UNIVERSITY OF LIFE SCIENCES
"KING MIHAI I" FROM Timisoara
Multidisciplinary Conference on Sustainable Development
15 – 16 May 2025

2025 MULTIDISCIPLINARY CONFERENCE ON SUSTAINABLE DEVELOPMENT

Influence of the starvation period on the technological performance of juvenile carp in a recirculating aquaculture system

Ionica BEJENARIU[1], Floricel Maricel DIMA[1,2], Neculai PATRICHE[1], Veta NISTOR[1], Elena SÎRBU[1], Anca Nicoleta CORDELI[1]

[1] Institute for Research and Development in Aquatic Ecology, Fishing and Aquaculture, 800211 Galati, 54 Portului Street, Romania,
[2] Faculty of Engineering and Agronomy in Braila, "Dunarea de Jos" University of Galati, , 810017, Braila, 29 Calea Calarașilor Street, Romania

Abstract: *Compensatory growth relates to a period of intensified feeding, typically following a brief period of starvation, and represents a technological opportunity to achieve the planned performance indicators. Two experimental rearing variants were utilized to evaluate compensatory growth: variant V1, the control variant (initial stocking density - 4.545 kg/m^3, number of carp fish- 40), where fish were fed continuously for 28 days, while in V2 (initial stocking density - 4.485 kg/m^3, number of carp fish- 40) the fish were starved for 3 days and then refed for 4 days, also for 28 days. The analysis of growth dynamics in the crop biomass highlights the potential of juvenile carp to recover the weight lost during the starvation period, reaching approximately the same biomass as in the control variant.*

•Introduction

Compensatory growth is a term used to describe a period of increased feeding, usually following a short period of starvation. The compensatory growth capacity of a fish species depends on a multitude of factors, among which the most important are: technological plasticity, duration and severity of the starvation period, disease states, inadequate technological management, misjudgment of feed requirements, and unpredictable changes in environmental conditions naturally accompanied by growth depression. The possibility that compensatory rearing could completely recover the mass gain lost during the starvation period could be a judicious technological opportunity to achieve the planned performance indicators, i.e., a way to increase the profitability of aquaculture.

•Material and method

The experimental research was carried out in a recirculating system consisting of 4 aquarium-type rearing units with a useful volume of 300 L.

The experiment lasted 28 days. The biological material used in the present experiment was a 5-month-old carp. To evaluate the compensatory growth of juvenile carp in a recirculating aquaculture system, two experimental rearing variants were utilized: variant V1, the control variant, where fish were fed continuously for 28 days, while in V2 the fish were starved for 3 days and then refed for 4 days, also for 28 days. (Figure 1).

In the present experiment, all fish in the four rearing units (20 fish/rearing unit) were measured and weighed at the beginning and the end of the experiment, determining total length (L±1mm) and body mass (W±1g). The main bioproductive parameters were calculated from the measurements.

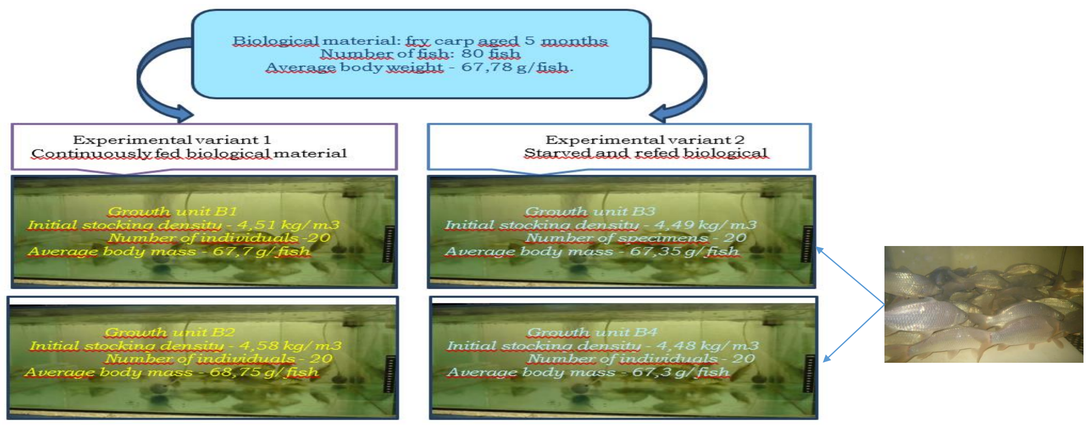

Figure 1. Distribution of biological material in the two experimental variants

•Results and discussions

From the analysis of the growth equations, presented in graphical form (Figures 2 and 3) for each of the experimental variants, the following observation emerges: the value of the parameter R^2 shows a decrease in the homogeneity of the condition coefficient in the variant in which the specimens were fed continuously and an increase in the homogeneity of the condition coefficient in the variant in which the specimens were starved and refed.

Statistical testing of the weights and lengths of juvenile carp in the two variants revealed no significant differences for the 95% confidence threshold at the start of the experiment ($p>0.05$, $p= 0.37$ for the mass of the fish, $p= 0.32$ for the length of the juvenile). Statistical testing of the weights and lengths at the end of the experiment revealed the following.

While no statistically significant differences were observed between the weights of juvenile carp in both experimental variants (control, starved and refed, respectively) at the end of the experiment ($p = 0.24$, $p > 0.05$;), significant differences were observed in the lengths of juvenile carp ($p = 0.02$, $p < 0.05$).

We can thus see that the biological material showed a total compensatory increase in mass and a partial compensatory increase in length at the end of the experiment.

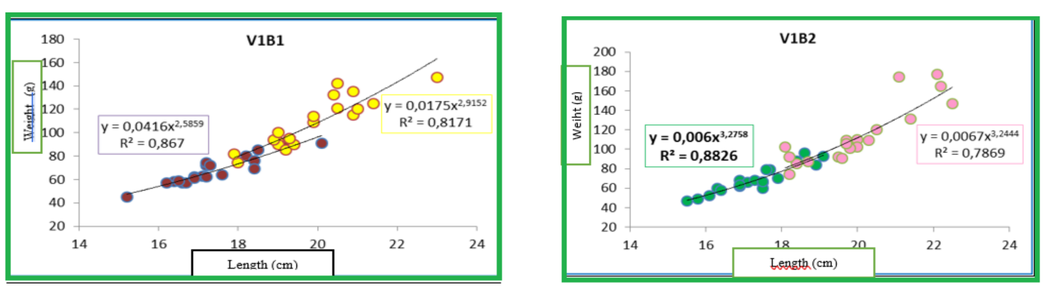

Figure 2. Length-weight regression for V1 fish groups at the beginning and end of the experiment

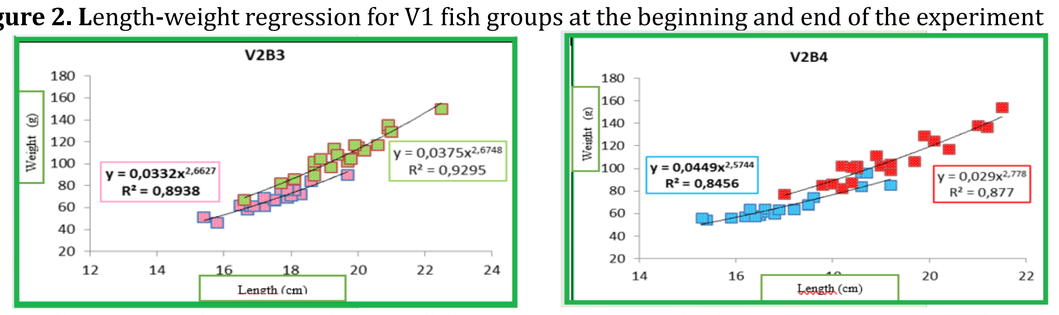

Figure 3. Length-weight regression for V2 fish groups at the beginning and end of the experiment

The dynamics of crop biomass growth in the two variants are also evidenced by the established parameters of growth performance presented/reported in Table 1.

Table 1. Technological indicators of carp farming

Experimental variant	Unitate de măsură	V1		V2	
Indicator/basin		B1	B2	B3	B4
Initial biomass	**(g)**	**1354**	**1375**	**1347**	**1346**
Initial storage density	(kg/m^3)	4,51	4,58	4,49	4,48
Final biomass	**(g)**	**2157**	**2280**	**2154**	**2141**
Final storage density	(kg/m^3)	7,18	7,59	7,17	7,13
Biomass growth	**(g)**	**803**	**905**	**807**	**795**
Biomass growth gain	(kg/m^3)	2,67	3,01	2,69	2,65
Initial number of fish	-	20	20	20	20
Final number of fish	-	20	20	20	20
Survival	(%)	100	100	100	100
Initial average weight	(g/eg)	67,70	68,75	67,35	67,30
Final average weight	(g/eg)	107,85	114,00	107,70	107,05
Growing days	days	28,00	28,00	28,00	28,00
Daily growth rate (GR)	(g/day)	28,68	32,32	28,82	28,39
Specific growth rate (SGR)	**(%/day)**	**1,66**	**1,81**	**1,68**	**1,66**
Individual growth gain	(g/eg)	40,15	45,25	40,35	39,75
Total amount of feed administrated	(g)	1001	1001	1001	1001
Feed conversion ratio (FCR)	**(g feed/g gain biomass)**	**1,25**	**1,11**	**1,24**	**1,26**
Protein efficiency ratio (PER)	**(g/g protein)**	**1,95**	**2,20**	**1,96**	**1,93**
Daily biomass	(%biomasă)	2,5	2,5	2,5	2,5
Crud protein feed (PB)	(%)	41	41	41	41

The feed conversion factor, specific growth rate, and protein conversion factor values are essentially equal in the two variants, suggesting that the 3-day starvation did not affect the forage conversion capacity of the fish and that they were able to regain the lost weight on the days of refeeding.

•Conclusions

The objective of the present study was to evaluate the compensatory growth potential of carp, a particularly complex process. Although, fish farmers use no intermittent feeding practices, and the use of certain restriction/feeding protocols could save the fish farmer work and food, we can conclude based on all the results obtained, that *Cyprinus carpio* species presents a remarkable technological plasticity, managing to fully recover the weight lost during the starvation period, the species being a viable alternative for diversification of culture species and production systems in Romanian aquaculture.

Acknowledgments

This scientific work has been realized with the support of the Research and Development Sectorial Plan of the Agriculture and Rural Development Romanian Ministry - ADER contract no 12.1.2., "Research on assessing the selective breeding potential and epigenetic programming to improve adaptation to changing environmental conditions (temperature, oxygen, water quality, feed, etc.)".