 with a break-even price per kilogram of fish above total costs of USD 2. Overall, the results indicate that it was cost-effective to grow Nile tilapia using the experimental diet and feeding chart 2 and a farmer can break even. However, where farmers are paying for labour to manage the ponds, they will need to include labour costs to the total variable costs.

Table 4 Enterprise budget for Nile tilapia reared in a fertilized open pond of 70 m^3 and fed on plant-based diet for 5 months using a feeding chart.

Enterprise description	
Production duration of 5 months	
Final average fish weight at harvest (g)	126.5
Pond size (m^3)	70
Number of fish stocked	241
Fish stocking density (per cubic meter)	3.4
Initial average weight of fish at stocking (g)	13.6
Amount of feed used (g)	55,603
FCR	2.47
Fish survival (%)	84.6
Fish pond yield (kg) - wet weight	25.8

Operating costs and returns	**Unit**	**Price per unit (USD)**	**Quantity**	**Cost (USD)**	**% TVC**
Gross receipts					
Nile tilapia sales	Kg	4	25.806	103	
TOTAL REVENUE				103	
Variable costs					
Nile tilapia fingerlings	Piece	0.04	241	10	30.93
Fish feed used	Kg	0.39	55.60	22	69.07
TOTAL VARIABLE COSTS (TVC)*				31	100
Fixed costs					
Pond construction (depreciation 10 years)	cubic meter	1.2	70	84	
Piping and water channeling	Piece	36	1	36	
TOTAL FIXED COST				120	
Fixed cost amortized for 10 years (well constructed pond can be used for at least 10 years with out rehabilitation/major repairs)					12
NET RETURNS ABOVE VARIABLE COSTS*					
Income over total variable costs				72	
Break-even price per kilogram of fish above variable costs				1	
Break-even price per kilogram of fish above total costs when fixed cost is amortized for 10 years				2	
Net income if fixed cost is amortized over a period of 10 years				60	

* Labour costs on fish husbandry are not included because the research team took care of the fish.
1 USD = 3050 Ushs

4. Conclusions

Fish fed using feeding chart 2 had higher somatic growth, therefore feeding chart 2 is recommended for growing Nile tilapia fed on the plant-based diet under the climatic conditions / water temperature recorded in this study. In addition, the fish fed following feeding charts 1 and 2 exhibited isometric growth (body structure). Future research could also investigate feeding charts for different seasons (wet or dry season).

It was cost-effective to grow the fish under semi-intensive pond culture using the plant-based diet and feeding chart 2.

5. Conflict of interests

The authors of this manuscript do not have any conflict of interests to declare.

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Annex 1
Experimental Feeding Charts

Feeding Chart 1-lower feed ratio

Weeks in production	Fish size (g)	Daily %Body Weight of feed per fish	Daily feed ratio per fish (g)
0	1	11	0.1
1	3	7	0.2
2	5	5	0.3
3	7	5	0.4
4	10	4.5	0.5
5	13	4.5	0.6
6	17	4	0.7
7	22	4	0.9
8	29	4	1.2
9	37	4	1.5
10	46	3.5	1.6
11	56	3.5	2.0
12	69	3.5	2.4
13	83	3	2.5
14	100	3	3.0
15	120	3	3.2
16	140	2.5	3.5
17	162	2.5	3.6
18	178	2.5	4.5
19	194	2	3.9
20	212	2	4.2
21	230	1.7	3.9
22	248	1.7	4.2
23	267	1.7	4.5
24	288	1.7	4.9
25	309	1.7	5.3
26	330	1.5	5.0
27	351	1.5	5.3
28	372	1.5	5.6
29	393	1.5	5.9
30	414	1.5	6.2
31	435	1.5	6.5
32	456	1.5	6.8
33	477	1.5	7.2
34	498	1.5	7.5
35	519	1.5	7.8
36	540	1.5	8.1

Feeding Chart 2-median feed ratio

Weeks in production	Fish size (g)	Daily %Body Weight of feed per fish	Daily feed ratio per fish (g)
0	1	13	0.1
1	3	8	0.2
2	5	6	0.3
3	7	6	0.4
4	10	5.5	0.6
5	13	5.5	0.7
6	17	5	0.9
7	22	5	1.1
8	29	5	1.5
9	37	5	1.9
10	46	4.5	2.1
11	56	4.5	2.5
12	69	4	2.8
13	83	3.5	2.9
14	100	3.5	3.5
15	120	3.5	4.2
16	140	3.2	4.5
17	162	3.2	5.2
18	178	3	5.3
19	194	2.5	4.9
20	212	2.5	5.3
21	230	2	4.6
22	248	2	5.0
23	267	2	5.3
24	288	2	5.8
25	309	2	6.2
26	330	1.7	5.6
27	351	1.7	6.0
28	372	1.7	6.3
29	393	1.7	6.7
30	414	1.7	7.0
31	435	1.7	7.4
32	456	1.7	7.8
33	477	1.7	8.1
34	498	1.7	8.5
35	519	1.7	8.8
36	540	1.7	9.2

Feeding Chart 3-higher feed ratio

Weeks in production	Fish size (g)	Daily %Body Weight of feed per fish	Daily feed ratio per fish (g)
0	1	15	0.2
1	3	10	0.3
2	5	8	0.4
3	7	8	0.6
4	10	7	0.7
5	13	7	0.9
6	17	7	1.2
7	22	6	1.3
8	29	6	1.7
9	37	6	2.2
10	46	5.5	2.5
11	56	5.5	3.1
12	69	5	3.5
13	83	4.8	4.0
14	100	4.5	4.5
15	120	4	4.8
16	140	3.7	5.2
17	162	3.5	5.7
18	178	3.2	5.7
19	194	3	5.8
20	212	3	6.4
21	230	2.6	6.0
22	248	2.6	6.4
23	267	2.4	6.4
24	288	2.3	6.6
25	309	2.2	6.8
26	330	2	6.6
27	351	2	7.0
28	372	2	7.4
29	393	2	7.9
30	414	2	8.3
31	435	2	8.7
32	456	2	9.1
33	477	2	9.5
34	498	2	10.0
35	519	2	10.4
36	540	2	10.8