Participatory Assessment of Fishpond for Multiple uses of Irrigation Water

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ABSTRACT

Routing of the irrigation water through a fish pond was experimentally found beneficial for the aquaculture as well as agriculture to enhance overall water productivity. The study was undertaken to assess the concept under farmer's field condition in participatory mode. Composite fish culture with Indian major carps and few exotic carps was followed in a tubewell fed fish pond with 256 m^2 of area. Provisions for routing of water through the pond and supplementary aeration were made using PVC pipes. A fish harvest of 76.8 kg was obtained which is about 23 kg higher than what farmer obtained last year without routing of irrigation water. Farmer also obtained 20 to 30% increase in yield of berseem (fodder crop) irrigated with the pond water. The reasons for the fish harvest (3 t/ha), which is less than expected, were identified in consultation with the farmers and discussed in the paper. The participating farmer and other farmers viewed this intervention as a tool to boost their overall economics through integrated farming system.

INTRODUCTION

In spite of plenty water resources available in the eastern region, the fish production is not sufficient to cater to the needs and a large amount fish is being imported from nearby states (Singh and Ahmad, 2003). There exists good opportunities of water resources development for enhancing the fish production to feed the rising populations (Ayyappan and Diwan, 2002). The farm ponds (Sivasankar and Uppreti, 1990) or other water bodies available with the farmers may suitably be utilized for fish production. Integration of agriculture with fish production has immense prospects to enhance the overall productivity of land and irrigation water. Efforts in this direction were made at the ICAR-RCER, Patna and it was experimentally found that routing of irrigation water through a fishpond (may be used at secondary reservoir) enhances the water quality and makes the environment more congenial for intensive fish production. A yield of more

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than 10 t/ha was obtained consistently for the four years of study as against 2 t/ha normally obtained in ordinary fishponds (Anonymous, 2003). In order to assess the technology in participatory mode under farmer's field condition, this intervention was included in the Institute-Village Linkage Programme (IVLP). The paper presents the details of the system adopted and farmers' response towards multiple uses of water using fish ponds.

MATERIALS AND METHODS

An existing fishpond (32m long, 8m wide and 1.5m deep) was selected at village Bhelura Rampur (Naubatpur block, Patna), owned by Sh. Anil Sharma. The source of water was a 5 hp tubewell located at about 150 m away and the water was conveyed through open channel, which is partly lined. Although the length-width ratio of 4.0 was not suitable for better fish production, but there was an opportunity for routing irrigation water as the tubewell water was also meant for irrigating fields. In 2001, around 54 kgs of fishes were harvested using high supplementary feed. The farmer had poultry farm adjacent to the pond and hence, used poultry waste (including some uneaten grains and manure) in the pond, which was a good source of fertilizers and supplementary feed.

Composite fish culture was followed in the fishpond with stocking of fish fingerlings of Grass Carp (*Ctenopharyngodon ideila*), Catla (*Catla catla*), Rohu (*Labeo rohita*) and Mrigal (*Cirrhinus mrigala*). As fry of the fishes were available to stock, higher mortality was expected. In view of this and the possibility of water exchange, higher stocking density (around 1,00,000 fry/ha) was used. The number of stocked fishes of different species is given in Table 1.

Table 1
Stocking and Harvesting of the Fishes from Fishpond

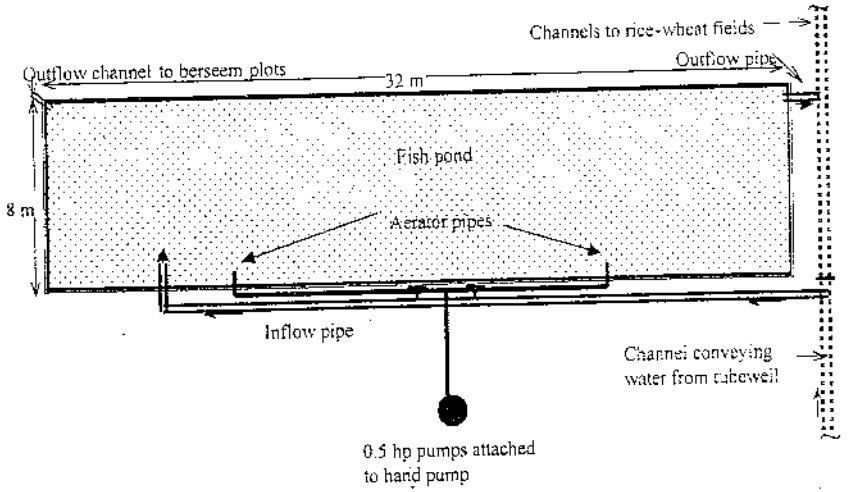
Date	*Grass carp*		*Catla*		*Rohu*		*Mrigal*		*Total*	
	Nos	*Weight*	*Nos*	*Weight*	*Nos*	*Weight*	*Nos*	*Weight*	*Nos*	*Weight*
					Stocking					
3-Aug-02	594		522		616		776		2508	
					Harvesting					
20-Jan-03	0	0.00	37	2.55	204	7.24	677	20.52	918	30.31
30-Apr-03	57	10.55	23	3.96	0	0.00	4	0.33	84	14.84
31-May-03	56	12.50	22	4.95	12	2.50	85	11.70	175	31.65
Total	113	23.05	82	11.46	216	9.74	766	32.55	1177	76.80

Weight in Kgs.

Before stocking, small amount of chemical fertilizers (0.5 kg Urea; 0.5 Kg SSP and 0.5 Kg of MOP) were broadcasted on the water surface to initialize the plankton growth. Subsequently, poultry waste (include fresh droppings and left over feed) was added (approximately 1 kg/day) to the fishpond that fertilized the water as well as supplemented fish feed. Farmer also supplemented fish feed using rice bran/wheat bran and mustard oil cake. However, application of poultry waste was discontinued as and when required depending upon the observed water quality and plankton bloom.

A gravity aerator (Fig. 1) was designed and installed in the pond during November 2002 as dissolved oxygen was adequately supplemented through rainfall during monsoon period. It consisted of 2" PVC pipes connected with a small pump (0.5 hp) drawing water from a hand pump. Water emits as a water jet at an angle of 45° from the horizontal from 1" PVC pipe that created bubbling and splashing in the water surface and replenished the dissolved oxygen.

Fig. 1: Sketch of fish Pond with Aeration and Irrigation Water Regulation Mechanism



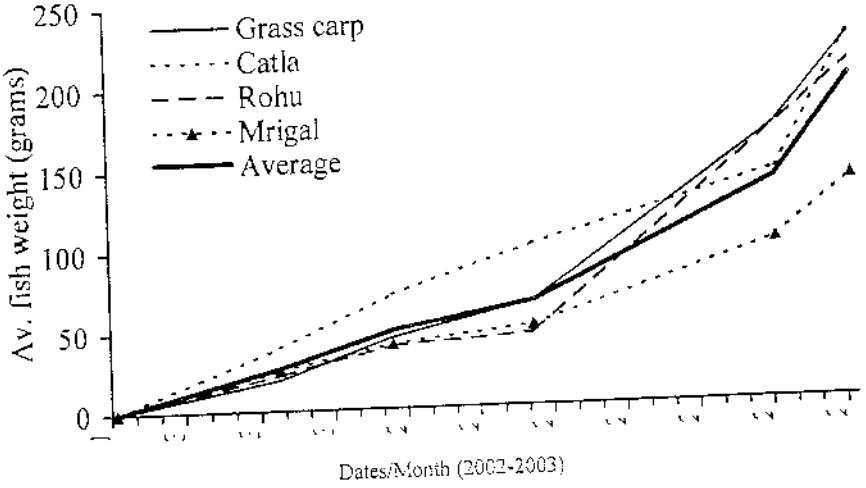
For better water exchange and mixing, 6" PVC pipes (Fig. 1) were installed such that the inflow water was delivered near to one end of the pond, while on the other end, outflow pipe had opening at the bottom of the pond that takes water from the bottom layer and delivers to the irrigation channels and convey to the rice-wheat fields. Near first end, a small channel conveys outflow water to the berseem (*Trifolium alexandrium*) plots. Farmer had routed water as and when required through the pond and applied water to rice-wheat fields or berseem plots. This way the integration of fish and crops was achieved at the farmer's field.

RESULTS AND DISCUSSION

The growth of different species of fishes in the pond was satisfactory (Fig. 2). The growth of catla and grass carp was better than rohu and mrigal. However, suddenly in the early morning of 20th January 2003, fishes started dying and a total of 918 fish died. The reasons may be the low water level (about 50 cm), and prolonged low temperatures (minimum temperatures fell to even below 3°C) along with overcast sky (that must have reduced the dissolved oxygen concentration in the bottom water layer). Bottom feeder mrigal was affected the most, column feeder rohu affected marginally, and surface feeder (catla and grass carp) were very less affected. Although, complete water exchange was

made with application of 5 kg slaked lime, this incidence was a set back to the farmer. Some live fishes were also sampled and shown to the farmer that still enough fishes are surviving. Before this incidence, the farmer was paying full attention to the fish culture, but afterwards, he paid quite less attention and even provided supplementary feed unevenly. The effect is clearly visible in Fig. 2 as the growth rate was reduced after 20th January 2003, which was expected to be rising due to increase in temperatures. After the incidence, farmer routed irrigation water 5-6 times till final harvesting and each time allowed water to flow through the pond for several hours during summer months. This indiscriminate flow of water reduced the natural feed (planktons) available in the pond.

Fig. 2: Growth Pattern of Different Species of Fish in the Fishpond



Three harvestings were conducted (including the dead fishes harvested on 20th January 2003) as given Table 1. Only 1177 fishes could be harvested which was 46.9% of the actual number of fishes that were stocked. The number of fishes (as per cent) harvested as compared to stocked was maximum for mrigal (98.7%), followed by Rohu (35%), Grass Carp (19%), and catla (15.7%). This indicates higher survival for mrigal as compared to other species. However, the number of surface feeders (Catla and Grass carp) must have reduced due to bird catching and poaching (as discussed below). A total production of 76.80 kg was obtained from 256m^2 of the fishpond that amounts to 3 t/ha of the fish production. It is about 23 kg more as compared to the farmers obtained during 2001-2002.

The production was less than expected. Based on the participatory response analysis of the farmer, following reasons are identified for reduced fish yield:

- Under the farmer's condition much mortality was expected due to change in environment for fish fry, intrusion of snakes, carnivorous fishes (*Clarias batrachus*, *Channa sp.*, etc.), etc.

- Catching of fish by birds (storks, etc.) was observed and reported by the farmer. However, the farmer tried to minimize such losses through special care (watch and ward).
- Loss of natural fish feed (planktons) due to excessive water flows through the fish pond,
- Aeration mechanism was not properly utilized,
- Poor supplementary feed made available during summer months, mostly owing to the disappointment due to mass fish mortality in January, and
- Poaching (unauthorized harvesting of fishes) that remained unrecorded, as the pond is in open field.

ECONOMICS

Economics of fish production was evaluated. The total cost of production included fish fry, fertilizers, feed, energy needed to replenish the water (including surface evaporation and seepage losses). However the farmer did not feel the cost on water lost through seepage and evaporation as he routed the irrigation water and the losses were of negligible quantity as compared to the total amount of irrigation water routed. The fishpond was dug for acquiring soil for house construction and hence the cost of digging was insignificant for the farmer. Table 2 shows a profit of Rs. 1743.00 that amounts to around Rs. 68,000/ha.

Table 2
Economics of fish Culture in the Fishpond

Item	*Quantity (Rs.)*	*Price (Rs.)*	*Cost (Rs.)*
Cost of fingerlings	2500 nos		375
Fertilizers		Lump sum	50
Rice bran	100 kg.	4.00 kg.	400
Mustard oil cake	70 kg	7.20 kg.	504
Total Cost			1329
Fish production	76.8 kg.	40.00 kg.	3072

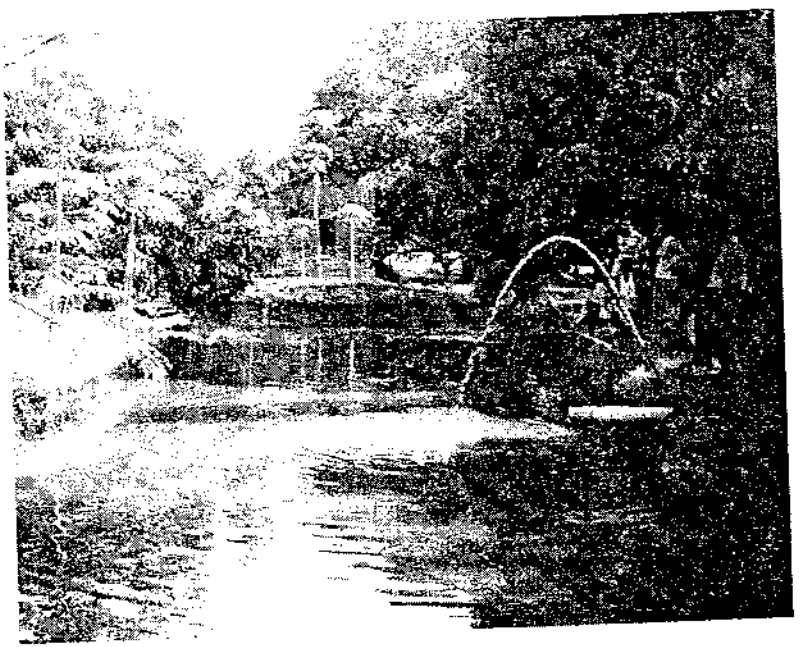
If the cost of digging is considered @Rs. 40/m^3 with repayment period of 25 years and interest rate of 8%, the annual installment comes to Rs. 1438.00. Hence, even after considering the cost of digging, the intervention was found to be economically beneficial. However, as the aeration system (costing around Rs. 1000 with annual installment of Rs. 150) and water exchange system (costing arund Rs. 3000 with annual installment of Rs. 350) were not utilized properly, hence their benefit could not be realized. It may be noted that only an enhaneed fish yield by 12.5 kgs/yr can compensate these costs.

FARMER'S PERCEPTION

During the course of undertaking the intervention, the farmer's perception was fluctuating. In the beginning, he was very much enthusiastic about growing the fishes in a better

way, but the incidence of 20th January 2003 discouraged him a bit. But, he realized that the growth of the berseem was enhanced by 20-30% and improved quality (softer leaves) when irrigated with water routed through the fish pond. However, it was difficult to realize such effect on wheat crop grown on a relatively larger area, which was irrigated with fish pond routed water as well as with direct flow of water. Project team discussed with the farmer from time to time about all pros and cons of the intervention and their experiences. In the end, although the total production was not as per expectations, but the farmer was fully convinced about the technique and felt that the fish farming with the irrigation water will be very much beneficial if managed carefully taking care of all the encountered problems. Apart from integrating aquaculture and agriculture, farmer is now convinced that horticulture can he added as an additional source of income by planting some vegetable and suitable fruit trees on and near the periphery of the pond. He is still enthusiastic and continuing to carry forward this integrated farming system approach on his farm in a better way (based on the lessons learnt).

Photo: Farmer's Fish Pond with Aeration and Water Regulation System



CONCLUSIONS

The participatory evaluation of a fish pond for multiple uses of irrigation water produced encouraging results, although the fish harvest was not up to expected level. Special efforts are needed to provide adequate knowledge and training to the farmers on technical aspects so that the fish production activities can be carried out more scientifically and

protect against losses of production due to various factors. The general perception of the farming community towards subsidies and availability of inputs free of cost or at subsidized prices are the major bottleneck felt in undertaking such activities. However, this aspect was properly taken care and the farmer fully participated in this endeavor and used his own resources to the extent possible. The farmer has shown keen interest in fish farming and now he is undertaking every activity carefully (based on the lessons learnt) to realize full benefit in the end of the current season ending in June 2004. The study got an overwhelming response from other farmers also and many farmers are showing keen interest in fish production in conjunction with agricultural production.

ACKNOWLEDGEMENT

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