Aquaculture in reservoir fed canal based irrigation systems of India – a boon for fish production.

K.M. Rajesh[1], Mridula R. Mendon[1], K. N. Prabhudeva[2] and P. Arun Padiyar[3]

1: Department of Aquaculture, College of Fisheries, University of Agricultural Sciences Mangalore – 575002, Karnataka state, India
E- Mail – rajeshkm3@rediff.com
2: Regional Research Station, P. B. No. 24, Raichur – 584101, Karnataka state, India
3: M.P.E.D.A. Regional Center, 32-2-10, Prajasakthi Nagar, Vijayawada – 520010, India

The dependence of Indian agriculture on the southwest monsoon and its consequent vulnerability have necessitated maximum utilization of country's surface and ground water resources. Consequently, a large number of tanks and small reservoirs have been created to raise the gross irrigated area. Experience has shown that these water bodies offer great potential for fish culture through extensive aquaculture techniques. Raichur farmers have developed the technique of constructing storage tanks for the dual purpose of agriculture and aquaculture. In this way the canal water of Tungabhadra reservoir captured during the wet season is used to sustain aquaculture and agriculture activities for the entire year.

Raichur is one of the districts of Karnataka situated along the southwest part of India (Fig. 1). It is endowed with two major perennial rivers, the Krishna and Tungabhadra, which cover a total length of about 300 km. The water area of Tungabhadra reservoir is about 15,600 ha. There are 120 major and 218 minor tanks with water area of 4,299 and 728 ha, respectively. In this article, we will be discussing the system wherein these tanks, constructed mainly to store water to raise nursery and to save paddy crops during canal breaches, are successfully used for fish rearing.

Construction of water storage tanks

Paddy cultivation is the main agricultural activity in Raichur district followed by cotton, sunflower and groundnut. Since this region receives a very low amount of rainfall (average 687mm per year), which is confined to certain periods of the year, the major agricultural activities depend on the water supplied through the network of irrigation canals of Tungabhadra reservoir. Due to the length and complexity of the canal network, canals often breach leading to irrigation failure. This situation occasionally causes panic among rice cultivators, especially those at the tail end of the canals. To overcome this problem, the farmers started looking for ways to save their standing crop. As a result, the idea of having farm ponds has taken the shape of water storage tanks. A farmer having 4 ha of paddy land will have a storage tank of 0.4 ha size. Similarly, farmers having 16-20 ha land will have a storage tank as big as 1.5-2 ha. The depth of these ponds ranges from a minimum of 2.5 meters to a maximum of 4-5 meters. In exceptional cases, the depth may be as high as 7 meters. Similarly, the bund height above the ground level may range from 1.25-2.5 meters up to 3.25-4 meters depending on the size of the tank. All these water storage tanks are constructed using own or hired tractors. The bunds are compacted so strong that there is no leakage. In most cases grasses are grown on the bunds to prevent soil erosion. It adds to the natural beauty of the pond. Depending on the width of the bunds, horticultural crops like mango, coconut, banana, flowers and vegetables are grown. These water storage tanks are filled with water, using either irrigation canal facilities or rainwater. Pumps are used to store water above the ground level or to lift water from below the ground level.

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Feeding from a coracle

Aquaculture activity

The water storage tanks are also used for raising fishes. This activity starts during the months of July – August. Prior to stocking of fish seeds, pre-stocking management practices are followed. The water level in the pond is usually very low, as the water is utilized for irrigating paddy crops during April – May. If necessary, water is pumped out of the tanks using electrical, diesel or tractor pumps. Mahua oil cake is applied (250 kg/ha) to eradicate weed and carnivorous fishes. Lime is applied at the rate of 100 – 250 kg/ha. The ponds are also fertilized, usually with cow dung, which is locally abundant at the rate of 2,000 – 3,000 kg/ha depending upon the age of the tank. Some farmers use poultry droppings as an alternative. Inorganic fertilizers like super phosphate and urea are sometimes used as well.

The tanks are stocked either with fingerlings or stunted yearlings of Indian major carps with the stocking density varying from around 2,000 – 2,500 / ha to 10,000 as the case may be. In most cases, only Indian major carps such as catla, rohu and mrigal are cultured. Feeding is usually done with de-oiled rice bran and groundnut oil cake at the ratio of 3:1 or 4:1. In bigger tanks, the rice bran filled in gunny bags with holes and is tied to the bamboo poles. The bags are hung in different locations so that only half of the bag is immersed in the water. The tanks are regularly manured with cowdung at 15 or 30 day intervals. Inorganic fertilizers are also used when necessary. Normally

these supplementary fertilizer rates are restricted to 10 to 20 percent of the initial dosage.

The water in the irrigation canal is available once in 15 days for a period of four to five months in a year. Most farmers pump nutrient rich water from the tanks to irrigate paddy fields and again store fresh canal water in the tanks. After 10 to 12 months of rearing, the fishes are harvested using drag or cast nets. The average fish production is around 5 to 6 tons/ha/crop with a survival rate of around 50 to 60 percent. The individual average weight of fish at final harvest ranges from 750 g to 1,500 g. When stunted yearlings are stocked the survival rate increases to about 75 to 90 percent with individual average weight 1.5 to 2.0 kg. Most of the farmers sell their fish to merchants from neighboring districts. A few selected farmers even sell fishes to government organizations like the Karnataka Co-operative Fish Federation. Those farmers with small fishponds often sell fishes directly from the pond to consumers following multiple harvesting. The average price obtained by these farmers varies from Rs. 25 – 30 / kg. According to the reports available from Fish Farmers Development Agency (FFDA), Raichur, the net incremental income out of fish harvest is around Rs. 48,000 to 50,000 /ha.

It is estimated that more than 1,000 such tanks are already been constructed for dual agriculture/aquaculture use with two crops of paddy and one crop of fish generally harvested each year.

There is urgent need to educate the farmers on advantages of de-silting of tanks. It has also been reported by FFDA that the fish production has temporally been affected because the farmers have brought diseased fish seeds from Andhra Pradesh. Therefore, it is felt that enactment of an Act is very necessary on purchase of seeds to avoid spread of diseases.

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Although, these water storage tanks have thrown open vast potential for development of inland fisheries, a cautious approach needs to be adopted in expanding the area under fish culture to avoid conversion of large scale paddy fields into fisheries tanks adversely affecting the food grain production and rendering the surrounding areas saline. If the existing 22,000 ha of inundated area is utilized for construction of water storage tanks and consequently used for fish culture, it is expected that, with a moderate fish production of just over 4 tons /ha/crop, the fish production in this district can reach 100,000 tons /year from the present production of less than 4,000 tons per year. Further, the nutrient rich water from these tanks may even support sustainable agriculture of paddy mainly by reducing the use of inorganic fertilizers.