Acta Entomology and Zoology

E-ISSN: 2708-0021
P-ISSN: 2708-0013
www.actajournal.com
AEZ 2024; 5(1): 77-79
Received: 09-01-2024
Accepted: 12-02-2024

Shanti Kumari
Research Scholar,
Department of Zoology,
B.N. Mandal University,
Madhepura, Bihar, India

Corresponding Author:
Shanti Kumari
Research Scholar,
Department of Zoology,
B.N. Mandal University,
Madhepura, Bihar, India

Review of ichthyological studies of poultry manure and its impacts on fish growth and water quality

Shanti Kumari

DOI: https://doi.org/10.33545/27080013.2024.v5.i1a.130

Abstract
Poultry manure is considered one of the best organic manures due to their rich nutrient content, including major nutrients such as nitrogen (N), phosphorus (P), and potassium (K), as well as various trace elements. Poultry manure as a fertilizer in limited dose in aquaculture systems can contribute to significant fish production and in improving water quality. The indiscriminate application of high amounts of poultry droppings in aquaculture ponds can have detrimental effects on water quality, plankton populations, and fish growth. Sustainable aquaculture practices, including proper nutrient management, stocking density regulation, and regular monitoring of water quality parameters, are essential to mitigate these adverse impacts and ensure the long-term viability of aquaculture operations.

Keywords: Poultry manure, fishes, water quality and fertilizer

Introduction
Fishes are a vital source of protein and essential nutrients for more than a billion people worldwide, contributing to food security, nutrition, and livelihoods. Fish consumption varies widely across different regions, but it is particularly significant in many coastal communities and countries with access to freshwater resources. In many developing countries, fish constitutes a major part of the diet due to their availability and affordability ((Omojowo and Omojasola, 2013) [7]. Aquaculture has indeed played a significant role in increasing global fish production, meeting the growing demand for seafood. Higher fish stocking densities and the use of artificial feeding have been key strategies in intensifying aquaculture operations and boosting production. However, the cost of feeding in aquaculture can be substantial, especially for species that require high-protein diets or specialized feed formulations. To address the cost challenges associated with feeding, aquaculturists have explored alternative sources of nutrients and enrichment for aquaculture systems. One such approach is the use of animal manure, including poultry litter, as a fertilizer or nutrient source for aquaculture ponds (El-Naggar *et al*., 2008) [6].

Fish pond manuring is a common practice in fish farming, especially in extensive and semi-intensive aquaculture systems, for the purpose of intensifying fish production and enhancing pond productivity. Fish pond manuring helps to balance the nutrient ratios in aquaculture ponds, particularly by providing carbon along with other essential nutrients such as nitrogen and phosphorus. This balance is crucial for supporting the growth of various organisms within the pond ecosystem. In fish pond manuring, organic materials such as animal manure, agricultural by products, or organic wastes are added directly to the pond water. These organic materials are consumed by fish as a food source, contributing to their growth and development. The organic matter in fish pond manure serves as a nutrient source for the pond ecosystem. When consumed by fish, organic matter is partially converted into fish biomass, while the remainder is broken down by microbial activity and utilized by other organisms in the pond, such as phytoplankton and zooplankton. The nutrients released from fish pond manure support the growth of photosynthetic organisms, primarily phytoplankton (Moav *et al*., 1977, Little and Edwards, 1999) [14, 4]. By enhancing primary production and providing a supplemental food source for fish, fish pond manuring can increase overall pond productivity and fish yields. Fish pond manuring can be cost-effective compared to the use of commercial feeds, especially for small-scale or subsistence farmers who have limited access to or affordability of manufactured feeds. It allows farmers to utilize locally available organic materials, reducing the need for external inputs (Moav *et al*., 1977, Little and

Edwards, 1999) [14, 4]. Various types of manure can be utilized in fish farming, each with its own characteristics and suitability for different aquaculture systems. Among the commonly used manures, cow dung, poultry dung, and semi-liquid pig manure are of particular interest due to their nutrient content and availability. Chicken manure is often preferred in fish farming due to its high solubility and nutrient content. It typically contains high levels of phosphorus, nitrogen, and potassium, making it a valuable source of nutrients for pond ecosystems. The readily available phosphorus in chicken manure can promote the growth of phytoplankton and aquatic plants, enhancing primary productivity in aquaculture ponds. Chicken manure is relatively easy to handle and apply, as it is typically available in a dry or pelletized form ((Knud-Hansen *et al*., 1991) [11]. Poultry manure, including chicken litter, is renowned for its high nutrient content, particularly nitrogen, which is largely attributable to the presence of proteins and amino acids.

The application of organic manure in nursery and rearing ponds can indeed play a vital role in ensuring the production of planktonic feed for fish fingerlings. Poultry manure and a combination of cow dung with poultry manure are often preferred for this purpose due to their high nitrogen and phosphorus content, which are essential for primary production and promoting fish growth ((Priyadarshini *et al*., 2011) [13].

Selection of fish species

The study conducted by Vivekanand *et al*. (2016) [9] evaluated the impact of different levels of poultry droppings on the growth performance of Indian major carps, including *Catla catla*, *Labeo rohita*, and *Cirrhinus mrigala*, in aquaculture ponds. Three ponds with an area of 1000 square meters each were selected for the study. These ponds were designated as T_0 (control), T_1, and T_2. The fish species were stocked at a rate of 10,000 fingerlings per hectare, with a ratio of 3:3:4 for *Catla catla*, *Labeo rohita*, and *Cirrhinus mrigala*, respectively. The study evaluated the growth performance of the fish species in terms of average daily weight gain. In T_1, the growth per day for *Catla catla*, *Labeo rohita*, and *Cirrhinus mrigala* were 1.59 g, 1.16 g, and 0.83 g, respectively. In T_2, the growth per day increased to 1.87 g, 1.49 g, and 1.15 g for the same species. In contrast, the control pond (T_0) showed lower growth rates, with *Catla catla*, *Labeo rohita*, and *Cirrhinus mrigala* exhibiting growth rates of 0.70 g, 0.51 g, and 0.41 g per day, respectively. The study found that both T_1 and T_2 ponds demonstrated higher fish production compared to the control pond (T_0). The T_2 pond, which received a higher level of poultry droppings, exhibited the highest yield among the treatment groups, indicating that an optimum amount of poultry droppings led to increased fish production.

The use of poultry manure in aquaculture systems can enhance the growth performance of common carp and other fish species by creating a nutrient-rich environment that supports primary production and improves water quality. This highlights the potential of poultry manure as a valuable resource for promoting sustainable and profitable fish farming practices (Gameredinn *et al*., 2018) [8].

The study conducted by Safi *et al*. (2016) [15] suggests that moderate application of poultry droppings, specifically at the rate of 1 chick per 11.1 square meters, is ideal for maintaining suitable water quality and plankton productivity in aquaculture ponds. This optimal application rate of poultry droppings resulted in enhanced fish growth and overall higher production of fish per unit area.

The study conducted by Kour *et al*. (2016) [12] evaluated the effect of organic manure and inorganic fertilizer on the growth and proximate composition of carp. Their findings indicated that the weight and specific growth rate of fish were significantly higher in ponds treated with chicken manure compared to those treated with organic and inorganic fertilizer.

The study conducted by Banerjee *et al*. (1979) [1] reported that poultry manure was the most effective, followed by a combination of poultry manure and cow dung, and finally cow dung alone, in terms of their impact on some aspect(s) of agricultural or aquacultural production.

The study conducted by Govinda *et al*. (1978) [9] concluded that a combination of poultry manure and cow dung was superior to poultry manure alone in terms of its effectiveness for a certain purpose.

The study conducted by Das *et al*. (2020) [18] suggests that the application of poultry manure at a rate of 10,000 kg per hectare per year is optimal for raising fish fingerlings in tanks under mid-hill conditions. They observed significantly higher survival and growth rates of two fish species, *common carp* and *Labeo gonius*, at the recommended stocking density in tanks treated with poultry droppings compared to control tanks.

Integrating chicken coops over tilapia ponds offers significant potential benefits for tilapia production, primarily due to the direct input of fresh chicken manure into the pond water. One of the primary advantages of integrated farming systems is the elimination of costs associated with purchasing and transporting manure. Since the chicken coops are situated directly over the ponds, there is no need to incur expenses for acquiring manure or transporting it to the pond site. Fresh chicken manure contains relatively high levels of nutrients, including nitrogen, phosphorus, and potassium. When chicken coops are positioned over ponds, the soluble excreta from the chickens enter the water directly, providing an immediate and continuous source of nutrients for the tilapia and other aquatic organisms (Knud-Hansen *et al*., 1991) [11].

Impact on water parameters

Vohra *et al*., (2012) [16] have reported that high amounts of poultry droppings can lead to water quality degradation in aquaculture ponds. The introduction of excessive organic matter from poultry droppings can result in increased nutrient levels, particularly nitrogen and phosphorus, which can lead to eutrophication. Eutrophication, in turn, causes decreased dissolved oxygen levels, increased turbidity, and changes in pH, all of which can negatively impact aquatic organisms, including fish.

Dhawan and Toor, (1989) [5] have reported that the indiscriminate use of poultry droppings as pond manure could potentially help alleviate problems such as eutrophication, algal blooms, and fish mortality in aquaculture ponds.

The findings indicate that while chicken manure inputs may have affected other aspects of the aquatic ecosystem (such as nutrient levels or primary productivity), they did not have a noticeable effect on dissolved oxygen concentrations at dawn or rates of community respiration. This suggests that other factors or processes may have been more influential in

determining oxygen dynamics in the experimental system (Knud-Hansen *et al*., 991) [11].

One of the study findings suggests that changes in alkalinity levels had a considerable impact on nutrient productivity and fixation in the experimental ponds. The strong correlation between alkalinity and both NP and NFY underscores the importance of considering water chemistry parameters, such as alkalinity, in understanding nutrient dynamics and productivity in aquatic ecosystems (Knud-Hansen *et al*. 1991) [11].

Hepher (1958) [10]; Boyd (1971) [2] have reported that organic inputs in ponds can have a beneficial impact on pond bottoms by potentially improving phosphorus (P) availability for phytoplankton. Organic matter can accumulate on pond substrates through sedimentation. While pond sediments are known to effectively remove phosphorus from the water column, the accumulation of organic matter on pond bottoms can also contribute to phosphorus availability. The accumulation of organic matter on pond substrates may enhance phosphorus availability for phytoplankton in the water column. Colloidal organic matter, which is present in organic inputs, may not adsorb phosphorus as readily as clay substrates. As a result, more phosphorus remains soluble in the water column rather than being bound to sediment particles. This increased solubility makes phosphorus more accessible to phytoplankton for uptake and growth. Organic matter can act as a source of nutrients, including phosphorus, through decomposition processes. As organic matter accumulates on pond bottoms, it undergoes decomposition, releasing nutrients such as phosphorus into the water column. This released phosphorus can then be utilized by phytoplankton for growth and primary production.

Conclusion

Poultry droppings can be beneficial in integrated fish-poultry farming systems, their effective use requires careful consideration of dosage and management practices to avoid negative impacts on fish and water quality. Balanced application and proper management are key to harnessing the benefits of poultry manure while mitigating potential risks.

References

1. Banerjee RK, Singit GS, Dutta BR. Poultry droppings its manural potentiality in aquaculture. J Inland Fish Soc India. 1979;11(1):98-108.
2. Boyd CE. Phosphorus dynamics in ponds. In: Proceedings of the 25th Annual Conference of the Southeastern Association of Game and Fish Commissioners. 1971;25:418-4.
3. Knud-Hansen CF, Batterson TR, McNabb CD, Harahat IS, Sumantadinata K, Eidman HM.
4. Little DC, Edwards P. Alternative strategies for livestock-fish integration with emphasis on Asia. AMBIO A J Hum Environ. 1999;28(2):118-124.
5. Dhawan A, Toor HS. Impact of organic manure and supplementary diet on plankton production and fish growth and fecundity of an Indian Major Carp, Cirrhinusmrigala (Ham) in fish pond. Biol Waste. 1989;29:289-297.
6. El-Naggar GO, NasrAlla AM, Kareem RO. Economic analysis of fish farming in Behera Governorate of Egypt. In: Elghobashy H, Fitzsimmons K, Diab AS, eds. From the Pharaohs to the Future, Proceedings of 8th International symposium on Tilapia in Aquaculture. 2008:693–708.
7. Omojowo FS, Omojasola PF. Microbiological quality of fresh catfish raised in ponds fertilized with raw and sterilized poultry manures. Am J Res Commun. 2013;1:1-2.
8. Gameredinn Y, Saharan N, Prakash C, Tiwari V. Growth Performance and Survival of Common Carp (Cyprinus carpio,Linnaeus 1785) Fingerlings Under Different Fertilizers. Int J Livestock Res. 2018;8(1):235-243.
9. Govind BV, Rajagopal KV, Singit GS. Study on the comparative efficiency of organic manures as fish food producers. J Inland Fish Soc India. 1978;10:101-106.
10. Hepher B. On the dynamics of phosphorus added to fishponds in Israel. Limnol Oceanogr. 1958;3:84-100.
11. Knud-Hansen CF, McNabb CO, Batterson TR. Application of limnology for efficient nutrient utilization in tropical pond aquaculture. Verhandlungen Internationale Vereinigung fur Theoretische und Angewandte Limnologie. 1991;24:2541-2543.
12. Kour S, Masud S, Khan A. Effect of organic manure and inorganic fertilizer on the growth and proximate composition of common carp, Cyprinus carpio. J Environ Biol. 2016;37:149-153.
13. Priyadarshini M, Manissery JK, Gangadhar B, Keshavanath P. Influence of feed, manure and their combination on the growth of Cyprinus carpio (L.) fry and fingerlings. Turk J Fish Aquat Sci. 2011;11:597-606.
14. Moav R, Wohlfarth G, Shroeder GL, Hulata G, Barash H. Intensive polyculture of fish in freshwater ponds. 1. Substitution of expensive feeds by liquid cow manure. Aquaculture. 1977;10:25-43.
15. Safi V, Achom D, Budhin G, Ram Kumar, Rajashree S, Debangshu Narayan D. Effect of different levels of poultry droppings on growth performance of Indian major carps in the foothills of Arunachal Pradesh, India. Int J Fish Aquat Stud. 2016;4(2):56-63.
16. Vohra AR, Narejo NT, Naeem M, Wadhar GM, Dayo A. Effect of dry poultry wastes on the phsico-chemical and fish growth parameters of exotic carps, Cyprinus carpio at carp hatchery (District Badin), Sindh, Pakistan. Sindh Uni Res Jour (Sci Sec). 2012;44(2):239-244.
17. Wilkinson SR. Plant nutrient and economic value of animal manures. J Anim Sci. 1979;48:121–133.
18. Das S, Pérez-Ramírez J, Gong J, Dewangan N, Hidajat K, Gates BC, *et al*. Core–shell structured catalysts for thermocatalytic, photocatalytic, and electrocatalytic conversion of CO 2. Chemical Society Reviews. 2020;49(10):2937-3004.
19. Muthukrishnan I, Vinoth P, Vivekanand T, Nagarajan S, Maheswari CU, Menendez JC, *et al*. Synthesis of 5, 6-dihydrodibenzo [b, h][1, 6] naphthyridines via copper bromide catalyzed intramolecular [4+ 2] hetero-Diels–Alder reactions. The Journal of Organic Chemistry. 2016 Feb 5;81(3):1116-1124.