EVALUATION OF WATER QUALITY AND FISH GROWTH IN AQUAMIMICRY FISH CULTURE SYSTEM

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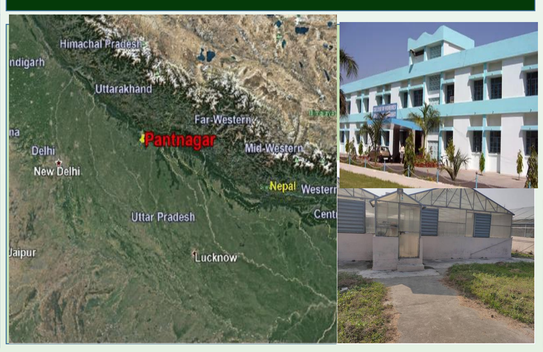
INTRODUCTION

- Aquamimicry is mimicking the natural environment of organisms in a confined water conditions.
- It strives to simulate natural conditions by creating zooplankton faunae (mainly copepods) as supplemental nutrition to the cultured fish and beneficial bacteria to maintain water quality.
- In this system suitable carbon ingredients (energy source e.g. fermented rice or wheat bran) along with probiotics are added, which helps to utilize the unutilized nitrogen, generated through feed and excreta and finally convert it to floc and help in maintaining the population of copepod as a source of proteinaceous feed.

OBJECTIVES

- Evaluation of water quality parameters.
- Qualitative and quantitative estimation of plankters.
- Assessment of fish growth in different culture units
- Economic feasibility and benefit cost analysis of the aquamimicry fish farming system.

EXPERIMENTAL SITE



EXPERIMENTAL DESIGN

Experimental Site	College of Fisheries, Pantnagar
Experimental Time	165 Days
Sampling	Fortnightly

MATERIAL AND METHODS

- 12 rectangular FRP tanks (4 m^3 each) under polycarbonate house, with 3 treatments T_1, T_2, T_3 in triplicate and one set of control for each group.
- Each tank was stocked with 160 fingerlings @ 40 fingerlings m^{-3} in three groups of fishes viz. Catla (T_1), Rohu: Mrigal @ 1:1 (T_2), and Silver Carp: Rohu: Grass Carp: Mrigal: Common Carp @ 15 :30 :15: 10: 30 (T_3) in triplicate and one set of control for each group.
- Preparation of water for stocking (fermented rice bran @50-100 ppm) - water and rice bran for fermentation are added @5-10:1
- Feeding Rate - Feeding regularly @ 50% of required feed for treatment and 100% for control (4-5% of body weight) (26% protein).
- Addition of fermented rice bran regularly @2-4ppm

Probiotics

YSI Pro DSS Multiparameter water analyzer

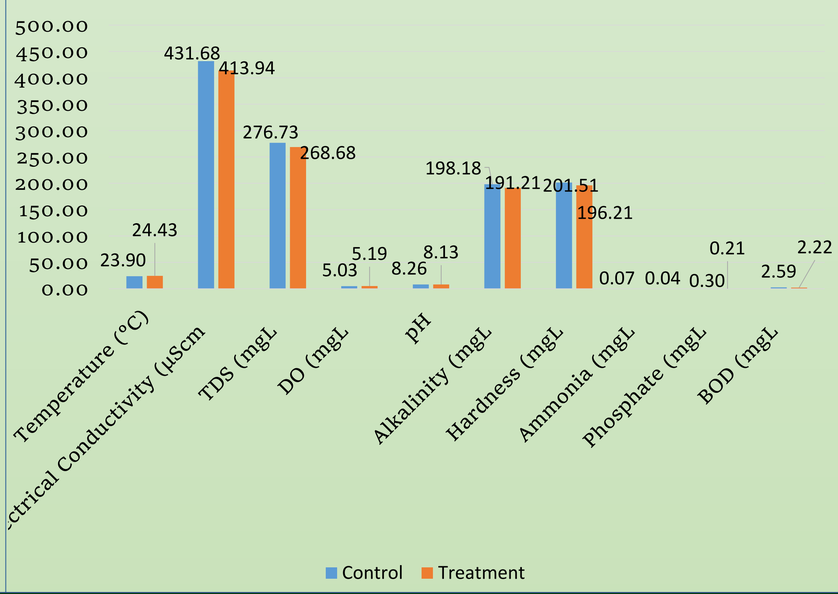
Fermented Rice Bran

Aeration

PARAMETERS	INSTRUMENT/ METHOD USED	PARAMETERS	FORMULA USED
Water Temperature, TDS, Electrical Conductivity, Dissolved Oxygen	YSI Pro DSS Multiparameter water analyzer	Specific Growth Rate (% day^{-1})	$\frac{\text{In (Final Weight)} - \text{In (Initial Weight)}}{\text{Days}} \times 100$
pH	Digital pH meter (Make: Eutech, Model Eco Tester pH2).		
Total Alkalinity	APHA 2017(Titrimetric method)		
Total Hardness	Hi Media Hardness Kit	Feed Conversion Ratio	$\frac{\text{Total Feed utilized(g)}}{\text{Weight Gain (g)}}$
Salinity	YSI Pro DSS Multiparameter water analyzer	Protein Efficiency Ratio	$\frac{\text{Weight Gain (g)}}{\text{Protein Intake (g)}}$
Ammonia	APHA,2017 (Spectrophotometrically at 410 nm wavelength)	Average Weight Gain (g day^{-1})	$\frac{\text{Final Weight} - \text{Initial Weight}}{\text{Days}}$
Phosphate	APHA,2017 (Spectrophotometrically at 690 nm wavelength)	Survival %	$\frac{\text{No.of Live Fish}}{\text{Total Stocked Fishes}} \times 100$
Plankton analysis	Sedgewick Rafter Counting Cell Standard compound microscope	Benefit cost ratio	$\frac{\text{Present value of benefits}}{\text{Present value of costs}}$
Primary Productivity	Light and Dark Bottle Method		

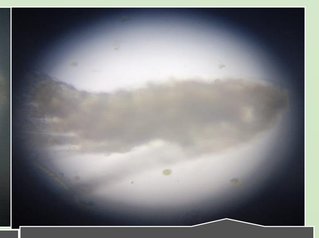
RESULTS

Water Quality Parameters

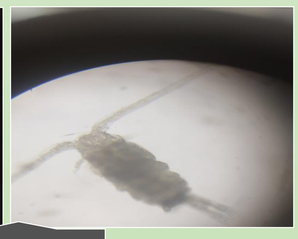


Commonly observed zooplankton during the experimentation period

Diaptomus



Phyllodiaptomus



Cyclops

		T1	T2	T3	C1	C2	C3
1	Cyclops	✓	✓	✓	×	×	✓
2	Diaptomus	✓	✓	✓	×	×	×
3	Vorticella	✓	✓	×	×	×	×
4	Brachionus	×	✓	✓	✓	✓	✓
5	Ceriodaphnia	×	×	✓	×	×	×
6	Asplanchna	✓	✓	✓	✓	✓	×
7	Daphnia	✓	×	✓	✓	✓	✓
8	Keratella	✓	×	×	✓	✓	×
9	Mesocyclops	×	×	×	✓	×	×
10	Chlorogonium	×	✓	×	×	×	×
11	Phyllodiaptomus	×	✓	×	×	×	×
12	Paramecium	×	×	×	×	×	✓
13	Paranemia	×	×	×	×	✓	×

FISH GROWTH PARAMETERS

		SGR (% day^{-1})	FCR (%)	PER	Survival (%)	
T1	Catla	1.798	0.728	5.72	98.75	98.75
C1	Catla	1.604	1.443	2.87	94.35	94.35
T2	Rohu	1.561	0.961	4.33	100	100
	Mrigal	1.409	0.904	4.61	100	
C2	Rohu	1.534	1.93	2.15	96.25	95
	Mrigal	1.388	2.01	2.07	93.75	
T3	Rohu	1.541	1.189	3.5	97.91	97.5
	Mrigal	1.255	1.103	3.78	93.75	
	Silver Carp	1.534	0.77	5.4	91.66	
	Grass Carp	1.213	1.406	2.96	100	
	Common Carp	1.595	0.729	5.71	100	
C3	Rohu	1.332	2.344	1.78	100	98.75
	Mrigal	1.19	2.317	1.8	93.75	
	Silver Carp	1.341	2.055	2.03	95.8	
	Grass Carp	1.345	1.995	2.09	100	
	Common Carp	1.485	1.941	2.15	100	

		% increase in average weight gain	% decrease in FCR	% increase in PER	% increase in SGR	% increase in benefit cost ratio
T1	Catla	9.37	49.55	99.30	12.37	50.15
T2	Rohu	4.887	50.207	101.39	1.96	55.78
	Mrigal	4.059	55.025	122.7	1.438	
T3	Rohu	46.6	49.27	96.63	15.789	61.11
	Mrigal	13.00	52.395	111.17	5.88	
	Silver Carp	42.31	62.53	166	14.179	
	Grass Carp	-21.93	29.52	41.63	-9.70	
	Common Carp	21.81	62.44	165.58	7.38	

ECONOMICS

TANK	Total cost incurred (Rs.)	Total output (kg fishes)	Income generated (Rs)	Benefit Cost ratio	Reduction in cost of production (%)
T1	1267.1	21.488	3867.8	3.05	33.4
T2	1136	14.48	2606.4	2.29	35.92
T3	1209.3	15.602	2808.4	2.32	37.87
C1	1698	19.177	3451.9	2.03	~
C2	1619.2	13.226	2380.7	1.47	~
C3	1647.1	13.2	2376.4	1.44	~

CONCLUSIONS

- ✓ It was observed that values of most of the water quality parameters remained more or less similar but during April and May BOD, ammonia and phosphate levels increased in the control tanks
- ✓ The phytoplankton and zooplankton showed more diversity in treatment tanks.
- ✓ This technique of fish culture can be used for growing indigenous carps as well as exotic carps in mono and polyculture. Catla, Rohu and Amur Common Carp can be preferred as they showed high Specific Growth Rate and good Feed Conversion Ratio. In general, phytoplankton to zooplankton ratio is found 10:1 but here it reached up to 3.12:1 which shows high zooplankton production which supports better fish growth.
- ✓ It also helps to maintain the levels of ammonia and phosphate and do not cause any harmful effects once fish gets acclimatized.
- ✓ It also helped to improve the benefit cost ratio.
- ✓ So this can also be concluded that this technology is efficient in fish production and also cost efficient.