AQUA-VEGECULTURE SYSTEMS

Integrated vegetable growing and fish farming polyculture systems have long been used in Far Eastern countries such as China and Thailand. Farm wastes are commonly added as feed to fish ponds and fish are often cultured in flooded rice paddies. However, little research has been done to test the productivity of closed mixed fish/vegeculture systems. Horticulturalists at North Carolina State University are demonstrating that fish and vegetable crops can be raised concurrently in an interconnected system to produce significantly higher yields than either system alone.

The purpose of the study conducted by Mark McMurtry is to assess relationships and yield potential of integrated recirculatory aquaculture and sand-based hydroponic vegetable horticulture as a food production system. Potential benefits include conservation of soil, water and plant nutrients, availability of high-quality food products in close proximity to centers of need and reduced operating costs for intensive co-production.

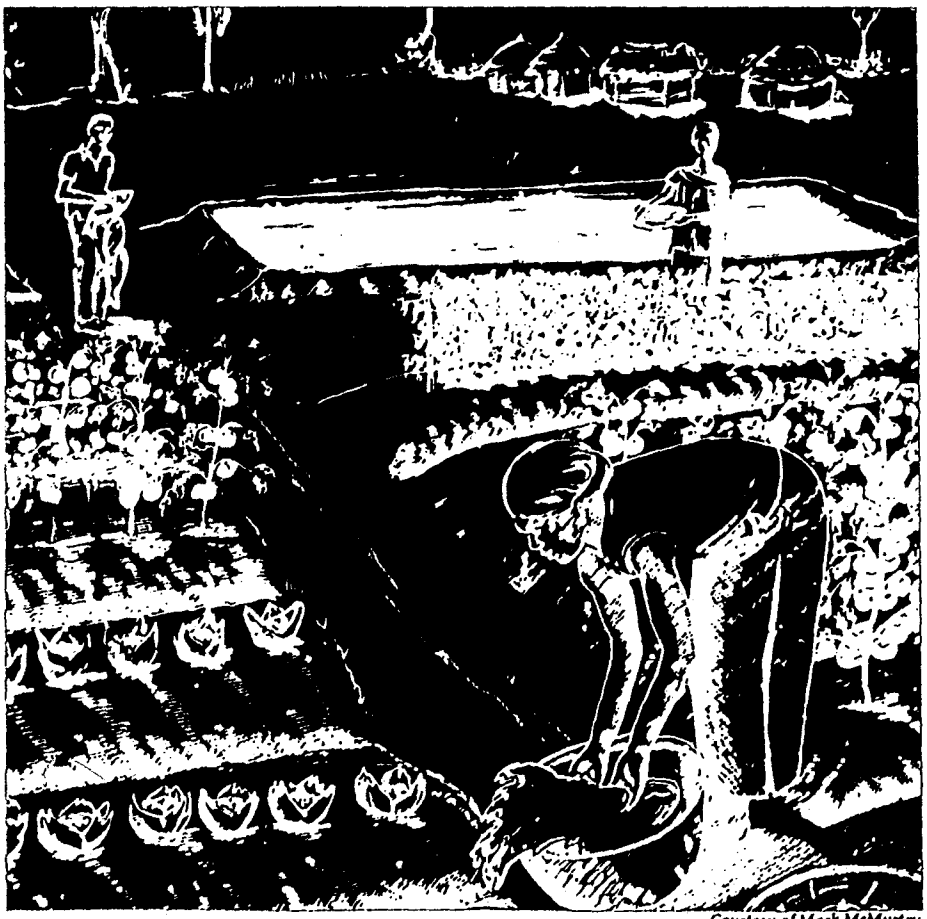
Water and fish wastes are recirculated from the bottom of a tank containing West African tilapia *(Oreochromis aureus)* through raised sand beds planted with tomatoes, cucumber, bush beans and other crops in this experimental North Carolina greenhouse system. As the water drains slowly back into the fish tank, the sand acts as a physical filter to remove dead algae and fecal matter. Meanwhile, the plants act as biological filters, taking up urea, urine and byproducts of decaying matter from the water. The filtration, aeration and mineral assimilation by the vegetable crops maintain water quality within acceptable limits for the tilapia.

In summer 1986 experiments, 813 mixed sex fingerlings (37.8 kg) were added to a 22.5 m^3 tank with inputs which included a total of 139 kg of commercial fish chow and replacement volumes for evaporated or transpired water, about 2.5 % of the system volume per day. A pump recirculated one-quarter of the tank volume every three hours. Vegetables were cultivated in sand media on a total area of 100 m^2 which was broken up into 2.25- m^2 plots lined with polyethylene plastic. The control plots consisted of sandy loam soil amended with one part composted horse manure to five parts soil; they were mulched with straw and watered as needed.

Initially, fish biomass increased by 106 kg over the 86-day feeding regime and survival rates were 99.3%. Crops developed rapidly, producing 231 kg of edible material, exceptionally high yields despite heat stress brought on by a lack of shading in the greenhouse. More recent experiments conducted with male hybrid Cherry Snapper *(Sarotherodon niloticus X mossambicus)* realized fish growth rates in excess of 50 kg per cubic meter per year. Meanwhile, experimental tomato yields have averaged about 2.5 kg per plant.

While these results were obtained with materials and inputs available in North Carolina, the concept could be adapted with materials available in various developing country environments. Because it conserves nutrients and allows for recycling of non-edible outputs, the system could fit the unique needs of LDC villages, especially in areas lacking good soil or water.

Mineral Content and Yield of Bush Bean, Cucumber, and Tomato Cultivated in Sand and Irrigated with Recirculating Aquaculture Water. M. R. McMurtry, P.V. Nelson and D.C. Sanders, Department of Horticultural Science, North Carolina State University, Raleigh, NC 27695-7609.



Courtesy of Mark McMurtry

Integrated fish and vegetable cultures have a high potential for supplying food needs in developing countries where water and soil resources are scarce.