Integrated Rice-Prawn Farming in the Mekong Delta, Vietnam: A Route Towards Sustainable and Profitable Farming Systems?

NGUYEN VAN SANH
TRUONG QUOC PHU
FARLYZ VILLANUEVA
JENS PETER TANG DALSGAARD

Case Study

One of the objectives of the Mekong Delta Farming Systems Research and Development Centre at Cantho University, Cantho, Vietnam, is to foster farming practices that are not only economically profitable, but also ecologically sustainable. To pursue this target, 42 rice-based farms into which prawns (*Macrobrachium rosenbergii*) had recently been introduced, were identified in the hamlets of Caicon and Mangca, Phunghiep District, Cantho, Haugiang Province (Fig. 1).

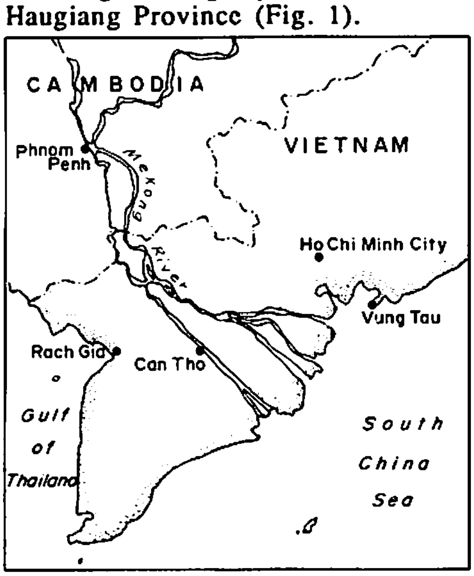


Fig. 1. ***Southern Vietnam location map.***

Farmers and Cantho University researchers drawing a bioresource flow model of Tang van Phouc's farm in Mangca Hamlet, Phunghiep District, Mekong Delta, Vietnam. (Photo by J.P.T. Dalsgaard)

Datasets on whole farm areas and all on-farm activities were collected throughout 1992. The data collection activities made use of pictorial modeling methods whereby farmers, guided by researchers and extension workers, draw farm transects and bioresource flow models. The former depicts the microtopographical features of the farm, the sequence of resource systems (land and water types), and individual enterprises. The latter captures the nature of enterprise and resource systems integration practised via recycling of crop and animal wastes/by-products. Fig. 2 shows a bioresource flow model of one of the selected farms.

On the basis of all 42 datasets a community resource systems transect was constructed (Fig. 3). Five resource systems were identified in the area: river/canal, homestead, garden dike, garden trench and rice-prawn system. Average farm size is just under 1.4 ha. Rice-prawn systems occupy nearly 50% of the farm area, garden dikes 25%, trenches 18%, and the homestead area 4%. All farms are under private ownership. The river/canal system is considered common property. Rice-prawn systems and garden trenches are connected and prawns feed in both areas. Garden dikes are used for growing a variety of fruit trees and vegetables and the homestead for rearing livestock and poultry as well as for vegetable cultivation (mainly cassava).

System Economics

Rice (IR varieties) and prawns constitute the two main crops. However, they perform very different roles within both the household economy and the farm system. Annual rice production (two crops) averages 8.5 t/ha compared to 354 kg/ha for prawns (one annual crop). The contribution to farm net income from rice is 42% versus 32% from prawns. But whereas rice is consumed at home, prawns are sold as a high value cash crop for export, yielding 43% of the cash income compared with only 20% from rice (see Fig. 4). Average prices are US$4.28/kg for prawns and US$0.10/kg for rice.

Prawns feed in the garden trenches and connected ricefield of Nguyen van Tuan's farm in Mangca Hamlet, Phunghiep District, Mekong Delta, Vietnam. (Photo by J.P.T. Dalsgaard)

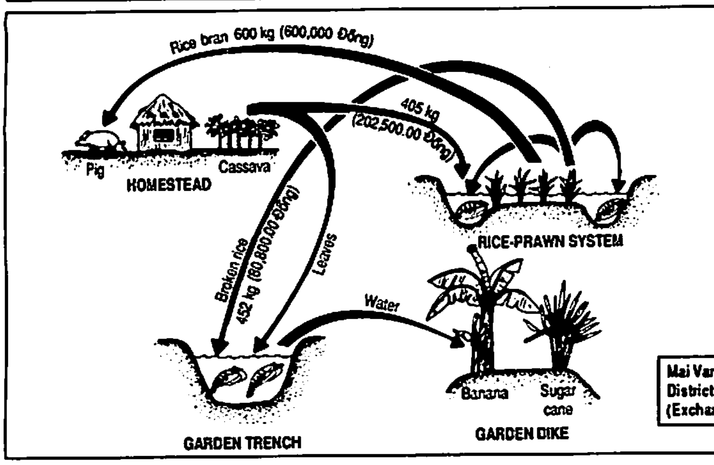
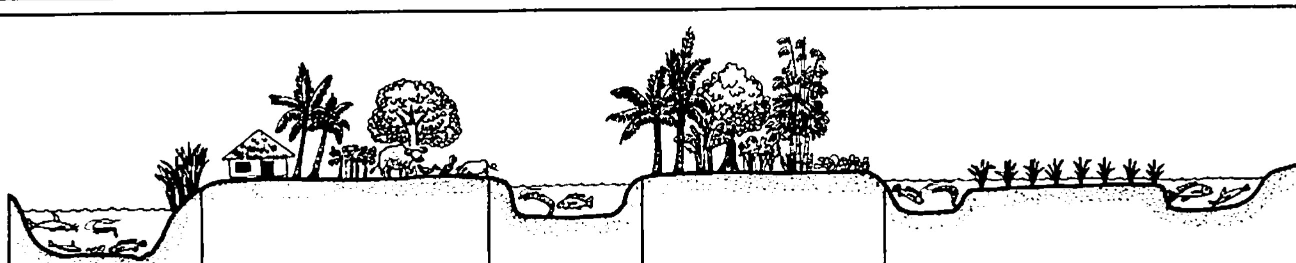


Fig. 2. ***Bioresource flow model.***

Less chemical fertilizers and pesticides are applied and less cash is spent on external material inputs after the integration of aquaculture. From comparatively little additional labor, a large increase (72%) in farm net cash income is realized. The costs of prawn fry do not appear to pose a constraint on the household economy or its cash flow, on the contrary, supply of fry cannot keep up with demand.

The direct economic contributions of the homestead and garden dike areas are of secondary importance as shown in Fig. 4, but their indirect contribution to the overall system performance is vital, in both economic and ecological terms, due to their role in the integration of aquaculture into agriculture (see Fig.2).



Resource System	River/canal (Song)	Homestead (Tho cu)	Garden trench (Muong vuon)	Garden dike (Vuon)	Rice-prawn system with field trenches (Ruong lua and Muong ruong)
Top soil Subsoil	Silt (Bun)	Loam (Thit) Slightly acid (Phen nhe)	Silt (Bun) Slightly acid (Phen nhe)	Loam (Thit) Slightly acid (Phen nhe)	Clay loam (Thit pa set) Slightly acid (Phen nhe)
Water source	River	Rainfall and river	River	Rainfall and river	River
Crops and Vegetables	Nipa (Dua nuoc)	Cassava (Khoai mi)	Water spinach (Rau muong)	Sugar cane (Onia) Cassava (Khoai mi) Cucumber (Dua leo) Bittergourd (Khogua) Sweet potato (Khoai lang)	Rice (Lua) Water spinach (Rau muong)
Trees		Coconut (Dua) Rambutan (Chom chom) Custard apple (Mang cau) Mango (Xoai)		Coconut (Dua) Banana (Chuoi) Rambutan (Chom chom) Jackfruit (Mit) Mango (Xoai) Durian (Sau rieng) Mandarin (Quit) Papaw (Du du) Bamboo (Tre, truc)	
Animals	Snakehead (Ca lec) Catfish (Ca tre, Ca tra) Prawn (Tom) Clam (hen)	Pig (Heo) Duck (Vit) Water buffalo (Trau) Chicken (Ga)	Prawn (Tom) Common carp (Ca chep) Silver carp (Ca me, Ca mo vinh, Ca troi)		Prawn (Tom) Common carp (Ca chep) Silver carp (Ca me) Silver barb (Ca me minh) Rohu catla and mrigal (Ca troi)

Fig. 3. ***Resource systems transect of Calcon and Mangca Hamlets, Daithan Village, Phunghiep District, Mekong Delta, Vietnam (1992).***

System Integration

Interesting changes occur when prawns are integrated into these rice-based farming systems. Most of the farm integration and recycling of by-products center around the integrated rice-prawn system: cassava chips and coconut waste from copra production, and leftovers of broken rice and bran from the milling process are thrown into the trenches as prawn feed. In turn, enriched mud is regularly dredged

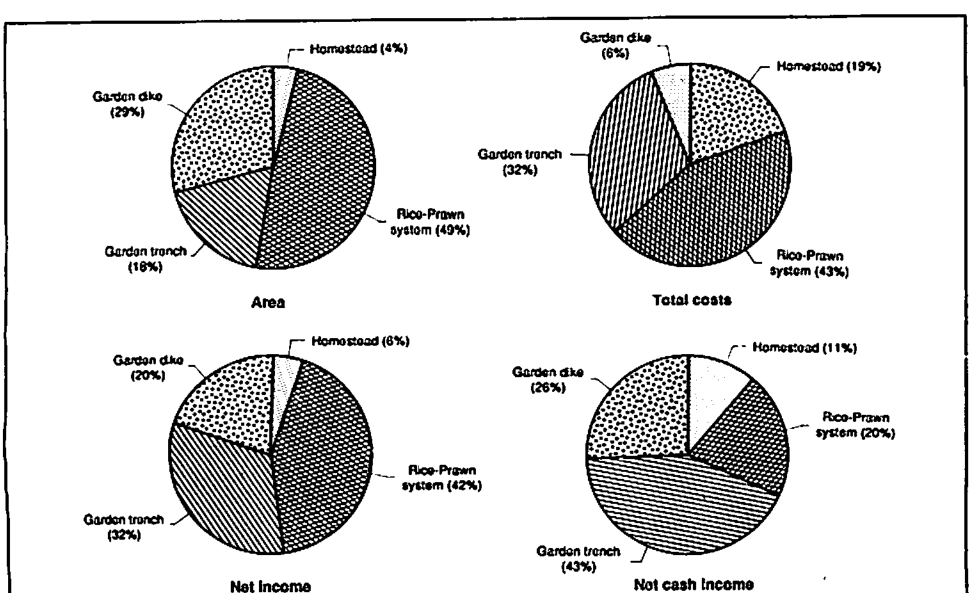
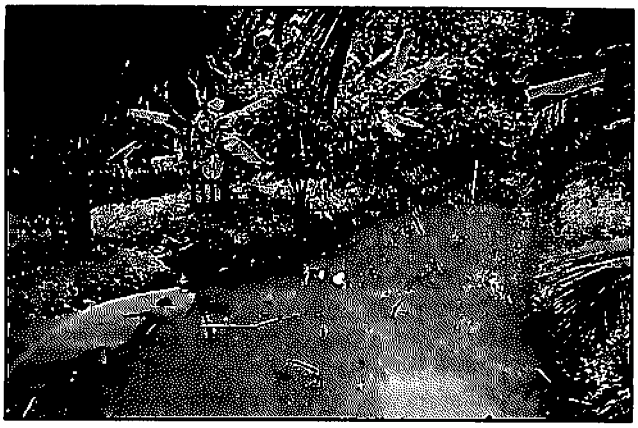


Fig. 4. ***Economic analysis of resource systems.***



The garden dike and trench system. (Photo by J.P.T. Dalsgaard)

Prawn harvest, Phunghiep District, Mekong Delta, Vietnam. (Photo by Nguyen van Sanh)

up from the trenches onto the garden dikes as fertilizer. This way the silting up of trenches is prevented, the dikes are maintained and on them are created a fertile environment for growing a wide variety of crops and trees.

Improved water management associated with the introduction of prawns and maintenance of a suitable water level in the trenches and ricefields further help prevent the oxidation of potential acid soils into actual acid soils, a problem presently affecting more than 25% of the 4 million-ha delta.

System Performance

Integrating prawns into these rice-based systems appears to present an attractive alternative to rice monocropping, both from an economic as well as an environmental/ecological point of view.

However, to monitor and attempt to measure the impact of integration on the ecological state of the farms is far from an easy task. Many definitions of sustainability have been proposed, e.g., ability of the system to maintain productivity in the face of external stress and perturbations (Conway 1987), or the ability to maintain or even increase present levels of productivity without reducing the quality of the natural resource base (Reintjes et al. 1992). Much has been said about the need for quantitative indicators of sustainability, but little has been done.

No sole measure of sustainability is likely to be found. Rather, sustainability should be assessed by looking simultaneously at a range of indicators. A 'performance kite' (Lightfoot et al., in press) of a typical rice-prawn farm is shown in Fig. 5. The four simple and easily quantifiable performance indicators are: efficiency (net income); diversity (no. of enterprises); recycling (no. of

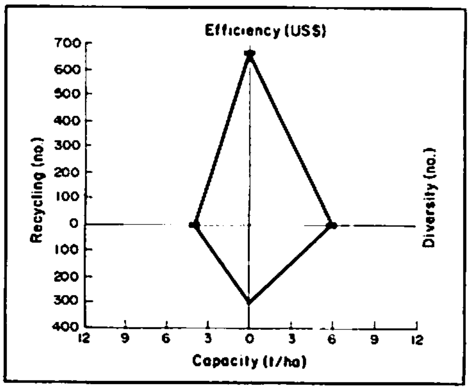


Fig. 5. *Performance kite for the farm of Mai Van Nhan, Daithan Village, Phunghiep District, Cantho, Vietnam (1992).*

bioresource flows - an indicator of the level of integration); and resource system capacity (biomass output in t/ha). The kite can be employed as a tool for comparing different types of systems across time or space, e.g., rice versus rice-prawn, and conveys a quick visual impression of the overall system performance. The larger the kite the better the performance of the system.

The introduction of a cash crop, here prawns, does not have to be synonymous with unsustainable practices such as reducing diversity, putting increased stress on the natural resources, or relying less on integration and more on external chemical inputs. On the contrary, it can help promote ecologically sound and economically attractive farming practices.

Problems and Constraints

Problems with the technology include the predation on prawns by hungry stocks of wild fish as well as by hungry neighbors. The former are controlled through screening of water inlets and the 'planting' of bamboo branches in the trenches to provide hideouts for the prawns. The latter, could be interpreted as another indication of the popularity and potential of this integrated system.

The spread of the technology has been constrained by a shortage in the supply of fry and problems of pollution throughout the delta. The latter stems from the heavy use of farm chemicals associated with intensive production of high-yielding rice varieties. Wild stocks of fish have been decimated as a result. Integrating rice with prawns may help point a way out of such seemingly unsustainable practices.

References

Conway, G.R. 1987. The properties of agroecosystems. Agric. Sys. 24:95-117.

Lightfoot, C., P. Dalsgaard, M.P. Bimbao and F. Fermin. Farmer participatory procedures for managing and monitoring sustainable farming systems. J. Asian Farming Syst. Assoc. (In press)

Reintjes, C., B. Haverkort and A. Waters-Bayer. 1992. Farming for the future. MacMillan Press, London.

NGUYEN VAN SANH *is from the Mekong Delta Farming Systems Research and Development Centre and* TRUONG QUOC PHU *is from the Faculty of Fisheries both of University of Cantho, Cantho City, Vietnam; while* F. VILLANUEVA *is ICLARM Research Assistant; and* J.P.T. DALSGAARD *is ICLARM Assistant Scientist.*

ICLARM Contribution No. 939.