

Production of Tilapia for export:

A. By shrimp / Tilapia 'crop rotation' intensive system

B. By integration of Aquaculture and Irrigation (IAI)

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I. General

Agriculture development in Panama: To successfully rehabilitate and develop the agriculture sector in Panama, under the conditions of open market economy, it is necessary to identify and introduce new, proven and competitive technologies, production systems and production strategies, which will increase employment, food and foreign currency through exports.

Taking advantage of proximity of Panama to the USA, and its stable tropical climate, it is clear that a significant component of its future agriculture must be based on the production of high quality consumer foods, exported FRESH to the USA.

The aquaculture sector in Panama produces presently only shrimp. The industry is in the state of crisis due to continuous attack by various diseases, causing significant reduction in shrimp productivity and exports. The industry requires rehabilitation, immediate solutions, diversification and introduction of new technologies.

Diversification into FISH production should be considered. The demand for FRESH FISH, whole or fillets, is increasing in the USA and EU. This represents a unique market niche for products from Panama (and other Central American countries). Tilapia fillets are presently exported in increasing amounts from Central America, none from Panama. To be competitive, production costs and air-freight should be lowest, as shall be achieved using the proposed approach.

II. Introduction of tilapia in brackish and seawater: Tilapia / shrimp multi-purpose intensive 'Crop Rotation'

The shrimp industry in Panama is undergoing a crisis due to the appearance of the *White Spot Disease*, which annihilates whole crops. Many of the existing shrimp ponds are idle, causing severe loss to the owners, increased unemployment and decrease in foreign currency earning. The proposed program entails 2 new activities:

* **A new Multi-purpose intensive 'Shrimp-tilapia' system:** The extensive shrimp production system (large ponds 5-10 ha, 10-12% water exchange, no aeration) is not reliable, is difficult to maintain optimal conditions and can not protect the crop from disease. Hence, it appears to be obsolete. It is therefore necessary to consider a NEW PRODUCTION CONCEPT, which will be designed to provide best conditions for growth, and will enable proper protection of the crop.

This can be achieved using small ponds, with aeration and fast water exchange, FOR THE MULTI-PURPOSE PRODUCTION OF SHRIMP OR TILAPIA, with the following advantages:

- Multi-purpose, for alternate production of fish (tilapia and other species) and shrimp
- Compact and intensive, requiring not more than 15 ha for 300-500 ton/year of shrimp or 2000 tons/year of tilapia
- Less risk: Easy to maintain optimal conditions and to sterilize
- Environmentally sound: possible implementation of a closed, or semi-closed system
- Multi-purpose (can produce shrimp OR tilapia OR other marines fishes).
- Easy to protect against thieves and against bird predation
- Easy to manage crop populations (stocking, size sorting, partial and final harvests)
- Easy and more efficient maintenance (of water supply and drainage systems, no erosion, no plant growth)
- Improved feed delivery
- Reduced off flavor
- Environmentally friendly, without any destruction of the mangrove areas and no pollution
- Last but not least: The production system can pass HACCP and ISO quality programs, which are becoming relevant not only to processing plant, but moves into the production level.

* ***'Crop rotation' tilapia in existing shrimp ponds:*** Tilapia can be into the large earthen shrimp ponds, as a second crop, to be raised as a 'Crop Rotation', and enable to production of another exportable product, in times of crisis. The strategy of 'Crop Rotation' with Tilapia should be introduced as a preventive measure.

APT was a pioneer in the polyculture of shrimp in tilapia in the western hemisphere and reported on the first results in 1991: (see the proceedings of the "I Simposio Centroamericano sobre camaron cultivado", pages 308-311).

II. The integrated aquaculture and irrigation (IAI):

The agriculture sector in Panama requires diversification and introduction of new technologies. To reduce investment and operating costs, it is advantageous to integrate irrigation and aquaculture, using the same water twice, to raise both aquatic foods and irrigated crops. The existing and/or planned irrigation schemes and irrigation infrastructure (dams, main canals, secondary canals, gates, etc.) could be used for the implementation of aquaculture, according to the proven technology developed and implemented in Israel for decades, as described below.

Fish production is compatible with irrigation in integrated systems, which are based on dual use of the same water, first for fish production and afterward for irrigation. In an irrigation system comprising of a water source, a water distribution system, and the irrigated field, IAI is achieved by installing or constructing the aquaculture facility near the water source, or between the water source and the irrigated field. In this way, the water is used twice, first for fish production and then for irrigation. Any water source could be used, including underground, river, or impounding

reservoir, and any water supply system including gravitational, pumping, or a combination of both. This results in:

- Overall reduction of production costs for irrigation
- Diversification into a high quality consumer foods
- Increased employment in rural areas, for men and women
- Competitive production of fish for local consumption
- Competitive production of fish for export, earning foreign currency
- Increased loan repayment capability
- Environmentally sound development

III. Participants and beneficiaries: Farmers, Farmers Associations, Water User's Associations (WUA), cooperatives, rural entrepreneurs and 'grupos campesinos' could form the back-bone of this project. They own and operate the main water systems and can benefit from the creation of a new profit center in their midst. The private sector tends to be attracted to aquaculture due to the possibility of earning foreign currency. It is the role of the Government to ensure that the rural farming community is provided with an equitable chance to participate in this activity. There is a potential fruitful association between the private sector and the farming communities (WUA's, Cooperatives, rural entrepreneurs), and between small businesses and large corporations. Such association should be encouraged to facilitate implementation of the vertically integrated production line and to ensure quality control and effective and sustainable (export) market penetration.

Suitable irrigation systems exist in Panama. For example, one was identified near rio Chiriqui Viejo, in David. This system is presently abandoned and can be rehabilitated.

WUA's will benefit by allowing use of their water and facilities for IAI, giving them another profit center to facilitate payment for irrigation operation and maintenance. The private sector will be attracted by the export potential and the availability of infrastructure.

For effective implementation it is proposed to consider the strategy of

- **Central Farms:** To include Fry Production Center (to provide high quality fish fry), Processing Plant (HACCP approved, to ensure high quality of exported products), Marketing organization (to coordinate the export activities), and central purchase and supply of required materials and goods (i.e. feed). This will be established by the private sector. The private sector is showing strong interest in this approach.
- **Satellite Farms:** Small production units, to be established by individual farmers, rural entrepreneurs, cooperatives and Water User's Associations. These will receive fish fry, and will sell market size fish to the Central Farm.

The inter-relationship between these two components should include equity participation of the Satellite farms in the central farm.

There is an opportunity here to establish THE SECOND GENERATION OF AQUACULTURE SYSTEM IN PANAMA, and lead the way to aquaculture 2000.

III. Effect on National economy:

It is feasible to project export potential of 20,000 tons of fish within 10 years, using available infrastructure, and generating about US\$ 40 million per year from tilapia alone. This does not include foreign currency generation of improved and secure shrimp production. Employment generated by tilapia related activities (production, processing and marketing, direct and indirect work force) could be estimated at 7,000 workers in rural areas, and including women.