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Comparative Feeding Trial in Growth Performance in Cage cum Fish Culture System on Farm

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Abstract

The study was conducted to assess the growth and feed performance of 3 fish species viz. Big head carp, Grass carp and Silver carp in cage in pond based system from September 2015 to January 2016 upto 136 days. The fish species i.e. Big head carp, Silver carp and Grass carp were stocked in 2:1:2 ratio, 100 in each 4 cages. Fishes in cage 1 and 2 were supplied with the ordinary feed prepared at lab having mustard oil cake and rice bran at 1:1 ratio. Similarly cages 3 and 4 were supplied with formulated feed (Him feed) on the basis of their 3% body weight for the first month and 2% body weight from second till harvest. Water quality parameter analysis was done on weekly basis and fish growth measurement was done on monthly basis. Total harvest weight from the four cages was 1.5 kg out of which 0.160 kg was from fish species fed with ordinary feed and 0.854 kg was from the fish species fed with the formulated feed. The mean PH, temperature, DO and turbidity during the experimental period were 8.2 moles/L, 22.02 °C, 5.44 mg/L cm & 12.577cm respectively. All the water quality parameters were within the optimum range of fish production except the mean temperature which was found below the optimum value and thus may be one of the reasons for the slow growth of fish in cage. Thus under the optimum condition of fish production, cage fish culture supplied with formulated feed has proven better result than the ordinary feed on farm condition of freshwater pond at IAAS.

Key words: Cage culture; Ordinary feed; formulated feed; Water quality parameters

Introduction

Rural pond aquaculture is the small scale and semi intensive polyculture of Indian and Chinese major carps in Nepal. High demand for fish as food has provided good scope for increasing fish productivity as well as the total fish production. Actually fisheries activities are primarily governed by policy laid down by the government in Nepal (MoAC, 2009). Fisheries are regarded as a long-rooted tradition and custom in Nepalese society. Aquaculture is commonly known as new and dynamic sector of agriculture in Nepal (APP, 1995). Carp polyculture in cage was previously practiced only in the lakes of pokhara valley in Nepal. This system is popular among the rural communities and fisherfolks living nearby the river and lake areas. Cages, nets and frames must be checked at the regular interval of time for signs of damage, wear and tear (Shrestha and Pandit, 2012). The cage pond fish farming is one of the new and innovative techniques of aquaculture in Nepal. In cages, silver carp (*H. molitrix*) and bighead carp (*A. nobilis*) are used as the main species for production (Gurung, 2003). This system was developed to increase the fish production, to improve feed utilization and recycling of nutrients within the pond. This system is environment friendly because fewer wastes are released to the environment. In this type of fish culture, the wastes of the cages are utilized by the pond fishes or the organisms present in the pond which increases the feed or nutrient utilization efficiency up to 50%. High

valued fish products are produced for the human consumption at a low cost while high growth performance are achieved in both the cage and pond (Shrestha and pandit, 2012). The growth of fishes depends upon the supplementary feed supplied to them. The various experiments carried out by the integrated fishery development project since 1976 found that cage fish culture could be carried out in an economic basis and several programs were launched to increase the fish production since then. Basically, two species of carps are popular for cage culture: bighead carp (*Aristichthys nobilis*) and silver carp (*Hypophthalmichthys molitrix*) in Nepal. This is perhaps due to their specialization of feeding on plankton in an extensive culture system (Bista *et al.*, 2013).

Materials and Methods

Experimental set up

The experiment was carried out in the earthen pond of Horticulture farm at IAAS Paklihawa, Rupendehi District on 2015/09/07 to 2016/01/20. (i.e. for 4 month).

Pond Preparation

The experimental pond was cleaned from the unnecessary waste materials present on the pond like stones, bricks, woods and garbages. Water depth of about 1.5 meter was maintained on the pond.

Cage preparation

The iron framed square shaped cages having 1*1*1 m³ volume were prepared using nylon net (2 green and 2 red

colour) nylon rope and white gallons. All these materials were brought from Bhairahawa market. The iron frame was tied at the corner and made box shaped structure. Finally 4 cages of 1 meter cube each were prepared. In order to keep the cages floating on the pond 4 empty gallons were tied at each corner of the cage.

Procurement of Research Materials

The fingerlings of Big head carp and Grass carp were brought from Mandal Fish Hatchery, Patthardada. Similarly the fingerlings of Silver carp were brought from Fisheries Development Center, Bhairahawa.

Feed seed stocking

The fingerlings were brought from Mandal Hatchery and Fishery Development Center to the experimental pond and stocked it by counting and kept inside the cages as per the stocking density (Table 1).

Table 1: Fish Seed stocking in each cage

Cage No.	Big head carp	Silver carp	Grass carp	Total
Cage 1 (Red)	40	40	20	100
Cage 2 (Red)	40	40	20	100
Cage 3 (Green)	40	40	20	100
Cage 4 (Green)	40	40	20	100
Total	160	160	20	400

Feed Preparation

Two types of feed were provided to test the growth rate of the carp fishes.

Formulated/Floating Feed (Him Feed)

Him feed, extruded floating fish feed were provided to Cage 3 and Cage 4.

Ordinary Feed

It was prepared by mixing Rice Bran and Mustard oil cake in the ratio of 1:1. Mustard oil cake was soaked in water up to one night, weighted in a digital weighing machine and mixed with bran in a plastic bucket and place it in hand operated feed machine. Hence feed prepared.

Packing

The feed was packed in the small plastic bag by weighing the required amount in the electronic balance and all together 30 packets were prepared for each cage based on the feeding rate.

Feeding

The fingerlings were given feed on the basis of average weight of the three species So, before stocking the fingerlings their average weight was taken in the ratio 2:2:1 which was calculated (Table 2)

Table 2: Average weight of the fingerlings of Big head carp and Silver carp for the first month

Number of fingerlings	Big head carp (Weight)	Silver carp(Weight)
8	x (say)	y (say)
1	x/8	y/8
40	(x/8)*40	(y/8)*40

Table 3: Average weight of the fingerlings of Grass carp

Number	Grass carp(Weight)
4	z (say)
1	z/4
20	(z/4)*20

Average weight of the fingerlings in each cage = Average weight of Big head carp+ Average weight of silver carp+ Average weight of Grass carp i.e. Average weight of the fingerlings in each cage= (x/8)*40 +(y/8)*40+ (z/4)*20 (Table 3). Therefore, Amount of feed in each cage = 3% of Body weight of the fingerlings in each cage

For second, third and fourth month: Amount of feed calculated

Procedure same as above but Amount of feed given to fingerlings in subsequent month is shown in the Table 4.

Table 4: Amount of feed given to the fingerlings in second, third and fourth month

Month	Second month	Third month	Fourth month
Amount of feed given	2% of Body weight of fingerlings in first month	2% of Body weight of fingerlings in second month	2% of Body weight of fingerlings in third month

Water quality analysis

Weekly measured water quality parameters

The weekly measurement of Dissolved oxygen, temperature, transparency, and pH of water was conducted using available instruments (Table no.5) directly into the experimental ponds at a depth of 23cm from the surface.

Dissolved oxygen

Dissolved oxygen was recorded weekly at 8:00-9:00 am. The oxygen meter was dipped in the water and calibrated and the reading so obtained was recorded on the note. At the same time temperature was also recorded from the same instrument.

pH

The pH of the water was measured weekly at 8:00-9:00am. It was also dipped in the pond, slowly shaken it and the reading so obtained was recorded on the note.

Water Transparency

It was measured weekly at 8:00-9:00am using Secchi disk. The secchi disk was dipped inside the pond up to that depth

where it disappears and reappears on the water surface. The length of the wetted thread was then measured using scale (Table 5).

Table 5: Water quality parameters measured during experimental pond

Parameters (Weekly measured parameters)	Measured unit	Method/Instruments
DO	mg/L	Lutron Oxygen meter Model DO 5510.
Temperature	°C	Lutron Oxygen meter Model DO 5510.
Transparency	cm	Secchi disk
pH	Moles/L	Lutron pocket type Model pH-201.

Fish sampling and growth measurements

The fish sampling was done monthly by using electronic balance, scoop net and plastic bucket. By the help of scoop net the fishes were trapped and placed in the plastic bucket and place on the electronic balance and weighte separately. The fish species were collected, identified and separated into three parts as Big head carp, Silver carp and Grass carp in 2:2:1 ratio individually weighted as shown in Table 6.

Table 6: Weight of the fingerlings in each cage

Number of fingerlings	Big head carp	Silver carp
8	X	Y
1	x/8	y/8
40	(x/8)*40	(y/8)*40

Average body weight of Big head carp=(x/8)*40

Average body weight of silver carp=(y/8)*40

Table 7: Weight of the fingerlings in each cage

Number of fingerlings	Grass carp
4	Z
1	z/4
20	(z/4)*20

Average body weight of Grass carp= (z/4)*20

Average weight of the individual carp species = Total weight of the individual carp species (Kg)/Total number of individual carp fish

Total weight of the fish=Final total weight of the fish-Initial total weight of the fish (Table 7).

Fish harvesting

The final harvesting of fish was done on January 20th 2016 by taking out each cage outside of the pond. From each cages the three species were identified, separated and counted. The total weight of each species was measured using electronic balance. Initially plastic bucket was placed on the electronic balance and then it was teared and then each harvested carps were placed on that teared bucket and

respective weight of the carps was taken and recorded on the note.

Statistical analysis

The statistical analysis of data was performed by using SPSS (version 16.0).Microsoft excel computer program was used for data tabulation and figure preparation. Microsoft word was used for the preparation of report.

RESULTS

Fish yield

Stocking and harvest weight of carps in different cages under different feeding composition during the different experimental period is given in Table 8.

Table 8: Stocking and harvest weight (kg/species) of carps

Parameters	Observations
Total Stock number	400
Total Stock weight (kg)	0.133 ± 0.014 ^a
Total Harvest number	68.50 ± 11.44 ^a
Total Harvest weight (kg)	1.507 ± 1.186 ^b
Harvest weight (ordinary) species wise/ kg	0.160 ± 0.058 ^a
Harvest weight (formulated)species wise/ kg	0.845 ± 0.167 ^a

Total carps fish harvest weight was found 1.5 kg. The species wise carps fish harvest in cage 1 and cage 2 fed with ordinary feeds was found 0.160 kg, whereas species wise carps fish harvest in cage 3 and cage 4 fed with formulated feed was found 0.845 kg. The total harvest weight of carp fishes was found significantly different among the cages during the experimental period. Moreover, there was no significantly different in species wise harvest of carp fishes among the cages during the experimental period.

Water Quality Analysis

Weekly and fortnightly means of water quality parameters are presented in Table 8.

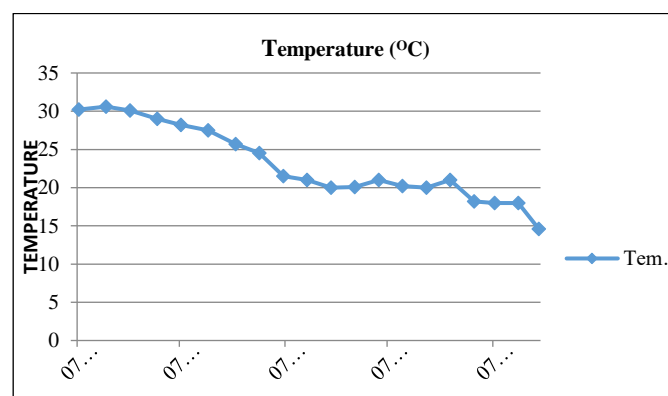


Fig. 1: weekly mean temperature (°C) of pond at 8:00 to 9:00 am during experimental period

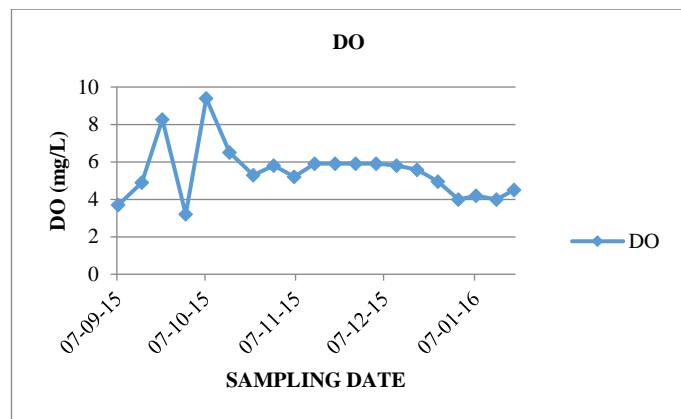


Fig. 2: weekly mean dissolved oxygen (mg/L) of pond at 8:00 to 9:00 am during experimental period

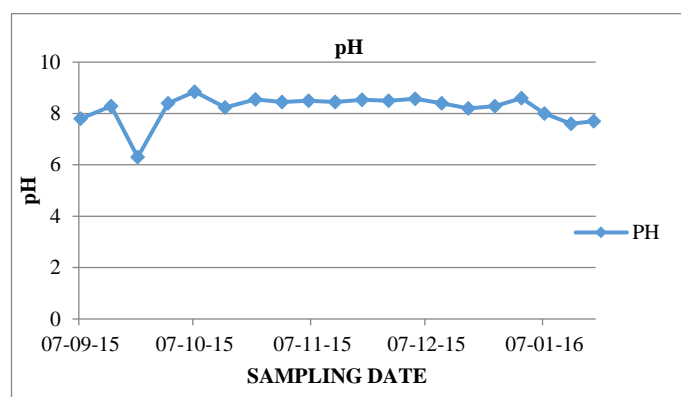


Fig. 3: weekly mean pH of pond water at 8:00 am to 9:00 am during experimental period

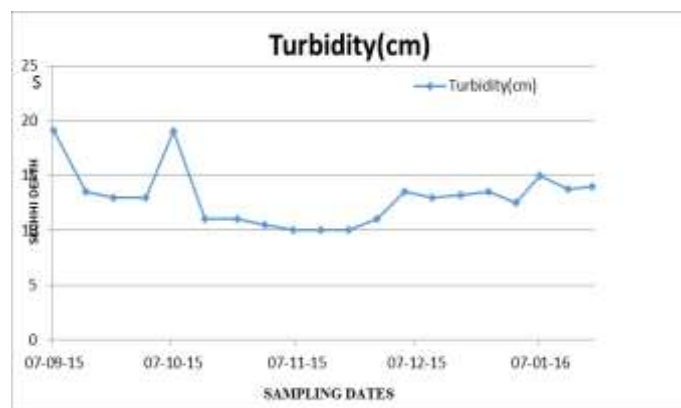


Fig. 4: weekly mean secchi depth (cm) of pond water at 8:00 am to 9:00 am during experimental period.

Table 9: Mean and range of Water quality parameters in different cages during the experimental period of 136 days (Mean±SE)

Parameters	Observation
pH	8.2095 ± 0.55097 (6.30-8.85)
DO (mg/L)	5.4450 ± 1.47186 (3.20-9.40)
Temperature (°C)	22.0200 ± 6.66356 (12.5-30.60)
Secchi disk depth (cm)	12.9775 ± 2.56548 (10.00-19.10)

The pond temperature ranged from 12.5 to 30.60 °C throughout the experimental period of 136 days (Fig. 1). Dissolved oxygen ranged from 3.20 to 9.40 mg/L during the experimental period (Fig. 2). Pond water pH ranged from 6.30 to 8.85 (Fig. 3). Similarly, secchi depth ranged from 10 to 19.10 cm during the experimental period of 136 days (Fig. 4).

Growth Performance Analysis

In carp fishes, the growth performance fed with formulated feed were found significantly different from the fishes fed with ordinary feed in Table 10. Similarly, there was significantly difference in other growth performance of individual carp fish species. Thus the growth performances of the fish species in cage 3 and 4 fed with formulated feed is better than the fish species in cage 1 and 2 fed with the ordinary feed.

Discussion

Water Quality

The present study shows that water quality was not drastically affected by the stocking densities of combination of carp fish species polyculture in cage in pond based system, as water quality parameters did not differed significantly (p<0.05) within the pond (Table 8). Weekly and fortnightly means values of water quality parameters such as pH, dissolves oxygen and turbidity (secchi depth) were found within a suitable range for fish production. There was seasonal fluctuation of temperature as temperature was decreasing gradually, which might have limited the growth and production of cultured fish species.

Table 10: Growth performance of carp fish species fed with different feeds in cages during the experimental period 136 days (Mean±SE)

Parameters	Carps	Bighead Carp	Silver Carp	Grass Carp
Ordinary Feed	0.104 ± 0.046 ^a	0.071 ± 0.149 ^a	0.0326 ± 0.0442 ^a	0.0119 ± .01329 ^a
Formulated Feed	0.336 ± 0.150 ^b	0.171 ± 0.171 ^b	0.2905 ± 0.2289 ^b	0.1210 ± 0.0954 ^b

Note: Ordinary feed-Cage1 and Cage 2, Formulated feed-Cage3 and Cage4

Ordinary feed- Rice bran + Mustard oilcake (1:1)

Formulated feed-Commercially manufactured floating feed

Pond water temperature was initially 30.8 °C and decreased gradually from 30.8 to 14.6 °C throughout the experimental period (Figure 1) with average temperature of 22.02 °C which was below compared to the optimum temperature 25 – 30 °C (NACA, 1989). The pH of pond water ranged from 6.30 to 8.85 and attained maximum during second and third half of the experiment and after that remained down. Mean pH during the experiment was 8.2 which within the optimum range i.e. 7.5-8.5 (NACA, 1989). Dissolved oxygen level ranged from 3.20 to 9.40 mg/L with average DO of 5.44 mg/L which was greater than minimum DO level i.e. 2.00 mg/L (NACA, 1989). DO reached maximum during the 3rd and 5th week of the experiment, after that it decreased and remained almost same throughout the experimental period. The pond water was turbid during the first week of the experiment, which may be due to the planktonic biomass in the pond. Transparency of pond water increased after the first week due to the addition of clear water.

Growth Performances of Fish

The total yield of carp fishes was found significantly different among the cages during the 136 days culture cycle. The growth performance of formulated feed over the ordinary feed in cage culture was found better. The total fish production with 1.5 kg was found higher with those cages of fish production range started with 1.3 kg in Phewa Lake (Wagle et al., 2007). The total carp fish yield was found lower than the yield 3.25 kg/m³ *Pangasius sutchi* at the stocking density 20/m³ with pellet Saudi-bangla feed reported by Golder et al. (1996). Similar result was found in accordance with the result reported by FRI (1993) in common carp found 3.2 kg/m³ at the density of 20/m³ fed with compound feed having fish meal (20%), rice bran (20%) and mustard oilcake (40%). Moreover the growth rate of silver carp in cages were found rapid than the grass carp and big head carp. Similar result was reported by Cremer (1980) in cage culture when supplemented with artificial feed. And fish growing season was also detrimental factor as the growing period of fishes followed by the cold season; cloudy weather might also the prime indication in the optimum result. Besides that low quality nylon net with continuous wear and tear problem also affect the entire result as well.

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