Time to Reappraise Rice-Fish Culture

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Rice-fish culture has been practiced for about 1,500 years in Asia. The most common system in use at present is rearing fingerlings or fattening fish to market size in rice fields, concurrently with the rice crop. The fish are either deliberately stocked or enter by chance when the fields are flooded. Many species are used especially omnivorous or detritivorous finfish like the carps, tilapias and mullets and to a lesser extent catfishes, snakeheads and crustaceans.

Declining Practice

While concurrent rice-fish culture has long been a source of important extra income for rural households in some localities, it has yet to become a major source of fish supply. In fact, the practice has been declining in, e.g., parts of Indonesia and all but disappeared in China and Japan. This decline has taken place in spite of a high level of institutional support for and developmental agency interest in the expansion of rice-fish culture, spurred no doubt by the obvious attractions of a high-value, high-protein cash crop from water bodies which are generally under constant supervision and in which natural fish feeds abound.

The reasons for this decline and for the failure of expansion programs are complex. They derive in part from the adoption of technologies associated with high yielding rice varieties, particularly the widespread use of pesticides which have adverse (lethal and sublethal) effects on fish and on the natural food chains on which they depend. There are, however, other less easily defined factors, including the motivation necessary for a farmer to change work and social habits in order to manage and husband a fish crop together with the more important rice crop. Moreover the yields of fish from rice-fish systems in which no supplemental feeds are given can be discouragingly low, especially in association with rice varieties with a short growing season: usually less than 100 kg fish/ha/rice crop.

Supplemental feeding of the fish and/or additional fertilization of the rice fields during concurrent rice-fish culture can increase yields to around 200 kg/ha/rice crop.

The systems which maximize fish production, and increase profitability and concomittant build-up of soil fertility are *rotational* rice-fish culture systems. In these, the rice-field is used exclusively for fish production for variable periods and yields of up to 700 kg/ha/equivalent rice growing season are possible.

New Factors

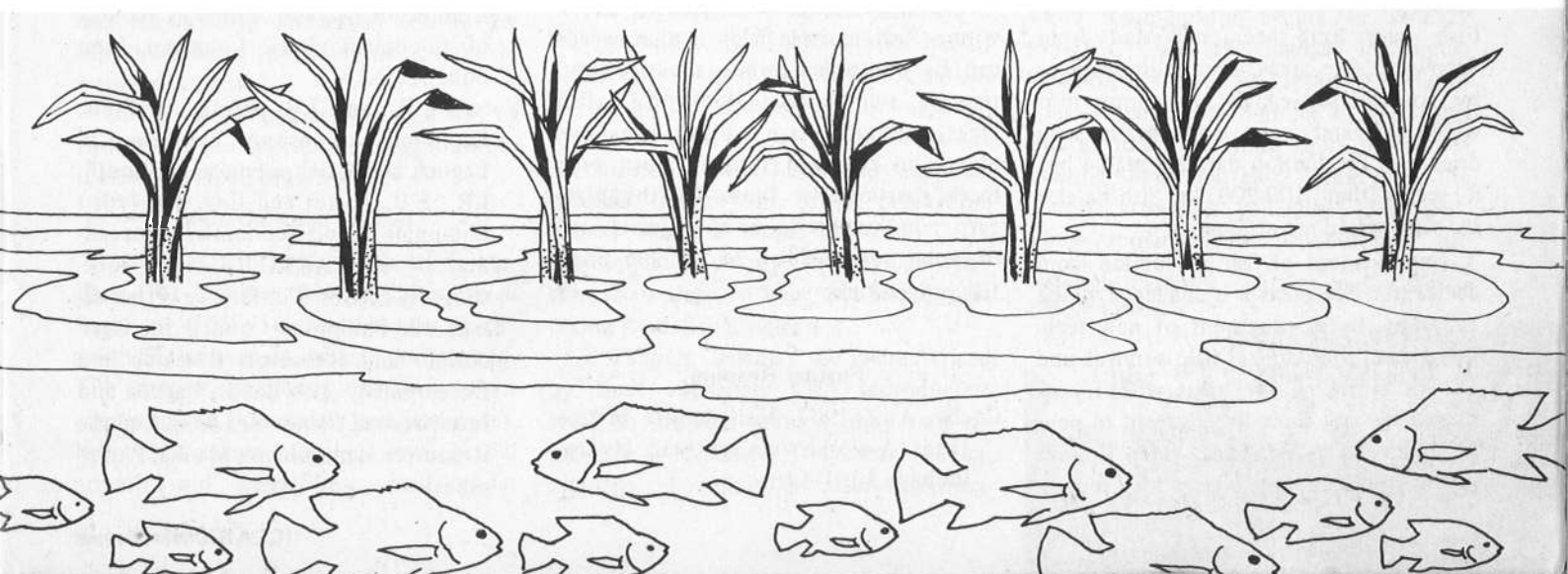
Some important new factors, described below, have emerged which call for reappraisal of rice-fish culture and the development of new technologies and management systems.

Anticipated changes in rice agronomy: implications for rice-fish culture

Economic difficulties in many Asian developing countries are forcing a reassessment of the production costs of high-yielding rice varieties. Many farmers are unable to purchase the required quantities of inorganic fertilizers and pesticides. The consequence has been a considerable research effort, particularly by the International Rice Research Institute, to evaluate organic fertilizers, such as the aquatic fern *Azolla,* and pesticides from natural sources, such as Neem oil and Neem cake derived from seeds of the Neem tree (*Azadirachta indica,* widely grown in India and Africa for its insect-repellent and medicinal value).

The results have been encouraging. It is clear that organic fertilizers can make considerable contributions to rice field fertility and that natural pesticides, notably Neem oil and Neem cake products, can control a wide spectrum of rice pests; Neem products are non-toxic to fish but their effect on aquatic food chains requires further research.

New technological development and trials are needed to assess and to demonstrate these benefits and to develop farm management approaches that take into account farm level constraints and opportunities. Considerable income improvement for farm households has been reported from areas where individual holdings of rice land have been partially converted to small-scale tilapia hatchery



Trenches for fish in rice paddies for concurrent rice-fish culture. Photo by R.S.V. Pullin.

ponds in the Philippines. Currently buoyant fish and fish fingerling markets and cheap supplemental fish feeds, particularly rice bran, can give rice farmers scope for a much more flexible approach to partial or complete rice-fish rotation on their lands than in the past, assuming, of course, that water availability is not limiting.

Fish production from deepwater rice ecosystems

Deepwater rice is a major crop in Asian floodplains and requires little management after establishment of the crop. In some countries, such as Thailand, water management is highly developed whereas in others, particularly in the Indian subcontinent, it is poor or lacking. Fish have long been harvested from deepwater rice areas, usually by traps or by constructing canals and sumps into which fish and water drain as the area dries out. Production data are scarce but it seems that 100-200 kg fish/ha/rice growing period are attainable.

Improvement of fish production from deepwater rice areas is a challenge which calls for the development of new technologies to maximize fish survival and growth. Stocking the areas with fry or fingerlings and their containment in pens or cages are possibilities which deserve investigation. Such practices may require changes in farmers' work habits to feed, husband and safeguard fish.

Raising herbivorous fish in rice-fields

From first principles, it might appear highly risky to introduce fish which eat aquatic plants into rice growing areas, lest they attack the rice crop. However studies on grass carp and herbivorous tilapias have shown that such fears are groundless and that these fish do not attack established rice plants in rice fields.

The most promising herbivorous tilapia in terms of growth rate is *Tilapia rendalli* which has so far seen little use in Asia.

The major benefit of growing herbivorous fish in rice fields is that weeds can be controlled, while the rice crop remains unmolested. Herbivorous fish feces could also have a highly beneficial effect on rice-field fertility since such feces, particularly those of the grass carp, are known to be a major source of pond soil fertility in Chinese pond fish polyculture. •

Further Reading

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