TECHNICAL BULLETIN

No. 10, 2019

Adaptation of the Community Enterprise Approach for Intensification of Floodplain Fish Production in Chalan Beel

The Chalan Beel is one of the largest, most important watersheds in the northwestern part of Bangladesh of the districts of Natore, Sirajganj and Pabna. Inappropriate management practices, indiscriminate harvesting of brood-stocks and undersized fish including spawns and fry are depleting fish stocks and affecting biodiversity in the Chalan Beel area. Annual fish production in Chalan Beel was 12,217 t in 2005-2006 which was less than half of that achieved in 1982. Out of 54 threatened freshwater fish species of Bangladesh, 28 are from Chalan Beel, 5 of which are classified as critically endangered, 12 as endangered and the remaining 10 as vulnerable. Fisheries and cropping in the Chalan Beel region are interrelated. Most of the floodplains in this region are three-crop lands. Overuse of chemical fertilizers and pesticides for crop production adversely affects the fisheries resources.

This study consisted of field level adaptive trials in a community enterprise approach (CEA) on aquaculture for intensification of fish production in the Chalan Beel floodplain area. The CEA approach is popularly known as the Daudkandi model. The fundamental aspects of CEA are:

a. Community led collective enterprise initiatives based on existing resources where the major capital is raised through share subscriptions by the community. In case of floodplains, community means the land owners and people living in surrounding villages.

b. Ecologically sustainable initiatives without any negative impact on the local ecology where the community makes decisions for sustainable management of their resources.

c. There are opportunities for greater participation and decision making where every shareholder enjoys one voting right irrespective of the share amount.

The three-stage model also socially empowers the disadvantaged community members to participate in wider community-level decision-making processes with mainstream decision makers and contribute in the management of community enterprises, which enhance their skills, experience and confidence to be more entrepreneurial.

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The hypothesis of this action research was that the adoption of CEA would help increase fish production in the floodplains to more than 1.5 t/ha from the current level of about 265 kg/ha without any negative impact on the environment and bio-diversity, enhance community members' employment opportunities and incomes and improve their nutrition and health status.

SHISUK, a CEA pioneer, coordinated the project and played the key role in field interventions with communities at selected trial sites, while BSMRAU conducted research on biological and genetic aspects of fish and biodiversity. The Department of Fisheries (DoF), Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh provided technical and support through their district and upazila offices.

Thirty-nine potential sites were identified in three districts, of which 16 were short listed for adaptation interventions based on comparative advantages. Exposure visits and training were organized at the place of best practice (Daudkandi, Cumilla). Finally 4 sites were selected for the adaptation trials: a) Barmitola Beel (30 ha) at Raninagar, Singra upazila, Natore, b) Kusar Beel (60 ha) at Mohishluti, Tarash upazila, Sirajganj, c) Shingari Beel (100 ha), Bhangura, Pabna, and d) Raninagar Floodplain (20 ha) at Raninagar, Singra upazila, Natore.

Three targeted floodplains were transformed into a regulated watershed by connecting the surrounding villages and roads with necessary environment friendly structures. The semi-intensive pen culture method was followed for aquaculture in floodplain during the monsoon season. In the first year, minimum supplementary feed (less than 0.5% of body weight) was applied to assess the natural productivity of the floodplain. Based on the first year's results, stockings of species and number were intensified with supplementary feeding. The community was motivated and mobilized to reduce the use of pesticides and chemical fertilizers.

Baseline data of fish production were established based on two type of secondary data, KI interview on the previous year's catches and the lease values of the water bodies/ditches in the selected floodplains. The soil quality of two experimental sites was analyzed by the Soil Science Department of BSMRAU. Water quality parameters including temperature, dissolved oxygen, pH were measured fortnightly during the study period. The transparency and depth of water were also measured. Water samples were collected to study plankton species and abundance. Aquatic weeds were also studied at the study sites. Fish species diversity and fish production were surveyed before and after management of interventions. Fish growth performance was observed including percentage of length gain, specific growth rate (SGR%/ day), and growth pattern by length-weight relationship and length-length relationship of stocked fish in the command areas. Growth patterns of non-stocked fish were also investigated.

Results and Outputs

1. Out of four trials, two successful community enterprises of floodplain aquaculture, Raninagar Community Enterprise (30ha) and New Raninagar Community Enterprise (20 ha), emerged as models for the Chalan Beel area in Natore. The project was nominated by the Deputy Commissioner of Natore for the Bangabandhu National Agriculture Award 2015. The two other initiatives (Kusher Beel) in Tarash, Sirajganj and Shingari Beel in Bhangura, Pabna) were not successful. However, these provided good lessons for success in the future.

2. Huge outputs were generated in three years, which, translated financially, amounted to four times the cost of the project. Table 1 shows, as an example, the benefits derived from the project. In the project area, a total of 222.94 t fish, worth Tk. 269,57,562 was produced in excess of the pre-project baseline amount. In 2016, an additional 83.2 t fish was produced, worth Tk. 1,20,70,000. Fish productivity was greatly increased to 1.83t/ha from the baseline figure of about 0.3 t/ha. The research findings suggest that proper management in floodplain

aquaculture can ensure a congenial environment for both stocked and non-stocked fish for optimum growth and productivity.

3. The communities raised Tk 55.6 lakh as collective capitals by subscribing shares at the four trial sites. Out of this, Tk 42.25 lakh was raised by two successful initiatives at Sherkol involving 652 community shareholders/ households. With technical assistance from the project, the communities invested Tk 23.72 lakh in building connecting roads between and development of necessary structures (properly designed polders equipped with culverts) to regulate water flow and environment friendly fish pass.

Table 1. Floodplain fish production by the Raninagar Community Enterprise, Sherkole, Singra, Natore

Year	Size of water body	Total fish production (t)	Total price (Tk)	Yield (t/ha)
Baseline 2013-14	30 ha during monsoon		250,000	>0.3
2014-15		41.85	5,037,844	1.40
2015-16		68.06	6,926,866	2.27
2016-17		55.00	8,636,743	1.84

4. All aquatic weeds including floating, emergent, submerged, spreading, rooted plants with floating leaves and rooted plants gradually decreased after management.
5. Most of the non-stocked and stocked fish showed algometric growth and the remaining showed isometric growth.
6. The growth patterns of 10 non-stocked indigenous fish including Nandus nandus, M. tengara, P. sarana, M. pancalus, A. testudineus, A. mola. C. nama, C. fasciata, G. giuris and P. ticto were observed. The growth performances including length gain, % length gain, weight gain, %weight gain and SGR (%/day) of stocked fish were in satisfactory productive range.
7. Finfish diversity including non-stocked increased by 14.3% and 10.0% after management of the two experimental sites at Barmitola Beel and Kushar Beel, respectively, over the baseline levels.
8. Shellfish diversity increased after intervention at two experimental sites. Of 61 species, the relative abundance of majority of the fish (40-43%) was recorded as common, few 31-32%, very uncommon 15-17%, very rare 4-6 % and rare 5-7%.
9. Fish production was enhanced by about 4-10 times after management interventions. The soil pH and organic matter (OM) % differed significantly between the two experimental sites. Soil pH and OM% ranged from 6.79 to 7.10 and from 1.94 to 2.12, respectively, which were well within the standard ranges. The total N, P and K levels in soil were also within standard ranges.
10. The water quality parameters including temperature, dissolved oxygen, pH, total N, ammonium-N, transparency and water depth were suitable for fish culture. A total of 8 genera of zooplankton were recorded in two beels belonging to two groups including Rotifer (Asplanchna, Brachionus,Keratella, Polyarthra) and Crustacea (Cyclops, Daphnia, Diaptomus, Moina).

Outcomes and Benefits

The community based floodplain aquaculture initiative showed unequivocally the usefulness of the community approach in collective inputs, actions and shared profits for substantially increasing fish production and enhancing shareholders' incomes in the Chalan Beel region. Moreover, the community initiative reduced crop production costs in the crops-fisheries enterprises, increased crop yields and improved soil quality.

- Zero cleaning (water hyacinth/weeds) cost--the floodplain remains clean because of aquaculture activities like regular netting, feeding, etc.
- Zero tillage--the system of timely draining of the water when the seedlings are ready for plantation eliminates the need for tillage. On the other hand, it helps groundwater recharge, increases the use of surface water for irrigation and reduces drawing of groundwater for initial irrigation as the seedlings are transplanted using the soil moisture.
- Savings on fertilizer costs--the supplementary feed for fish and fish droppings contribute to the improvement of soil fertility and micronutrient status and minimizes pest infestation.

Recommendations

1. The suitability of the CEA (the Daudkandi Model) was successfully applied in a well organized, scientific way to increase fisheries and crop productivity and enhance growers' incomes, livelihood and socio-economic status. This technology of collective capital and entrepreneurship holds great promise for arresting and reversing productivity deterioration, environmental degradation and socio-economic downslide threatening the region.
2. Strong public and private measures are needed to conserve the ecological parameters and balances and regain fisheries diversity.
3. Further R&D work is needed to determine extrapolation domains in a broader national perspective.
4. Due consideration should be given to enhancing the ability to cope with situations resulting from climate change, such as, temperature rise and erratic rainfall, floods, droughts, etc.
5. CEA technology publicity and dissemination through systematic learning and IEC materials (video documentation), print and electronic media coverage, policy advocacy, etc. need to be strengthened.

Expected Impacts

- Bangladesh is now the fifth major fish producing country in the world. The country has substantially raised fish production from 7.5 lakh to 34.9 lakh t/yr in the last three decades. Out of the total production, around 20 lakh t comes from aquaculture. Several thousand ponds, about 0.4 million ha in area, in the villages comprise the most dominant source of fresh water fish in the country. Pond fish yield has reached a near saturation point (4.11 t/ha). Bangladesh has 2.8 million ha of flood plains, which are robust, renewable resources. The typical yield 265kg/ha, currently achieved from open floodplain fisheries is very low, compared with that derived from aquaculture. If the CEA model can be scaled up in additional 5.88% floodplains, an additional production of 0.5 million t fish is possible. That would greatly help attain the national target of around 45.1 lakh t/yr by the year 2021. Besides contributing significantly to national fisheries production floodplain fisheries can play an important role in poverty reduction and in achieving the Sustainable Development Goal (SDG).
- Bio-diversity (species of flora and fauna) can be maintained and improved though sustainable use of the floodplains by maintaining sanctuaries (not draining out water or filling up of low-lying basins).
- CEA based floodplain fisheries can play an effective role in halting the emerging trend of converting crop fields to fish ponds. Aquaculture in floodplains during the monsoon followed by cropping in the dry season will increase economic returns from land and make crop agriculture cost effective and profitable.

This bulletin has been prepared on the basis of technical information available from a completed CGP project of KGF, the details of which are given below:

Project code and title: TF 10-F: Adaptation of community enterprise approach for intensification of floodplain fish production in Chalan Beel; Principal Investigator: Dr. Binay Kumar Chakraborty, Department of Fisheries (DOF), Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh; project duration: May 2013 to May 2016

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