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Original Research Paper

Role of Duck Droppings on Pond Productivity Through Fish-Cum-Duck Integrated Farming System in Agro Climatic Condition, Assam

H. K. Kalita*, B. Talukdar*, R. A. Baishya*, S. Basumatary*, J. Das, A. Dutta*, R. Ch. Barman*** and D. Sarma*†**
*Department of Zoology, Gauhati University, Guwahati, Assam, India
**Department of Zoology, Goalpara College, Goalpara, Assam, India
***NFDB Regional Centre, Campus of NIRD, NERC, Khanapara, Guwahati, India
†Corresponding author: D. Sarma

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ABSTRACT

The study was conducted in a society pond of Gandhibasti village of Abhayapuri, Bongaigaon, Assam to assess the impact of duck droppings on water quality and pond productivity. The pond was integrated with ducks (*Anas platyrhynchos*) to obtain the benefit of duck litters on the pond productivity and fish growth. The mean dry weight of 80 ducks excreta was estimated as 3.864 kg/ha/day, discharging into the pond. 18,000 fingerlings. Indian major carps along with few exotic carp were stocked in the month of April, 2013. Supplementary feed was also given to the fishes in alternate days to ensure their steady growth. All the studied physico-chemical parameters were found within the permissible limit and the growth of fishes was also satisfactory. The maximum growth was recorded in *Catla* followed by silver carp, common carp, *Rohu* and *Mrigala*.

INTRODUCTION

Integrated farming system is one of the best methods for maximizing animal and plant protein production through optimum use of land, water and waste resources at sustainable level. In this system, nothing is wasted and ecological balance is maintained. Recycling of organic wastes for fish culture serves the dual purpose of cleaning the environment and providing economic benefits (Shyam et al. 2012). The recycling of animal dung/wastes in aquaculture ponds is important for natural fish production, which supports sustainable aquaculture and also reduces expenditure on supplementary feeds and fertilizers. Some works have already been reported on animal manures like cow dung, poultry droppings and biogas slurry which are suitable substitutes for costly feeds and fertilizers (Schroeder 1980). This type of integration can increase overall production intensity and economics on land, labour and feed requirements for both poultry and fish. Fish-cum-duck integration is very common in countries like China, Hungary, Germany, Poland, Russia and to a very small extent in India (Ayyappan et al. 1998). From the viewpoint of input-output relationship fish-cum-duck integration is the best model of integrated fish, livestock and poultry. However, except a few government sponsored programmes, fish-cum-duck farming practices are lagging far behind in Assam than other states of India. Therefore, the present study has been undertaken to work out the effect of duck droppings on pond productivity along with the fish growth in a society pond of Assam.

MATERIALS AND METHODS

The present investigation was carried out for a period of one year (March, 2013 to February, 2014) in a society pond of Gandhibasti village, Abhayapuri in Bongaigaon district of Assam with active participation of villagers. Preparation of pond was carried out through renovation and repairing of dyke, dewatering, fertilization (with lime and cowdung @8 tons/hectare) followed by ploughing. Advanced fingerlings (7g to 20g in weight) of Indian major carps (*Catla, Rohu, Mrigal*,) and a very few number of exotic carps (silver carp, grass carp, common carp) as a means for biological control for excess growth of algal bloom, aquatic vegetation etc., were stocked in the month of April, 2013. Depending upon the size, shape and water retention capacity of the pond as well as load of duck droppings, the ratio of the fingerlings (18000 nos) were maintained as follows. *Catla : Rohu : Mrigala : silver carp : grass carp : common carp* :: 1:1:1:0.09:0.09:0.09. After four months of fingerlings rearing (when the fingerlings attained average weight of 40 g to 100 g), 80 ducklings of the age group from 2 to 3 months and average weights of 0.81 kg to 0.95 kg were introduced and reared in the duckery shed built on the banks of the pond. Ducks were fed with branded (Godrej) feed @ 50g/

duck × 3 times. The ducks belonged to the Indian runner ducks and released in the morning hours (9.00 a.m.) in the pond and guided back at noon and in evening respectively. Certain water quality parameters (water temperature, pH, free CO_2, dissolved oxygen (DO_2), hardness, total alkalinity, chloride, conductivity, total dissolved solid (TDS) and salinity) of the pond were analyzed on monthly basis following standard methods (APHA 1989). Planktons were also studied monthly using plankton nets (70µm mesh size). Qualitative and quantitative estimation of plankton was performed through Sedgewick Rafter counting cell and binocular research microscope.

RESULTS AND DISCUSSION

Duck dropping loads were analyzed for seven days in a week and an average dropping per day has also been recorded. The ducks excrete 41g-55g excreta/day, thus 80 ducks excrete 3.864 kg/ha/day. Growth of fish was observed on monthly and the net and gross fish productions were calculated annually.

After introduction with duck droppings, all the studied water quality parameters except FCO_2 were observed in increasing trend compared to pretreated pond water (Table 1). The water quality was found within the suitable limit for fish culture in pond condition. The pH of treated water was estimated between the range of 6.53 and 8.3. Maximum value of pH was estimated in the month of August. It is reported that duck excreta is likely to be more beneficial in production system as it is maintaining an alkaline state (Chari 2003, Golterman 1970) throughout the culture period. The level of pH and alkalinity were observed in increasing trend in the treated water (Table 1). The co-efficient of correlation between pH and alkalinity also showed positive relation throughout the period of investigation and was in conformity with the investigation of Chari (1980). The value of DO was estimated between the range of 6.5-8.3 which indicates favorable environment for fish growth. It can be presumed that movement of ducks in the pond helped in aeration of the water.

pH of soil samples was found to be mildly alkaline throughout the experimental period in duck treated pond (7.10-7.65). The central Inland Fishery Research Institute (CIFRI) recommends that pond soil pH between 6.5 and 7.5 is a productive range. The present study is also in agreement with these observations.

Plankton diversity: The plankton were estimated as maximum after introduction of duck droppings (6253unit/L) as compared to the plankton estimated before treatment (1592 unit/L). Prior to the application of duck droppings, the population of phytoplankton was estimated as 698 unit/L and after treatment the number of phytoplankton was estimated upto 2721unit/L. The population of zooplankton was estimated as 894 unit/L before treatment and after treatment, the number of zooplankton was estimated as many as 3532 unit/L. A total of 17 genera of phytoplankton under 9 families as well as 28 genera of zooplankton under 15 families were recorded in the treated pond, however, prior to the treatment,10 genera of phytoplankton under 6 families and 14 genera of zooplankton under 8 families were recorded. Amongst phytoplankton, the most common genera were *Chlorella, Spirogyra, Ulothrix, Volvox, Anabaena, Microcystis, Nostoc, Oscillatoria, Navicula, Pinnularia, Euglena* and *Trachelomonas*. Whereas, *Daphnia*, *Moina, Cyclops, Diaptomus, Asplanchna, Brachionus* and *Keratella* were among the most abundant zooplankton genera. The plankton productivity was also estimated maximum in comparison to other waste treated water such as duck-cow dung combinations and cow dung alone (Kapur 1981, Kapur et al. 1986). This is also evident from water quality parameters (Table 1).

Table 1: Mean value of physicochemical characteristics of the experimental pond before and after treatment.

Parameters	Pre-Treated Pond ±SD	Treated Pond ±SD
pH	6.53-7.12±6.8	6.93-8.3±0.48
FCO_2 (mg/L)	6.4-7.2±5.08	4.4-5.3±2.87
DO (mg/L)	6.19-7.3±0.56	6.45-8.52±0.70
Hardness (mg/L)	28-82± 27	17-97±35
Total alkalinity (mg/L)	50-73±23.5	55-82±21.7
Chloride (mg/L)	13.01-17.01±2	10.07-37.04±8.01
Conductivity (µmhos/cm)	81.9-335±145.87	54.8-330±89.68
TDS (mg/L)	76-97.8±40.2	45.2-85.2±27.6

Growth of fish: In the present investigation, it has also been observed that duck droppings increased the growth of all the species of Indian major carps and exotic carps. *Catla* growth was recorded maximum (2.5 kg) in 8 months followed by silver carp attaining the weight of 1.5 kg. However, the growth of *Rohu* and *Mrigala* was recorded as 1.0 kg each after 11 months of rearing, which indicates normal growth in agro climatic condition of Assam (Table 2). This indicates that the duck droppings had no direct role in the growth of *Rohu* and *Mrigala*. As a proximate composition of duck manure, moisture 68.4%, nitrogen 4.3%, phosphorus 1.41%, ash 11.9% and mean loading rate total input 6.10 g, total nitrogen 0.25 g, total phosphorous 0.10 g and total ash 1.12 g, which may also play a role for the growth of *Rohu* and *Mrigala*.

Moreover, the duck droppings increased the

Table 2: Mean value of intial and final weight of fingerlings of the experimental pond.

Fingerlings	Initial weight±SD (g)	Final weight±SD (g)
Catla	19±0.79	2340±96.18
Rohu	14.5±0.79	1180±57.01
Mrigal	10.8±0.57	960±65.19
Silver carp	16.3±0.57	1460±41.83
Common carp	13.7±0.57	1460±41.83
Grass carp	16.6±0.65	960±41.83

zooplankton population of rotifers which in turn increased the growth of *Catla* and silver carp as both of them are surface feeders. The mortality of reared fishes was recorded as almost nil, except for four individual grass carps, which died in the later part of experiment, which might be probably due to non availability of hydrophytes in sufficient quantity.

The study carried out during the present investigation, clearly demonstrates that with the increase in concentration of duck droppings, the growth of fish species showed positive growth trend, which is also evident as (Cruz et al. 1980) reported maximum fish growth of 1,690 kg/ha/90 days (18.8 kg/ha/day) in their duck-fish culture experiments in Philippines.

CONCLUSIONS

Present experiment concludes that, duck excreta is a good source of nutrients for plankton production. The physio-chemical parameters of water and soil in treated pond are in more productive range, giving good survival of fish and ducks. The cost and returns of fish-cum-duck farming is more profitable than fish farming alone.

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