*Quest Journals*
*Journal of Research in Agriculture and Animal Science*
*Volume 2 ~ Issue 11 (2014) pp:07-13*
*ISSN(Online) : 2321-9459*
www.questjournals.org

**Research Paper**

# Production performance of over-wintered freshwater giant prawn (*Macrobrachium rosenbergii*) in polyculture with common carp (*Cyprinus carpio*) for an early crop

M. N. Ahsan[1], M. S. Parvez*[2], M. A. Rouf[1], I. Joarder[3] and S. Aktar[3]
*[1]Professore, Fisheries and Marine Resource Technology (FMRT) Discipline, Khulna University, Khulna-9208,*
*[2]Ph.D. Student, FMRT Discipline, Khulna University, Khulna-9208,*
*[3]MS student, FMRT Discipline, Khulna University, Khulna-9208*

**R**eceived 1 January, 2015; **A**ccepted 31 January, 2015 

***ABSTRACT:-*** *This study was undertaken to investigate some technical issues and commercial feasibilities of raising an early aquaculture crop with over-wintered late season freshwater prawn, Macro brachium rosenbergii (de Man, 1879) and common carp, Cyprinus carpio juveniles found early first half of the year. From that point of view, an experiment was conducted for optimizing freshwater prawn and common carp stocking density considering production performance evaluation and economic feasibility. A factorial design of 6×3 (treatment×replicate) experimental setup was employed using eighteen earthen ponds measuring 81 $m^2$ each for a culture period of 170 days in between March, 2013 to August, 2013. Essential water quality parameters were found in the suitable range. Among the six treatments, $T_2$ (60 prawn and 15 common carp/decimal density combination) showed highest result in respect of production performance viz. weight gain, specific growth rate, feed conversion ratio, survival, total yield. Again, in case of economic feasibility, $T_2$ (60 prawn and 15 common carp/decimal density combination) further showed most profitable venture which was economically feasible than the other treatments and real farmers net profit. The experiment suggested to stock 60 no/decimal of prawn with 15no/decimal of common carp for the success of the study objective.*

***Keywords:-*** *Common carp, economic feasibility, freshwater prawn, production, stocking density.*

## I. INTRODUCTION

Freshwater prawn has been appeared as a major aquaculture species in many countries including China, India, Indonesia, Vietnam, Bangladesh and Ecuador after its domestication in 1960s. Eventually, Bangladesh has entered into the commercial prawn farming in early 1990s and has become a world player as one of the seven major export countries (Wahab, 2009). In Bangladesh, about 62.9 thousands hectare area are under prawn culture with 39.9 thousands MT production. It is noticeable that, about 90-91% area of total farmed area and 88-99% production of total production is from southwest region especially from Khulna, Bagerhat, Narail, Gopalgonj districts (FRSS, 2013). Paddy-prawn gher farming of crop rotation is the main technique applied to the production of both fisheries and agricultural sector in Bangladesh. This method of prawn production is very popular in southwest Bangladesh and the people of these areas have more or less adopted this technique.

However, constant diminishing of agricultural lands, increasing family sizes, generation of new needs of the added populations, escalating cost of living, etc all combine to push the poor farming community into a vicious circle of poverty and malnutrition. This situation warrants urgent enhancement of their income, purchasing power and easy access to adequate food. Income enhancement is particularly urgent in low lying and mono-crop (single) areas where only one boro paddy can be grown during January - April. These lands remain fallow after paddy harvest, which could be used for fish and prawn culture. Such integration and crop-rotation are not only necessary to free the farming communities from chronic poverty and the consequent malnutrition through additional livelihood opportunities but it will also ensure the better utilization of natural resources in an environment friendly way (Karim, 2006).

In greater Khulna region, paddy-prawn-fish (and recently vegetable on the dykes) culture system is being increasingly practised under the backdrop of negative social and environmental consequences of mono culture of prawn/shrimp (Ahsan, 2010; Karim, 2000). Such technological shift has been creating a very positive

*Corresponding Author: M. S. Parvez
*Ph.D. Student, FMRT Discipline, Khulna University, Khulna-9208,*

impact in terms of various social, economical and environmental indicators (Ahsan, 2010). However, the full potential of this crop rotation and integration technology cannot be realized. The two major inputs, monsoon fed water and prawn fry, are unavailable or scarce during the first quarter of the year. While the scarcity of water issue is not a problem for the coastal districts where tidal waters are available or where the issues can be addressed through the use of low lift pumps or irrigation waters to some extent, availability of hatchery produced prawn PL remains to be the major obstacle. Shifting of monsoon periods towards the third quarter of the year in recent times, apparently due to climate change, further limits the grow out period for aquaculture. It is, therefore, highly relevant to investigate the technical and economic feasibility of raising an early crop of prawn during the first half of the year. But no attempt has been taken in Bangladesh for investigating technical issue considering the production performance in terms of growth rate, feed conversion ratio, survival, yield etc and also considering optimum stocking density. The present study was, thus, undertaken to investigate these technical issues and commercial feasibilities of raising an early aquaculture crop with over-wintered late season prawn and common carp juveniles found early first half of the year.

## II. METHODOLOGY

To accomplish the objective of the study, an experiment was done for optimizing prawn and common carp stocking density considering production performance evaluation. Weight gain, specific growth rate, feed conversion ratio, survival, total yield were determined and finally an economic comparison was done among different stocking density combinations accompanied with economic return from overwintered prawn culture of ideal farmers.

### 2.1 Experimental location with duration

The experiment was carried out for a period of 170 days during March, 2013 to August, 2013 using eighteen 81 $m^2$ (2 decimal) earthen ponds located at the research pond complex of Fisheries and Marine Resource Technology Discipline (FMRT), Khulna University, Khulna, Bangladesh.

### 2.2 Experimental design

The experiment employed factorial design with 6×3 treatment-replication setup. Three stocking densities (40 no./decimal, 60 no./decimal and 80 no./decimal) for prawn with two stocking densities (15 no./decimal and 20 no./decimal) for common carp made six combinations (named as treatment for each combination) (Table 1). Each treatment had three replications.

**Table 1: Layout of the experimental stocking density**

| | | Stocking density for prawn (no./decimal) → | | |
|---|---|---|---|---|
| | | **40** | **60** | **80** |
| **Stocking density for common carp (no./decimal)** ↓ | **15** | 40+15<br>Treatment-1 ($T_1$) | 60+15<br>Treatment-2 ($T_2$) | 80+15<br>Treatment-3 ($T_3$) |
| | **20** | 40+20<br>Treatment-4 ($T_4$) | 60+20<br>Treatment-5 ($T_5$) | 80+20<br>Treatment-6 ($T_6$) |

### 2.3 Experimental ponds preparation and stocking

Prior to the experiment, the ponds were prepared according to the general pond preparation system. The ponds were limed using agricultural lime at the rate of 1 kg/decimal and fertilized to enhance pond productivity using cow-dung, urea, and triple super phosphate (TSP) at the rate of 2.5 kg/decimal, 200 g/decimal and 200 g/decimal, respectively. A fine synthetic net (1.0 mm mesh size) was used to fence around the ponds to prevent prawn escape. Shelters were made using dried branches of bamboo.

Overwintered prawn juveniles (mean weight ranged 1.07g to 1.21g) purchased from a local prawn farm of Bagerhat sadar upazilla, Bagerhat and fingerlings of common carp (mean weight ranged 8.06g to 8.44g) purchased from BRAC fish seed multiplication centre, Khulna were stocked.

### 2.4 Feeding strategy

Feeding was done considering prawn juveniles since common carp production was considered as an extra crop. A commercial feed named 'Quality fish feed' for prawn constituting 35-39% of protein was fed and feeding was done twice daily at 09:00 am and 17:00 pm at the rate of 8-5% of total prawn body weight.

### 2.5 Water quality parameter determination

Water quality was monitored at every 15 day's interval throughout the culture period to ensure optimal and identical conditions for the cultured species by routine measurements of temperature, pH, and dissolved oxygen (DO), total ammonia nitrogen (TAN) and total alkalinity. Temperature (°C) from each pond was recorded at least three spots by using a Celsius thermometer. DO (mg/l) and pH were measured using a digital DO meter (HANNA, model HI 9542) and a direct reading digital pH meter (HANNA, model HI 9123), respectively. TAN was measured by nesslerization method whereas total alkalinity (mg/l) was determined titrimetrically (APHA, 1992).

### 2.6 Harvesting and analysis of experimental data

After 170 days of rearing (from stocking day to final harvesting day), all prawn and common carp individuals were counted and weighed from each pond by repeated netting using a seine net followed by dewatering the ponds with a submerged low lift pump. The experimental parameters were analysed by- a) Feed conversion ratio (FCR) = Dry weight of feed/ Wet weight gain, b) Specific growth rate (SGR) = [Ln (final weight)-Ln (initial weight) x 100]/ culture period (days), c) Survival rate = [(total numbers at harvest / total numbers stocked) ×100], d) Weight gain (g) = [mean weight (g) at harvest -mean weight (g) at stocking], e) Yields (kg/ha) = biomass at harvest - biomass at stocking time. Finally, a simple economic analysis was showed to estimate the net profit (total returns from harvest - total cost of production) and cost-benefit ratio (CBR = total benefit/total cost) based on the whole sale market prices of the inputs used during the 2012-2013 period. All the data were analyzed using MS excel software and the statistical package (SPSS, version 17). One-way ANOVA test was performed to identify any significant difference (at 5% level) among treatment means.

## III. RESULTS AND DISCUSSIONS

### 3.1 Water quality analysis

The water quality parameter and their fortnightly fluctuation during the experimental period as shown in the Table 2 were found within the suitable ranges for both species. Temperature of pond water was found to be more or less similar in different treatments. Boyd and Zimmerman (2000) recommended the suitable range of water temperature as 28–32ºC for grow out phase of *M. Rosenbergii*. Water temperature in the present study varied from 30–34ºC, which was suitable both for prawn and finfish culture. Water pH less than 6.5 or more than 9 - 9.5 for long periods is harmful to reproduction and growth of fish (Mount, 1973). According to Boyd and Zimmerman (2000) ideal range of pH for the grow-out phase of *M. rosenbergii* is 7 - 8.5. Water pH in the treatments of the present study was ranged from 7.42 to 8.01, which indicated a suitable environment both for prawn and common carp culture.

Wahab *et al.* (1994) recorded dissolved oxygen for prawn culture ranging from 5.10 to 7.15 mg/l. Boyd and Zimmerman (2000) suggested DO range between 3-7 mg/l for prawn culture. In this study, recorded DO levels were within the optimum range. The variations in total alkalinity in the treatments were found as very productive for aquaculture ponds. In this study, ammonia nitrogen (NH3-N) was recorded ranged from 0.07 ppm to 0.28 ppm, that supported the findings of Dewan *et al*. (1991).

**Table 2: Mean values of water quality parameters in different treatments**

| | Average values±Standard deviations | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | ***$T_1$*** | ***$T_2$*** | ***$T_3$*** | ***$T_4$*** | ***$T_5$*** | ***$T_6$*** |
| ***Temperature(°C)*** | $32.27 \pm 1.02^{a}$ | $32.27 \pm 1.35^{a}$ | $31.18 \pm 0.98^{a}$ | $32.10 \pm 1.19^{a}$ | $32.31 \pm 1.23^{a}$ | $32.23 \pm 0.80^{a}$ |
| ***DO (mg/l)*** | $6.80 \pm 0.36^{a}$ | $6.60 \pm 0.51^{a}$ | $6.60 \pm 0.69^{a}$ | $6.90 \pm 0.36^{a}$ | $6.60 \pm 0.52^{a}$ | $6.81 \pm 0.40^{a}$ |
| ***pH*** | $7.78 \pm 0.18^{a}$ | $7.72 \pm 0.21^{a}$ | $7.71 \pm 0.16^{a}$ | $7.73 \pm 0.14^{a}$ | $7.64 \pm 0.18^{a}$ | $7.74 \pm 0.17^{a}$ |
| ***Alkalinity (mg $CaCO_3$/l)*** | $183.43 \pm 0.00^{a}$ | $175.00 \pm 68.93^{a}$ | $175.00 \pm 68.93^{a}$ | $141.77 \pm 35.36^{ab}$ | $105.00 \pm 26.50^{b}$ | $105.00 \pm 26.50^{b}$ |
| ***$NH_3$-N (ppm)*** | $0.10 \pm 0.02^{a}$ | $0.13 \pm 0.04^{b}$ | $0.15 \pm 0.03^{b}$ | $0.11 \pm 0.05^{a}$ | $0.09 \pm 0.03^{a}$ | $0.21 \pm 0.07^{c}$ |

**Values of the parameter in each rows with different superscripts (a, b,c and d) Differs significantly (*$p<0.05$*).**

### 3.2.1 Individual production performance of freshwater giant prawn

*Weight gain, Specific growth rate (SGR), Survival and yield*

Weight gains were calculated as 46.38±0.43g, 52.44±0.62g, 43.83±0.22g, 49.81±0.83g, 43.24±0.39g and 40.31±0.40g in $T_1$, $T_2$, $T_3$, $T_4$, $T_5$ and $T_6$ treatments respectively (Table 3). From the experiment, it was revealed that increasing stocking density of prawn showed lower mean weight gain which was resembled with the result of Chowdhury *et al* (1991). Except the stocking density of 60no/decimal ($T_2$), growth performance was declined due to increasing density and there were significant variations among the treatments though there was no significant difference among the initial weight.

Specific growth rate (%/day) in the treatments was found ranged between 2.10 to 2.28 where highest was found in $T_2$ (2.26±0.02) and lowest was found in $T_6$ (2.11±0.01). SGRs of 170 days experiment were about to similar to the findings of Trino *et al* (1992) and Haque *et al* (2003). Highest SGR was found in $T_2$ treatment (60 no/decimal) which was less than the findings of Haque *et al* (2003).

Survival rate was found to be considerable ranged from 56% to 75%. Among the treatments, $T_1$ showed the highest survival (75.00±2.50%). $T_3$ along with $T_6$ showed the lowest survival (Table 3). Survival rate of the experiment supported the findings of Haque *et al* (2003) who found prawn survival ranged from 32.22% to 75.5%.

Again, yield was more satisfactory in the treatments of $T_3$ and $T_2$ and were calculated as 490.76±8.50 kg/ha and 474.87±1.97 kg/ha respectively. $T_4$ showed lowest yield having 315.85±1.86 kg/ha (Table 3) which were statistically ($p<0.05$) different from each other. Thus, yield (kg/ha) was ranged from 312 kg/ha to 498 kg/ha which was more or less similar to the findings of Ahsan *et al* (2010), where the yield was ranged from 364 to 484 kg/ha.

**Table 3: Growth performance, SGR (%/day) and survival of prawn *(M. rosenbergii)* at different density combination (Treatment)**

| Parameters | Treatment | | | | | |
|---|---|---|---|---|---|---|
| | ***$T_1$*** | ***$T_2$*** | ***$T_3$*** | ***$T_4$*** | ***$T_5$*** | ***$T_6$*** |
| ***Prawn*** | | | | | | |
| ***Mean initial weight (g)*** | $1.15\pm0.03^{a}$ | $1.16\pm0.05^{a}$ | $1.11\pm0.04^{a}$ | $1.12\pm0.03^{a}$ | $1.17\pm0.04^{a}$ | $1.15\pm0.02^{a}$ |
| ***Mean final weight (g)*** | $47.53\pm0.44^{a}$ | $53.60\pm0.65^{b}$ | $44.94\pm0.18^{c}$ | $50.93\pm0.85^{d}$ | $44.41\pm0.43^{c}$ | $41.46\pm0.42^{e}$ |
| ***Weight gain (g)*** | $46.38\pm0.43^{a}$ | $52.44\pm0.62^{b}$ | $43.83\pm0.22^{c}$ | $49.81\pm0.83^{d}$ | $43.24\pm0.39^{c}$ | $40.31\pm0.40^{e}$ |
| ***SGR (%/day)*** | $2.19\pm0.01^{a}$ | $2.26\pm0.02^{b}$ | $2.18\pm0.02^{a}$ | $2.24\pm0.01^{b}$ | $2.14\pm0.01^{c}$ | $2.11\pm0.01^{d}$ |
| ***Survival (%)*** | $75.00\pm2.50^{a}$ | $61.11\pm0.96^{b}$ | $56.67\pm0.72^{c}$ | $64.17\pm1.44^{d}$ | $69.44\pm0.96^{e}$ | $56.67\pm0.72^{c}$ |
| ***Yield(kg/ha/ 170 days)*** | $343.61\pm1.06^{a}$ | $474.87\pm1.97^{b}$ | $490.76\pm8.50^{c}$ | $315.85\pm1.86^{d}$ | $445.01\pm2.28^{e}$ | $451.33\pm1.37^{e}$ |
| ***Common carp*** | | | | | | |
| ***Mean initial weight (g)*** | $8.06\pm0.18^{a}$ | $8.44\pm0.58^{a}$ | $8.35\pm0.56^{a}$ | $8.25\pm0.20^{a}$ | $8.29\pm0.42^{a}$ | $8.39\pm0.58^{a}$ |
| ***Mean final weight (g)*** | $610.73\pm1.86^{a}$ | $637.14\pm2.90^{b}$ | $613.88\pm2.68^{a}$ | $440.60\pm2.11^{c}$ | $452.03\pm1.44^{d}$ | $442.87\pm3.01^{c}$ |
| ***Weight gain (g)*** | $602.67\pm1.78^{a}$ | $628.70\pm3.44^{b}$ | $605.53\pm2.38^{a}$ | $432.35\pm2.06^{c}$ | $443.74\pm1.02^{d}$ | $434.48\pm2.83^{c}$ |
| ***SGR (%/day)*** | $2.55\pm0.01^{a}$ | $2.54\pm0.04^{a}$ | $2.53\pm0.04^{a}$ | $2.34\pm0.01^{b}$ | $2.35\pm0.03^{b}$ | $2.33\pm0.04^{b}$ |
| ***Survival (%)*** | $100.00\pm0.00^{a}$ | $97.78\pm3.85^{a}$ | $91.11\pm3.85^{b}$ | $96.67\pm2.89^{ac}$ | $98.33\pm2.89^{a}$ | $91.67\pm2.89^{bc}$ |
| ***Yield(kg/ha/ 170 days)*** | $2262.75\pm6.89^{a}$ | $2307.98\pm8.81^{a}$ | $2072.12\pm8.70^{cd}$ | $2103.85\pm5.82^{cad}$ | $2195.69\pm7.57^{a}$ | $2005.51\pm6.86^{d}$ |
| ***Combined* (Both prawn and common carp)** | | | | | | |
| ***Yield(kg/ha/ 170 days)*** | $2606.37\pm7.95^{a}$ | $2782.86\pm0.1078^{b}$ | $2562.88\pm17.20^{ad}$ | $2419.70\pm7.68^{c}$ | $2640.70\pm9.85^{a}$ | $2456.83\pm8.23^{cd}$ |
| ***FCR*** | $1.93\pm0.01^{ac}$ | $1.83\pm0.02^{b}$ | $1.94\pm0.03^{ac}$ | $1.99\pm0.05^{cd}$ | $1.87\pm0.04^{ab}$ | $2.05\pm0.08^{d}$ |

Values of the parameter in each rows with different superscripts (a, b,c and d) differs significantly (*$p<0.05$).*

### 3.2.2 Individual performances of common carp

*Weight gain, Specific growth rate (SGR), Survival and yield*

In case of *C. carpio*, special feed were not given and the carp stocked because of harvesting as an extra early crop. From that sense, growth performance and specific growth rate of the present experiment was very much satisfactory compared to the farmer's commercial production in grater Khulna region. The final weight of *C. carpio* were found to be 610.73±1.86g, 637.14±2.90g, 613.88±2.68g, 440.60±2.11g, 452.03±1.44g and 442.87±3.01g in the treatments $T_1$, $T_2$, $T_3$, $T_4$, $T_5$ and $T_6$ respectively (Table 3). The highest weight gain was found in $T_2$ and lowest was in $T_4$.

Specific growth rate was observed as two cluster which were significantly ($p<0.05$) different from another cluster. $T_1$, $T_2$ and $T_3$ comprised one cluster which showed 2.49% to 2.58% growth ranges per day, whereas $T_4$, $T_5$ and $T_6$ comprised another cluster which showed 2.29% to 2.37% growth ranges per day.

An extra percentage of survival was found in the common carp experiment. Survival ranged from 94 to 100% and $T_1$ showed highest survival. $T_2$ showed highest yield followed by $T_{1,}$ $T_{5,}$ $T_{4,}$ $T_3$ and $T_6$.

Yields (kg/ha/170 days) for six treatments were found to be above 2000-2300 kg/ha/170 days). Ahsan *et al* (2010) found 1600-2000kg/ha yields which were fewer compared to the six different treatments of the present study.

### 3.2.3 Combine performances of both species

*Feed conversion ratio (FCR) and yield*

Experiment found highly satisfactory feed conversion ratio (FCR) ranged from 1.81 to 2.10 where most of the experimental unit showed FCR below two (Table 3). $T_2$ having the FCR of 1.83±0.02 showed good performance in terms of economy. $T_2$ also showed highest combine yield (2782.86±0.1078) which was significantly different from others.

Feed conversion ratio was under two which can be applied in the field in terms of commercial perspectives. Lowest FCR was observed in T2 (60 prawns with 15 common carp per decimal).

Combine yield was found to be more than the findings of Haque *et al* (2003). Even, it was much higher than the existing yields obtained in the farms of grater Khulna region.

### 3.3 Cost benefit analysis

In the cost benefit analysis, $T_2$ showed higher performance than the other treatments though it showed fewer yields than $T_3$ (Table 4). Higher stocking density increased the input cost for $T_3$ (80no/decimal) which again proved for the $T_1$ (40 no/decimal) combination. The present study also analyzed real commercial farmers' cost benefit index from surveyed areas which resembled the findings of $T_6$ combination (80 prawn and 20 common carp/decimal). Again, the real farmer's net profit was much lower than rest of the densities combinations.

Finally, cost benefit ratio (CBR) profile for all cases were not satisfactory compared to Jasmine *et al* (2011). Here, CBR was found to be less than 1 which made the experiment little unsatisfactory.

Among the experimental treatments, $T_2$ (i.e., 60 prawn and 15 common carp/decimal density combination) showed satisfactory result in respect of production performance and economic return

**Table 4: Cost benefit analysis of treatments and real farmers of the surveyed area**

| **Parameters** | **Item** | **Cost in (Tk./hactor) (mean±SD)** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** | **$T_5$** | **$T_6$** | **Real farmer** |
| ***Seed cost*** | Prawn juveniles | 108680±1202 | 163020±1150 | 217360±1240 | 108680±1320 | 163020±1050 | 217360±1040 | 103740±1000 |
| | *C. carpio* fingerlings | 5557.5±230.50 | 5557.5±210.40 | 5557.5±250.50 | 7410±310 | 7410±280.50 | 7410±260 | - |
| ***Lime cost*** | | 2223±130 | 2223±110 | 2223±120 | 2223±120 | 2223±135 | 2223±110 | 1500±120 |
| ***Feed cost*** | | 136360.807±2300 | 137712.83±1970.50 | 135039.2894±1990 | 130430.7548±2060.80 | 133820.4741±2140.30 | 136510.8732±1950 | 113456±1780.80 |
| ***Fertilizer cost*** | Urea, TSP, Cowdung | 2507.05±110 | 2507.05±90 | 2507.05±70 | 2507.05±130 | 2507.05±100 | 2507.05±70 | 1680±80 |
| ***Labour cost*** | Pond preparation | 34580±200 | 34580±210 | 34580±250 | 34580±180 | 34580±200 | 34580±200 | 34580±210 |
| | Harvesting and netting | 22230±560 | 23465±600 | 23876.66667±710 | 24700±590 | 25935±500 | 27170±620 | 7500±250 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ***Land rental cost*** | | 30000±00 | 30000±00 | 30000±00 | 30000±00 | 30000±00 | 30000±00 | 30000±00 |
| ***Other cost*** | | 12350±250 | 13585±240 | 14820±200 | 13585±220 | 14820±250 | 16055±280 | 10000±210 |
| ***Total input cost*** | | 354488.357 ±2350 | 412650.38 ±2157.80 | 465963.506 1±2452 | 354115.804 8±1968 | 414315.524 1±2021.90 | 473815.923 2±2359 | 302456±2050 .60 |
| ***Total income*** | From prawn | 281026.103 ±1360 | 419085.3± 1280.50 | 389558.52 ±1609 | 257136.262 5±1360 | 353958.904 ±1420.40 | 351036.153 ±1380.90 | 347776±1260 .40 |
| | From *C. carpio* | 294158.105 ±990 | 346197.67 ±870 | 269375.071 3±770 | 189346.544 4±900 | 197612.103 ±1040.80 | 180495.521 7±850.50 | - |
| ***Total revenue*** | | 575184.207 ±1040 | 765282.97 ±1090 | 658933.591 3±1230 | 446482.806 9±1170.80 | 551571.007 ±1200 | 531531.674 7±1100 | 347776±1300 |
| ***Net profit*** | | 220695.85 ±1036 | 352632.59 ±1100 | 192970.085 2±1290 | 92367.0021 1±1095 | 137255.482 9±1210 | 57715.7515 ±1080 | 45320±990 |
| ***Cost benefit ratio (CBR)*** | | 0.63±.006$^{a}$ | 0.86±.004$^{b}$ | 0.42±.002$^{c}$ | 0.27±.001$^{d}$ | 0.34±.001$^{e}$ | 0.13±.001$^{f}$ | 0.15±.001$^{f}$ |

## IV. CONCLUSION

This study was undertaken to address the technical issues of existing prawn aquaculture for raising an early prawn-fish mixed aquaculture crop besides a traditional prawn monoculture. From this point of view, an experiment was conducted to optimize the stocking density of prawn with common carp polyculture. In the experiment, stocking density of 60 no/decimal of prawn with 15no/decimal of common carp showed reasonable performance in terms of economic view. The result of the experiment is particularly highly relevant for the coastal communities because the risks and vulnerabilities of the poor who live in insecure places and need to build their resilience to cope with climatic fluctuations will be immensely benefited by being equipped with the results.

## ACKNOWLEDGEMENT

The authors express their gratitude to Ministry of Education, Government of the People's Republic of Bangladesh for funding during the study period under the allocation programme of "grants for advanced research in science".

## REFERENCES

[1]. Wahab, M. A. 2009. Freshwater prawn (Golda Chingri) Farming in Bangladesh: Technologies for Sustainable Production and Quality Control. In Wahab M.A. and M. A. R. Hossain (eds). Abstracts. National Workshop on "Freshwater prawn (Golda Chingri) Farming in Bangladesh: Technologies for Sustainable Production and Quality Control". 9 July 2009, Dhaka, Bangladesh. 32 p.

[2]. FRSS. 2013. Fisheries Statistical Yearbook of Bangladesh. Fisheries Resources Survey System (FRSS), Department of Fisheries, Bangladesh.

[3]. Karim, M. 2006. Fisheries sub-sector road map for implementation of PRSP Policy recommendations, 2002 – 2015. 34 p. Ministry of Fisheries and Livestock, GoB, 34p.

[4]. Ahsan, M. E., Haque, M. R., Islam, S., Das, D. R. and Islam, M. J. 2010. Impacts of inclusion of column feeder rohu (Labeo rohita) at different Stocking densities on growth and production in freshwater prawnfinfish Polyculture system. Int. J. BioRes. 2(8): 07-12.

[5]. Karim, M. 2000. Present Status of Galda Culture in Bangladesh. Agribusiness Bulletin, 5th Yr. Vol. 52 – 54, ATDP-1

[6]. APHA, 1992. Standard Methods for the Examination of Water and Waste Water, 17th edition., Am. Pub. Health Association., New York., pp. 1527

[7]. Boyd, C. and S. Zimmerman. 2000. Grow-out systems – water quality and soil management. In: New, M.B and W.C. Valenti (eds), Freshwater prawn culture. Blackwell Science, Oxford, UK. pp.221-238.

[8]. Mount, D. I. 1973. Chronic effect of low pH on fathead minnow survival, growth and reproduction. Water Res., 7: 987-993.

[9]. Wahab, M.A., Ahmed, Z.F., Islam, M.A. and Rahmatullah, S.M. 1994. Effect of introduction of common carp, Cyprinus carpio (L), of the pond ecology and growth of fish in polyculture. Aquaculture Research, 26: 619-628. Wahab. M.A., Ahmed, Z.F., Haq, M.S. and Begum, M. 1994. Compatibility of silver carp in the poly culture of cyprinid fishes. Progress. Agric., 5 (2): 221-227.

[10]. Dewan, S., Wahab, M.A., Beveridge, M.C.M., Rahman, M.H. and Sarker, B.K. 1991. Food selection, electivity and dietary overlap among planktivorous Chinese and Indian major carps fry and fingerlings grown in extensively managed, rain-fed ponds in Bangladesh. J. Aquaculture and Fisheries Management, 22: 277-294.
[11]. Chowdhury, R., H. Bhattacharjee and C. Angell, 1991. A manual for operating freshwater prawn hatchery BOBP/MAG/, pp: 1336. BOBP, Madras, India.
[12]. Trino, S.T., V.D. Penaflorida and E.C. Holiver, 1992. Growth and survival of Penaeus monodon juveniles fed diet lacking vitamin supplements in a modified extensive culture system, Aquaculture, 101:25-32. Haque, M.M., Narejo, N.T., Salam, M.A., Rahmatullah, S.M. and Islam, M.A. 2003.
[13]. Determination of optimum stocking density of Macrobrachium rosenbergii in carp polyculture in earthen pond. Pakistan journal of Biological sciences 6(10): 898-901
[14]. Jasmine, S., Molina, M., Hossain M.Y., Jewel M.A.S., Ahamed, F. and Fulanda, B. 2011. Potential and Economic Viability of Freshwater Prawn Macrobrachium rosenbergii (de Man, 1879) Polyculture with Indian Major Carps in Northwestern Bangladesh. Our Nature (2011) 9: 61-7261.