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# Study on the Stocking Density of Fry for Fingerling Production of Common Carp at BAPARD Nursery Ponds

**Md. Abdul Halim[1, 2*], M. M. Nabi[2]**

[1] International Institute of Aquaculture and Aquatic Sciences, Universiti Putra Malaysia (UPM), Port Dickson 71050, Malaysia
[2] Bangabandhu Academy for Poverty Alleviation and Rural Development (BAPARD), Kotalipara, Gopalganj, Bangladesh
***Corresponding Author:** rabihalim@gmail.com; robi21114@gmail.com)

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**ABSTRACT**

The present study was designed to assess the growth and production performance of common carp (*Cyprinus carpio*) fry reared at various stock rates in the pond of BAPARD campus, Gopalganj from the 1st of April till June the 15th in 2022. Six typical ponds (three treatments with two replications) were selected with a rectangular size of 10±0.25dec and an average depth of 1.52±0.03 meter. Three different stocking densities with two replications, $T_1$ (20,000 fry/dec), $T_2$ (22,500 fry/dec) and $T_3$ (25,000 fry/dec) were examined. Fry samples with initial length & weight of 0.30±0.05cm and 0.28±0.06g, respectively, were collected from Sonali Fisheries Hatchery, Kotalipara, Gopalganj. The survival rate of the stocking common carp was 53±0.15%, 51±0.12% and 50±0.20 in $T_1$, $T_2$ and $T_3$, respectively. The weight gain of common carp recorded values of 1821.43±1.00, 1507.14±0.75 and 1239.29±0.89 in $T_1$, $T_2$ and $T_3$ respectively. The daily weight gain (g/day) of common carp was recorded as 0.07±0.05, 0.50±0.04 and 0.40±0.045 in $T_1$, $T_2$ and $T_3$, respectively. The biomass gains (g) of common carp were 5.09±0.05, 4.22±0.06 and 4.34±0.07 in $T_1$, $T_2$ and $T_3$, respectively. The feed conversion ratio was evaluated to be 1.80±0.07, 2.15±0.05 and 2.50±0.08 in $T_1$, $T_2$ and $T_3$, respectively. The SGR in weight (%/day) of common carp was recorded as 3.94±0.03, 3.71±0.04 and 3.70±0.05 in $T_1$, $T_2$ and $T_3$, respectively. The condition factor (K) of common carp recorded values of 1.06±0.02, 1.04±0.04 and 1.00±0.03 in $T_1$, $T_2$ and $T_3$, respectively. The production (kg/dec.) of common carp registered values of 57.02±0.02, 50.87±0.82 and 46.29±0.50 in $T_1$, $T_2$ and $T_3$, respectively. The benefit cost ratio (BCR, species) was significantly ($P$<0.05) higher in $T_1$ (1.46) than $T_2$ (1.27) and $T_3$ (1.05). The findings of this experiment showed that the lower stocking density produces high production with low expenditure.

## INTRODUCTION

Aquaculture is a biological process that involves increasing aquatic organisms' production properly: saving aquatic areas, controlling environmental factors and positively managing the organisms' life history. In its most recent "Food Outlook" report, the Food and Agriculture Organization of the United Nations (FAO) stated that, it anticipates a 1.5% increase in worldwide aquaculture and fisheries output to reach 184.6 million ton in 2022 (**FAO, 2022**). More than 225 nations and regions export products from the fishing and aquaculture industries, which are valued over $150 billion annually **(FAO, 2022)**. In Bangladesh, one of the most productive and dynamic sectors is fisheries which helps to create job opportunities for employment and earning foreign currency **(Haque *et al.*, 2015; Shamsuzzaman *et al.*, 2020; Tikadar *et al.*, 2021)**. During the Fiscal Year (FY) 2020-21, Bangladesh produced 4.621 million metric ton (MT) of fish, which ranked it globally the 3rd **(DoF, 2022)**. Bangladish was the 3$^{rd}$ for aquaculture production of inland fish production and the twelfth for the growth of marine fish throughout the globe **(FAO, 2020; DoF, 2022)**. The fisheries sector makes up 3.57% of the country's gross domestic product (GDP), 26.50% of the GDP from agriculture, and 1.24% of the country's export revenue **(DoF, 2022)**.

In 2018, the total world aquaculture production was nearly 4.2 million ton of common carp, making it the fifth most cultured species in world aquaculture **(FAO, 2020)**; this estimate constitutes 8% of the total aquaculture production **(FAO, 2018)**. In several Asian and some European countries, common carp is regarded as a crucial fish species **(Rahman, 2015)**. It is a sizable benthivorous fish native to Eurasia and has been widely distributed, which is now regarded as one of the most invasive species in the world **(Kulhanek *et al.*, 2011)**. It is readily available in all countries but especially favored in Asia and among several European nations **(Kloskowski, 2011; Weber & Brown, 2011; Parkos & Wahl, 2014)**. In the world, common carp is the third most culturable species **(Rahman, 2015)**. It is one of the important species for fish farming in the entire globe, and it is the species of choice because of its rapid development, ease of breeding, resistance to ecological stress and relatively high market value **(Abbass, 2007)**.

Common carp is the second most important species in the European freshwater aquaculture, with 164,755 ton produced in Europe in 2017 **(FAO, 2019)**. In the fertilized ponds, the stocking density is not more than 30,000/ ha **(Váradi, 2022)**. While, in the Near East and North Africa regions, the production of the species increased between 2005 and 2014 from 31,194 to 125,787 ton, with an average annual growth increment of 17.3% **(El-Sayed, 2017)**. It is regarded as a prospective candidate for commercial aquaculture among various European and Asian nations due to its extremely high capacity for environmental and dietary adaptation **(Soltani *et al.*, 2010; Manjappa *et al.*, 2011; Rahman, 2015)**. The common carp belongs to the order Cypriniformes and family of Cyprinidae, and it is the largest family of freshwater fish **(Rahman, 2015)**. It rarely lives in brackish freshwater ecosystems and mostly occupies freshwater ones, especially ponds, lakes and rivers **(Barus *et al.*, 2001)**.

As an omnivorous freshwater fish species, the common carp (*Cyprinus carpio* L.) acts as a supplementary component of environmental protection **(Biermann & Geist,**

**2019)**. Common carps are omnivore fish with a strong preference for eating animal products such as worms, mollusks, water bugs, insect larvae and zooplankton **(FAO, 2004)**. Compared to fish soecies that are predatory such as trout and salmon, it can be grown without the need of fishmeal or oil **(Hoole *et al.*, 2008; FAO, 2015)**. During 1960, the common carp breeding was successfully established, and since then fingerlings were available for interested farmers **(FAO, 2004)**. Fish fry and fingerling production has increased as a result of the yearly increase of fish demand and the establishment of new culture areas **(Pokhrel, 2020)**. However, the lack of sufficient supply of high-quality fry and fingerlings forms a significant obstacle hindering the globally promotion of fish farming **(Jha *et al.*, 2015)**.

There are 1.29 million ponds in Bangladesh, covering 0.14 million hectares of land, along with a significant number of haors, baors, beels, lakes with natural depressions that are suitable for fish farming **(Tasi, 1997)**. The sustainability of closed water farming is primarily determined by the availability of carp fry. Bangladesh's primary source of carp seed production has always been its rivers. During the monsoon (May-August), millions of eggs and spawning were gathered from different water bodies including rivers **(Sharif & Asif, 2015)**. To maintain a consistent and stable supply of fish fingerlings, it is crucial to develop appropriate nursing strategies **(Bostami *et al.*, 2020)**. An effective regulated approach to fry nursing requires understanding the dietary and ecological obstacles that the fry in the aquatic habitat face **(Mollah, 1985)**.

Maintaining the ideal stocking density is essential for the survival and development of fish fry and fingerlings in order to obtain the highest financial returns **(Bostami *et al.*, 2020)**. The stock number of selected animals is a crucial element for fish farming that significantly influences aquatic ecology **(Soundarapa & Kannan, 2008; Rahman *et al.*, 2012; Amira *et al.*, 2016)**. Higher stocking numbers in common carp have many negative impacts on aquatic environments **(Rahman *et al.*, 2006; Kloskowski, 2011; Rahman, 2015)**. The ideal density of common carp in polyculture ponds can enhance the stimulatory activity with other fish, which may boost the efficiency of recycling nutrients in fish and reduce loss of nutrients in the substrate **(Rahman *et al.*, 2007)**.

One of the finest methods is to nurse fry in ponds since it is feasible, affordable, as well as allowing for more thorough observation. Grading confirms that the fry is evenly harvested and has improved survival rates **(Blow & Shivaon, 2005; Kunda *et al.*, 2014)**. However, stocking numbers and environmental issues affect the consequences of nursing fry in ponds **(Asase *et al.*, 2016)**.

The goal of the current study was to establish the ideal stock number for common carp fry raised by nursery owners and fish farmers. This study would provide comprehensive data for farmers and policy makers to popularize this species throughout the country.

## MATERIALS AND METHODS

### Site Selection

The study was carried out for a total of 75 days from the 1st of April till June the 15th 2021 in the pond of BAPARD campus, Kotalipara (located at 22.9833°N 89.9917°E), Gopalganj (Fig. 1). The typical pond has a rectangular size of 10±0.25 dec. and an average depth of 1.52±0.03 meter. For the experimental design, six ponds were used for this experiment.

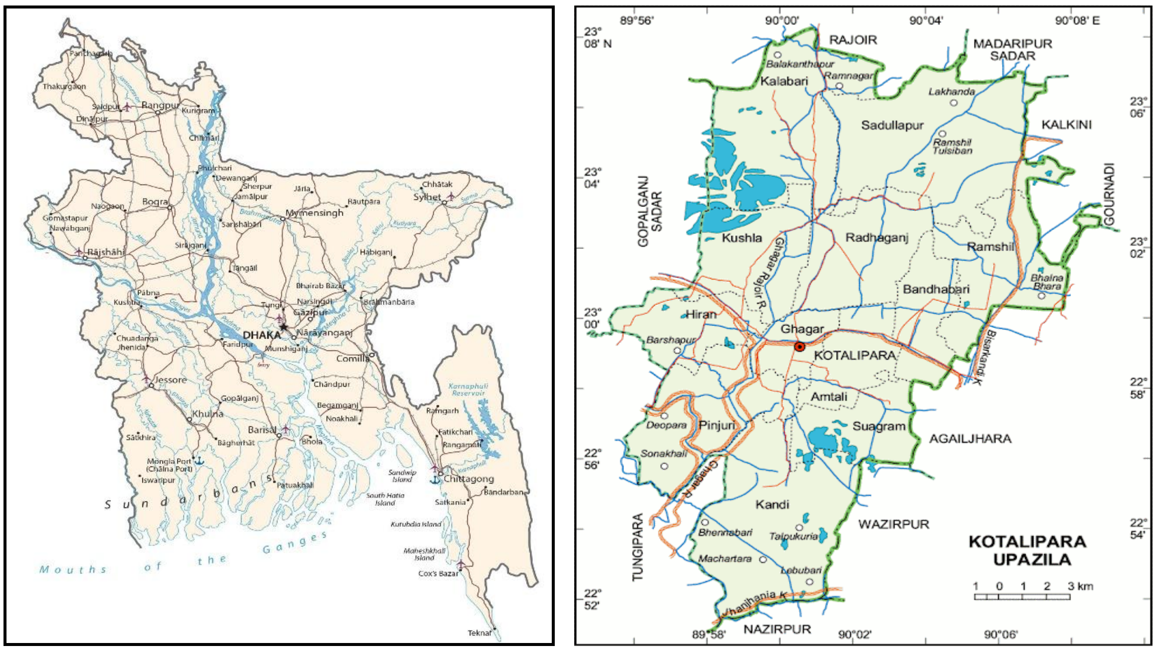


**Fig. 1.** A map for Kotalipara showing the study area

### Pond preparation

Aquatic weeds were physically removed when the ponds were totally cleaned. All ponds underwent 1 kg/dec of liming. Following liming, the ponds were filled with water and fertilized with urea and TSP at rates of 100g/ dec and 50g/ dec, respectively. After soaking TSP overnight, it was combined with urea and manually applied to the surface of the pond's water on a sunny day (10-11 am).

### Collection of experimental fry and stocking

Specimens of common carp, with initial length & weight of 0.30±0.05cm and 0.28±0.06g were collected from Sonali Fisheries Hatchery, Kotalipara, Gopalganj. Three different stocking densities were tested via treatments of $T_1$ (20,000 fry/decimal), $T_2$ (22,500 fry/decimal) and $T_3$ (25,000 fry/decimal), respectively.

## Experimental design

Experimental design is the systematic, organized process of conducting research. It makes it possible to draw exact conclusions regarding a hypothesis. The goal is often to ascertain the influence of an element or independent variable on a dependent variable.

| SL | Treatment | Replication | Stock density (decimal) | Feed supplies | Duration (days) |
|---|---|---|---|---|---|
| **1** | $T_1$ | 2 | 20,000 | 25-10% | 75 |
| **2** | $T_2$ | | 22,500 | | |
| **3** | $T_3$ | | 25,000 | | |

### *Feeding*

All trials ponds received weekly fertilization at the same rate (100g/ dec of urea and 50g/ dec of TSP). At the start of the experiment, the feed was provided at a rate of 25% of the fry's body weight, and then it was decreased to 10%. Commercial pellet feed with a 30% protein content [Quality Feeds-Nursery-1 (Crumble)] was used for feeding. Feed was introduced twice daily: half at 9.00 am and the other half at 4.00 pm.

### *Sampling*

In order to monitor fry growth and adjustment of feeding rates, sampling was done after a 15 days interval. For sampling purposes, one percent of the total fry was calculated which represented the whole number. A portable digital balance was used to weigh the fry during sampling.

### *Water quality parameters*

Water quality indicator measurements such as temperature, dissolved oxygen (DO), pH, ammonia, nitrite, nitrate, alkalinity and hardness were measured every two weeks. An API® commercial test kit (API® Aquarium Pharmaceuticals, North America) was used to measure the ponds' temperature and dissolved oxygen levels. A pH meter was used to track the pH of the water. Using API® commercial test kits (API® Aquarium Pharmaceuticals, North America), ammonia, nitrite, nitrate alkalinity and hardness levels were monitored.

### *Growth performance*

To determine the body weight of fishes, a random sampling was taken from each pond every two weeks. Due to known growth performance and feed adjustment average, 1% of fry individuals was weighed and measured for length. The ensuing formulas were employed to estimate the survival rate, weight gain, daily weight gain, biomass gain, FCR, SGR and condition factor (*K*).

$$\textbf{Survival Rate (\%)} = \frac{\text{Number of harvested fish}}{\text{Number of stocked fish}} x100$$

**Weight gain (%)** = $\frac{\text{Mean final weight} - \text{Mean initial weight}}{\text{Mean initial weight}} x100$

**Daily weight gain (DWG) (g/day)** = $\frac{Wt-W0}{t}$

Where, $W_{t.}$ and $W_0$ are the final and initial bodyweight of the fishes, respectively, and t is the total duration of the grow-out trial in days.

**Biomass gain (g) = Harvested biomass (g)- Stocked biomass (g)**

**Feed conversion ratio** = $\frac{\text{Total amount feed given (g)}}{\text{Weight gain (g)}}$

**Specific growth rate (SGR, % day$^{-1}$)** = $\frac{lnWf-lnWi}{t} x100$

Where ,$W_f$ = final weight; $W_i$ = initial weight, and t = time in days.

Fulton's condition factor (K): Fulton's condition factor (*K*) was calculated according to **Htun-Han (1978)** equation as per formula given below:

$$K=\frac{W}{L3}X100$$

Where, k = condition factor; W = average body weight (g), and L = average body length (cm).

**Benefit-cost ratio (BCR)** = $\frac{Total\ net\ return}{Total\ input\ cost}$

### Statistical analysis

SPSS version-25 was used for the data analysis. Shapiro-Wilks and Levene's procedures were used to determine the variances normality and homogeneity. The differences in treatment means were examined using one-way analysis of variance (ANOVA). Duncan's multiple range tests were employed for the post hoc comparison of mean between several groups when significant differences were found at the level of 5% ($P$< 0.05). Data in Tables are displayed as mean, standard deviation and significant difference at $\alpha$ = 5%.

## RESULTS

### Water quality parameters

The results of water quality parameters measured during the study period are shown in Table (1).The mean standards of pH are not drastically difference ($P$>0.05) from 7.80±0.50 ($T_1$), 7.70±0.56 ($T_2$) and 7.50±0.60 ($T_3$). The ammonia (mg/ L) was noticeably ($P$<0.05) higher in $T_3$ (0.50±0.015) than $T_1$ (0.25±0.01) and $T_2$ (0.25±0.02). The dissolved oxygen (mg/L) was significantly ($P$<0.05) higher in $T_1$ (5.5±0.60) than $T_2$ (5.10±0.75) and $T_3$ (4.90±1.50). The temperature ($^0$C) was the same (not significantly, *P*>0.05) in $T_1$ (28.50±0.01), $T_2$ (28.52±0.012) and $T_3$ (28.60±0.15). The nitrite (mg/L) was significantly (*P*< 0.05) higher in $T_3$ (0.25) than $T_2$ (0.00) and $T_1$ (0.00). The nitrate (mg/L) was significantly (*P*< 0.05) higher in $T_3$ (0.25) than $T_2$ (0.00) and $T_1$ (0.00). The hardness (mg/L) was similar (not significantly, *P*> 0.05) $T_1$ (90.50±0.05), $T_2$ (90.75±0.10) and $T_3$ (90.80±0.04). The alkalinity (mg/L) was also similar (not significantly, *P*> 0.05) $T_1$ (120±0.05), $T_2$ (120.25±0.07) and $T_3$ (120.20±0.08).

**Table 1.** Mean values of physico-chemical parameters during the period of common carp fry nursing

| **Water quality parameters** | **Treatments** | | |
|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ |
| **pH** | 7.8±0.50$^a$ | 7.7±0.56$^a$ | 7.5±0.60$^a$ |
| **Ammonia (mg/L)** | 0.25±0.01$^a$ | 0.25±0.02$^a$ | 0.50±0.015$^b$ |
| **Dissolved oxygen (mg/L)** | 5.5±0.60$^a$ | 5.10±0.75$^b$ | 4.90±1.50$^c$ |
| **Temperature ($^0$C)** | 28.50±0.01$^a$ | 28.52±0.012$^a$ | 28.60±0.15$^a$ |
| **Nitrite (mg/L)** | 0.00$^a$ | 0.00$^a$ | 0.25$^b$ |
| **Nitrate (mg/L)** | 0.00$^a$ | 0.00$^a$ | 0.25$^b$ |
| **Hardness (mg/L)** | 90.50±0.05$^a$ | 90.75±0.10$^a$ | 90.80±0.04$^a$ |
| **Alkalinity (mg/L)** | 120±0.05$^a$ | 120.25±0.07$^a$ | 120.20±0.08$^a$ |

Mean ± SE in same row with a similar superscript are not significantly different (*P*> 0.05).

**Growth parameters**

The growth parameters results of the common carp are recorded in Table (2) and illustrated in Figs. (2, 3). It was found that the survival rate (%) was significantly varied (*P*< 0.05) between different treatments; $T_1$ had a considerably better average survival rate (53±0.15) than $T_2$ (51±0.12) and $T_3$ (50±0.20). The FCR species were significantly (*P*< 0.05) varied, with best values in $T_1$ (1.80±0.07) than $T_2$ (2.05±0.05) and $T_3$ (2.30±0.08). The specific growth rate (SGR, % day$^{-1}$) was significantly (*P*< 0.05) higher in $T_1$ (3.94±0.03) than $T_2$ (3.71±0.04) and $T_3$ (3.70±0.05). The weight gain (g) of species was significantly (P<0.05) higher in $T_1$ (5.38±0.10) than $T_2$ (4.50±0.40) and $T_3$ (3.75±0.15). The daily weight gain (g/day) of common carp was significantly (*P*< 0.05) higher in $T_1$ (0.07±0.05) than $T_2$ (0.05±0.04) and $T_3$ (0.04±0.045). The biomass gain (g) of common carp was significantly (*P*< 0.05) higher in $T_1$ (5.09±0.05) than $T_2$ (4.22±0.06) and $T_3$ (4.34±0.07). The condition factor (K) of common carp was significantly (*P*< 0.05) higher in $T_1$ (1.06±0.02) than $T_2$ (1.04±0.04) and $T_3$ (1.00±0.03). The production (kg/dec) of common carp was significantly (*P*< 0.05) higher in $T_1$ (57.02±0.02) than $T_2$ (50.87±0.82) and $T_3$ (46.29±0.50).

**Table 2.** The growth parameters of common carp during the study periods

| Growth parameter | Treatments | | |
|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ |
| Initial length (cm) | 0.30±0.05 | 0.30±0.05 | 0.30±0.05 |
| Initial weight (g) | 0.28±0.06 | 0.28±0.06 | 0.28±0.06 |
| Culture periods | 75 days | | |
| Stocking density | 20,000 | 22,500 | 25,000 |
| Final length (cm) | 7.98±0.45$^{a}$ | 7.55±0.80$^{a}$ | 7.20±0.26$^{b}$ |
| Final weight (g) | 5.38±0.10$^{a}$ | 4.50±0.40$^{b}$ | 3.75±0.15$^{c}$ |
| Survival rate (%) | 53±0.15$^{a}$ | 51±0.12$^{b}$ | 50±0.20$^{c}$ |
| Weight gain (%) | 1821.43±1.00$^{a}$ | 1507.14±0.75$^{b}$ | 1239.29±0.89$^{c}$ |
| Daily weight gain (gm/day) | 0.07±0.05$^{a}$ | 0.05±0.04$^{b}$ | 0.04±0.045$^{b}$ |
| Biomass gain (g) | 5.09±0.05$^{a}$ | 4.22±0.06$^{b}$ | 4.34±0.07$^{c}$ |
| Feed conversion ratio | 1.80±0.07$^{c}$ | 2.05±0.05$^{b}$ | 2.30±0.08$^{a}$ |
| SGR in weight (%/day) | 3.94±0.03$^{a}$ | 3.71±0.04$^{b}$ | 3.70±0.05$^{c}$ |
| Condition factor, *K* | 1.06±0.02$^{a}$ | 1.04±0.04$^{a}$ | 1.00±0.03$^{a}$ |
| Production (kg/dec.) | 57.02±0.02$^{a}$ | 50.87±0.82$^{b}$ | 46.29±0.50$^{c}$ |

Mean ± SE in same row with a similar superscript are not significantly different ($P > 0.05$).

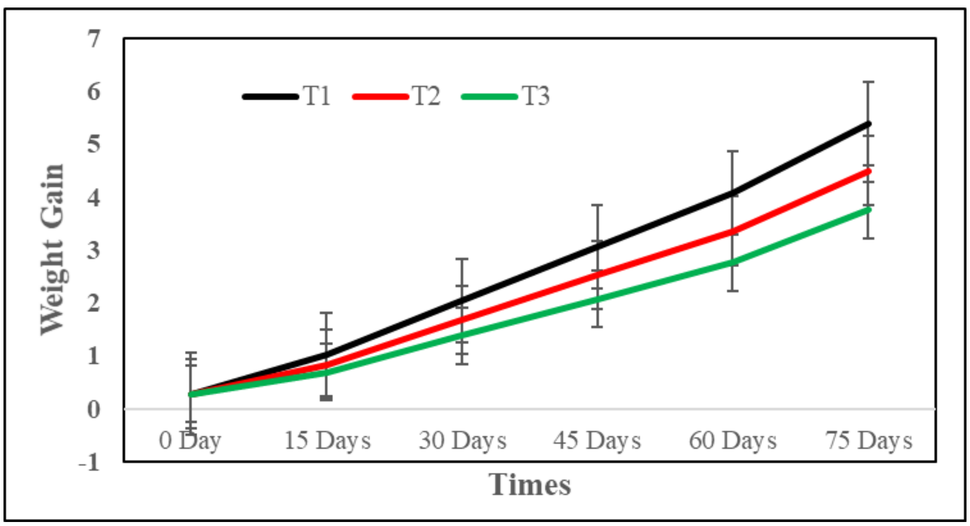


**Fig. 2.** Weight gain of common carp during study period

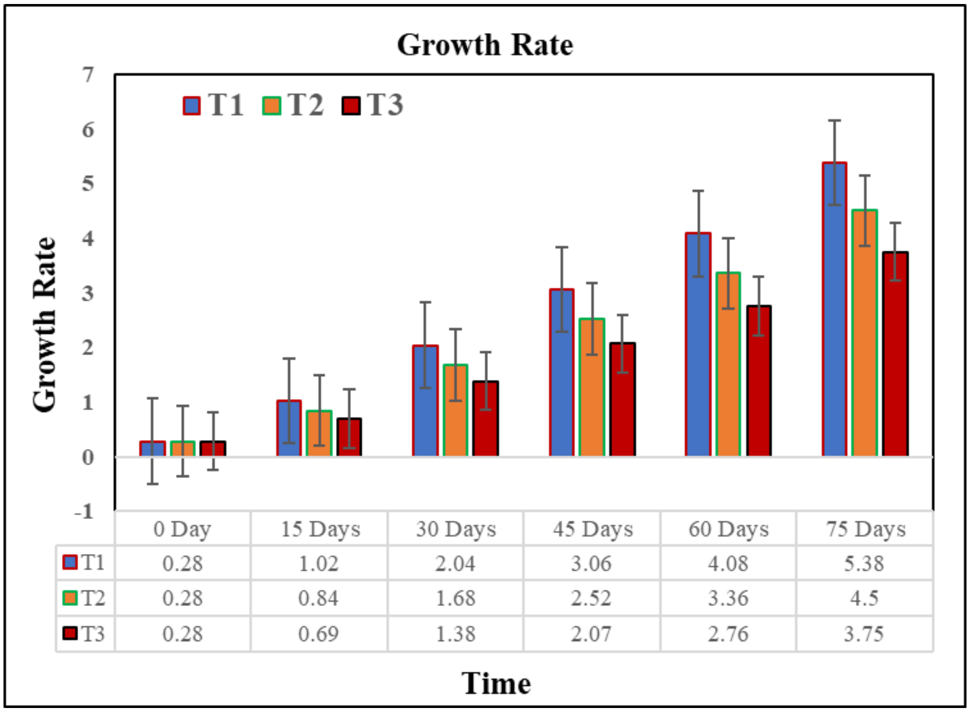


**Fig. 3.** Growth rate of common carp during study period

**Table 3.** Economic analysis of common carp in different treatments

| **Component** | **Treatments** | | |
|---|---|---|---|
| | **$T_1$** | **$T_2$** | **$T_3$** |
| **Expenditure (Tk/Dec)** | | | |
| **Fingerling cost (0.25 Tk/pic)** | 5,000.00 | 5,625.00 | 6,250.00 |
| **Feed requirement (Kg/Dec.)** | $102.64 \pm 0.04^{a}$ | $104.28 \pm 1.76^{b}$ | $106.46 \pm 1.25^{c}$ |
| **Feed cost (60Tk/Kg)** | $6{,}158.40 \pm 2.40^{c}$ | $6{,}256.80 \pm 5.07^{b}$ | $6{,}387.60 \pm 5.85^{a}$ |
| **Lime cost (Tk/Dec)** | 50.00 | 50.00 | 50.00 |
| **Operational cost (Tk/Dec)** | 100.00 | 100.00 | 100.00 |
| **Total expenditure (Tk/Dec)** | **$11{,}308.40 \pm 2.40^{c}$** | **$12{,}031.20 \pm 1.76^{b}$** | **$12{,}787.60 \pm 1.25^{a}$** |
| **Income** | | | |
| **Gross return (250Tk./Kg)** | $16{,}535.80 \pm 2.40^{a}$ | $14{,}752.30 \pm 1.76^{b}$ | $13{,}424.10 \pm 1.25^{c}$ |
| **Net return (Tk./Dec)** | $5{,}227.40^{a}$ | $2{,}721.10^{b}$ | $636.50^{c}$ |
| **BCR** | $1.46^{a}$ | $1.27^{b}$ | $1.05^{c}$ |

Mean ± SE in same row with a similar superscript are not significantly different ($P > 0.05$).

**Economic study**

The data of economic analyses and the benefit cost ratio were found in Table (3). It was found that the feed requirement (kg/dec) of common carp was significantly ($P<0.05$) higher in $T_3$ (106.46±1.25) than $T_2$ (104.28±1.76) and $T_1$ (102.64±0.04). The feed cost (60Tk/Kg) of common carp was significantly ($P<0.05$) higher in $T_3$ (6,387.60±5.85) than $T_2$ (6,256.80±5.07) and $T_1$ (6,158.40±2.40). The total expenditure (Tk/dec.) of common was significantly ($P<0.05$) higher in $T_3$ (12,787.60±1.25) than $T_2$

(12,031.20±1.76) and $T_1$ (11,308.40±2.40). The gross return (250Tk./Kg) of common was significantly ($P<0.05$) higher in $T_1$ (16,535.80±2.40) than $T_2$ (14,752.30±1.76) and $T_3$ (13,424.10±1.25). The net return (Tk./dec.) of common was significantly ($P<0.05$) higher in $T_1$ (5,227.40) than $T_2$ (2,721.10) and $T_3$ (636.50). So, the benefit-cost ratio **(**BCR, species) was found to be significantly ($P<0.05$) higher in $T_1$ (1.46) than $T_2$ (1.27) and $T_3$ (1.05).

## DISCUSSION

Pond management has a significant impact on water quality which includes culture organisms, stocked number and the amount & type of nutrient inputs **(Milstein, 1993; Diana *et al.*, 1997)**. The preservation of the best possible water quality is a concern for fish farmers. The fact that there were no significant differences in the water quality indicators of the analyzed ponds over the study period suggests that the pond rearing was well-managed. The mean values of pH are not noticeably different ($p>0.05$) from 7.80 ±0.50 ($T_1$), 7.70±0.56 ($T_2$) and 7.50±0.60 ($T_3$). According to **(Swingle, 1975)**, pH levels between 6.5 and 9.0 are ideal for pond fish production, but pH levels above 9.5 are undesirable because free $CO_2$ isn't present in these conditions. The ideal pH range for pond-based carp mix culture is 6.50-9.00 **(Dewan *et al.*, 1991; Wahab *et al.*, 1994)**. The ammonia (mg/L) was noticeably ($P<0.05$) greater in $T_3$ (0.50±0.015) than $T_1$ (0.25±0.01) and $T_2$ (0.25±0.02). The dissolved oxygen (mg/L) was drastically ($P<0.05$) higher in $T_1$ (5.5±0.60) than $T_2$ (5.10±0.75) and $T_3$ (4.90±1.50). The optimal level of DO is 5-15 mg/L **(Biswas *et al.*, 2009)**. Its proximity to a body of water provides both direct and indirect characteristics, including layers, microbial activity, photosynthesis, and the presence of nutrition **(Premlata, 2009)**.

The high stocking densities of the fish may be responsible for the comparably lower amounts of dissolved oxygen in the culture water **(Boyd, 1998)**. In the study ponds at the BAU campus in Mymensingh, the concentration of dissolved oxygen ranged from 2 to 7.4 mg/L, roughly matching the present findings **(Kohinoor *et al.*, 2000)**. The temperature ($^0$C) was the same (not significantly, $P>0.05$) $T_1$ (28.50±0.01), $T_2$ (28.52±0.012) and $T_3$ (28.60±0.15). For aquaculture species an appropriate water temperature has been reported from 25-32 $^0$C **(Boyd, 1998)**. Temperature observed distance of 25-35.5 $^0$C in pond water **(Ali *et al.*, 1982)**. The growth performance of *Cyprinus carpio* is best when the water temperature is high (23-30°C) **(Váradi, 2022)**. The nitrite (mg/L) was significantly ($P<0.05$) higher in $T_3$ (0.25) than $T_2$ (0.00) and $T_1$ (0.00). Nitrites are toxic (harmful or death) to many fish and shrimp at 2 ppm (mg/L) and above; the acceptable threshold of nitrite for aquaculture industry was 0<0.3 mg/L **(Boyd, 1990)**. The nitrate (mg/L) was significantly ($P<0.05$) higher in $T_3$ (0.25) than $T_2$ (0.00) and $T_1$ (0.00) similar to **(Biswas *et al.*, 2009)**.

It was discovered that $T_1$ (53±0.15) had a considerably better ($P<0.05$) average survival rate (%) than $T_2$ (51±0.12) and $T_3$ (50±0.20). There were 70.07%, 71.44%, and 58.32% survival carp spawn recorded from various ponds, respectively **(Haque & Ahmed, 1993)**. *Cyprinus carpio* var. *specularis* had a survival rate of 54.20% ($T_1$), 62.90% ($T_2$), and 74.56% ($T_3$), respectively **(Samad *et al.*, 2016)**. The FCR species were discovered $T_1$ (1.80±0.07) substantially ($P<0.05$) lower than $T_2$ (2.05±0.05) and $T_3$ (2.30±0.08) comparable to **(Nabi *et al.*, 2020)**. This discovery was made with Nile tilapia, which had the best ultimate weight, FCR and SGR when stocked at a density of 400 fish per hapa **(Asase *et al.*, 2016)**. The SGR (% $day^{-1}$) were found $T_1$ (3.94±0.03) noticeably ($P<0.05$) greater than $T_2$ (3.71±0.04) and $T_3$ (3.70±0.05). The condition factor (*K*) species were found $T_1$ (1.06±0.02) noticeably ($P<0.05$) higher than $T_2$ (1.04±0.04) and $T_3$ (1.00±0.03) to **(Roy *et al.*, 2002)**. The weight gain (g) of species was found $T_1$ (5.38±0.10) noticeably ($P<0.05$) higher than $T_2$ (4.50±0.40) and $T_3$ (3.75±0.15). Common carp fry generation from cages yielded an average total harvest weight of 7.82, 12.83, and 11.58 $kg/m^2$ after 240 days from 3 comparable enclosures with supplementary feeding **(Ahmed *et al.*, 2002)**.

The production (kg/dec) of common carp was found $T_1$ (57.02±0.02) dramatically ($P<0.05$) larger than $T_2$ (50.87±0.82) and $T_3$ (46.29±0.50). The production performance (kg/ha) of *Cyprinus carpio* var. *specularis* was 76.32±4.96 ($T_1$), 77.60±5.19 ($T_2$), 91.04±6.02 ($T_3$) respectively **(Samad *et al.*, 2016)**. The output and finances were notably different in terms of benefit cost ratio (BCR) enlarged in fry group stocked $400/m^3$ (Stocking density-4) than stocking group $600/m^3$ (Stocking density-6) and $800/m^3$ (Stocking density-8) **(Bostami *et al.*, 2020)**. The BCR species was found $T_1$ (1.46) noticeably ($P<0.05$) larger than $T_2$ (1.27) and $T_3$ (1.05). The cost benefit ratio (BCR) was noticeably ($P<0.05$) greater in stocking density-4 (1.97± 0.004) group than stocking density-6 (1.81± 0.003) and stocking density-8 (1.72± 0.005) groups **(Bostami *et al.*, 2020)**.

## CONCLUSION

Finally, it can be said that the stocking densities were negatively correlated with the survival rate, development and output performance of *Cyprinus carpio* fries. For growing *Cyprinus carpio* fries for 75 days in single stage nursing, a stocking density of 20,000 spawns/dec. displayed significantly higher profit in the pond. As a result, such study will produce knowledge that will assist both commercial and subsistence farmers in increasing their productivity in various aquaculture systems.

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