Economics of Periphyton-Based Aquaculture Production in Bangladesh

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Abstract: The study evaluates the production practice and relative profitability of periphyton-based aquaculture both on-station and off-farm condition. The findings of this study are that with relatively lower production cost, this technology yields better than that of existing fish production practices. The net return was estimated 2408 Taka ha⁻¹ on-station and 33306 Taka ha⁻¹ on-station from periphyton-based aquaculture for three months while it was 9796 Taka ha⁻¹ on farm and 16744 Taka ha⁻¹ on-station without this technology. The study also confirmed that it is an economically viable technology of fish production and the adopters could get better yield and net return from adopting such technology if positive steps undertaken for extension.

Key words: Periphyton-based aquaculture, net return, Bangladesh

Introduction
The rice-based diet of Bangladesh is complementing by fish. In this country, fish represent 70% of protein source (BBS, 2000). Unfortunately, the inland natural fisheries production in Bangladesh declined steadily due to overfishing, siltation of water bodies etc. So different nutrition related problems of the poor people of the society are increasing as a consequence of human modification to the environment.

For the improvement of this situation, scientists in Bangladesh have developed different technologies of fish culture. The extension of these technologies for increasing production is becoming increasingly reliant on extended resources like feed, fertilizer etc. But in a resource constrained country like Bangladesh where more than 75% of households spend 90% of their income on basic needs (BBS, 1995), many cannot afford to provide even rudimentary supplementary feeds for their fish ponds (O’Riordan, 1994). As a result scope for intensified fish culture by supplementary feed is not expanding as expected.

An alternative means of increasing fish culture based on the natural production and home supplied cheaper inputs could be a solution for a poor country like Bangladesh. The periphyton based aquaculture is such type of fish production diet designed by fisheries scientists.

The traditional "acajas" of Ivory Coast, West Africa and kathem of Bangladesh are brush-sparking based fish alternative devices used by fishermen (Welcomme, 1972, Wahab et al., 1994). Dense masses of tree branches on bamboo are placed in lakes, lagoons, on rivers and the fish are attracted by provision of shelter from predators and suitable breeding place in which natural food are abundant. Beveridge et al. (1996) argued that this type of fish attracting device called periphyton based aquaculture, served as a model for cheaper and efficient fish production in different fish feed deficit countries.

Wahab et al. (1998), found that inclusion of substrate for periphyton production in earth pond system results in increased production of fish such as rohu (Labeo rohita) and catla (Labeo calbasu) by different trials on periphyton-based aquaculture production in on-station research in Bangladesh. However, it is unknown whether this technology is profitable or economically viable at pond-based aquaculture.

This study attempts to examine the economics of periphyton-based aquaculture system in terms of efficiency of resource uses. The results of the study also generate information which immense use to the existing and prospective producers in making decision on their scarce resources on periphyton-based aquaculture production practice and help to increase overall production. The specific objectives of the study include:

To assess the profitability of pond fish culture with and without periphyton situation
To examine resource use efficiency in periphyton-based aquaculture

Materials and Methods
The study undertaken on the basis of different on station research on periphyton-based aquaculture conducted by fishery scientist of Bangladesh Agricultural University and some on-farm ponds managed by the farmer under the instruction of Care Life project's extension worker in Kishorgonj district. On-station fish culture was under scientific management but in on-farm farmer managed by himself following the extension worker's technical support. On station experiment conducted for the period of 1995 to 1997 at the Faculty of Fisheries in Bangladesh Agricultural University, Mymensingh. Amongst the experiment, data of 15 ponds with periphyton and data of 15 ponds without periphyton were collected. To compare the results with on-farm ponds managed by farmers, a total number of 30 ponds were purposely selected, of which 15 with and 15 without periphyton situation in Kishorgonj district. The data of on-farm level were collected for the period of March to August 2000 by a set of questionnaire. It is a privilege of study that experimental data recorded properly on-station.

Data analysis: The collected data were checked for consistency and were summarized, tabulated and analyzed in accordance with the objectives of the study. A simple tabular method, cost and return analyses were done to achieve the objective of the study.

On the basis of cost and return analysis, the following algebraic equation was developed to determine the profitability of pond fish culture with and without periphyton situation both on-station and off-farm (Miah, 1990).

$$ P = P_B - P_F = TFC $$

Where,

$$ P = \text{Profit or net return} $$
$$ P_B = \text{Per unit price of fish (Taka/kg)} $$
$$ P_F = \text{Per unit price of ith inputs} $$
$$ X_i = \text{Quantity of ith inputs} $$
$$ TFC = \text{Total fixed cost} $$

Finally, the findings were condensed by using average to meaning full results.

Results and Discussion
Pond environment and production practices: Both on-station and
on-farm fish culture was carried out for three months. On-station earthen ponds were rectangular in shape and sized (75 cm²). First, all experimental ponds were drainage renovated and cleaned of aquatic vegetation eradication. After renovation, narrow bamboo sticks were installed vertically into the bottom mud spaced 30 cm apart. Five days latter ponds were limed (CaO) @ 250 kg ha⁻¹ and filled with water. The ponds were kept for 15 days to allow sufficient production of periphyton on the substrate. The ponds were subsequently fertilized fortnightly with manure, urea and T.S.P. @ 6000, 50 and 60 kg ha⁻¹ respectively, throughout the culture period (Wahab et al., 1999).

The farmers of on-farm prepared their ponds according to the advice of extension worker, which was same as on-station preparation. But they use different types of substrate namely, branches of bamboo, jute stick, branches of tree etc. as convenience of home supply. The ponds were different in size ranged from 20 to 80 decimal.

After sufficient growth of periphyton on substrates, all ponds were stocked with same sized fingerlings of rohu (Labeo rohita) at a density of 1 m⁻² in on-station. On-farm average stocking density was 3 m⁻² with same species.

The management practice were same in without periphyton situation except using substrate both on-station and on-farm.

### Table 1: Comparative performance of periphyton-based aquaculture

<table>
<thead>
<tr>
<th>Items of comparison</th>
<th>On-station</th>
<th></th>
<th>On-farm</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>With</td>
<td>Without</td>
<td>*Differences</td>
<td>With</td>
</tr>
<tr>
<td>Yields (kg ha⁻¹)</td>
<td>1108</td>
<td>629</td>
<td>479 89</td>
<td>49400</td>
</tr>
<tr>
<td>Gross returns (Tk ha⁻¹)</td>
<td>55400</td>
<td>31450</td>
<td>23950</td>
<td>49400</td>
</tr>
<tr>
<td>Gross cost (Tk ha⁻¹)</td>
<td>22094</td>
<td>14708</td>
<td>7388</td>
<td>25314</td>
</tr>
<tr>
<td>Net return (Tk ha⁻¹)</td>
<td>33308</td>
<td>16744</td>
<td>16562</td>
<td>24086</td>
</tr>
<tr>
<td>Benefit cost ratio (BCR)</td>
<td>2.5</td>
<td>2.1</td>
<td>0.4</td>
<td>1.96</td>
</tr>
</tbody>
</table>

Source: Authors' calculation. * The differences in per hectare yield of fish and net return were found statistically significant at 1.0 % level of significance.

Production performance and relative profitability of periphyton-based aquaculture: The results of this study clearly indicate that periphyton-based aquaculture production is highly profitable both in on-station and on-farm condition than without periphyton. It is evident from the results (Table 1) that percentage of fish yield is far better under periphyton technology (on-station 1108 kg ha⁻¹, on-farm 986 kg ha⁻¹ per three month) than the yield of fish without periphyton (on-station 628 kg ha⁻¹, on-farm 638 kg ha⁻¹ per three months). Wahab et al. (1999) also found that the growth and production was significantly higher in the ponds with bamboo substrates as compare to the ponds with out substrates. He argued that fish production with periphyton situation was 1.7 times higher than that of without substrates over a culture period of four months. Huchette (1997) assessed the potentiality of periphyton based cage aquaculture in Meghna-Gumti river (Bangladesh) and found that periphyton situation can easily yield 1800 kg ha⁻¹ per month (here the yield is higher than pond fish culture within a short time due to riverine environment). The present study also supports the above findings of different scientists.

In the study found that on-station performance is better in terms of net return, under periphyton situation because of fisheries scientists' proper supervision and management. Despite of different cost involve under periphyton aquaculture for cost of substrates earn much higher amount of net return (Tk. ha⁻¹ 33308 on-station, Tk. ha⁻¹ 24086 on-farm) than the return obtained from the without periphyton situation (Tk. ha⁻¹ 19744 on-station, Tk. ha⁻¹ 9786 on-farm). In fact incremental cost for substrates (on station Tk. ha⁻¹ 7388, on farm Tk. ha⁻¹ 3210) is higher than incremental benefit (on station Tk. ha⁻¹ 16562, on farm Tk. ha⁻¹ 14290). Nevertheless per hectare yield and net return are found statistically significant in this study. Undiscounted benefit cost ratio (BCR) estimated 2.5 on-station and 1.95 on-farm with periphyton, which revealed that per Taka investment on periphyton based aquaculture production in on-station easily return Tk. 2.5 and Tk. 1.95 in on-station respectively. That's why this periphyton-based technology of pond fish culture is a economically viable technology.

Under the circumstances periphyton based aquaculture technology has got a lot of comparative and positive advantages over the simply pond fish culture.

The overall findings of the research suggest that periphyton based aquaculture in an economically viable technology. It can increase fish production with cheaper local resources. At the same time, it can intensify fish culture cope with environment and contribute for sustainable economic development of the country. The concerned government agencies should take positive steps to train-up the farmers who are interested to adopt the technology. For this reason provision should be made by Upazila Agriculture Extension office to train the interested individual farmer every year on these technologies. Finally, the present study provides the most valuable information for farmers, researcher, farm management specialist and policy makers regarding the profitability of periphyton-based aquaculture.

### References


