Effect of different organic manure on the growth of Amur carp (Cyprinus carpio haematopterus) fingerlings with supplementary feed in the tarai region of Uttarakhand

Abhishek Kumar, Meenakshi Kumari, Tanuja Dhami

Abstract
The present study was designed to observe the effect of different organic manure on the growth of Amur carp (Cyprinus carpio haematopterus) fingerlings with supplementary feed in the Tarai Region of Uttarakhand. During this study, ponds were treated with cow dung, vermicompost and poultry manure for seven months to observe the effect of these organic manures on the growth of Amur carp fingerlings. The final weight of Cyprinus carpio haematopterus was recorded as 306.78g in Poultry treatment (TP), 256.63g in Vermicompost treatment (TV), 231.07g in Cowdung treatment (TC) and 203.54g in Control (C). The final length was recorded as 29.11cm in TP, 26.256.63g in Vermicompost treatment (TV), 231.07g in Cowdung treatment (TC) and 203.54g in Control (C). The survival rate of Cyprinus carpio haematopterus was recorded as 96.66 % in TP, 96.00% in TV, 95.66% in TC and 92.66 in C treatment. Leukocyte count was achieved in TP (13.252x10^6 µl), followed by TV (12.651 x10^6 µl), TC (11.650 x10^6 µl), and C (10.245 x10^6 µl). The treatment TP (3.876x10^6 µl), TP (11.650 x10^6 µl) and C (2.223 x10^6 µl) showed maximum Specific Growth Rate (SGR) was achieved in case of treatment TP (1.77%), followed by TV (1.69%), TC (1.64%) and minimum in C (1.58%). Feed Conversion Ratio (FCR) was recorded in TP treatment (2.71) followed by TV (2.81), TC (2.96) and minimum in C (3.18). Highest Gross Conversion Efficiency (GCE) was achieved in TP (0.36), where fishes were fed with natural food and also fed by supplementary feed followed by TV (0.35), TC (0.33) and minimum with C (0.31). The survival rate of Cyprinus carpio haematopterus was recorded as 96.66 % in TP, 96.00% in TV, 95.66% in TC, and 92.66 in C treatment. Leukocyte count was achieved in TC (13.252x10^6 µl) followed by TV (12.651 x10^6 µl), TP (11.650 x10^6 µl) and lowest TLC level was recorded in the control C (10.245 x10^6 µl). The treatment TP (3.876x10^6 µl) resulted best Total Erythrocyte Count, followed by treatment TV (2.626 x10^6 µl), TC (2.386 x10^6 µl) and C (2.223 x10^6 µl). Maximum haemoglobin % was achieved in case of TP (10.53%) followed by TV (8.623%), TC (7.816%) and minimum in control (7.326%). In this study poultry manure deserved priority in fish production followed by vermicompost and cow dung which is important to sustainable aquaculture and to reduce expenditure on cost of feeds and fertilizers which form more than 50% of the total input cost.

Keywords: Cowdung, vermicompost, poultry manure, supplementary feed, haemoglobin

Introduction
Fish as a food is easily digestible and nutritionally better, can mitigate the problem of malnutrition. Fish production can be increased by feeding and pond fertilization. Pond fertilization using both organic and inorganic fertilizers to enhance the biological productivity of treated waters. Diminishing fishery harvests, wild fish food-safety issues, environmental concerns, increased fish consumption, and the increasing market share of organic foods have combined to focus attention on “Organic Aquaculture”. Presently fish culture mainly depends on the application of organic fertilizers and to some extent on inorganic fertilizers. Fertilization enhances phytoplankton productivity in rearing and stocking ponds [3]. Phytoplankton and zooplankton are rich source of protein (40-60%) on dry weight basis which is sufficient for fish growth at low stocking densities [35, 31]. The study of fertilization in the carp polyculture has focused to address issues about the effect of chemical and organic fertilization on water quality and growth of carp [3]. Fertilizers increase fish production without risk of dietary, diseases and also play an important role in the formation of soil structure. The growth of fish is strongly correlated with increase of phytoplankton and zooplankton productivity as a result of fertilization. The ultimate goal of fertilization is to achieve suitable environmental conditions for the production of natural food for fish, but in comparison with organic manure, fertilizers increase the level of primary productivity, algae abundance, dissolved oxygen, pH and total phosphates [24]. Excessive fertilization can create noxious algal blooms and deteriorates water quality which induces stress to fish, retards growth and causes variety of diseases [16, 6].
reported that poultry manure triggers more production of phytoplankton in the fish ponds than any organic fertilizer including chemical fertilizers. Though fertilization increases productivity but it takes time and costs, money and demands proper time of application. In pond fish culture, poultry manure, seems to be the most efficient way of adding nitrogen and other essential nutrients and in this connection poultry excreta is more abundant, nutrient rich and cost effective. Traditionally cattle manure is often used in semi-intensive systems to improve the primary productivity of the ponds and fish growth. The pond sediments are greatly influenced by the frequent application of organic manure and artificial feed. Cattle manures, which are generally plentiful worldwide, constitute a cost effective source of nutrients. Organic manures if not decomposed completely before application in aquaculture pond may deteriorate the water quality as they utilize oxygen during decomposition. Therefore, the amount of any organic manure to be added in the pond mainly depends upon its Biological Oxygen Demand (BOD), as their excessive use may cause severe dissolved oxygen depletion in the pond and results in production of toxic gases like CO₂, H₂S, NH₃, etc., and can spread parasitic diseases [3]. Hence, to minimise the harmful effects of organic manures on pond ecosystem, the best alternative is to utilize fully decomposed/digested organic manures in comparison to undigested or semi-digested organic manures. Among the decomposed manures, Vermicompost is rich in all types of major and minor nutrients, vitamins, enzymes, antibiotics, growth promoters etc. [3, 32] observed higher manural value of the vermicompost as compared to raw cow dung and poultry droppings in terms of its effect on hydrobiology of water. Even if vermicompost dries up, there is no harm to its microflora hence, it is referred to as potential biological manure or biofertilizer [30]. In this study Amur carp (Cyprinus carpio haematopterus), was selected as it has a good food conversion ratio and also good natural feed selection capacity. Amur carp can be fed with a conventional feed mixture of rice bran and groundnut cake, cooked rice and kitchen waste. Its feeding habit is similar to other common carp species. According to [2] it is suitable for growing in different water bodies such as small tanks, farm ponds, and large water bodies. It has relatively low fat content and its viability is also good.

The present study was conducted with the following objectives
1. To study physico-chemical parameters of experimental ponds.
2. To examine growth parameters (weight and length, food conversion ratio, gross conversion efficiency, specific growth rate, survival rate).
3. To observe the haematological parameters (total leukocyte count, total erythrocyte count and Haemoglobin).

Materials and Methods
The experimental work was conducted at the Instructional Fish Farm, College of Fisheries, G.B. Pant University of Agriculture and Technology, Pantnagar, Dist. Udham Singh Nagar in the Tarai region of Uttarakhand.

Structural Detail of Ponds: The proposed experiment was conducted in four rectangular earthen ponds (E1, E2, E3, and E4) at the Instructional Fish Farm of College of Fisheries, Pantnagar. The dimensions of ponds were 1.5m depth, 43m length and 19m breadth. The study was conducted in the four earthen rectangular ponds sized 0.08ha. The water depth 0.75-1.0m was maintained in experimental pond throughout the period of experimental (1st October 2014-28th April 2015). The source of water supply was an artesian tube well which was regularly used to maintain water level (0.6-0.7 m) throughout the experimental period. Each pond was divided into three partitions with the help of bifurcating net. Descriptions of experimental sets are given in table 1.

Table 1: Details of different organic manure used in experimental pond

<table>
<thead>
<tr>
<th>Experiment set</th>
<th>Manure applied</th>
<th>Replicates</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>Cow dung</td>
<td>TC1, TC2, TC3</td>
</tr>
<tr>
<td>E2</td>
<td>Vermicompost</td>
<td>TV1, TV2, TV3</td>
</tr>
<tr>
<td>E3</td>
<td>Poultry Manure</td>
<td>TP1, TP2, TP3</td>
</tr>
<tr>
<td>E4</td>
<td>Control</td>
<td>C1, C2, C3</td>
</tr>
</tbody>
</table>

Pond Management: The ponds of the Instructional Fish Farm were managed as recommended by ICAR (2011) Hand book of Fisheries and Aquaculture

Pre-Stocking Practices: Under pre-stocking management practices, the ponds were dewatered and the water weeds were removed manually before 10-15 days of seed stocking. Liming was done with the aim to provide prophylactic measures and fast mineralization. Ponds were manured by different organic manures. The ground limestone broadcasted over the water surface in a single dose 15-20 days before stocking @100-200 kg/ha. Manuring schedule (per pound) in different treatments (TC, TV, TP) were: total dose-560 kg, initial dose- 160 kg and monthly dose (Oct-March)-80 kg.

Fish Stocking: The experimental fish Amur carp (Cyprinus carpio haematopterus) was procured from the Instructional Fish Farm of College of Fisheries. The rate of stocking was 10,000 fingerlings per hectare. Healthy and disease free fingerlings, weighing average body weight 7.29 gm of Cyprinus carpio haematopterus were stocked. Initial length and weight of each fish was recorded prior to release into the ponds after acclimatization.

Post Stocking Practices: Water level of the pond was maintained up to 0.75-1.0 meter with the help of inlet facility connected directly to the artesian tube well. Sampling of fishes was done monthly with the help of fry net. Fishes were fed with nutritionally balanced diet. Natural food and supplementary feed consisting of rice bran, mustard oil cake, soybean oil cake and mineral mixture were fed to the fishes during the culture period @ 3-5% of body weight for seven months.

Design of Experiment: The experiment consisted of 4 pounds (3 treatments+1control) each having three replications and each replication was stocked with 100 fingerlings of Amur carp. The control fishes were fed with normal diet and treatment fishes were fed with normal diet followed by different animal organic manure like cow dung, manure or biofertilizer...
vermicompost and poultry manure. The growth parameters were analysed monthly. Haematological analysis was done at the end of the experiment.

**Feed Preparation:** Feed was prepared by mixing of rice bran, mustard oil cake, soybean oil cake and made as dough containing 26% crude protein (Table 2 and 3).

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Ingredients</th>
<th>% Composition of ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rice bran</td>
<td>61.4</td>
</tr>
<tr>
<td>2</td>
<td>Mustard oil cake</td>
<td>18.8</td>
</tr>
<tr>
<td>3</td>
<td>Soybean meal</td>
<td>18.8</td>
</tr>
<tr>
<td>4</td>
<td>Mineral mixture</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Results and Discussion**

The experiments were conducted for 7 month to observe the fish growth in the different manuring ponds. The results and discussion for the set objectives are as follows:

**Physico-chemical parameters of experimental ponds**

The average water analysis of different experimental ponds has been presented in table 4.

**Temperature:** In the present study, Water Temperature was well within the optimum tolerance limit of Amur carp strain of common carp. Analysis of variance showed that difference in water temperature between all experimental ponds was significant (0.01). The temperature of ponds as observed in this study appeared to be suitable for fish culture which agreed with the findings of [12] as reported lowest temperature during November -December and highest temperature during May –April. The values indicated that water temperature ranges significantly affected the average body weight gain by the fish. The analysis of the data also revealed that the temperature of water significantly influenced the total length of the fish. The results support the earlier findings of [17, 26] Reported that water temperature is the only variable that affect significantly the growth rate of major carps (Catla calla, Laobeo rohita and Cirrhinus mirgal) which is indicated by linear increase in growth with rise in temperature. Studies have further revealed that common carp is the only species which have reasonable growth during the colder months of year. This finding more or less agrees the finding of [21].

**PH:** During the present experimental period, there was non-significant difference among each other. The PH can also affect fish health. Optimum PH level for carp culture is 7.5-8.5 the observed PH in this study appeared to suitable for fish culture which agreed with the finding of [28]. It has been suggested that the embryonic and larval fish stages are most sensitive to PH changes [19]. Higher water PH has a detrimental effect on survival rate of fish. Alkaline conditions (PH > 9) can contribute to fish mortality through gill damage, decreased plasma ion concentrations, and decreased NH3 elimination [18]. The results of the present experiment demonstrated that Amur common carp grow and survive best when exposed to a water PH vary from 7.2-8.1 in TP treatment. This result is similar to [2]. Similarly [36], found that a range of PH 7.0-8.0 produced the best functioning of many physiological responses and enzyme activities in the carp.

**Alkalinity:** All the values of total alkalinity during the experiment period were found to be statistically non-significant among each other. Thus it is clear that alkalinity was within the range for productive aquaculture system. The range of alkalinity is more or less similar to [29], he recommended alkaline levels for aquaculture production as 80 to 300 mg/l. According to [37] alkalinity between 75 to 200 mg/l, but not less than 20 mg/l is ideal in an aquaculture pond.

**Free CO2:** All the values of CO2 during the experiment period were found to be statistically non-significant among each other. The result is agreed to the findings of [4] that 5-8mg/l free carbon dioxide is essential for photosynthetic activity [14]. Suggested that fish can tolerate concentrations of 10 ppm DO.
level concentrations and water of fish pond for good fish populations normally contains less than 5 ppm of free CO₂.

**Dissolved oxygen:** In the present experiment the dissolved oxygen content was within the optimum range of fish culture practices. It is needed by fish to respire and perform metabolic activities. Observed DO in this study appeared to be suitable for fish culture which agreed with the [25]. The growth rate of fish is influenced by factors such as feed availability, temperature, photoperiod and other environmental conditions [22].

<table>
<thead>
<tr>
<th>Experimental ponds</th>
<th>Temp. (°C)</th>
<th>pH</th>
<th>Alkalinity (ppm)</th>
<th>Free CO₂</th>
<th>Dissolved oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>15.5-26.6</td>
<td>7.3-8.0</td>
<td>125.8-177.5</td>
<td>4.0-7.9</td>
<td>5.2-8.7</td>
</tr>
<tr>
<td>TV</td>
<td>15.5-26.8</td>
<td>7.3-8.2</td>
<td>132.2-195.1</td>
<td>4.3-6.9</td>
<td>5.1-8.4</td>
</tr>
<tr>
<td>TP</td>
<td>14.9-26.9</td>
<td>7.2-8.1</td>
<td>132.7-198.3</td>
<td>4.3-7.8</td>
<td>5.0-8.1</td>
</tr>
<tr>
<td>C</td>
<td>15.0-26.3</td>
<td>6.9-8.1</td>
<td>99.2-144.5</td>
<td>4.1-7.9</td>
<td>4.0-8.3</td>
</tr>
</tbody>
</table>

**Manure Analysis**

Chemical analysis of fresh cow dung, vermicompost and poultry manure was carried out to observe total nitrogen, available phosphorus and potassium content. The results of the analysis presented in Table 5. The above results indicate that poultry manure is superior among all the three manures in terms of N.P.K values while cow dung is inferior among the all three manures and vermicompost comes in the middle of them.

<table>
<thead>
<tr>
<th>Proximate component (%)</th>
<th>Cow dung</th>
<th>Vermicompost</th>
<th>Poultry manure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (%)</td>
<td>1.64</td>
<td>1.81</td>
<td>2.08</td>
</tr>
<tr>
<td>Phosphorus (%)</td>
<td>0.105</td>
<td>0.340</td>
<td>0.512</td>
</tr>
<tr>
<td>Potassium (%)</td>
<td>0.15</td>
<td>0.25</td>
<td>0.41</td>
</tr>
</tbody>
</table>

**Growth Parameters**

The observations on weight gain and length gain is given in table 6.

**Weight gain of fish:** There was regular increase in weight of fish in all the treatments, however the growth was much greater in the treated pond with poultry manure TP [10]. also observed that the final body gain in fishes reared with poultry manure and fed at supplementary diet in ponds were improved compared with those reared with cow manure. When monthly increments were compared among different treatments, maximum increment in body weight was recorded in TP. Statistically there were significant differences among the treatments (p<0.05).

<table>
<thead>
<tr>
<th>Experimental ponds</th>
<th>Avg. weight (gm)</th>
<th>Weight gain</th>
<th>Avg. length (cm)</th>
<th>Length gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>7.28</td>
<td>23.79</td>
<td>6.52</td>
<td>19.42</td>
</tr>
<tr>
<td>TV</td>
<td>7.29</td>
<td>249.34</td>
<td>6.54</td>
<td>20.41</td>
</tr>
<tr>
<td>TP</td>
<td>7.27</td>
<td>299.51</td>
<td>6.55</td>
<td>22.56</td>
</tr>
<tr>
<td>C</td>
<td>7.29</td>
<td>196.25</td>
<td>6.53</td>
<td>17.58</td>
</tr>
</tbody>
</table>

**Specific Growth Rate (%)**: The observation on SGR attained in various treatments has been presented in Table 7. The highest SGR (1.77%) was recorded in treatment TP (Poultry manure + supplementary feed) which was significantly different from C, TC, TV (P<0.05). The treatments means revealed that the best SGR was recorded in TP (1.77%). Thus treatment TP showed best SGR which is significantly (<0.05) high as compared to control C as well as all other treatment. [26, 9] also found that the

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Table 4: Avg. physico-chemical parameters of experimental ponds

Table 5: Proximate composition (%) of the organic manure applied in experimental ponds (dry weight)

Table 6: Weight and length gain during experiment in the treatment ponds
provision of each additional input including fertilization such as cow dung, urea and single super phosphate, and supplementary feed did effect fish growth.

Survival Rate: In the present study the maximum survival was observed in TP pond (table 7). Average survival was observed as 96.66%. Water quality parameters were within range for the growth of fishes thus survival was higher (>90%), showing that the environment had effect on the fish survival [15-21]. Confirm the finding of present study.

Haematological Parameters
Total Leukocyte Count (TLC): The details of total leukocyte count in different treatment ponds of fishes have been depicted in Table 8. The highest TLC level was found in TC (cow dung + supplementary feed) which was significantly different from C, TV and TP (P<0.05). The treatments means revealed that the best total leukocyte count was recorded in TC, followed by TV, TP and minimum with C. Thus treatment TC showed best TLC level which is significantly (P<0.05) higher as compared to control C as well as all other treatments. [38] observed WBC count highest in cow dung supplemented treatment, this may be due to any infection or due to stress and this can be due to metabolic disturbances.

Total Erythrocyte Count (TEC): The observation of Total Erythrocyte Count in different treatment group has been depicted in Table 8. The highest TEC level was found in TP (poultry + supplementary feed) which was significantly different from C, TC and TV (P<0.05). The treatment means revealed that the best total erythrocyte count was recorded in TP followed by TV, TC and minimum in C control. [13] Who observed higher R.B.C count in poultry and mix feed, this can be due to age of fish, cycle of sexual maturity and good health condition.

Haemoglobin: Profile of haemoglobin obtained in different treatment ponds has been presented in Table 8. Haemoglobin analysis of fish blood showed the highest Hb level in treatment TP (poultry + supplementary feed). The treatment means revealed that the best Hb level was recorded in TP followed by TV, TC and minimum in C control (7.32g %). Treatment TV showed second best Hb concentration level which is significantly (p<0.05) high as compare to control as well as other treatment.

Summary and Conclusion
The present investigation Study on the Effect of Different Organic Manure on the Growth of Amur carp (Cyprinus carpio haematopterus) fingerlings with Supplementary Feed in the Tarai Region of Uttarakhand was carried out to study the assessing culture feasibility of Amur carp in the tarai region of Uttarakhand. The experiment was conducted at the Instructional Fish Farm of the College of Fisheries, G.B. Pant University of Agriculture & Technology, Pantnagar, and Uttarakhand. On the basis of the present experiment, it can be concluded that organic manure is a down-to-earth solution to Cut input costs. The higher level of nitrate and phosphate content in poultry manure than cow manure, helps in natural food production in fish pond. The effects of organic fertilizers (poultry and cow manure) increase significantly the productivity of phytoplankton and zooplankton in fish ponds. Organic manuring is normally considered more beneficial for the farmer because it is economical and cuts down 50% cost of inorganic fertilizer and supplementary feed. According to [38] organic manuring have better nutrients balance rather than inorganic fertilizers. Present study showed that poultry manure and vermicompost treated ponds had maximum production compared to cow dung manure application. Therefore, it is suggested that use of poultry manure deserved priority in fish production/ pond productivity followed by vermicompost and cow dung respectively.

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