



RESEARCH ARTICLE.....

# Role of poultry bird droppings on pond productivity through poultry + fish integrated farming system

S.N. VINODAKUMAR AND B. K. DESAI

**ABSTRACT.....** The experiment was conducted at Main Agricultural Research Station (MARS), Raichur of Karnataka to study the impact of poultry bird droppings on physico-chemical, parameters of pond ecosystem and overall production of fish. The pond was stocked with common carp (*Cyprinus carpio*) and integrated with broiler poultry birds (Giriraj breed) which fertilizes the pond with their excreta during rearing. No supplementary feed was given to the fish while the birds were fed with leftovers of maize, cowpea and bengal gram which are easily available commodities in rural areas. The mean dry matter loading rate of birds excreta was 64 and 65 kg/year during first and second year into the pond resulting considerable influence on physico-chemical parameters viz., dissolved oxygen, pH, alkalinity changed and plankton volume also improved considerably. These parameters in totality affect the overall fish production ranging from 114.81 to 156.56 kg during 2012-13 and 2013-14, respectively. The average bird meat produced was 2.46 to 2.56 kg/bird. The results conclude that, integration of fish with poultry birds is more sustainable and profitable than farming fish farming alone.

**KEY WORDS.....** Integrated farming system, Poultry + fish integration, Pond ecosystem, Meat, Fish production

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## INTRODUCTION.....

Fisheries is destined to play an important role in human nutrition but the cost is beyond reach of many people. Utilization of grain and animal protein as feed in aquaculture may not be economical as it might lead to food crisis and attention is being redirected to wider use of all resources and integrated fish farming offers a solution to the problem. Recycling of organic wastes for fish culture serves the dual purpose of cleaning the environment and providing economic benefits. In India

about 40 per cent of cultivated area is under irrigation and 60 is under rainfed condition. Whereas, in Karnataka the irrigation percentage to net sown area is 33.5 per cent and the rest is rain fed (Anonymous, 2017). In Karnataka the main water resource is village ponds and dug wells. The village ponds are used for irrigation, fish culture and other multipurpose domestic activities (bathing, washing etc.). These ponds are mainly rainfed in nature. In which no inputs are given and nutrient availability is very poor, as a result there is low fish

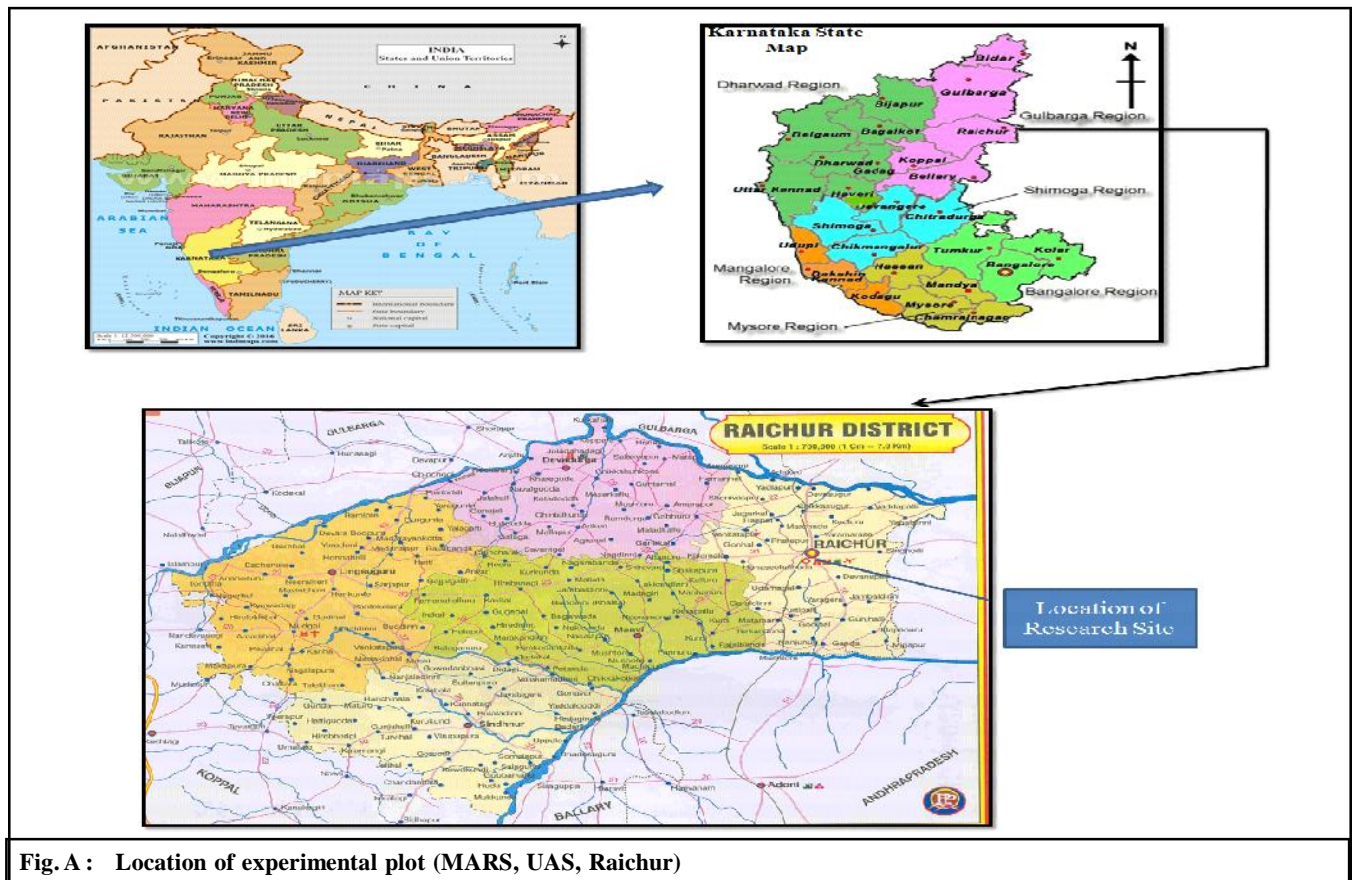
production. In such ponds, recycling of nutrients through integrated farming is a suitable alternative. The recycling of animal dung/ wastes in fish ponds is important for natural fish production as also sustainable aquaculture and to also reduce expenditure on costly feeds and fertilizers which form more than 60 per cent of the total input cost in semi intensive fish culture systems. However, the indiscriminate use of these manures in fishponds, instead of improving the pond productivity, may also lead to pollution. Although some work has been done on animal manures like cow dung, poultry droppings and biogas slurry which are suitable substitutes for costly feeds and fertilizers (Schroeder, 1980; Dhawan and Toor, 1989), there are few reports on the recycling of duck manure in fish ponds and more so under Chhattisgarh and Indian conditions (Sasmal *et al.*, 2010).

Presently the tanks and water bodies are being utilized for domestic purposes and no inputs are allowed into it for fear of killing the aesthetic value of the pond. So only fish seed as input is allowed and any other input is taken as a cognizance offence by the village folk hence, fish production is very low. To overcome this problem

integration of fish with poultry and duck farming is a suitable alternative for which the farmers and village folk do not have any objection. The birds can be fed on locally available agricultural by products by the farmers. These poultry birds' droppings contain undigested grains that can be consumed by the fish and is also nutrient rich, which will improve the plankton (ultimately fish production) through nutrient accumulation over a period of time. At harvest in addition to fish, poultry bird meat will also become available to the farmers as an additional source of income as also nutritional security to his family. Hence, the present study on integrated farming system under North Eastern Karnataka was formulated with the fish + poultry bird integration to study the productivity and profitability of farmers over fish farming alone.

**RESEARCH METHODS**.....

The experiment was conducted at Main Agricultural Research Station (MARS), Raichur of Karnataka (Fig. A) to study the impact of poultry bird droppings on physico-chemical parameters of pond ecosystem and overall production of fish. The study involved two ponds



**Fig. A :** Location of experimental plot (MARS, UAS, Raichur)

– one with giriraj poultry birds (0.1 ha) another without poultry birds (0.1 ha). Both ponds are perennial and shrinking in nature. Unwanted fishes were removed with repeated netting. In August, 2012 and August, 2013, advanced fingerlings of common carps (*Cyprinus carpio*) were stocked @ 6,000 ha<sup>-1</sup> weighing around 0.4 to 0.45 g. After one month of fingerlings stocking, 2 weeks old 25 broiler poultry birds (Giriraj breed) were brought into use and birds were reared in battery system (Fig. 1) each year.

Water quality parameters of ponds were analyzed monthly for pH (Digital pH meter), temperature (Thermometers), turbidity (Nephello Turbid Meter), dissolved oxygen (Winkler method by titration), carbon dioxide (Titration method), alkalinity (Titration method), chloride (Titration method), hardness (EDTA complexometric by titration), BOD (Titration), COD (Condensation and digestion by titration), NO<sub>3</sub> (Spectrophotometer) and PO<sub>4</sub> (Spectrophotometer). Manure loading rates in treated pond were determined by randomly collecting samples from 5 birds over a period two years. The poultry manure was analyzed for phosphorous (Yoshida *et al.*, 1971), nitrogen and ash (Anonymous, 1975) also. Birds were fed with agricultural by products *viz.*, maize, cowpea and bengal gram etc. Growth of fish were recorded every month from sample catches obtained by cast netting.

## RESEARCH FINDINGS AND ANALYSIS.....

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

### Poultry manure composition :

In the present study two ponds were studied for fish production in which one was conventional fish farming (control) and the other one was integrated with giriraj poultry birds. The stocking density of 300 birds/ha

accordingly a batch of 25 birds were reared in battery system (Fig. 1) in batch. The proximate composition of poultry litter is depicted in Table 1.



Fig. 1 : Battery system of poultry bird rearing (cage on pond)

### Water quality parameters :

Various physico-chemical parameters were analyzed for both the farming systems and depicted (Table 2). Water temperature fluctuated widely between 21.7 to 26.4°C. The pH of water varied from 7.0 to 8.1 with moderate fluctuations. In treated pond, maximum pH was observed during summer periods, especially during March to June. Pond with poultry bird's integration recorded mildly alkaline pH. Use of poultry excreta is likely to be more beneficial in production system as it is maintaining an alkaline state (Chari, 2003).

In the present study pH influenced CO<sub>2</sub> content of the pond ecosystem. Higher values of alkalinity were observed in pond integrated with poultry birds (94.0 and 98.7 mg/lit during first and second year study, respectively) in comparison to controlled system (73.0 and 78.5 mg/lit during first and second year study, respectively). Poultry bird droppings registered influence

Table 1 : Composition of poultry bird droppings during 2012-13 and 2013-14

Composition	2012-13			2013-14		
	Min	Max	Average	Min	Max	Average
pH	6.2	8.7	7.45	6.0	8.9	7.45
DM (kg)	47	81	64	51	78	64.5
Total - N (kg)	2.3	4.1	3.2	2.5	3.8	3.15
P <sub>2</sub> O <sub>5</sub> (kg)	1.8	2.8	2.3	1.6	2.7	2.15
K <sub>2</sub> O (kg)	2.1	4.8	3.45	2.6	4.3	3.45

on pH and alkalinity of the pond water in both years. The mean dissolved oxygen (DO) was 8.1 and 8.6 mg/lit during 2012-13 and 2013-14, respectively which indicates favourable condition for fish growth. In integrated farming system, monitoring BOD is absolutely essential as thick organic sediment may settle at the pond bottom, increasing depletion of oxygen and enhancing the production of toxic gasses which can result in fish kills. In the present study, BOD level was in treated pond in the range of 3.5 and 3.7 mg/lit during first and second year study, respectively. An increase in BOD was seen with input of waste into pond by birds. It was found that while DO decreased there was an increase in BOD level (Chattopadhyay 1997). Similar findings were observed by Sasmal *et al.*, 2010.

Nitrate-N and phosphate values were lower initially when poultry birds were not introduced but later when birds were integrated with pond nutritional composition enhanced. It has been reported that, phosphates are essential for the growth of green algae (Jana, 1973).

A nitrate content in water influence the population density of plankton biomass significantly. Similar result was also obtained earlier by Chari (1980) and Sasmal *et al.* (2010).

### Growth of fish :

The growth parameters of fish species under conventional fish farming and poultry + fish farming systems are depicted (Table 3). The average initial weight of fingerlings at the time of stocking ranges from 0.40 and 0.45 g. Pisciculture integrated with giriraj poultry birds recorded highest survival rate (65 and 71% during 2012-13 and 2013-14, respectively), growth rate (0.079 and 0.098 kg during 2012-13 and 2013-14, respectively), final body weight (0.785 and 0.980 kg during 2012-13 and 2013-14, respectively) compare to conventional fish farming system in both the years. Total fish yield recorded was highest with integrated system (poultry + fish farming) with (114.81 and 156.56 kg during 2012-13 and 2013-14, respectively).

**Table 2 : Physico-chemical parameters of experimental ponds during 2012-13 and 2013-14**

Parameters	Conventional fish farming	Poultry + fish farming	Conventional fish farming	Poultry + fish farming
	2012-13		2013-14	
pH	7.0	7.4	7.1	8.1
EC ( $\mu$ mhos/cm)	145.8	183.7	155.1	203.7
Temperature ( $^{\circ}$ C)	21.7	25.7	2.3	26.4
Turbidity (NTU)	28.0	38.0	32.0	56.0
DO (mg/lit)	7.3	8.1	7.4	8.6
CO <sub>2</sub> (mg/lit)	1.84	1.57	1.91	1.67
Alkalinity (mg/lit)	73.0	94.0	78.5	98.7
Chloride (mg/lit)	15.3	19.1	16.1	23.7
Hardness (mg/lit)	83.7	106.9	87.3	109.7
BOD (mg/lit)	2.1	3.5	2.2	3.7
COD (mg/lit)	9.3	15.5	10.1	17.9
PO <sub>4</sub> (mg/lit)	0.2	0.3	0.2	0.4
NO <sub>3</sub> (mg/lit)	0.7	1.2	0.8	1.5

**Table 3 : Survival rate (%), growth rate (g), average weight and yield (kg) of fish reared in farm pond (F<sub>7</sub>)**

Farming systems	Year	Initial average weight (g)	Initial total weight (g)	No. of fingerlings released	Survival rate (%)	Final average			Monthly average growth rate (g)	Total fish yield (kg)
						Length (cm)	Width (cm)	Weight (kg)		
Poultry birds + fish	2012-13	0.40	104	225	65	31.6	12.4	0.785	0.079	114.81
Control (Fish alone)	2013-14	0.45	101	225	71	33	13	0.980	0.098	156.56
	2012-13	0.41	102	225	63	30.0	10.3	0.721	0.072	106.3
	2013-14	0.44	103	225	64	30.8	10.8	0.743	0.074	115.8

Not statistically analysed

**Growth of Giriraj poultry birds:**

Growth performance was studied at fortnightly intervals measuring weight gains in poultry birds (Giriraj birds). The average initial weight of birds were 50 and 52 g during 2012-13 and 2013-14, respectively. The maximum weight of birds were recorded till 9<sup>th</sup> week (economic rearing period for broilers) which increased to 2.46 and 2.56 with dressing weight of 1.74 and 1.82 kg for first and second year, respectively. During experimental period, the peak mean weight of birds was observed in January- March and a decline was observed in April to May, due to increase of ambient air temperature.

**Conclusion :**

Poultry birds excreta is a good source of nutrients, which is readily soluble in water and available for plankton production. On the other hand, the birds excreta

is improving the nutrient level in fish pond ecosystem at productive range. The physico-chemical parameters of water and soil in treated pond are in more productive range giving good survival of fish. The fish + poultry farming is more sustainable and profitable than fish farming alone.

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