Food and Agriculture Organization of the United Nations

SAVE AND GROW FARMING SYSTEMS
FACT SHEET 8

RICE/AQUACULTURE

Agro-ecological zone
Monsoon paddy systems
Main cereal Rice
Other products
Finfish, crustaceans, snails

A richer harvest from paddy fields

A field of rice in standing water is more than a crop – it is an ecosystem teeming with life, including ducks, fish, frogs, shrimp, snails and dozens of other aquatic organisms. For thousands of years, rice farmers have harvested that wealth of aquatic biodiversity to provide their households with a wide variety of energy- and nutrient-rich foods. The traditional rice-fish agro-ecosystem supplied micronutrients, proteins and essential fatty acids that are especially important in the diets of pregnant women and young children.

During the 1960s and 1970s, traditional farming systems that combined rice production with aquaculture began to disappear, as policies favouring the cultivation of modern high-yielding rice varieties – and a corresponding increase in the use of agrochemicals – transformed Asian agriculture. As the social and environmental consequences have become more apparent, there is renewed interest in raising fish in rice fields.

There are two main rice-fish production systems. The most common is concurrent culture, where fish and rice are raised in the same field at the same time; rotational culture, where the rice and fish are produced at different times, is less common. Both modern short-stem and traditional long-stem rice varieties can be cultivated, as can almost all the important freshwater aquaculture fish species and several crustacean species.

In China, rice farmers raise fish in trenches up to 100 cm wide and 80 cm deep, which are dug around and across the paddy field and occupy about 20 percent of the paddy area. Bamboo screens or nets prevent fish from escaping. While fish in traditional rice-fish systems feed on weeds and by-products of crop processing, more intensive production usually requires commercial feed. With good management, a one-hectare paddy can yield from 225 to 750 kg of finfish or crustaceans a year, while sustaining rice yields of 7.5 to 9 tonnes.

KEY POINTS

A one-hectare paddy can produce up to 9 tonnes of rice and **750 kg of fish** a year.

Fish raised with rice provide protein, essential fatty acids and **a wide range of micronutrients**.

Fish are **biological control agents** for weeds, insect pests and vectors of serious diseases, such as mosquitoes.

High yields, fish sales and savings on inputs produces income up to **400 percent higher** than income from rice monoculture.

In China, ricefield aquaculture production reached more than **1.2 million tonnes**.

The Indonesian Government has launched a '**one-million hectare rice-fish programme**'.

The combination of different plant and animal species makes rice-fish systems productive and nutritionally rich. Equally important are the interactions among plant and animal species, which improve the sustainability of production. Studies in China found that the presence of rice stem-borers was around 50 percent less in rice-fish fields.

A single common carp can consume up to 1 000 juvenile golden apple snails every day; the grass carp feeds on a fungus that causes sheath and culm blight.

Weed control is generally easier in rice-fish systems because the water levels are higher than in rice-only fields. Fish can also be more effective at weed control than herbicides or manual weeding. By using fish for integrated pest management, rice-fish systems achieve yields comparable to, or even higher than, rice monoculture, while using up to 68 percent less pesticide. That safeguards water quality as well as biodiversity.

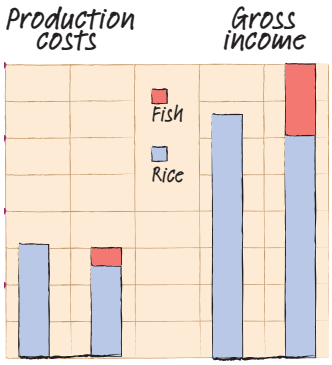
The interactions among plant and animal species in rice-fish fields also improve soil fertility. The nutrients in fish feed are recycled back into fields through excreta and made immediately available to the rice crop. Reports from China, Indonesia and the Philippines indicate that rice-fish farmers' spending on fertilizer is lower.

Cultivating fish reduces the area available for planting rice. However, higher rice yields, income from fish sales and savings on fertilizer and pesticide lead to returns higher than those of rice monoculture. Profit margins may be more than 400 percent higher for rice farmers culturing high-value aquatic species.

Raising fish in rice fields also has community health benefits. Fish feed on the vectors of serious diseases, particularly mosquitoes that carry malaria. Field surveys in China found that the density of mosquito larvae in rice-fish fields was only a third of that found in rice monoculture. In one area of Indonesia, the prevalence of malaria fell from 16.5 percent to almost zero after fish production was integrated into rice fields.

Combining rice and aquaculture also makes more efficient use of water. However, rice-fish farming requires about 26 percent more water than rice monoculture. In areas where water supplies are limited, the introduction of rice-fish systems is not, therefore, recommended. However, FAO has estimated that almost 90 percent of the world's rice is planted in environments that are suitable for the culture of fish and other aquatic organisms.

Economics of rice-fish farming and rice monoculture, Indonesia (US$/ha)



In China, aquaculture in rice fields has increased steadily over the last two decades, and production reached 1.2 million tonnes of fish and other aquatic animals in 2010. New opportunities for diversifying production are opening up in Indonesia, where the *tutut* snail, a traditional item in rural diets, is becoming a sought-after health food for urban consumers. The resurgence in rice-fish farming is being actively promoted by the Government of Indonesia, which recently launched a 'one-million hectare rice-fish programme'.

While there is compelling evidence of the social, economic and environmental benefits of aquaculture in rice farming systems, its rate of adoption remains low outside of China. Elsewhere in Asia, the area under rice-fish production is only slightly more than 1 percent of the total irrigated rice area. Interestingly, the rice-fish farming area is proportionally largest outside Asia, in Madagascar, at nearly 12 percent.

There are many reasons for the marginality of rice-fish farming, including lack of awareness of its benefits, the availability of low-cost pesticides and smallholder farmers' limited access to credit for investment in fish production. Overcoming those barriers is difficult because multi-sectoral policymaking is involved.

Rice-fish farming needs to be championed by agricultural policymakers and agronomists who recognize the benefits of integrating aquaculture and rice, and can deliver that message to rice-growing communities. Just as agricultural development strategies once promoted large-scale rice monoculture, they can now help to realize the potential of intensive, but sustainable, rice-fish production systems.

Adapted from:
Save and Grow in practice: maize, rice, wheat. A guide to sustainable cereal production (FAO, 2016).
ISBN 978-92-5-108519-6
The book can be downloaded in PDF from:
http://www.fao.org/3/a-i4009e.pdf
For a print copy, write to: publications@fao.org

Contact
Plant Production and Protection Division
Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla, 00153 Rome, Italy

AGP-Director@fao.org
www.fao.org/save-and-grow

I5311E/1/12.15

Recommended citation: FAO. 2015.
Save and Grow Farming Systems Fact Sheet - 8.
Rome. https://doi.org/10.4060/i5311e