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A Sustainable Approach to Resource Optimization Yielding Higher Profitability: Paddy-Fish Farming System

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Paddy-Fish farming offers tremendous potential for food security and poverty alleviation in rural areas. It provides an efficient way of using the same land resource for production of both fish and paddy concurrently or serially. Having rice in the fields and fish in the water is an epitome of abundance and sufficiency. No other combination would seem to be so fundamental and nutritionally complete in the Asian context.

Keywords: Concurrent, alternate culture.

Introduction

Paddy-fish farming is practiced in many countries in the world, particularly in Asia. While each country has evolved its own unique approach and procedures, there are also similarities, common practices and common problems. In the present context of Indian agriculture, out of 45.5 million hectares of cultivated land under paddy, 20 million hectare is suitable Paddy-Fish culture mainly in rainfed medium land, water-logged or lowland and in canals commands. However, only 0.33 hectare is actually under Paddy-Fish culture. And most of the system being adopted in the country is the concurrent system of Paddy-Fish cultivation. The low degree in adoption, low yield, exploitation is primarily due to the introduction of high yielding varieties involving the use of pesticide that greatly impeded fish culture in paddy fields, shorter rearing period of fish, insufficient water availability.

History

It is assumed that paddy-fish farming with stocked fish started in China. Archaeological and written records trace paddy-fish culture in China over 1700 years ago and the practice may have started when fish farmers with excess fry released them in their rice fields (Li 1992; Cai and Wang 1995). Global recognition of, and interest in, the potential of paddy fish farming in helping combat malnutrition and poverty has been well known for a long time. The FAO Rice Committee recognized the importance of fish culture in rice fields back in 1948 (FAO 1957). It was not until the late 1980s when global interest in rice-fish farming was renewed. Rice-fish farming was identified as a project of the International Rice Research Institute's (IRRI) Asian Rice Farming Systems Network (ARFSN). Rearing of fish along with paddy is an old practice in India. It is suggested that fish culture in paddy field was introduced into South-East Asia from India about 1500 years ago. It has largely been practised in a traditional way in the coastal state of Kerala and West Bengal. However, it has not been popular, although considerable potential exists, in West Bengal, Assam, Bihar, Orissa and Andhra Pradesh (Ghosh *et al.* 1985).

Types of ecosystems

IRRI (1993) has categorized rice land ecosystems into four types: irrigated rice ecosystem, rainfed lowland rice ecosystem, upland rice ecosystem, and flood-prone rice ecosystem. Apart from the upland system, the others are characterized by wet rice cultivation. Asia

accounts for over 90% of the world's production of rice and almost 90% of the world's rice land areas. Regardless of the ecosystem, fish can conceivably be raised wherever wet rice cultivation is practiced. The main determinant in the feasibility of raising fish in any given rice land is the availability of water and the water holding or dike-forming characteristic of the soil.

Impact of paddy-fish farming on the ecosystem

The aquatic fauna plays an important role in nutrient recycling. Whether as primary or secondary consumers, animals excrete inorganic and organic forms of nitrogen and phosphorus and are a major factor in the exchange of nutrients between soil and water. Fish plays an important role in the nutrient cycle of the rice fi eld ecosystem. Cagauan (1995) lists ways how fish may influence the nutrient composition of the flood water and the oxidized surface soil as well as the growth of the rice plant. It contributes more nutrients to the rice field through faeces excretion as well as through decomposition of dead fish. By making the soil more porous when fish disturb the soil-water interface, fish increase the nutrient uptake by rice. Finally, fish assist in the recycling of nutrients when they graze on the photosynthetic biomass and other components of the ecosystem. Cagauan *et al.* (1993) found that a rice fi eld with fish has a higher capacity to produce and capture nitrogen than one without fish.

Types of paddy-fish farming systems

1. **Concurrent culture:** The growing of fish simultaneously with rice is what comes to mind for most people when paddy-fish culture is mentioned. This is often referred in short as "rice + fish" (Yunus et al. 1992; Roger 1996). The timing in stocking fingerlings is crucial since if stocked too soon after the rice is planted, some fish species are likely to damage the newly planted seedlings (Singh et al. 1980), and if too late there may be a multitude of predator species in the fields. For the management of the rice crop, compromises are made with respect to the application of fertilizer, which is done judiciously. One constraint of the concurrent system is that the growing period of the fish is limited to that of rice, which is usually 100 to 150 days. Consequently, the harvested fish are small, especially if early-yielding rice varieties are used.
2. **Concurrent but compartmentalized culture**: Here the rice and fish are cultured side by side sharing the water source. One advantage of this set-up is that fish rearing becomes independent from rice, making it possible to optimize the conditions for both rice and fi sh. However, the synergistic effect of rice and fish on each other is no longer present. Generally, there is only a one-way influence from fish to rice in the form of nutrient-enriched water.
3. **Rotational culture:** Raising fish during the fallow period or as a winter crop is practiced to make use of the rice fi eld when it otherwise would not be used (Ni and Wang 1995). In Indonesia, particularly West Java, the art of rotating fish with rice has been developed to a greater degree and can be traced back to 1862 or earlier. The only physical modification required is the raising of the dike to hold water. Without the rice, the entire rice fi eld can be operated and managed just like a regular fish pond from three to six months a year.

Conclusion

Integrating aquaculture with agriculture results in an efficient nutrient use through product recycling since many of the agricultural by-products can serve as fertilizer and feed inputs to aquaculture (Willmann et al. 1998). This in turn leads to more fish for the household and can put more cash in the pocket. An important side effect is a cleaner and healthier rural environment. At present rice-fish farming at best is considered a novelty and at worst a fringe activity that does not merit serious consideration in the formulation of national rice production strategies, and is often relegated to a limited set of projects. In order to realize this potential, there is a need for a fundamental shift in attitude towards rice-fish farming in all sectors involved in rice production, from policy-makers to extension officers and farmers.

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