Success story 1 : Empowering Communities: Sustainable Income Generation through Fish Farming in Tribal Areas

Context

Many tribal areas possess a wealth of underutilized water bodies viz., farm ponds and tanks are having untapped potential. These resources, often neglected, hold the key to unlocking sustainable income generation and improved livelihoods for tribal communities. One of the most underexploited resources in many tribal areas is the abundance of natural and man-made water bodies. These ponds, lakes, and reservoirs often remain underutilized, serving limited purposes such as irrigation or livestock watering. Recognizing the potential of these water bodies for aquaculture can transform them into productive assets. Proper utilization of these resources can provide a dual benefit: enhancing local food security and generating a sustainable income source for the tribal communities. To tap this potential for livelihood security of tribal families, Krishi Vigyan Kendra, West Godavari (Venkataramannagudem) has surveyed the villages, where the water bodies are unutilised and implemented the demonstration of composite fish culture in those neglected water .

This success story elaborates on the power of composite fish culture, a technique that harnesses these water bodies for productive fish farming. By strategically combining different fish species with complementary feeding habits, composite fish culture maximizes resource utilization while minimizing adverse effects on environment.

Good practices followed

Benchmark survey and village selection

A Benchmark survey was conducted during the year 2016 and 2017 and found that each village in Buttaiahgudem and Polavaram mandals are having at least one pond to a maximum of six ponds. Pilot testing of the technology implemented in four selected ponds in Pandugudem and Bandarlagudem villages of Buttaiahgudem Mandal, West Godavari District which were KVK adopted villages during 2016-17. Further in the next year (2017-18) it was implemented in 13 villages of Buttaiahgudem and Polavaram Mandals of West Godavari District covering 25 ponds. In consecutive years, it was spread to 84 water bodies in three tribal mandals of West Godavari district.

Ponds selection and preparation

Small-scale rainwater harvesting structures, previously underutilized, were repurposed for storing irrigation water during the summer season. These bodies of water were subsequently converted into fish production units to enhance the livelihood opportunities of tribal farmers, promoting both income generation and nutritional security. Under the Tribal Sub Plan (TSP) activities implemented by Dr. YSR Horticultural University's Krishi Vigyan Kendra (KVK) in Venkataramannagudem, four such small water bodies (tanks) were selected for program implementation during the year 2016-17. These tanks were located in the villages of Pandugudem (2 tanks), Bandarlagudem (1 tank), and Kamaikunta (1 tank) within the Buttaiahgudem mandal of West Godavari District, Andhra Pradesh. Prior to implementation, the ponds underwent a preparatory process. This involved removing

weeds, sun-drying the beds for approximately 15 days, and applying lime at a rate of 200 kg ha-1 to improve buffering capacity, eliminate pathogens, and neutralize the pH alterations if any.

Fish species selection and stocking

Fish species were chosen based on local environmental conditions, market demand, and compatibility.

Types of Fishes Used in Composite Culture

In composite fish culture, selecting the right combination of fish species is critical. The common practice involves using species that occupy different layers of the pond and have varying feeding behaviours. Here are some typical species:

1. **Surface Feeders (e.g., Catla)**

    - **Catla (*Catla catla*)**: Primarily feeds on zooplankton found in the upper layers of the water column.
    - Benefits: Efficient use of the surface water layer and plankton resources, quick growth rates.

2. **Column Feeders (e.g., Rohu)**

    - **Rohu (*Labeo rohita*)**: Feeds on phytoplankton and detritus found in the middle layers of the water body.
    - Benefits: Utilizes the middle water column efficiently, contributing to the overall biomass of the pond.

3. **Bottom Feeders (e.g., Mrigal, Common Carp)**

    - **Mrigal (*Cirrhinus mrigala*)**: Feeds on detritus and decomposed organic matter at the bottom.
    - **Common Carp (*Cyprinus carpio*)**: Feeds on a variety of food sources, including benthic organisms and detritus.
    - Benefits: Cleans the bottom of the pond, preventing the accumulation of organic waste, and ensures efficient nutrient cycling.

4. **Aquatic Vegetation / Weed control (e.g., Grass carp)**
    - **Grass carp (*Ctenopharyngodon idella*)** : Grass carp are herbivorous, feeding primarily on aquatic vegetation.
    - Benefits: Natural method for controlling unwanted aquatic plants in ponds, lakes, and canals without resorting to chemicals

    Indian major carp (IMC) fingerlings were stocked in the stagnant water bodies at a density of 10,000 individuals per hectare, despite the absence of aeration. To ensure optimal growth, disease-free fingerlings of similar size and high growth potential were selected. Stocking events were conducted in the early morning hours (before 9:30 AM) to coincide with lower water temperatures.

Prior to introduction, the fingerlings underwent a 1-2 minute acclimation process in a 2% sodium chloride (NaCl) solution to minimize stress and promote successful adaptation to the pond environment. The initial mean weights of the stocked IMC species, Catla, Rohu, Mrigal, and Grass Carp, were recorded as 25.5 ± 1.09g, 21.5 ± 1.29g, 22.5 ± 1.08g, and 21.3 ± 1.06 g, respectively.

The composite fish culture strategy was employed, incorporating surface feeders (Catla), column feeders (Grass Carp and Rohu), and bottom feeders (Mrigal) in a ratio of 3:4:3 respectively. This approach, coupled with improved management practices, aimed to maximize the yield of table-sized fish within the limited water storage duration (Reddy et al., 2017).

Feeding and Management

Indian major carps (IMC) are known for their ability to utilize natural food sources in ponds, making them a good option for low-cost aquaculture. However, for optimal growth and production, proper feeding and management practices are crucial. To cultivate plankton within the ponds, various manure sources were utilized, including cow dung, goat dung, and poultry excreta. This continuous fertilization stimulated the growth of both phytoplankton (plant-based plankton) and zooplankton (animal-based plankton), providing a natural food source for the fish. The Krishi Vigyan Kendra (KVK) provided training to tribal farmers on improved feeding practices, including proper feed selection, feeding quality, and optimal feeding times. These trainings aimed to enhance overall fish productivity. Additionally, the KVK supplied critical feed inputs in the form of concentrated fish feed. The fish diet consisted of a mixture of rice bran and commercially produced, protein-rich pelleted feed containing 24% protein. This sinking feed, with a diameter of 2-4 mm, was broadcasted across the pond embankments (dykes) to meet the fishes' nutritional requirements. The feeding regime was determined based on the fish's body weight.

Water quality management

Water quality parameters like dissolved oxygen (DO), pH, and ammonia were regularly monitored since it is very crucial. Maintaining good water quality ensures optimal fish health and growth.

Health management

Regular monitoring for fish diseases and implementing preventive measures are important for maintaining a healthy fish population.

Harvesting

A staggered harvesting approach was implemented to ensure continuous fish production and supply throughout the year. Drag nets were employed to harvest fish after a culture period of 8-10 months. Grass carp exhibited the highest growth and final size, followed by Catla, Rohu, and Mrigal . This superior performance in grass carp is attributed to their ability to utilize

grasses growing on the pond embankments and marginal weeds as a food source. Partial harvesting commenced after 8 months, followed by periodic harvests using cast nets on a weekly or bi-weekly basis depending on market demand. This strategy allowed tribal farmers to obtain a regular fish catch, ranging from 50 to 100 kg per week, which they were able to sell at a price of ₹120 per kg. Consequently, individual pond yields ranged from 2162 kg/acre to 2883 kg/acre, with an average production of 2412 kg/acre. The average gross income generated from fish sales reached approximately ₹2,89,440 per pond, based on an average market price of

Impact of composite fish culture technology

Composite fish culture, also known as polyculture, is an innovative and sustainable aquaculture practice that involves cultivating multiple compatible fish species in a single water body. This method leverages the diverse feeding habits of different fish species to maximize the utilization of natural resources within the pond. By stocking a variety of fish species such as surface feeders, column feeders, and bottom feeders, composite fish culture ensures efficient use of available food resources and space, leading to higher yields and reduced ecological impact. This practice not only increases productivity but also contributes to the overall health and balance of the aquatic ecosystem.

Harvesting of fish after 10 months of stocking and management

This approach offers a promising pathway for tribal communities to achieve:

1 **Increased income and financial security:** Fish farming provides a steady source of income, empowering communities to improve their economic well-being.
2 **Enhanced food security and nutrition:** Freshly produced fish contributes to a nutritious diet, promoting overall health and well-being.
3 **Sustainable utilization of resources:** Composite fish culture utilizes water bodies responsibly, promoting environmental conservation practices for future generations.

Key Principles:

1. **Species Compatibility**: Selection of fish species that can coexist without significant competition for food or habitat.
2. **Ecological Balance**: Maintaining a balanced ecosystem within the pond by leveraging the different feeding levels and habits of the fish.
3. **Resource Optimization**: Efficient use of natural food resources, supplemented by additional feed if necessary.
4. **Sustainability**: Practices that promote environmental health and long-term productivity of the water body.

This guide delves into the practical implementation of composite fish culture in tribal areas, emphasizing good practices for successful fish farming. It empowers communities to transform underutilized water bodies into vibrant sources of income and sustainability, fostering a brighter future for tribal development.

Conclusion and way forward

One of the most underexploited resources in many tribal areas is the abundance of natural and man-made water bodies. These ponds, lakes, and reservoirs often remain underutilized, serving limited purposes such as irrigation or livestock watering. Recognizing the potential of these water bodies for aquaculture can transform them into productive assets. Proper utilization of these resources can provide a dual benefit: enhancing local food security and generating a sustainable income source for the tribal communities.

In this context, composite fish culture presents a promising opportunity for the tribal areas. By integrating this practice, underutilized water bodies can be transformed into thriving hubs of aquaculture activity, fostering economic growth and promoting sustainable development.

This study investigated fish production and water quality within small-scale water bodies in the upland regions of Buttaigudem and Polavaram Mandals, West Godavari District. The average fish yield from these ponds was recorded at 2400 kg/acre. The findings suggest that these underutilized water bodies hold promise for polyculture fish production under semi-intensive management practices. This approach, coupled with effective natural resource utilization and conservation efforts, has the potential to further enhance production yields and increase income generation for local communities. This

technology demonstration successfully established the potential of semi-intensive fish culture in tribal areas to generate increased income and improve nutritional security for local communities.