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Growth performance of Indian major carps on different feed regimes with cost – benefit analysis.

Akhtarunnessa Chowdhury and Md. Kamrul Hasan
Department of Zoology University of Dhaka Bangladesh.

Abstract

A study was conducted to establish and optimal methods under twofeeding regime (poultry waste and supplimental) for the culture of Indian major carps by comparing the growth patterns and to develop a cost efficient feed and feeding technique through cost benefit analysis for future use in Bangladesh. Static 5.00 mg/L dissolved oxygen content was the remarkable observation during the investigation period in both study ponds except March'14 at treatment I and treatment II. The ponds were slightly alkaline with pH values ranged from 6-7 Hardness, alkalinity and ammonia showed narrow difference in their mean value. All of the water variables showed significant deference (P<0.05) excepting water temperature. The ten months investigation showed the average final weights (gm) of *Labeo rohita, Catla catla,* and *Cirrhinus mrigala* were 700±2.89 , 900±0.78, 700±1.55 at treatment-I and 170± 2.23, 235± 1.22 165±0.45 at treatment II respectively. Monthly mean weight gain (gm.) of the species were 1.23±0.79 , 1.23±0.75, 0.92±0.67 at treatment I and 0.64±0.43, 0.64±0.56 and 0.50±0.47 at treatment II respectively and specific growth rate (%) of rohu, catla, and mrigal were 0.87%, 0.87% and 0.89% at treatment I and 0.40 and 0.39% at treatment II respectively. Weight gain pattern was same for both the treatments. *Catla catla* was the fastest growing species among species under investigation. Food conversation ratio was the lowest (0.034) in *Catla catla* which indicate better conversion of food into flash and followed by *Labeo rohita* and *Cirrhinus mrigala* (0.045) at treatment I. At treatment II, the calculated food conversion ratio showed highest value in *Cirrhinus mrigala* (5.74) followed by *Labeo rohita* (5.20) and *Catla catla* (3.67) indicated poor growth performance of species under investigation. CB indicate higher profit (53591Tk) at treatment I. The level of input given to the treatment produced 690kg at treatment I and 170kg at treatment II. Which were much higher than the break-even production level (120.24kg and 113.36 kg), the two feeding regimes are economically viable. It was also observed that there were many possibilities to increase production further by introducing and adopting better management practices.

Key words- Water quality Feed, Growth, performance, cost , benefit and viability.

Introduction: Fish is an inexpensive source of protein and an important cash crop in Bangladesh. Water is the physical support in which they carry out their life functions viz, feeding, swimming, breeding, digestion and excretion [(1)]. In most of the countries, fishes are cultivated in ponds (lentic water). If make aware about water quality management practices, they can get maximum fish yield in their ponds to a greater extent [(2)].The role of environmental factors like temperature, turbidity, water carbon dioxide, pH, alkalinity, ammonia, nitrite, primary productivity, biochemical oxygen demand (BOD), plankton population etc. can't be overlooked for maintaining a healthy aquatic environment [(3)]. The objectives of the present research investigation were to establish an optimal method under a certain condition for the culture of major carps *Labeo rohita ,Catla catla* and *Chirrhinus mrigala* by comparing the growth pattern as affected by different feeding habitat (poultry waste and supplemental) in separate treatments of the same area.

Materials and methods;

Two perennial ponds were selected naming as treatment I and treatment II located at Sukundia under Gazipur district, Dhaka, Bangladesh. Treatment I, was conducted in a rectangular pond with creepy and grassy slopping banks of 7.50 x1.65^{2}m., with 2.4m.., water depth during monsoon and 1.3.m., during winter period. Supplemental feed was applied at the rate of 2-5 % of total body weight of fishes daily [(4).]. Treatment II, was also a rectangular pond with small to medium trees on the banks with a sloping zones of 4.35x2.35^2 m., The water depth were 2.2m,. during monsoon and 1.3., during winter. In this treatment instead of supplemental feed poultry manure was applied once in a week [(5)].

The selected ponds(Treatment I and Treatment II, supplement loaded and poultry manure) loaded were cleaned by eradication of unwanted aquatic weeds and fish species. 2kg /decimal crushed and soaked lime stone was spread all over the pond water. For the production of natural food. Fertilization with 12 hours water soaked 53%/dec., Compost; 26%/dec. T.S.P.; 13.33%/dec, Urea and 6.66%/dec., Oil cake were spared all over the two treated ponds. Supplemental food for fingerling were made with 10-12 hours water soaked oil cakes and rice barns at ratio of 1:1 plus 2% (Narish). Before every meal 10 kg feed again was mixed with 20-25 gm. premix vitamins. Feed were applied as feed balls all over the pre-selected feeding points. At treatment II, dried poultry manure without feathers and other undesired component were spread every week at 4kg/dec., as the same procedure.

Fingerlings of same batches of major carps *Labeo rohita, Catla catla* and *Cirrhinus mrigala* were collected from Government Fish Hatchery and Training Center (FHTC), Ripur, Bangladesh. Acclimatization was done for two week in glass aquaria and fee on rice polishing. Stocking was done in the same day after 10 days of fertilization. Fingerlings of same batches of three Indian major carps were stocked in two designated treatment I and II ponds.

The surface water and sediment samples were collected directly from the undisturbed surface of four stations of treatment I and treatment II once in a month during the investigation period. The physical variables, viz., water temperatures were recorded at the spots. The chemical variables, pH (HANNA pH meter ,Model HI 8424), dissolved oxygen (Lutron DO meter ,Model DO 5509) , free CO2, hardness, ammonia samples were determined by HACH kit (FFD, HACH FF2, USA) and HACH conductivity meter (Model session 5). Statistically the data of physico-chemical variables were analyzed on principal "Culture and influenced diet" using SPSS-17. For comparative growth study of the experimental fishes, mean initial weight, mean final weight, monthly mean weight gain, specific growth rate and food conversation ratio were done. [(6)] Break even production level for economic evaluation online calculator was used [(7).]

Result and Discussion

Comparative graphical presentations of the physicochemical parameters at treatment I and treatment II have been given ing Figs-1.2, 3, 4, 5, 6, 7.

Water temperature

The ranges of temperature varies from 27°C to 30.8°C with 29°C ±0.96 mean at treatment I and 25°C -30°C with 28.35°C±1.59 mean at treatment II. This is well within desirable limit. The maximum temperatures (30°C) at treatment I prevailed from April'14 to September'14, where on the other hand at treatment II the maximum temperatures (30°C) prevailed from August'14 to September'14, whereas the minimum temperature (25°C) was observed during December'13,which was suitable water temperature for subtropical carp culture [(8)], range 28-32^{0}C are good for tropical major carps culture [(9).] Water temperature differences between two treatment were not significantly different (P = 0.01>0.05)

Dissolved oxygen:

Dissolved oxygen concentration at two treatments was found to be more or less similar. During the study period, the dissolved oxygen (DO) contents varied from 4.5 to 5.00 mg/L^{-1} at both the treatments. The mean values of dissolved oxygen recorded were 4.95±0.15 and 5.00±00 respectively. Static 5.00 mg/L dissolved oxygen content was the remarkable observation during the investigation period except March'14 at treatment I. Oxygen depletion in water leads to poor feeding of fish, starvation, reduced growth and more fish mortality, either directly or indirectly [[10]] DO level >5ppm., is essential to support good fish production. [11] and [9]The values of dissolved oxygen at investigated treatments differ significantly (P = 0.333<0.05).

Free Carbondioxide :

CO_2 is highly soluble gas in water, main source of carbon path way in the nature, is contributed by the respiratory activity of animals and can exist in water as bicarbonate or carbonates. CO_2 ranged between 5-6 mg/L^{-1} with a 5.1±0.31 mg/L^{-1} mean and a range between 4-5 mg/L^{-1} with a 4.8±0.33 mg/L mean. When dissolved in water it forms carbonic acid which decrease the pH of any system. fish avoid free CO_2 levels as low as 5 mg/L^{-1} but most species can survive in waters containing up to 60 mg L^{-1} carbon dioxide (12). The water of the two treatments showed little variation in the free CO_2 concentration in during thel study period are significantly different (P=0.244<05) in between the treatment I and II.

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Hydrogen ion concentration (pH)

The ponds were slightly alkaline with pH values ranged from 6-7 in both the Treatments. The mean values of pH obtained at treatment I and treatment II were 6.77±0.41 and 6.93±0.10 respectively. A sudden dip during August'14 may have a effect in growth rates. pH ,the negative logarithm of hydrogen ions concentration and the pH of natural waters is greatly influenced by the concentration of carbon dioxide, as an acidic gas [12] . Fish have an average blood pH of 7.4, a little deviation from this value, generally between 7.0 to 8.5 is more optimum and conducive to fish life. pH between 7 to 8.5 is ideal for biological productivity [13] and [8]. The suitable pH range for fish culture is between 6.7 and 9.5. pH level between 7.5 and 8.5 is ideal, above and below this is stressful to the fishes. There was significant difference of pH among the two treatments (P =0.293<0.05).

Hardness

Hardness is the measure of alkaline earth elements such as calcium and magnesium in an aquatic body along with other ions such as aluminium, iron, manganese, strontium, zinc, and hydrogen ions. Calcium and magnesium are essential to fish for metabolic reactions such as bone and scale formation. The recommended ideal value of hardness for fish culture is at least 20 ppm [18] and a range of 30-180 mg [8]. Is the desirable range . As $CaCO_3$ the acceptable range is above 10 mg L-[1]. Hardness values less than 20ppm causes stress, 75-150 ppm is optimum for fish culture to and >300 ppm is lethal to fish life as it increases pH, resulting in non-availability of nutrients[6].The observed range, mean with standard deviation at treatment I and treatment II were 110-140 ,114 ±9.36 and 100-115 ,108.5 4.11 indicative of well presence of essential earth elements with significant difference between the two treatments. (P> 0.0.111<05).

Alkalinity

Alkalinity is the water's ability to resist changes in pH and is a measure of the total concentration of bases in pond water. The values of total alkalinity as recorded from two ponds were found to vary from 140 to 150 mg/L^{-1}. The mean values of total alkalinity observed at treatment I and treatment II were 159±1.58 mg/L and 147±4.21 mg/L^{-1} respectively The range of 0.0 - 20.0 ppm., total alkalinity indicate for low production, 20.0 40.0 ppm., low to medium production, 40.0 - 90.0 ppm., medium to high production and above 90.0 ppm., productive [16]. Water with total alkalinities of 20 to 150 mg/L^{-1} contain suitable quantities of carbon dioxide to permit plankton production for fish culture [12]. According to The ideal value for fish culture is 50-300 mg L-[1] [8]. The difference was significant (P=0.096<0.05) between the treatments.

Ammonia

Ammonia is the by-product from protein metabolism excreted by fish and bacterial decomposition of organic matter. The range and mean with standard deviation at treatment I were 0.020-0025 mg/L and 0.0237±0.0021 mg/L^{-1} and were 0.02-0.025 mg/ L^{-1} and 0.0235 ±0.00241mg/L. at treatment II . Maximum limit of ammonia concentration for aquatic organisms is 0.1 mg L^{-1} [17], [8] . The level of ammonia (<0.2 mg L^{1}) suitable for pond fishery [11] and levels below 0.02 ppm were considered safe [18]. Highly significant difference was observed between the two treatments (P=0.840 <0.05).

Growth performance

Growth parameters of two treatment in two feeding regime were recorded and presented in Table-1.

The monthly growth of *Labeo rohita ,Catla catla and Cirrhenus mrigala* in weight (gm.) are shown in graphically in Figs. 8,9 and 10.

The initial average weights (gm.) of *Labeo rohita ,Catla catla and Cirrhenus* mrigala, were found as 50±2.89 g, 65±0.57 g and 48±1.5 at two treatments were same. The average final weights (gm.) of *Labeo rohita ,Catla catla and Cirrhenus* mrigala were 700±2.89 , 900±0.78,700±1.55 at treatment-I and 170± 2.23, 235± 1.22 165±0.45 at treatment II respectively.

Monthly mean weight gain rates (gm.) of *Labeo rohita ,Catla catla and Cirrhenus* mrigala were 1.23±0.79 , 1.23±0.75, 0.92±0.67 at treatment I and 0.64±0.43, 0.64±0.56 and 0.50±0.47 at treatment II respectively.

Weight gain pattern were same for both the treatments. Water quality variables were considered as growth promoting factors. The net production basically depends upon growth and survival of species. Also other effectors like water quality feed and management techniques may associate with total production. In treatment I and treatment II, the net production of *Catla catla* was higher than those of other two species. In present study, *Catla catla* was found to be the fastest growing species among Indian major carps which agreed with the reports by (19).The records of weight gain per day of all the groups

were found to be the highest in the month of June probably may be due to the higher temperature (about 30°C).

Specific growth rate (SGR)

Specific growth rate (SGR%) Specific growth rate (SGR%) is the instantaneous change of body of fish as the percent increase in body.

weight per day over a certain interval In the present investigation the SGR of three carps showed more or less same growth rate in their designated treatments. 0.87%, 0.87% and 0.89 % were for *Labeo rohita,Catla catla Cirrhinus mrigala*.at treatment I and 0.04%,0.43% and o.39% at treatment II.

Food conversion ratio (FCR)

A ratio expressing the weight of food required to produce a unit gain in the live weight of an animal .The ratio showed that *Catla catla* among the three species under both the treatments showed faster growing rate (0.036 and 3.67) followed by *Labeo rohita* (0.045 and 5.20) and *Cirrhinus mrigala* (0.045 and 5.47) at treatment I and treatment II..respectively. Food conversation ratio was the lowest in *Catla catla* which indicate better conversion of food into flash and followed by *Labeo rohita* and *Cirrhinus mrigala* at treatment I. At treatment II, the calculated food conversion ratio with highest value in *Cirrhinus mrigala* (5.74) followed by *Labeo rohita* (5.20) and *Catla catla* (3.67) indicative of poor FCR.

Cost benefit analysis

To evaluate the potential of feed management of the treatment I and treatment II cost of the total expenditure are presented (table-2) and prediction of cost benefit differences are presented (table-3). Input costs includes fixed cost viz., cost of pond preparation, fingerlings. and variable cost like, cost of fertilizer, cost of feed, cost of labor and transportation costs were recoded and total expenditure are presented table-3

The probable net income from treatment 1 was calculated to be Tk 53591 and that was for treatment II was Tk. 6150. Profit were 63.48 % and 21.33% at treatment I and II. Growth performance at treatment I was much higher than the treatment I and it is noteworthy that water quality played a significant role as affecters.

No taxes were involved in these treatments. Treatment I, which was loaded with supplemental feeds was higher (75%) than that of treatment II, loaded with poultry manure (25%). Total cost for treatment I was Tk. 84,409, whilst it was 28,050 for treatment II.

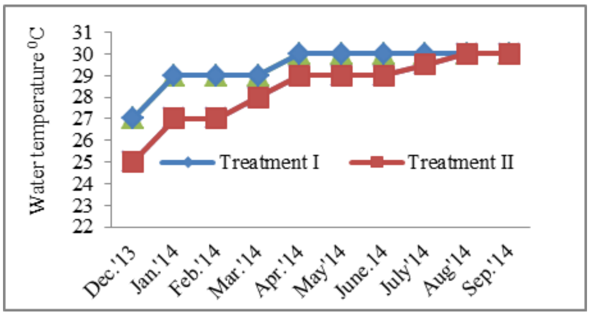

Fig.-1, Monthly fluctuation of temperature at treatment I and II.

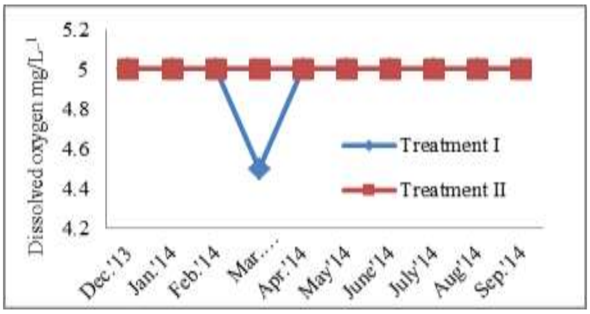

Fig.-2, Monthly fluctuation of Dissolved oxygen at treatment I and I

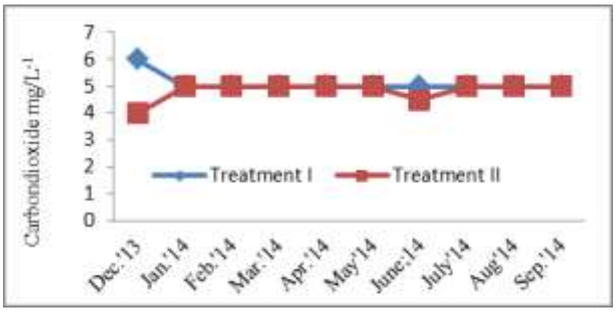

Fig.-3, Monthly fluctuation of Carbondioxide at treatment I and II.

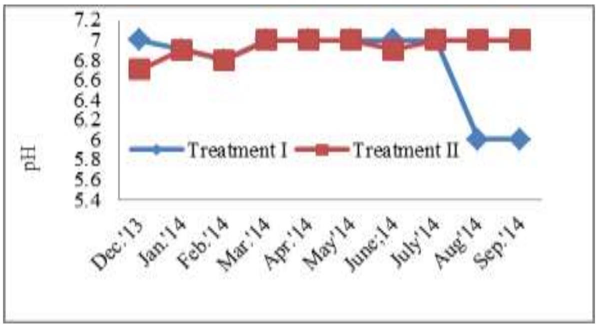

Fig..4, Monthly fluctuation of pH at treatment I and II.

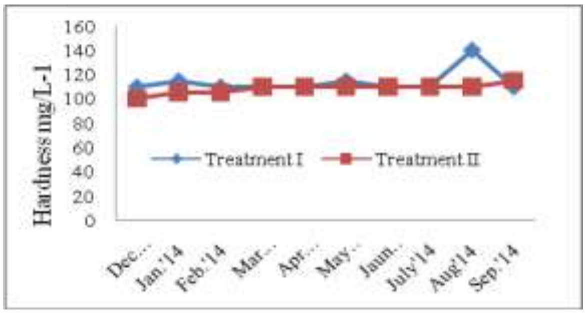

Fig.5 Monthly fluctuation Hardness at treatment I and II.

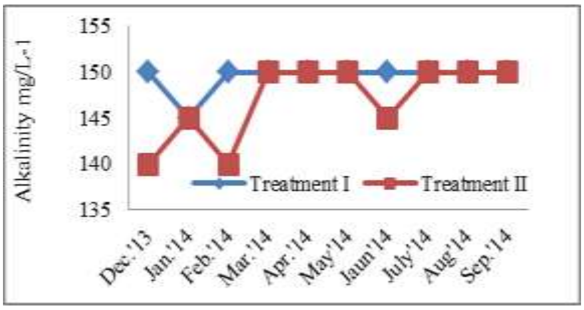

Fig. 6, Monthly fluctuation of Alkalinity at treatment I and II

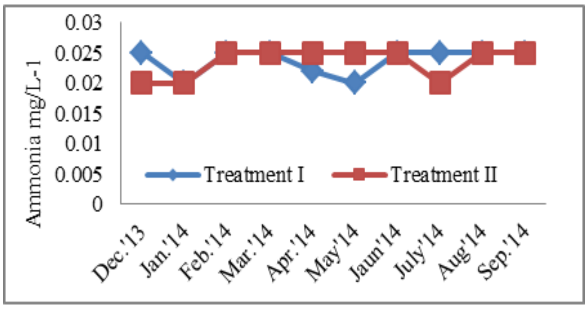

Figure-7, Monthly fluctuation of Ammonia at treatment I and 11

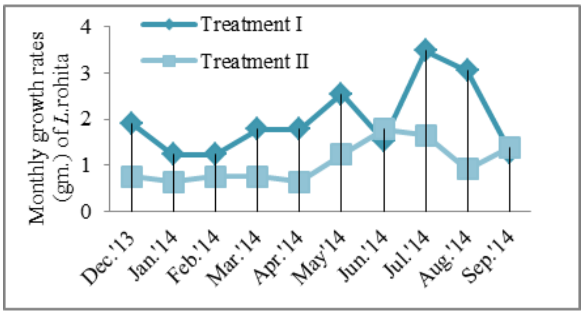

Fig.8, Monthly growth rates (gm,) of *L.rohita* at treatment I and II.

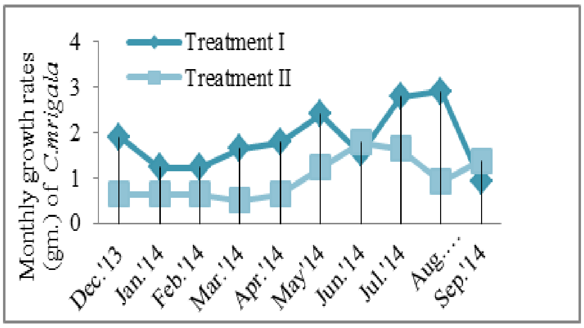

Fig.9, Monthly growth rates (gm.) of *C.catla* at treatment I and II.

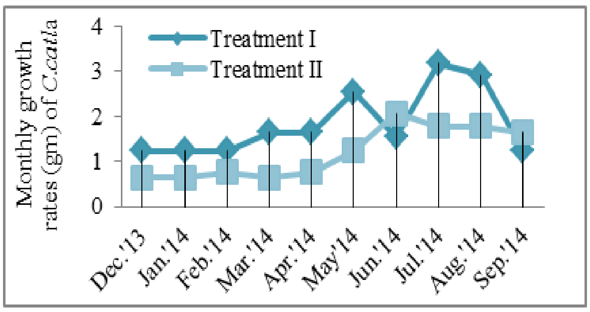

Fig.10. Monthly growth rate (gm.) of *C, mrigala* at treatment I and II.

Conclusion:

The result marked significant effector roles of water on growth performance. The break-even production for the level of input given to the treatment was 690kg at treatment I and 170kg at treatment II, which is much higher at treatment I and moderately higher at treatment II. This result concludes with the fact that the both the treatments are economically viable .

It was also observed that there were many possibilities to increase production further by introducing and adopting better management practices.

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Table-1,Growth parameters of *L.rohita.C.catla* and *C.mrigala* with total productions of treatment I and II

Growth Parameter	**Treatment I**			**Treatment II**		
	L. rohita	***C. catla***	***C. mrigala***	***L. rohita***	***C. catla***	***C. mrigala***
Mean Initial weight (gm)	50	65	48	50	65	48
Mean Final weight (gm)	700	900	700	170	235	165
Monthly mean weight gain(gm)	1.23±0.79	1.23±0.75	0.92±0.67	0.64±0.43	0.64±0.56	0.50±0.47
Specific growth rate (%)	0.87	0.87	0.89	0.40	0.42	0.39
Food conversion ratio	0.045:1	0.035:1	0.045:1	5.20:1	3.67:1	5.47:1
Total Production (Kg)	210	270	210	51	70.5	49.5

Table-2. Monthly and total expenditure of treatment I and treatment II .

Months	Treatment I						Treatment II					
	Fixed cost		Variable cost				Fixed cost		Variable cost			
	Cost of pond preparation (Tk.)	Cost of Fingerlings (Tk.)	Cost of Fertilizr (Tk.)	Cost of Feed (Tk.)	Cost of Labor (Tk.)	Vehicle and others (Tk.)	Cost of pond preparation (Tk.)	Cost of Fingerlings (T.)	Cost of Fertilizer (Tk.)	Cost of Feed (Tk.)	Cost of Labor (Tk.)	Vehicle and others (TK)
Dec'13			362	1000	1000	500			362	622	1000	500
Jan'14			362	1190	400	200			362	622	400	200
Feb'14			362	1388	400	200			362	622	400	200
Mar'14			362	2854	400	200			362	622	400	200
Apr;14			362	3783	400	200			362	622	400	200
May '14	2660	8650	362	4692	400	200	2660	8650	362	622	400	200
Jun'14			362	5386	400	200			362	622	400	200
Jul'14			362	7572	400	200			362	622	400	200
Aug'14			362	14127	600	200			362	622	400	200
Sept'14			362	20187	600	200			362	622	400	200
Total	2660	8650	3620	62179	5000	2300	2660	8650	3620	6220	4600	2300
Total	11310		73099						17140			

Table-3. Key financial and economic indicators of two feeding regimes.

Species	Treatment I				Treatment II			
	Weight (Kg)	Price (Tk)	Expend. (Tk)	Profit (Tk)	Weight (Kg)	Price (Tk)	Expend. (Tk)	Profit(Tk)
L. rohita	210	42000			51	10200		
C. catla	270	54000	Table-3	53591	70.5	14100	Table-3	6150
C. mrigala	210	42000			49.5	9900		
Total	690	138000	84409	53591	171	34200	28050	6150

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