INTEGRATED RICE-FISH FARMING IN NIGERIA: Its feasibility and economic viability

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ABSTRACT

Rice-Fish culture is an accepted farming system in Asia especially in Bangladesh, China, Philippines, Vietnam etc. Its practice in the West African region has assumed international recognition with the Regional Association for irrigation and Drainage, the International Institute of Tropical Agriculture and West African Rice Development Association and its two regional research consortia, the Inland Valley Consortium and the Regional Rice Research Network championing the campaign for the establishment of integrated irrigation aquaculture (IIA) in all the countries in West African Sub-region. A look at the irrigation system in Nigeria as shown by the activities of Ministry of Water Resources, the floodplains and the Lowland system, one will be fully convinced of the ability of this country to be self-sufficient in both rice and fish production through the adoption of integrated rice-fish culture in these systems.

INTRODUCTION

Integrated rice-fish farming has existed in China about two thousand years ago (Li, 1992) with China cultivating almost one million ha and Indonesia 94000ha (Lightfoot *et. al.* 1992). In rice-fish culture system, fish are usually cultured within rice areas protected from excess flooding by dwarf dikes. Usually a central or diagonal canal or trench or refuge is dug inside the rice farm for holding fish at low water levels or prior to harvest. Rice-fish culture started in Asia as a captural practice. However presently fish are cultured in rice paddies either concurrently with rice or in rotation. A wide range of fish species have been tested in rice fields and these include: *Oreochromis niloticus,* common carp (*Cyprinus carpio*), Indian major carps such as catla *Catla catla*) mrigal (*Cirrhinus mrigala*) and rohu (*Labeo rohita*). Other fish species that have shown good results and are of high acceptability in Asia and China include Chinese carps like silver carp (*Hypophthalmichthys molitrix*) and grass carp (*Ctenopharyngodon idella*) etc. Reported fish production figures also vary widely, ranging from less than 100kg per hectare to over 2000kg per hectare depending on the management system (Lightfoot et. Al. 1992). In China, average fish production in 1988 from 800,000 ha of rice fields was estimated at 133kg per hectare (Mackay, 1995).

The importance of rice-fish culture has been recognized in most Asian countries. In the Philippines the provision of over 1.5 million hectares of irrigated rice lands has renewed the interest in rice-fish culture among rural rice growers. In Malaysia where over 50% of the total animal protein consumed comes from fish (China, 1986), the importance of rice-fish culture has been recognized (Tan et al 1973). Over 1.5 million hectares of swamp areas in Niger Delta as well as in the Niger flood plain between Yauri in Kebbi State and Lokoja in Kogi State show good prospects for rice-fish culture. Potential land area that could be put under rice production in Nigeria is estimated at about 4-6 million hectares, but only

some 2 million hectares (40%) are currently cultivated (Miller, 2003). Rice is produced in virtually all the states of the federation. However seven states of Kaduna, Taraba, Niger, Benue, Borno, Kano and Adamawa make up half the area in rice cultivation in the country.

With such potentials for rice production and with the Presidential task force on rice production, the country should be self-sufficient in rice production and should be able to stop rice importation within the next five years. The integration of fish production with rice production otherwise called rice-fish culture should be able to boost fish production in the country. This paper is therefore aimed at showing the traditional rice-fish culture, the experimental systems so far undertaken and comparing all these systems with what has been achieved in Bangladesh and as well as the financial analysis of successful and unsuccessful rice-fish culture systems. This will assist Nigerian rural rice farmers especially those within irrigated systems in adopting the technology with ease.

2.0 RICE-FISH FARMING IN NIGERIA

2.1 Traditional or Captural Method

Presently rice-fish farming is not practised in Nigeria as a culture system. Primarily it is capture method that is practised. This is the method through which the Asians started before going into concurrent or rotational methods.

This is a traditional method whereby wild fish species which enter the flooded rice paddias from steams or irrigation canals are trapped and allowed to grow along with the rice. When the rice is harvested, fish are captured for sales or consumption. The catfishes (*Clarias* and *Heterobranchus species*) are mostly caught in this type of system since they have the ability to move from one environment to another with or without water.

2.2 Culture method

Most of the rice-fish culture methods in Nigeria have been on experimental basis. Yaro (2001) was able to show through cost-benefit analysis of rice mono-culture, fish mono-culture and rice-cum-fish culture in 675m^2 farm (Table 1) that rice-cum-fish culture system gives an increase of 10% in rice yield and increase of 54% in revenue due to inclusion of fish in the culture system. Okoye et al (1998) was able to show that rice-fish farming started in new Bussa on a farmer's plot at Karabande, New Bussa where a farmer used the run-off from NEPA water system to grow rice and fish twice a year. The Institute (NIFFR) came to this farmer's aid through the supply of fish fingerlings. The trials however did not last long as the farmer later lost his source of water. From this farmer's initiative, Okoye *et al.* (2001) initiated series of studies with NCRI, Badeggi at their Rice Experimental Farm, Badeggi (Niger State) and at Iddo and Gwagwalada Farms of Abuja ADP in the FCT and at the Dadin-kowa (Gombe State) outstation of NIFFR. The results of these studies as shown in Tables 2,3 and 4 show that the growth performance of the fish species and rice yields were considered to be encouraging.

On-farm adaptive research trials (OFAR) as reported by Miller (2003) have been undertaken with favourable results in Lagos, Niger and Imo States through extension staff of the Agricultural Development Programme (ADP). Presently NSPFS is making efforts to sensitise and create awareness of the rice-fish technology through farmer participatory demonstrations. These are directed to show rural farmers of the technical and economic viability of rice-fish farming in

Table 1: Cost -Benedit Analysis of Rice Monoculture, Fish Monoculture, and Rice -Cum-Fish culture method in 675m² farm.

Items	Rich Monoculture			Fish Monoculture		Rice-Fish Farming	
	Weight Kg	Value N Kg		Weight	Value N Kg	Weight	Value N
Sale of Rice 30/kg	101.70kg	3,051.0		-	-	111.92	3,357.0
Sale of O.N. fing				No.			
N5 each	- (3.38kg)	-		243	1,215.00	138.(1.92kg)	690
Total Sales		3,051			1,215.00		4,047.60
2. Operating Expenses							
Rice seeds N60/kg	2kg	120		-	-	2kg	120
O.n seeds N1.00 each	-	-		450No	450	450No	450
Chicken Manure							
N50.kg	90kg	100	90kg	100	90kg	100	
Fertilizer N.P.K.	18kg	466.67	18kg	466.67	18kg	466.67	
Soil Preparation	270	270					279
Rice transplanting		450		450	450		
Maintenance of farm							
	180			180			180
Harvesting	90			90			90
Thrashing & Winnowing	270						270
Miscellaneous	100			100	100		
Total Expenditure		2,046.67		2,1067	2,496.67		
Net Returns		1,004			-891.67		1,550.93
Difference in net returns Between rice only and Rice-cum-fish							546.6
% increase in net income							54.4%

% Increase in rice yield due to introduction of fish
10.1%

Source : **Ibrahim Yaro, 2001**

lowland/swampy areas, fadama (floodplains) and irrigation schemes , NSPFS has established demonstration plots in many places in Ondo, Abia States including the one in Kubwa, near Abuja in the FCT. All these demonstration efforts are being carried out with Chinese South-South Cooperation experts. This is a right step in the right direction. With the completion of the irrigation system on the Dadin-kowa reservoir, and with all the irrigation systems of Kano, Katsina and Sokoto States, there are great prospects for the expansion of rice-fish farming in the country within the next few years.

Table 2: Performance of both rice and fish under rice-cum fish culture system at Dadinkowa (Gombe States)

A	**RICE**	B	**FISH**
	Pond Size – 2000m²		**Pond Size: 2000m2**
	Rice variety Planted: FARO 8		**Total Fish Stocked: 1700 pieces**
	Time of planting: 4 weeks of age		**Experimental period: 5 months**
	Spacing: 20m inter and intra row		
	Plant population 10,000 stands		
	Culture Period: 103 days		
	Rice Yield: 100kg		

SPECIES	CLARIAS	TILAPIA	COMMON CARP
No. of fish stocked	1000	500	200
Initial mean wt(g)	20	10	10
Final mean et. (g)	450	100	800
Mean wt. Gain (g)	430	90	790
Survival Rate	70%	80%	90%
No. of fish harvest	700	400	180
Total weight (kg)	315kg	40kg	144kg
Unit Price (Kg) (N)	100.00	50.00	80.00
Projected total Income	31,500.00	2,000.00	11,520.00
GRAND TOTAL			N55,020.00

Table 3: Performance of both rice and fish under ricecum fish culture system at IDDO, FCT.

A	RICE	B	FISH
	Pond Size – 1000m^2 925m x 40m)		Pond Size: 1000m^2 (25x40)
	Rice variety Planted: FARO 8		Stocking Rate: 2.5 fish/m^2
	Time of planting: 4 weeks of age		Total Fish No. Stocking 2500
	Spacing: 20m inter and intra row		Experimental period: 98 days
	Plant population 5,000 stands		
	Culture Period: 105 days		
	Rice Yield: 150kg		

Table 4: Performance of both rice and fish under rice-cum fish culture system at Phase III, Gwagwalade, Abuja

A.	RICE	B	FISH
	Pond Size: 550m2		Pond Size: 550m2:
	Rice variety planted: FARO 8		Stocking Rate: 2.5 Fish/mm2
	Time of planting: 4 weeks of age		Total Fish No.
	Spacing: 20m inter row and 20cm intra -low		Experimental period: 98 days
	Fertilizer Application: NKP (applied to rice 3 days after transplanting)		
	Rice Plant population: 2750 stands		
	Yield: 80kg		

ECIES	CLARIAS	TILAPIA	COMMON CARP
Stocking rate	2	2	1
No. stocked	530	530	265
Initial mean wt.	50g	50g	50g
Final mean et.	362g	240g	550g
Mean wt. Gain	312	190	500
Total No. of Fish Recovered	371	424	239
Survival Rate	70%	80%	90%
Total weight (kg)	134.3kg	101.8	131.5
Unit Price (kg) (N)	200.00	100.00	180.00
Projected – Total Income	26,860.00	10,180.00	23,670.00
GRAND TOTAL			N60,710.00

3.0 FUTURE PROSPECTS

The recent workshop on integrated irrigation aquaculture (IIA) in Bamako, Mali has called for the creation of IIA network across the West African sub-region on IIA and the initiation of IIA in the countries within the sub-region. This has coincided properly with the Presidential Task Force in Rice Production across the nation with the aim of making the country self-sufficient in rice production. With the reactivation of many irrigation schemes scattered all over the country and privatisation of many irrigated government lands within many communities, the rural rice farmers will invest in these irrigation systems and boost their rice production. With the launching and take-off of IIA system in Nigeria fish production will be fully integrated into the irrigated systems. This will surely create a lot of jobs among the rural dwellers and alleviate poverty.

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