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Determinants of Rice and Fish Farmers Perception of Integrated Rice-Cum-Fish Farming in Coastal Wetlands of Ondo State, Nigeria

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ABSTRACT

The study examined the determinants of the perception of rice-cum-fish production technology among rice and fish farmers in Ondo State, Nigeria. Specifically, the study examined the socio-economic characteristics of rice and fish farmers in the study area; ascertained their awareness and perception of rice-cum-fish farming production technology; and determine the factors affecting the farmers' perception of rice-cum-fish technology. A multi-stage sampling technique was used to select 180 respondents for the study from which data was sourced; using structured interview schedule, Data collected was analysed using descriptive and chi square. The result revealed that majority of the respondents were male (rice farmers = 78.38%; fish farmers = 83.92%), fairly young with mean age of 31 and 50 years for the fish and rice farmers respectively, married (fish farmers = 100%; rice farmers = 85.31%), formally educated with an average household size of 8, and over 10 years enterprise experience. More than half the respondents were not aware of rice-cum-fish farming technology (fish farmers = 51.53%; rice farmers = 56.73%); Majority of the respondents (fish farmers = 75.68%; rice farmers = 95.10%) had a high perception of the potential benefits associated with the practice of rice-cum-fish technology. There exist a significant relationship between respondents sex (P=0.960), age (P=0.017), educational level (P=0.033) and farming experience (P=0.008) and perception of production technology. The study thus concludes that farmers' socio-economic characteristics influence their perception of integrated rice-cum-fish technology. The study recommends that farmers should be exposed to training on the rice-cum-fish production technology given the high level of ignorance of the technology. This will create increased awareness and deepen their positive perception of the technology, particularly when the potential benefits of the technology are emphasized.

Keywords: *Integrated, rice cum fish, production technology, awareness and Perception*

INTRODUCTION

The practice of integrating aquaculture and agriculture, also referred to as Integrated Agri-Aquaculture Systems (IAAS), is a relatively recent development in Nigeria. Integrated agri-aquaculture systems (IAAS) link aquaculture to conventional farming systems. The development of such systems, according to Gooley and Gavine (2003),has been driven by different needs in different parts of the world, including a desire to improve food security on small, subsistence family farms or to minimize pollution and use valuable resources (such as water) more efficiently and effectively. Integrated rice-cum-fish farming is gaining popularity today as it can diversify agricultural production system towards attaining improved productivity and farm income. Rice-cum-fish system is seen as a sustainable alternative to rice monoculture. Rice and fish are important components of the diet of the people in the world, especially in developing country like Nigeria. Rice–fish farming is not practised as a culture system in Nigeria; rather, it is primarily the capture method that is practised. Most of the rice–fish culture methods in Nigeria have been on experimental bases (Ujoh*et al.*, 2016; Akegbejo*et al.*, 2010).

The studies of Okoye (2004) and Yaro (2003) showed 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. It was also observed in these studies that farmers have always caught wild fish in lowland rice fields, but integrated rice–fish culture has never been common. Nevertheless, there is considerable potential for increased involvement of poor farming households in rice–fish culture in both rain fed and irrigated rice, as indicated by successful

examples from such widely separated areas as Bangladesh, Madagascar and Thailand. Rice–fish culture has been practised in 28 countries on six continents. The introduction of fish along with deep water rice in waste wetland ecosystems has been described as having potential benefits: it promotes food output and total productivity (Puste and Bandyopadhyay 2000,; Jhingran, 1991; Dutta*et. al*, 1984). It also can optimize resource utilization through the complementary use of land and water (Frei and Becker, 2005), improves diversification, intensification, productivity, profitability, and sustainability (Ahmed *et al.*, 2007; Nhan*et al.*, 2007).

Rogers (2003) and Neupane*et al.*, 2002 posited that farmers perception determine adoption of improved technology. Farmer's views therefore go a long way in influencing their decision to either accept or reject an innovation. It is in the light of the foregoing that the study provides answers to the following research questions; Are the farmers aware of integrated rice-cum-fish farming? Are rice and fish farmers perception of integrated rice-cum-fish production technology in Ondo State favourable? What are the constraints to integrated rice-cum-fish farming among farmers in the study area?

Thus, the objectives of the study focus on the following:

1. To examine the socio-economic characteristics of rice and fish farmers in Ondo State;
2. To ascertain the farmers' awareness of rice-cum-fish production technology;
3. To determine the farmers' perception of rice-cum-fish production technology; and
4. To determine the socio-economic factors of the farmers influencing their perception of rice-cum-fish production technology

Hypothesis of the study

The null hypothesis formulated is stated as follows:

Ho: There is no significant relationship between respondents' socio-economic characteristics and perception of rice-cum-fish production technology.

MATERIALS AND METHOD

The study was conducted in three local government area in Ondo State, Nigeria namely, Ilaje, Okitipupa and Akure north LGA, areas that are predominantly made up of rain forest and mangrove swamp. Ondo state lies in the southwest geo-political zone of Nigeria, occupying a total land area 15,500km^2 (NPC, 2006). Common food and tree crops cultivated in this area include cassava, yam, maize, rice, plantain, oil palm, cocoa and rubber. The State was specifically targeted for study because it was identified as the most important and promising areas for rice-fish culture, given their favourable resources and climatic conditions, such as the availability of low-lying agricultural land, warm climate, fertile soil, and cheap and abundant labour.

Geographically, the study is limited in scope to the three LGAs being coastal wetlands and areas with potentials for rice-cum-fish farming in the State. The LGAs were Ilaje, Okitipupa and Akure north. Hydrological conditions are also favourable for rice-fish farming as the selected areas are located within the coastal and wetlands of Nigeria (Anyanwu*et al.*, 2007). Data was collected by using validated and pretested structured questionnaire. A multi-stage sampling technique was employed in the selection of respondents. Stage 1, involved purposive selection of 3 local government areas (LGAs), characterized by wetlands, in the State. Information on the selected LGAs was obtained from Nigerian Institute for Oceanography and Marine Research (NIOMR) and validated with the State Agricultural Development Programme (ADP). The LGAs selected areIlaje, Okitipupa and Akure north. Stage 2 involved purposive selection of 3 wetland communities per LGA to give a total of 9. Given the lack of data on population of rice and fish farmers in the purposively selected LGAs, snowball sampling was employed in stage 3, to select 20 rice farmers and 5 fish farmers per community. The higher proportion of rice farmers sampled in this study was because the proposed rice-cum-fish technology was primarily targeted at them. Contact with these farmers was facilitated by personnel of the ADP in Ondo State and NIOMR research scientist. The total targeted samples were 225. However, field response was 180 for rice and fish farmers, which represent about 80% response rate.

Data collected from the respondents were analysed using descriptive statistics (means, standard deviation and percentages) and Chi-square. Percentages and mean were used to analyse the percentage distribution of respondents' personal characteristics. Chi-square analysis was used to determine the

relationship between respondents' characteristics and perception of rice-cum-fish production technology

Measurement of Variables

Famers' Perception of Rice-Cum-Fish Farming: Farmer's perception of the benefits associated with rice-cum-fish technology was assessed on a 4-point Likert type scale as follows: Strongly agree (scored 4), agree (scored 3), disagree (2) and strongly disagree (1). Respondent's agreement or disagreement with the questions/statements were determined using the weighted mean of 2.50. A statement with a score greater than 2.50 means the respondents had positive perception towards rice cum fish farming, or negative perception if less than 2.50.

Results and Discussion

The results of the socio-economic characteristics are shown in Table 1. For the sampled rice and fish farmers, the sex distribution reveal that males recorded higher proportion of persons engaged in rice and fish farming in the study area, with a percentage of 78.38% and 83.92% respectively. This indicates that female participation in these enterprises was probably low**.** This result confirms the earlier findings of Ele (2012), which reported a higher participation of males in the cultivation of rice and raising of fish in Nigeria. The author attributed the observed gender discrepancy to land rights which generally favour male as well as female likelihood and tendency to be engaged in off-farm activities like processing and marketing. Similarly, a training conducted by West Africa Agricultural Productivity Programme and Nigerian Institute for Oceanography and Marine Research WAAPP/ARCN/NIOMR for farmers on commercialization of integrated rice-cum-fish farming in coastal wetland for food production in 2015, also reported high participation of males, implying that men are more involved than women in rice and fish farming in Ondo State. This could be due to the tedious nature of the activities involved in rice and fish farming.

Age is an important socio-economic characteristic because it affects productivity, output and adoption of innovation. Age also indicate the level of youth employment and participation in agricultural activities. The result for age (Table 1) indicates that the highest proportion of the respondents (fish farmers = 43.24%; rice farmers = 41.96%) were 31-50 years old. Overall, over 80% of each respondent group were less than 50 years with a mean age distribution of about 40 and 43 years respectively for the fish and rice farmers respectively. The mean age of the respondents implies that fish and rice farmers in the study area were relatively young and in their active age with an assumption that they could continue in the production processes of rice and fish for many more years and would be able to cope with the labour demand associated with this enterprise or their integration. Being within the productive and economic active age, it is very likely that this age group could support increasing productivity plans for rice and fish production; and this could lead to an improvement in their livelihood.

Table 1: *Percentage distribution of respondents' personal characteristics*

Personal characteristics		Fish farmer		Rice farmer	
		Freq	%	Freq	%
Sex	Female	8	21.62	23	16.08
	Male	29	78.38	120	83.92
	Total	37	100.00	143	100.00
Age range (years)	<= 30	3	8.11	12	8.39
	31 – 40	16	43.24	35	24.48
	41 – 50	12	32.43	60	41.96
	51 – 60	6	16.22	25	17.48
	61+	0	0.00	11	7.69
	Total	37	100.00	143	100.00
Marital Status	Single	0	0.00	19	13.29
	Married	37	100.00	122	85.31
	Widow(er)	0	0.00	2	1.40
	Divorced/Separated	0	0.00	0	0.00
	Total	37	100.00	143	100.00
Educational level	No formal education	3	8.11	3	2.10
	Adult education	1	2.70	2	1.40

	Primary education	2	5.41	45	31.47
	Secondary education	15	40.54	40	27.97
	Technical education	3	8.11	4	2.80
	College of education	3	8.11	18	12.59
	Polytechnic	5	13.51	12	8.39
	University	5	13.51	19	13.29
	Total	37	100.00	143	100.00
Household size	1-4	0	0.00	13	9.09
	5-8	19	51.35	79	55.24
	9-12	4	10.81	21	14.69
	>12	14	37.84	30	20.98
	Total	37	100.00	143	100.00
Farming experience (years))	<= 10	16	43.24	35	24.48
	11 – 20	13	35.14	72	50.35
	21 – 30	8	21.62	31	21.68
	31 – 40	0	0.00	5	3.50
	41+	0	0.00	0	0.00
	Total	37	100.00	143	100.00
Source of farmland	Purchased	1	2.70	16	11.19
	Rented	8	21.62	44	30.77
	Inherited	22	59.46	76	53.15
	Others	6	16.22	7	4.90
	Total	37	100.00	143	100.00

Table 1 also reveal that married persons dominated fish (100%) and rice (85.31%) production in the study area, which suggest that a reason for the respondents' involvement in the enterprise was to better cater for their families. A study carried out by Ofuoku, Egho and Enujeke (2011) also showed that married individuals were more involved in farming. Table 1 also indicate that most of the fish (40.54%) and rice (31.47%) farmers had some level of formal education. The highest proportion of the fish farmers (40.54%) had secondary education while an almost equal proportion of the rice farmers had both primary (31.47%) and secondary education (27.97%). The fact that most of the farmers had formal education, may likely affect or promote a favourable attitude towards rice-cum-fish production technology. Education plays important role in technology perception as well as adoption, and this has significant implication for agricultural development in Ondo State, as there is positive correlation between level of education and innovativeness among farmers (Onemolease, 2004).

Size of farming household is a strong determinant of family labour availability for agricultural production in rural areas. Majority of fish (51.35%) and rice (55.24%) farmers had a household size comprising 5 to 8 members. This was followed by those that have more than 12 household members (fish farmers = 37.84%; rice farmers = 20.98%). The average household size for both farmer groups was 8, suggesting that the respondents had large family size. This finding supports the preponderance of large family sizes among the rural inhabitants (Kumolu-Johnson and Ndemle, 2010). Such large size offers some advantages such as the respondents' access to free and/or cheap or costless labour to assist in the enterprise.

Farmers' years of production experience dictates efficiency and effectiveness in agricultural production, as well as adoption of improved agricultural practices. Table 1 show the experience of farming households with 1-10 years of farming experiences was in the majority among the fish (43.24%) and rice 11-20 years (50.35%) farmers in the study area. The average experience ranged from 21 to 30 years for the fish and rice farmers respectively. The years of farming suggest that rice and fish farmers in the study area have over a decade experience in their respective enterprises, indicating they were quite experienced. This many years of farming may motivate the farmers to want to attempt something new such as rice-cum-fish production system in an attempt to exploit the potentials of agricultural diversification and enhance household income (Kumolu-Johnson and Ndemle, 2010).

Source of farmland, especially ownership of farmland/tenancy security tends to stimulate agricultural production. Table 1 show that majority the fish (59.46%) and rice (53.15%)

farmers inherited the land used for their production purposes. This was followed by those that rented theirs (fish farmers = 21.62%; rice farmers = 30.77%). Rented land tends to increase cost of production, while ownership of land reduces the cost. Ownership of farmland makes it easier for the farmer to incorporate recommended technologies into his/her production plan, while production plan could be distorted in rented land due to dispute, urbanization and land reform policy. Thus, the fact that majority of the respondents inherited their land may enhance favourable attitude towards adoption of the rice-cum-fish production technology, particularly if the original owner of the land has transferred to the next generation. Size of farm determines the scale of production in agriculture. The highest proportion of the respondents operated on less than 1ha of farmland. The average hectare operated by the respondents was 2.52ha. This signifies that rice farmers in the study area operated small farm holdings, which does not really favour commercialization to a great degree. This is so because the tendency to divert most of the output produced by farmers to family consumption is very high. It is possible however, that such small-scale size may discourage the farmer from a positive perception of the rice-cum-fish technology and its potentials to enhance income. Generally in rural Nigeria, farmers hardly cultivate more than a hectare of land as supported by earlier findings of Ogunlade, Adekunle and Akangbe (2000)

Majority of the fish farmers (50.31%) earned above N250,000 monthly while many of the rice farmers (57.45%) earned between ₦50,000-N250,000 monthly. The mean income was ₦184,386.5 and ₦134,784.56 for the fish and rice farmers respectively. The findings suggest that monthly income from rice and fish farming is considerable enough to support their households. However, discussion with some respondents brought to the fore that the income figures quoted differ from month to month depending on the season. Furthermore, this income level may empower the farmers to adopt the proposed rice-cum-fish production technology, since its adoption will require some additional capital investment.

RICE-CUM-FISH PRODUCTION TECHNOLOGY AWARE OF

There are different types of rice-cum-fish production technologies practiced globally. Table 2 explores the actual types the respondents who claimed to be aware of the technology were aware of. The results showed that the most widely known technology among the rice farmers was rice and fish grown on different piece of land on the same farm (32.87%) and rice grown and fish enters from river or stream (11.19%). For the fish farmers, the most widely known technology also was rice and fish grown on different piece of land on the same farm (24.32%), rice and fish being grown concurrently and rice grown and fish enters from river or stream (16.22% respectively). The result indicates that the level of knowledge of rice-cum-fish production technologies among fish and rice farmers in the study area was generally very low.

Table 2: *Rice-cum-fish production technology aware of*

Technologies	Fish farmer		Rice farmer	
	Freq	%	Freq	%
Rice and fish grown concurrently	6	16.22	10	6.99
Rice and fish grown alternately	0	0.00	5	3.50
Rice and fish grown on different piece of land on the same farm	9	24.32	47	32.87
Rice grown and fish enters from river or stream	6	16.22	16	11.19

FARMERS' PERCEPTION OF RICE-CUM-FISH PRODUCTION TECHNOLOGY

Table 3 presents the result of respondents' perception of rice-cum-fish production technology in the study area, with a view to identify salient factors for promotion and commercialization of the technology through programme targeting. The result shows that the addition to income was the major consideration of both the fish (mean = 3.65) and rice (mean = 3.59) farmers. Other considerations include the belief that the system was feasible (fish farmers = 3.59; rice farmers = 3.57), the simplicity of the practice/system (fish farmers = 3.57; rice farmers = 3.53) as well as the government should encourage farmers to go into this system of rice/fishg farming (fish farmers = 3.03; rice farmers = 3.50).

Table 3: *Farmers perception of rice-cum-fish production technology*

Perception statements	Fish farmer		Rice farmer	
	Mean	SD	Mean	SD
It will make any major addition to my current farm income	3.65	.48	3.59	.66
The practice will work well	3.59	.55	3.57	.62
The practice is simple	3.57	.60	3.53	.66
I will encourage others to try this new system	2.62	.72	2.87	.60
The government should encourage farmers to go into this system of rice/fish farming	3.03	.99	3.50	.71
Engaging in this system will enhance my family welfare	2.95	.94	3.29	.71
It is a better way of making better use of the same land for two farming activities i.e. rice and fish farming	2.92	.92	3.28	.71
This system of farming helps reduce labour cost since the same labour is used for both rice and fish farming.	2.86	.89	3.34	.71

CATEGORIZATION OF RESPONDENTS BASED ON PERCEPTION OF RICE-CUM-FISH TECHNOLOGY

In order to categorize the respondents based on their perception on the benefits associated with rice-cum-fish farming technology, the average of the maximum and minimum scores obtainable from the 8 perception statements measured on a scale of 4 to 1 was used. This gave an average of 20 derived as follows: (maximum score: 8*4 = 32); (minimum score: 8*1 = 8); (average: ((32+8)/2) = 20). Thus, any farmer whose composite perception score is above 20 is considered to have a high perception of the benefits of rice-cum-fish farming technology, while anyone who scores less than 20 is said to have a low perception of the benefits. An examination of the frequency distribution in Table 4 shows that almost all (95.10%) of the rice farmers and majority (75.68%) of the fish farmers had high perception of the benefits of the technology. Such high perception may serve as an encouragement for them to adopt the technology.

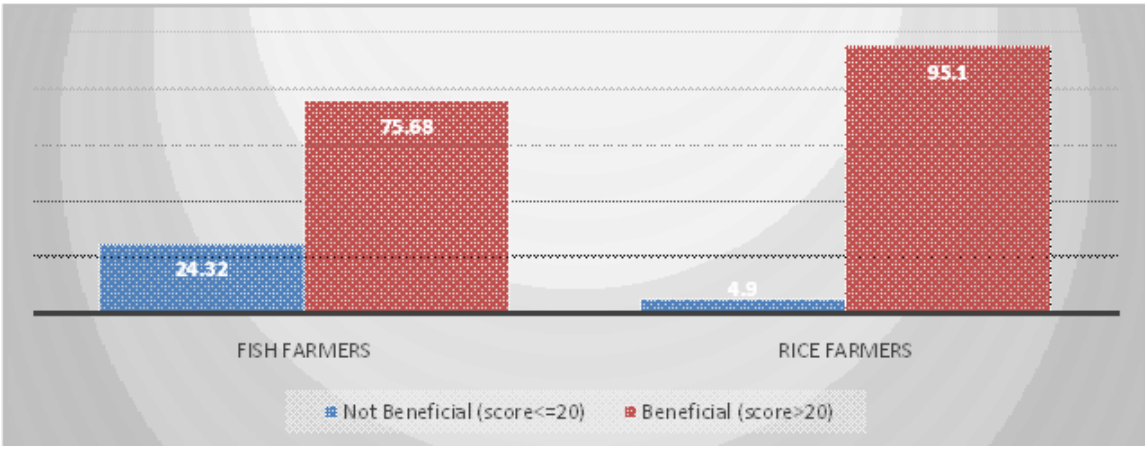

Fig1. *Categorization of respondents based on perception of Benefits*

RELATIONSHIP BETWEEN RESPONDENTS' CHARACTERISTICS AND PERCEPTION OF RICE-CUM-FISH PRODUCTION TECHNOLOGY

Chi-squre was used to estimate the relationship between the respondents' socio-economic characteristics and their perception of rice-cum-fish production technology. The result is presented in Table 5. The analysis was done for both the rice and fish farmers. The probability level for the rice farmers indicate that only one variable was significant or had a significant influence on the farmer's perception to adopt rice-cum-fish technology (i.e. educational level with a chi-square value of 19.40 ($p < 0.01$). Human capital of the farmer is assumed to have a significant influence on farmers' decision to adopt new technologies. (Mwangi and Kariuki, 2015). Most adoption studies have attempted to measure human capital through the farmer's Education (Keelan*et al*., 2014; Mignouna*et al*, 2011; Fernandez-Cornejo*et al*., 2007; Fernandez-Cornejo & Daberkow, 1994). Education of the farmer has been assumed to have a positive influence on farmers' decision to adopt new technology. Education level of a farmer increases his ability to obtain; process and use information relevant to adoption of a

new technology (Lavison, 2013; Namara et al., 2013; Mignouna*et al*., 2011). Education had a positive and significant influence on adoption of the technology. This is because higher education influences respondents' attitudes and thoughts making them more open, rational and able to analyse the benefits of the new technology (Waller *et al*., 1998).

On the other hand, three variables (age, educational level and farming experience) were significant in the fish farmer model. The chi-square value for age was 10.17 ($p < 0.05$). A positive relationship between farmers age and technology adoption have been reported by researchers (Shaibu*et al.,* 2017; Olumba*et al.,* 2014; Asadu, 2011).

The result for education also significant (chi-square = 15.27; $p < 0.05$), suggesting a significant association between education and perception. More educated rice farmers are more likely to have higher perception of the benefit associated with rice-cum-fish technology compared to the less educated farmers. A possible explanation for this result is that the more educated rice farmers are more exposed to information on new technologies, while the less educated may be more dependent on old practices, and therefore will not be interested in any farm innovation that is new. This finding is in line with the expectation, since it was expected that the more educated farmers will be more willing to adopt the technology. Education is said to promote awareness and understanding of complex issues such as farm innovations (e.g. Feder*et al.,* 1985; Prokopy*et al.,* 2008). Other studies have reported the positive correlation between education and farm innovation adoption (Motamed and Singh, 2003; Haque and Ray, 1983).

Similarly, the result for experience shows a significant association between farmers farming experience and their perception of the rice-cum-fish technology (chi-square = 9.60; $p < 0.05$). this suggests that farmers with experience are likely to be more aware of the implications of embarking on this new enterprise.

Table5: *Relationship between respondents' characteristics and perception of rice-cum-fish production technology*

Characteristics	Rice farmer			Fish farmers		
	Chi-square	Df	Prob. Level	Chi-square	Df	Prob. Level
Sex	1.410	1	0.23	0.003	1	0.960
Age range	1.79	4	0.77	10.17	3	0.02*
Educational level	19.40	7	0.01*	15.27	7	0.03*
Farming experience	3.35	3	0.34	9.60	2	0.01*

**Prob. Level < 0.05 are significant*

CONCLUSION

The result of the study has revealed average level of awareness of rice-cum-fish technology among both the rice and fish farmers in the study area. This indicates that this technology is new to the majority of the farmers. Thus, any intervention efforts must devote attention to enlightening the farmers of the existence of technology. The study equally revealed a higher positive perception of rice-cum-fish technology among the sampled farmers. The findings thus suggest that the technology is likely to be widely adopted by the farmers. The study thus recommends that the rice and fish farmers should be exposed to training on the rice-cum-fish production technology. This will enhance their capacity to practice the technology

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