AQUACULTURE RESEARCH - TECHNOLOGY TRANSFER FOR RURAL DEVELOPMENT IN NIGERIA

BY

B. I EZENWA
O. A. AYINLA AND
A. M AJANA

Nigerian Institute for Oceanography and Marine Research
P.M.B. 12729
Victoria Island
Lagos

ABSTRACT:

Conventional aquaculture has been promoted in Nigeria for the past five decades with minimal impact (Tables III & IV) in rural communities: From the findings of Maclearen (1949) where he popularized the use of culturable fish predators *Lutjanus sp: Pomades sp*; *Tarpon atlanticus*; *Chrysichthys nigrodigitatus* in earthen ponds near Onikan - Lagos, (Zwilling 1963), when common carp, *Cyprinus carpio* was propagated and cultured in Panyan Fish Farm, near Jos; (FAO 1965) on culture potentials of marine mullets in brackish water ponds in Buguma, Rivers State. The work of other researchers Sivalingam, (1970; 1973), Ezenwa (1976), development officers and extension officers contributed to the development of Aquaculture in few rural areas of the country - both inform of public and private owned fish farm infrastructures.

Despite a moderate long history of aquaculture research and development in Nigeria, an annual production level of 25,000 metric tons was recorded in 1999. This calls for a more sustainable approach for a stronger link between Aquacultural research and technology transfer for the development of rural communities of the Country.

This paper therefore examines some of the issues involved in the continuous flow of the new Aquaculture technology in the improvement of fish protein output, standard of living of rural farmers; and prevention of urban migration by the youth.

RURAL AREA DEVELOPMENT:

Nigeria as with the rest of the world is undergoing a period of rapid socio-economic changes. This is affecting demography and through its resources use, population continues to rise in Nigeria and much of increase is now urban rather than rural. This means that many of the hitherto subsistence and artisanal ways of life are giving ways to exploitation patterns based on urban markets demand. There is therefore a choice to make between two alternatives of either creating jobs and infrastructure in rural areas to prevent rural-urban migration or to channel the rural resources including fisheries, to satisfy the needs of urban populations and export to the growing world trade in food commodities (Ayinal (1999). If fish is going to continue to be a basic food for the poor, the first alternative of job creation through aquaculture in the rural areas of Nigeria is inevitable. There must therefore be a vigorous attempt to accelerate aquaculture development in rural areas. Fortunately aquaculture is include as one of the areas to be promoted under the Federal Government National Poverty Eradication Programme, through establishment of Fish Farm Estate for each Local Government Area in a senatorial district.

AQUACULTURE TECHNOLOGY - DRIVEN DEVELOPMENT:

Aquaculture development like other aspects of the mix depends on the context, it usually includes good infrastructures, access to credit, water, land, markets, input delivery, social orgnisation, relevant technology and rewarding prices. As Aquaculture and other forms of Agricultural development, the need for this mix is increasingly met, giving farmers more control over their environment. The greater their control, the more important knowledge and technology becomes as the major determinants of development (Jiggin's 1988). Strong national agricultural research systems are therefore needed to solve the problems of food security, rural unemployment, leading to decline in your migration to the cities.

AQUACULTURE STRATEGIC PLANNING:

It has been observed, in a recent FAO Survey of Aquaculture development that most Sub-Saharan Agricultural development requires a mix of conditions. Although the precise nature of the mix depends on the context, it usually includes good infrastructures, access to credit, water, land, markets, input delivery, social organisation, relevant technology and rewarding prices. As Aquaculture and other forms of Agricultural development, the need for this mix is increasingly met, giving farmers more control over their environment. The greater their control, the more important knowledge and technology become as the major determinants of development (Jiggin's 1988). Strong national agricultural research systems are therefore needed to solve the problems of food security, rural unemployment, leading to decline in youth migration to the cities. African Countries with the exception of Madagascar have no development strategic plans (Moehl et al 2000). In Madagascar, a physical tonnage is forecasted, which assists policy makers in evaluating progress. In Madagascar, shrimp farm below 50 ha, are classified as small (Hihamunda, 2000), while in Zimbabwe 3 - 5 hectare farms represent medium sized operations (Machena, 1999); In Nigeria any farm less than 1ha. is generally regarded as small holder farm. Nigeria lacks a good "Aquaculture Plan" - pro-active strategy for the development of the industry especially in the rural areas. In some countries, there is multi-year indicative planning in which aquaculture output is projected and a development strategy outlined (OECD, 1989). Examples of an Aquaculture Development Niche (Table IV) and a Holistic approach to Aquaculture Planning have been worked out by FAO (2001).

FIG. 1: ILLUSTRATION OF AN AQUACULTURE DEVELOPMENT NICHE (FAO, 2001)

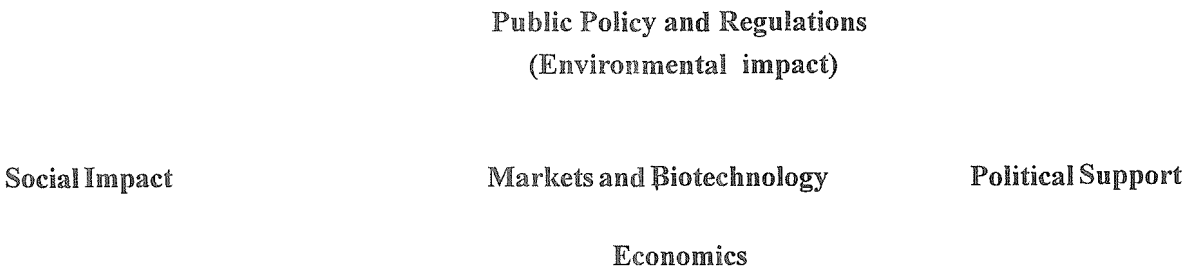

TABLE 1: EXAMPLE OF HOLISTIC APPROACH TO AQUACULTURE PLANNING (FAO, 2001)

Special	Technology System	Culture Potential	Market	Economic Potential	Comments/Out look
Eel (Anguilla sp)	Well established. dependent on wild	Freshwater. All systems Pond/tank.	No domestic market, small export market	Limited profit potential smoked has potential	Need to expand market; little potential
Argylle bream (H. Jenkinsis)	Some research needed	Freshwater. All system. Pond/Tank. Polyculture.	Very good Domestic market; export potential; price elastic	Unknown but probably good; Asian market very price elastic.	Very good candidate; production cost are low; freezes well; Fish are robust.

MODES OF FARMER PARTICIPATION IN THE TECHNOLOGY TRANSFER FOR RURAL DEVELOPMENT:

Several authors including Biggs (1989) have advocated for strong links between:

- researchers and farmers
- on farm and on-station researchers
- researchers and technology transfer workers
- technology transfer workers and farmers

Four distinct modes of farmer participation were classified by Biggs (1989):

i. **Contract participation:**

Scientists contracts with farmers to provide land or services. In this approach the farmer's role is passive and participation is not an explicit objective. Researchers investigating the biological relationships between productivity, soils, and climate manage trials themselves so as to maintain tight control over the variable. Multi-locational testing is a good example of contract participation. Although this mode cannot itself be considered as client-oriented research, it can form an important component of such efforts.

ii. **Consultative participation:**

Scientists consult farmers about their problems and then develop solutions. This type of participation has been linked to the 'doctor-patient' relationship. Researchers use formal and informal surveys to define farming systems and diagnose priority problems. They then design experiments to test various solutions or to better understand identified problems. The emphasis is on adapting technology to the socio-economic as well as the agro-ecological conditions facing farmers. Researchers involve farmers mostly in the diagnosis and the later in the evaluation of proposed solutions. Consultative participation was the dominant and preferred mode used in more than half of the on-farm research programs reviewed.

iii. **Collaborative participation:**

Scientists and farmers collaborate as partners in the research process. The approach, found in about a third of the programs reviewed, involves more intensive and continuous interaction. Researchers actively draw on farmers' knowledge and constraints. Regular meetings are held between farmers and researchers to understand current-farming practices, set priorities among research problems, develop potential solutions, monitor progress and jointly review results.

iv. **Collegiate participation:**

Scientists work to strengthen farmers' informal research and development system in rural areas. Here the emphasis is on increasing the ability of farmers to carry out research on their own as well as to request information and services from the formal research system. This mode of participation is soften used with large-scale commercial producers, but is much less common with resource - poor farmers.

RECOMMENDED TECHNOLOGY PACKAGES FOR AQUACULTURE RURAL DEVELOPMENT:

1. CULTURE SYSTEMS:

i) Backyard farming (Pond/Tanks) - Target 50 - 100kg per six months production cycle.

(ii) Enclosures - pens; ***aqadja:*** cages for estuarine communities and villages close to rivers, stream and flood plains,-target: 200kg - 500kg per growth cycle.

(iii) Integrated Fish Farming in small holder units - fish/vegetables/cassava/maize.

(iv) Fish Farm Estate Technology: It is recommended that for each senatorial district (one hectare fish farming estate); should be established for the Local Government Area. This holds the promise for positive catchment community impact including unemployment reduction, rural-urban migration abatement and poverty alleviation. In addition death of information in the socio-cultural and socio-economic structure of rural communities have been the bane in the success of various developmental and economic projects that have been executed in the past. Provision of realistic data on the socio-cultural/economic structure of these communities will ensure proper execution and sustainability of the project. The one hectare fish farm will incorporate the following:

- Fish ponds 0.6ha (nos of 0.1ha each)
- Poultry pen (built over ponds)
- Plantain farm (0.1ha)
- Maize farm (0.1ha)
- Vegetable farm (0.1ha)
- Cassava farm (0.1ha)
- Production of small ruminants (goat, sheep); ducks and dogs
- Production of poultry by free range method using hybrid of native and agriculture species
- Establishment of small snail farm.

The project will be located in one local government area of each senatorial district in Nigeria actively supported by the three tiers of Government for each selected community.

II) FISH CULTIVARS:

Fingerlings proven for fast growth rate i.e. Clarias *gariepinus, Heterobranchus bidorsalis, H. Longifilis, Heteroclarias niloticus* etc, have been developed. Research Institutes should transfer the technology for production in the rural areas through training at each of the six geopolitical zones. By this approach, fingerlings scarcity, which is one of the major constraints to fish farming would be adequately addressed.

Other species include the marine mullets (Mugil sp. Predators - *Tarpon altantaicus; Lutjanus spp; Pomadasys spp;* oysters, *Crassostrea spp;* and marine shrimps *Penaeus notialis* (Ezenwa, 1976).

III) FEEDS:

Accounting for at least 60% of fish production cost, feed determines the viability of aquaculture production system. It was established that no profitable aquaculture can take place without feeding. Local methods of producing pelleted feed is available for the rural areas. Various fish formulae adaptable to different ecological zones of Nigeria are also available based on the use of local ingredients.

By products of Agricultural and industrial raw materials have been identified and selected and proven very effective and acceptable to culture species. They include groundnut cake; palm kernel cake; soya beans cake; flour mill wastes; brewery wastes; poultry wastes (Ezenwa 1979).

IV) INPUT SUBSIDIES:

A major constraint to easy adoption of Aquaculture technology in the rural areas is high cost of inputs - feed; fingerlings; fertilizer; harvesting/fishing equipment. Input subsidies that lead to increased supply of feed and fingerlings definitely could lessen the problem of high costs. Federal Government research and development institutions need to strongly provide free or subsidised fingerlings and feeds to rural communities.

Financial credit is inimical to Agricultural development in Nigeria. Ventures in Aquaculture and Fisheries are still regarded as risky by most banks and financial houses in Nigeria. In addition to providing start-up funds to eliminate or lessen the need to borrow, a policy that has been widely followed in many countries has been providing interest rate subsidy. According to FAO (2001), France, Greece, Jamaica, Portugal and Spain are among countries that have used this policy to promote Aquaculture. This approach can be recommended for Nigeria since interest rate subsidies are preferable to cash grants because the burden of default falls on the producer as well as the taxpayer.

TABLE II: BUDGETARY ALLOCATION TO CROPS AND FISHERIES (IN N MILLION)

YEAR	CROPS	FISHERIES
1987	170.0	4.4
1988	213.0	13.9
1989	573.0	6.3

Source: CON Merchant Bankers special budget bulletin - 1987/88/89

** Disparity in budgetary allocation on crops/fisheries is obvious as above.

TABLE III: EXTENSION IMPACTS ON FISHERIES ACTIVITIES IN THE COASTAL STATES

TECHNOLOGY		PERCENT ADOPTION OF TECHNOLOGY IN THE STATES						
		Lagos	Ogun	Ondo	Delta	Rivers	Akwa Ibom	Cross River
1.	**Capture Fish**							
	- use of larger mesh size	20	10	15	15	10	10	10
	- Disuse of obnoxious fishing methods	25	15	15	20	20	15	15
2.	**Fish Farming:**							
	- Application of organic manure in jute bags	75	60	60	50	40	40	40
	- Stocking rates of 3 fish/m^2.	35	20	20	15	25	20	20
3.	Integrated agriculture and fish farming.	85	58	55	40	40	45	40

Source: NIOMR/NARP Survey Data 1995/96

Low level of technology adoption.

TABLE IV: EXTENSION IMPACTS ON AGRICULTURE ACTIVITIES IN THE MIDDLE BELT

PERCENT ADOPTION OF TECHNOLOGY IN THE STATES (FACU 1994)

TECHNOLOGY	BENUE	PLATEAU	NIGER	KOGI	KWARA	ABUJA	RIVERS
Yam Use of Fertilizer	70.6	148.7	69	39	43.2	66	-
Upland rice: Improved variety	57.9	37.8	78	32	38	52.8	-
Maize: Improved variety	63.3	42.8	77	45	48	47	-
Soya bean processing and utilization	-	-	-	-	-	-	80
Rabbit rearing	-	-	-	-	-	-	58
Homestead fish farming	-	-	-	-	-	-	58
Cassava: Improved variety	57.7	35.5	23	40	48	22.7	80

NOTE: **No fisheries extension finding in the Middle Belt which has a lot of inland waters, lakes and reservoirs.**

TABLE V: ACTIVITIES AND ACHIEVEMENT ON RIVERS STATE ADP FOR 1995

ITEM/ACTIVITY	TARGET	ACHIEVEMENT	% ACHIEVEMENT
Contact farmers	4,680	4,193	87.6
VEA Visit	26,064	22,019	84.4
FNTs	180	22,019	94.4
MTRM	12	170	100
Radio	39	170	64.1
Print media	10,024	5,016 copies	58.0
* Contact Fisherman	1,175	114	9.7%
* Fish pond construction	1,175	114	9.7%

Source: FACU (1994) Project Report, FACU, Abuja and Reports from ADPS.

Note: **Low level impact fisheries extension activities in Rivers State - a State with fishing as major occupation.**

CONCLUSION:

The development of Aquaculture in rural villages in Nigeria is surest avenue for provision of fish protein, employment opportunities and higher standing of living through sustainable regular income from farm products. This pre-supposes a continuous flow of new technology to rural farms to reduce the drastic decline of those leaving farming among the youths in the villages. It is estimated that production from Aquaculture in the rural communities could contribute up to 300,000 metric tons of fish per annum if the production environment is conducive.

REFERENCE

Ayinla, O. A. (1999): Trends in Aquaculture development in Africa: medium and large scale system, FAO/UN Publication.

Biggs, S.D (1989): Resource-poor farmer participation in research: a synthesis of appearances from Nine national Agricultural Research system - 58pp.

Ezenwa, B. (1976): Fish seed production in Nigeria. CIFA Tech pap., (4,suppl, 1):441 - 449

Ezenwa, B (1979): Supplementary diet in fish culture and feed formulation technology in Nigeria. NIOMR Occ. Pap., 30

Ezenwa, B.I.O (1994): Aquaculture development in Nigeria, pp. 41 - 80. In Coche, A.ed. aquaculture development research in sub-Sahara Africa, National Reviews, CIFA Technical paper No. 23. Supply. Rome, FAO, 39799.

FAO (1965): Investigations of the possibility of brackish water fish culture in the Niger Delta. Based on the work of T.V.R Pillay Report No. 1973, 52pp.

Jiggins, J.M. (1998) Innovate or Evaporate: Test and improve your organisation's IQ - Its Innovation Quotient. Winter Park: New Management Publishing Company.

ISNAR, (1998): New technology demands: The methodological frame word for an INIA/BID/ISNAR Project. The Hague: International service for National Agricultural research.

Macleren, P.I.R. (1949): Brackish water fish cultivation experiments at Lagos, Nigeria Federal Fishers Occasional Paper I.

Moehl, J,. Coche, A & Sagua, V. O (In press): Africa Regional Aquaculture Review CIFA Occasional.

Neil Ridler and N. Hihamunda (2001): Promotion of sustainable commercial aquaculture in sub-Sahara Africa. Vol. I. Policy framework FAO Fisheries Technical paper 408/1.67pp.

OECD (1990) Modern biotechnology and the OECD. Policy Brief. Paris, France: Organization for economic Development and Cooperation.

Sivalingam, S. (1970): Pisciculture dens less estrins due Nigeria: Bull: Piscio FAO. 2(3): 11

Sivalingam, S. (1973): On the grey mullets of the Nigerian coast, prospects of their culture and results of trials. Fed. Fish Occ. Paper

Zwilling, K. K. (1963): Carp farming on the Jos, Plateau. Paper prepared by Federal Fisheries, Lagos. Bulletin de I-Ifan txv. Series A.

MANAGEMENT OF ENVIRONMENTAL ISSUES FOR SUSTAINABLE FISHERIES PRODUCTION FROM AQUACULTURE IN NIGERIA

E. A. AJAO

Nigerian Institute for Oceanography and Marine Research

Victoria Island, Lagos.

ABSTRACT:

Aquaculture depends largely upon a good aquatic environment. The quality of the aquatic medium determines success to a large extent in aquaculture. The medium is particularly vulnerable to excessive abstraction (i.e surface or groundwater) and contamination from a range of sources (industrial, agricultural or domestic) as well as risks of self-pollution. Environmental management options proffered so far include: improvements in farming performance (especially related to feed and feeding strategies, stocking densities, water quality management, disease prevention and control, use of chemicals, etc.) and in the selection of sites and culturable species, treatment of effluents, sensitivity of recipient waters and enforcement of environmental regulations and guidelines specific to the culture system. There are presently conceptual frameworks for aquatic environment management backed by legal and administrative tools to create or enforce rational system for water management, fisheries and aquaculture development strengthened by adaptive institutionalisation.