Introduction of aquaculture to rice farmers, Guyana and Suriname

GENERAL INFORMATION	
Sources of information of the practice	Introduction of aquaculture and other integrated production management practices to rice farmers in Guyana and Suriname. Inception and evaluation mission report. FAO, Halwart, M. B. Chakalall, W. Settle, R.C. Joshi 2004 and 2006. Rome Introduction of aquaculture and other integrated production management practices to rice farmers in Guyana and Suriname. T. Geer, R. Debipersaud, H. Ramlall, W.Settle, B. Chakalall, R. Joshi, M. Halwart. FAO Aquaculture Newsletter, Food and Agriculture Organization of the United Nations (FAO)
Relevant contacts	Matthias Halwart, FAO. Email: Matthias.Halwart@fao.org
Useful links	-
INFORMATION ABOUT THE PROGRAMME OR PROJECT PROMOTING THE PRACTICE (IF APPLICABLE)	
Programme or project	Introduction of aquaculture and other integrated production management practices to rice farmers in Guyana and Suriname. (TCP/RLA/3003)
Time frame	2004 -2006
Donor	FAO
Implementer of the programme or project	IGO: FAO Government Organisations: Governments of Guyana and Suriname, Guyana Rice Development Board (GRDB), Rice Producer Association
LOCATION OF THE PRACTICE	
Region	South America
Country	Guyana and Suriname
Province, Districts, Villages	Suriname: Niew Nickerie Guyana: East Berbice-Corentyne (Region 6)
Climatic zone	Perhumid
Other descriptive information	The rice-growing areas in the two countries which were targeted by the project are in close proximity
INFORMATION ABOUT THE PRACTICE	
Practice category	Managing natural resources sustainably
Practice type	Technology for improving farm productivity sustainably
Sector	Fisheries and aquaculture management and conservation
Institutions fostering the practice	As Implementer of the project
Beneficiaries of the practice	180 rice farmers who participated in the training sessions and other rice farmers who attended the field day, 16 rice extension officers
Users of the practice	180 farmers who participated in the IPM and aquaculture participatory training exercises in Guyana and Suriname
Natural resource used or accessed (if applicable)	Land, water, high yielding rice seeds, red tilapia, armoured catfish
BRIEF DESCRIPTION OF THE PRACTICE	
Background/problem statement	In Guyana, approximately 140,000 hectares of arable land is under rice cultivation and the industry is the largest private sector activity. It employs over 100,000 people directly and indirectly. In Suriname, about 42,000 ha is

	under rice cultivation. Niew Nickerie is the main rice growing area in the country. The rice industry is the major economic activity and employer in the area. However, profitability from rice farming in both countries has been declining with the increasing cost of cultivation and declining international prices for rice. The increasing use of chemicals (insecticides, herbicides, fentin acetate for snail control) over time has resulted in additional costs, as well as increased costs to the environment and human health, with questionable corresponding returns in yield increases. In view of this situation, rice farmers have been looking for ways to reduce input costs in paddy cultivation and to introduce other crops into the farming system. Aquaculture (cultivation of natural produce of water such as fish, shellfish, algae and other aquatic organisms) has been recognized as one of the diversification crops for inclusion in the rice farming systems; however, significant use of crop-protection chemicals in close proximity will threaten fish production in the rice fields or adjacent pond areas. The project aimed to provide technical support to address these constraints.
Approach followed	The project sought to introduce aquaculture as a fundamental component and reinforcement of IPM strategy, with training of rice extension staff being an integral part of the strategy. It was designed to follow the Training of Trainers (TOT) methodology to rapidly increase the skills of rice extension staff, coupled with the Farmer Field School (FFS) approach to empower farmers in the use of the new technology. In order to get a picture of the rice cultivation and aquaculture practices in both countries and subsequently develop a training curriculum, two FAO Technical Cooperation among Developing Countries (TCDC) consultants, held discussions with major stakeholders, including the Guyana Rice Producers Association, the Guyana Rice Development Board (GRDB), rice farmers and rice extension personnel at the beginning of the project. The FFS IPM/rice-fish curriculum, one of the key outputs of the project, was then used in a 15-week season long Training of Trainers programme at a TOT plot in the Black Bush Polder area, Corentyne, Guyana. Sixteen rice extension officers from both Guyana (12) and Suriname (4) were exposed to theoretical and practical aspects of FFS training in rice IPM and aquaculture principles. This included topics such as proper land preparation, better water management, rice yield loss experiments, pest and natural enemy identification, pond preparation, fish stocking, fish health, fish feed sourcing and management, construction of lift net and traps among others. Following the weekly training sessions, 16 extension staff fanned out to conduct six FFS in the Corentyne area, with an average of 15 small famers (less than 15 –20 acres) per FFS. Farmers from Suriname and Guyana were selected based on their interest. The farmers usually met once a week, for several hours, observing and analysing the rice agroecosystem, doing experiments in the field, constructing their own tools and implementing and discussing rice and fish-related topics. On the rice side, for example, farmers cut rice leaves to mimic damage of leaf-feading insects and compared the individual harvest of these damaged plants to the harvest of undamaged plants – and found out that yields were the same, thus learning through their experiments of the compensatory growth potential of rice plants. For the fish, farmers experimented with locally produced on-farm feeds versus using prepared feeds and thus learned about the economic value of many previously unused resources which are available on the farm. Also, at the end of the field school, each participant was able to construct his own pond and build his own liftnet from locally available material. Plots in farmers' homesteads were planted with various high yielding local rice varieties and the ponds connected to the rice fields in Guyana were

	stocked with Red tilapia and in Suriname with armoured catfish (*Callichthys callichthys*). The choice of fish species reflected farmer preference. Red tilapia was provided by Mon Repos Aquaculture Station in Guyana, whereas the indigenous armoured catfish fingerlings were caught in the wild. Red tilapia is not a native fish species, but was introduced in Guyana as early as 1958 and is well established in the natural environment with no documented environmental negative effects. Farmers experimented with producing feeds from agricultural by-products and kitchen waste on their own farms. In other cases, they used commercial fish feeds. Participants regularly monitored water quality as part of the curriculum. As the rice in the plots approached harvest time, a small field day exercise was held at each plot, accomodating cross visits by farmers from other plots. The harvest of rice and fish and all related issues such as rice quality, fish mortality, self consumption, marketing, were discussed in detail among farmers and trainers. Since market opportunities and constraints had been identified as an important issue, a separate study by a Guyanese expert was conducted and a special report is available. All of these activities culminated in a General Field Day at the TOT site in Black Bush Polder, Guyana. The general aim of the Field Day was to inform the persons directly associated with the project and the general public of the objectives of the project and the progress to-date. The Field Day included visits to rice-fish trial plots, a photo exhibition, examination of trial progress and presentations by consultants, extension staff and the trainees themselves. In the second season, six additional plots were established in other rice-growing regions in Guyana. Four plots were also established in Suriname. The TCDC consultants also supported these activities in additional plots in both Guyana and Suriname, made possible by the proximity of the rice-growing regions in the two countries. A farmer exchange visit was again facilitated, allowing for valuable exchange of views and experiences between farmers from both countries. The project also provided important additional training activities on aquaculture for rice extension staff, including attendance to the Integrated Freshwater Fish Farming (IFF) course in Wuxi, P.R China and a tilapia fish production course organized by the Mon Repos Aquaculture Station in Guyana.
Innovative elements	This project represented the first occasion where the use of Training of Trainers (TOT) methodology and the FFS approach including the development of a curriculum (currently being published by FAO) have been used for the introduction of aquaculture into rice-based farming.
Impacts on natural resource base	Actual: There is a major reduction in the use of pesticides after the introduction of IPM/FFS technologies. The average number of pesticide applications in the project area was reduced from 10 applications per crop to between 0-3 applications per crop. The drastic reduction of fish-toxic pesticides not only resulted in increased rice yields but also showed other beneficial impacts: Farmers reported that they have observed an increase in fish and other aquatic biodiversity in rice fields. Expected: With the adoption of the new technologies the aquatic fauna is expected to recover quickly ultimately resulting in a well-balanced rice-based ecosystem that exhibits high resilience towards external shocks and negative impacts.
Impacts on livelihood of the practice users	Actual: In East Berbice-Corentyne, the average rice yield of conventional rice farmers is about 24 bags per acre (4,173 kg/ha). IPM farmers harvested an average rice yield of 28 bags (4,869 kg/ha) representing an average increase of 4 bags per acre (696kg/ha).

	There was an increased rice yield from the rice-fish plot. The average production of rice from seven rice-fish plots was 47 bags per acre equivalent to 8,173 kg/ha in East Berbice-Corentyne This significant increase can be attributed to the elevated attention that farmers provide to the crop in the generally smaller rice-fish plots, but also to the positive impact of the fish themselves as well as the fish farming practices favouring better growth of the rice plants. The reduction in the use of pesticides has decreased production costs: one farmer reported a 66 percent reduction in the cost of chemicals after the introduction of the IPM technologies. Expected: A significant improvment in the health and well-being of farming communities with the adoption of IPM technologies.
Other impacts	Actual: The farmers showed their enthusiasm by continuing their weekly meetings without project involvement and a modest scaling-up is taking place as the practice has been introduced to more rice-producing provinces in Guyana. This is believed to be a direct result of the awareness raising and training of rice extension officers. Positive impact diffusion is already taking place from the participating farmers to their neighbours as they continue to practice, show and share (tell). Moreover, the project has been featured by local news and television stations. The success of this project in raising awareness about the danger of harmful pesticides and the power of IPM and rice-fish is also evident in the fact that even vegetable farmers in the project area are now asking their extension staff for IPM technologies. Another impact was the high natural enemy diversity and abundance in the project sites, compared to those in non-project sites; as well as other harmful rice arthropods that attained pest status from abuse and misuse of agrochemicals. For example, the golden apple snail, Pomacea spp. (the world's worst invasive alien aquatic pest species) was not a problem in all the project sites. This can be attributed to the impacts of local predators in healthy and balanced rice ecosystems that were maintained by good agricultural practices. The availability of an armoured catfish breeding manual. This manual facilitates the step from wild fisheries to aquaculture, and reduces pressure on wild populations of this indigenous and highly-valued fish species. Expected: The FFS curriculum is considered particulary valuable since it will serve as a basis for introducing similar activities in other countries and regions.
General success factors	• The consultations undertaken during the FAO inception mission with partners and stakeholders set the scene for a project implementation schedule that was practical and achievable. It addressed the expectations of the stakeholders and provided an opportunity for them to discuss and agree on project implementaion. • The two TCDC consultants lived and worked with the rice farming communities for the duration of the project. This was much appreciated by the farmers, as they had a contact point for all their questions whenever they came up. Farmers now have the confidence to continue on their own. • Use of the participatory season-long, practical "hands-on"field training (FFS) approach as the vehicle for delivering extension services to the farmers. • The keen interest and involvement of the rice extension officers in rice-fish farming, i.e. going beyond their previous focus on the rice crop only. • Highly motivated farmers. • The excellent cooperation among the partners involved in the project.
Technology success factors	Generate incomes with acceptable limit of risk Increase farm production and/or stabilizes it

Institutional success factors	Farmer's capacity for adoption of the technology
Problems remaining to be resolved	Although the approach has been embraced at all levels (from farmers to government) the funding for up-scaling the activities are not in place.
Keywords	Aquaculture, Capacity building, Environment, Extension activities, Fish ponds, Food production, Integrated pest management, Participatory approaches, Pesticides, Training, Yields
Editorial note	We are grateful to Dr. R. C. Joshi (Chief Science Research Specialist, Philippine Rice Research Institute, Department of Agriculture, Philippines) who took part in a peer review of the practice and confirmed its success and sustainability.