THE INFLUENCE OF FEEDING INTENSITY ON GROWTH PERFORMANCE OF RAINBOW TROUT JUVENILS

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Abstract

The purpose of this experiment was to evaluate how feeding intensity influence the growth performance of juvenile rainbow trout (Oncorhynchus mykiss) reared in a recirculating system. A number of 152 rainbow trout with an average weight of 174.41±0.73 g were divided into four rearing units in order to create the same stocking density (20 kg/m3). The fish were fed a 41% protein feed. Two variants were compared V1 (B1, B2) and V2 (B3, B4), with repetition. In V1-1.0% feed from total biomass and a double amount of feed in V2-2.0% from total biomass. At the end of the experiment were obtained average body mass of 224.09±0.20 g in variant V1 and 245.59±0.73 g in variant V2. Specific growth rate (SGR) varied as follows: V1-0.95 g% / day, V2-1.33 g% / day. Regarding the feed conversion factor (FCR), the better values were obtained in V1 variant -0,93 g feed/g gain biomass, while in V2 we obtain a value of FCR-1.22g feed/g gain biomass. The parameters of fish growing showed that changing the quantity of fodder, the fish growing was positively influenced.

Key words: rainbow trout, feeding intensity, recirculating system

INTRODUCTION

After the physico-chemical properties of water, feed is the most important factor determining fish farming environmental impacts and production costs. Thus one of the main concerns of aquaculture is to minimize production costs and maximize growth because about 60% of the costs involved in salmonids rearing is the food [6], [2].

If the act of feeding is the most important step for the fish farmer, then the part of that step that includes the calculation of the feeding intensity is perhaps the most difficult [3]. An optimal ration will give maximal growth while maintaining a good feed conversion ratio (FCR), the ratio of feed ingested to body weight gained. One may assume that once the daily ration is known, that merely weighing up the daily amount as a proportion of the biomass of the fish to be fed, will be a simple procedure [5]. Underfed fish do not reach maximal growth, and may exhibit aggressive behaviour during feeding due to limited feed availability, thereby potentially harming themselves or other fish. Underfeeding may also increase the variability of fish sizes within a tank. Overfeeding increases fish production cost and causes deterioration of water quality, which can eventually reduce growth of fish.

Determining optimum feed rations should contribute to improving the feasibility and economics of commercial fish units, through better feed utilization and reducing feed waste [5]. Starting from the reasoning summarized above, the purpose of the experiment was to establish the level of optimal nutrition for juvenile rainbow trout, grown in a recirculating system.

MATHERIAL AND METHODS

The experiment took place between 12th march 2011 and 11th April 2011. The facilities used for this research was represented by the experimental recirculating system of the Aquaculture, Environmental Sciences and Cadastre Department, "Low Danube" University of Galati, provided with 4 aquarium with total volume of 0.320 m^3 (0.40×80×100

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cm) each and water quality maintenance units represented by water filtration unit, water sterilization unit (represented by a UV lamp) and water oxygenation unit (represented by two compressors).

The system was populated with 38 exemplars of rainbow trout per rearing unit. The food used for the biomass culture was Classic Extra 1P pellets, 41% protein content (table 1). Two variants were compared V1 (B1, B2) and V2 (B3, B4), with repetition. In V1, the feeding intensity was 1% from body weight and in V2 was administrated a double amount of feed (2%) from total biomass.

Table 1 The biochemical composition of Classic extra 1P pellets

Composition Quantity	Quantity
Crude Protein %	41.0
Crude fat%	12.0
Crude cellulose %	3
Crude ash %	6.5
Phosphorus %	0.9
Digestible energy (MJ/kg)	14.2
Vitamin A (UI)	10000
Vitamin D3 (UI)	1250
Vitamin E (mg)	150
Vitamin C (mg)	75
Cystine%	0.6
Lysine %	2.4
Methionine %	0.75
Fish meal, fish oil, haemoglobin, full fat, soybean, soybean oil, wheat gluten,sunflower flour, wheat and wheat products, BHT.	

Every day were measured water temperature (°C), the content of dissolved oxygen (mg/L) and pH, with the help of of Hanah HI 98186 oximeter and pH meter WTW model 340. $N\text{-}NH_4$, $N\text{-}NO_2$, $N\text{-}NO_3$, $P\text{-}PO_4$ concentrations were measured with the help of the Spectroquant Nova 400 photometer twice/week.

In the end of the experiment the fish were weighed and the growth performance of the fish were calculated:

✓ Weight Gain (W) = Final Weight (Wt) - Initial Weight (W0) (g)

✓ Food Conversion Ratio (FCR) = Total feed (F) / Total weight gain (W) (g/g)

✓ Specific Growth Rate (SGR) = 100 x (ln Wt - ln W0) / t (% BW/d)

✓ Protein efficiency ratio (PER) = Total weight gain (W)/amount of protein fed (g).

RESULTS AND DISCUSSIONS

Feeding intensity, among other important factors (feeding frequency, metabolism intensity, feed waste and feed composition), directly influences the water quality from rearing units [4]. During the experimental period the water quality was similar in all the four rearing units, without significant differences between the two experimental variants (t-test, $p>0.05$). On average was as follows: water temperature 16.39±0.84°C, oxygen concentration 6.27±1.40 mg/L, pH 6.96±1.02 pH units, nitrite 0.02±0.01 mg/L, nitrate 23.94±2.10 mg/L, ammonia 0.157±0.01 mg/L, phosphate 0.42±0.16 mg/L. All the water quality parameters were in the in the recommended range for rainbow trout grow [1].

In table 2 there are shown the growth parameters of juvenile rainbow trout from the two experimental variants.

As we mention before the recirculating system was populated with 38 rainbow trout per each rearing units. After the random distribution of fish, data obtained from individual biometrics were statistically analysed. So, the test showed statistical normal distribution of the fish in terms of body mass (K-S test, $p>0.05$, $p = 0.99$).

At the end of the experiment, between the average masses of the fish from the two experimental variants Anova test revealed no statistically significant differences (ANOVA, $p>0.05$; $p = 0.09$). (figure 1).

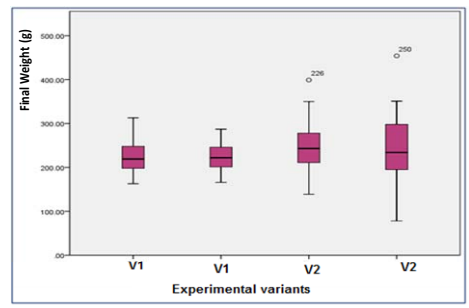

Figure 1 The variation of the average individual weight – median, minimum, maximum values and quartiles, at the end of the experiment

So, at the end, the final average weight of the exemplars was between 224.24±35.27 g/fish in tank B_1, 224.24±35.27 g/fish in B_2, 246.11±55.44 g/fish in B_3 and 245.08±75.31 g/fish in B_4. Although for the two experimental variants, there were no statistical differences ($p>0.05$) regarding the body weight it can be observed that in the variant V2, where the feeding intensity was 2% BW, a slightly higher body mass than fish from V1 variant.

Table 2 The technological performance indicators for the rainbow trout in a recirculating aquaculture system

Growth performance	I1 (1%BW)		Mean±SD	I2 (2% BW)		Mean±SD
	B1	B2		B3	B4	
Initial biomass (g)	6659	6642	6650.50±12.02	6600	6609	6604.50±6.36
Initial number of fish	38	38	38	38	38	38.00
Mean individual weight (g/fish)	175.24	174.79	175.01±0.32	173.68	173.92	173.80±0.17
Final biomass (g)	8521	8510	8515.50±7.78	9352	9313	9332.50±27.58
Final number of fish (g/ex)	38	38	38	38	38	38.00
Mean individual weight (g/fish)	224.24	223.95	224.09±0.20	246.11	245.08	245.59±0.73
Mean individual weight (g/fish)	1862	1868	1865.00±4.24	2752	2704	2728.00±33.94
Specific growth rate SGR (%/day)	0.95	0.95	0.95	1.34	1.32	1.33±0.02
Feed conversion ratio FCR (g/g)	0.93	0.93	0.93	1.21	1.23	1.22±0.02
Protein efficiency ratio PER (g/g)	2.62	2.57	2.60±0.04	1.97	1.93	1.95±0.02

In order to determinate the correlating between length and weight, six fingerlings per experimental variant were measured and the results were graphically represented using Power regression: $W=a \times L^b$ where W-fish weight (g), L=total length (cm) and b -L power. Regression analysis showed a higher coefficient of determination (R^2 = 0.84 or 0.83) for the fish that were fed with the intensity of 2% BW, where at the end of the experiment were obtained the best values of the growth parameters (figure 2).

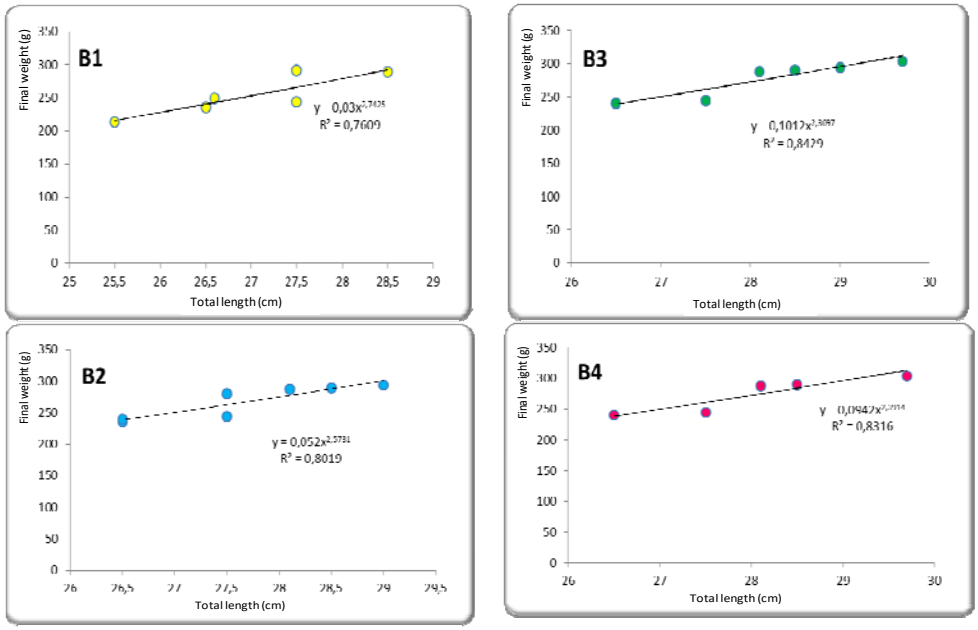

Figure 2 Regression length-growth of rainbow trout groups

Analysing the data presented in table 2, it can be seen that the total increase growth of biomass was recorded in the experimental variant V1-1865.00±4.24 g, while in the experimental variant V2 increase total growth was 2728.00 ± 33.94 g.

Regarding values of feed conversion ratio (FCR) obtained for the two experimental variations among which were tested both the intensity of feeding, statistical comparison revealed no significant differences ($p>0.05$), a better values of FCR being recorded for variant V2. Also, Specific growth rate (SGR) indicated the best values in the variant V2.

After analysing the results of the main indicators of growth it can be observed a positive correlation between feeding level applied and technological performance, reflected by indicators of growth, which were higher in the experimental variant with a higher feeding.

CONCLUSIONS

Ideally, the feed conversion factor values should be as small as possible, because reflects the amount of feed needed to be consumed in order to obtain a kilogram of fish. Thus, the feed conversion factor and protein efficiency ratio, expresses the measure of economic efficiency of fishery activity, therefore, in most cases, the FCR and PER are decisive in choosing variants of applied technology management. In this case, choosing the optimal technology was made after the analysis of technological performance indicators in order to maintain a balance between production and economic efficiency, which, in economic terms, defines profitability. Thus, we can conclude that for rainbow trout with body weight of 170 g, the choice of feeding level of 1% bw leads to generating profit productions.

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