World Journal of Agricultural Sciences 3 (4): 530-535, 2007
ISSN 1817-3047

Farmers' Adoption of Improved Rice Technology in Niamey, Rive Droite Area, Niger Republic

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Abstract: The study attempted to investigate the farmers' adoption of improved rice technology in Niamey, Rive Droite area of Niger republic. Multistage sampling technique was used to select 80 rice farmers from the study area. Data were collected through interview schedule. Frequency counts, percentages, regression analysis and correlation analysis were used as statistical tools for data analysis. The results of the study showed that majority of the respondents were males (92.5%), married (68.8%), with the age range between 41 and 50 years. About 67.5% were illiterate and 71.3% of them were farmers who cultivated less than one hectare with rice. The level of adoption of improved rice technology was high among the farmers. The major sources of information used by the farmers are farmers' groups and extension agents. Multiple regression analysis results showed that sex, primary occupation, farm size and farming experience were significant factors in adoption of improved rice technology. Recommendations included provision of necessary support for utilization of interpersonal media by the farmers in order to further improve the farmers' adoption of improved technology. Also incentives such as credit facilities should be made available to rice farmers by the to enable them procure necessary improved inputs for rice production.

Key words: RIce farmer · adoption · improved rice technology

INTRODUCTION

Since the early 1980's food demand in sub-Saharan Africa has been growing faster than food production, resulting in a decrease in per capita food availability [1]. The need to meet the deficit in food supply has led to the introduction of strategies to increase food production within a short time at a minimum cost [2]. In the light of this, improved rice technology was introduced to farmers in order to boost food production.

Rice (*Oryzae sativa*) is one of the cereals most commonly consumed in the world, especially in Asia and Africa and specifically in Niger Republic. It was noted that since 1973, West Africa's demand for rice has grown at an annually rate of 6.0% driven by the population growth of 2.9% [3]. The consumption of traditional cereals mainly sorghum and millet has fallen by 12 kg per capita and their share in cereals use decreased from 62% in the early 1980's to 50% in the early 1990's. In contrast the share of rice in cereals consumed has grown from 15 to 45% over the same period. Although, the annual rice production is far below the annual rice demand of the country. There is therefore, the need to boost the national production in order to fill this gap.

In order to salvage this situation, FAO in 1994 launched a programme tagged Special Programme for Food Security (SPFFS) [4]. It focused on Low Income Food Deficit Countries (LIFDCs). The SPFFS focused its activities on rapid increase in productivity through participatory development of farming systems. Rice is a major crop in the activities of SPFFS because it is the main food consumed by over 3 billion people in Low Income Food Deficit countries [4]. Apart from being food for people, rice straw is used as forage and hay in livestock production; rice bran and milling are important constituents of livestock feeds. The husks obtained

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from hulling process of rice are an important supplement in the pig industries [5].

The results from SPFFS demonstration pilot area in Niger Republic revealed that through the adoption of improved rice technology package introduced to the farmers, rice yield and benefit-cost ratio had improved [3]. The demonstration success has led more farmers to become interested in rice production, not only for their family's consumption but also for the markets. It is important to find out the extent of adoption of improved rice technology package introduced to the farmers. This study therefore examined farmers' adoption of improved rice technology and its effects on rice productivity in Niamey Rive Driote Area, Niger Republic.

MATERIALS AND METHODS

The study was carried out in Niamey, the municipality number 3 commonly called RIVE DROITE, meaning the right side of the river. Niamey is divided into three municipalities and is crossed by River Niger. Most of the rice farmers are located along the river and RIVE DROITE is one of the most populated rice producing zones.

Traditionally, most of the people in this area are crop farmers; they cultivate rice, millet, sorghum and vegetables. The ecosystem of the area is dominated by sahelian environment where the raining season is relatively short (4-5 months ranging from late May to early October). The major type of rice cultivated is irrigated rice, which is grown along the river with perfect water control in the hydro agricultural parcels, which are under government control.

Multistage sampling technique was used in selecting eighty rice farmers in the study area. The sampling procedure involved random selection of four (4) cooperative societies from the list of cooperative societies in the study area. These are Karaigorau, Kirkissoye, Sagiaamont and Sagiaaval. Each cooperative comprises of several farmers groups from which four farmers groups were randomly selected making a total of 16 farmers groups. Finally, 5 farmers were randomly selected from each farmers group making a total of 80 respondents as sample for the study.

The instrument used for the data collection was structured interview schedule. Personal interview with the respondents was made in their local language (Zarma) and responses were correctly entered and recorded in English language against the questions.

Data were collected on the personal characteristics of the respondents. The respondents were also asked to indicate their level of adoption of improved rice technology based on a five (5) point scale of '1' for knowledge, '2' for persuasion, '3' for decision, '4' for implementation to '5' for confirmation. These five points are based on the stages of adoption of an innovation as identified by Rogers [6]. Thirteen (13) items were listed for the farmers to indicate their level of adoption for each of the item. They included:

- Improved Rice Varieties-IR8, IR15, IR22, IR54, ITA8, ITA 222 and BG 90.
- Herbicide: Londax and Garyl.
- Pesticides: Dimethoate and Furadan.
- Fertilizers: Urea and NPK

The total score on all the items of improved rice technology formed the adoption score of each respondent. Therefore, the expected maximum score was 65 points and the expected minimum score was 13 points for each respondent.

Data collected were subjected to descriptive statistical analysis such as frequency counts and percentages. Inferential statistical analysis was also carried out using correlation coefficients and multiple regression analysis.

Regression equation: $Y = a+b_1X_1+b_2X_2+b_3X_3+b_4X_4 +b_5X_5+ b_6X_{56}+b_7X_7$

Where,

Y = Level of adoption of improved rice technology.
a = Constant
X_1 = Sex (Dummy, Male = 1, Female = 2)
X_2 = Age in years
X_3 = Marital status (Single, Married, Divorced/Widowed)
X_4 = Formal Education in years
X_5 = Primary occupation (Dummy, Rice farming = 1,other occupations = 2)
X_6 = Farm size in hectares
X_7 = Farming experience in years

RESULTS AND DISCUSSION

Personal characteristics of the respondents: Majority (92.5%) of the rice farmers were males while the remaining 7.5% were females (Table 1). This agrees with the finding

Table 1: Distribution of sampled rice farmers according to socioeconomic characteristics, n = 80

Variables	Frequency	Percentage
Sex		
Male	74	92.5
Female	6	7.5
Marital status		
Single	10	12.5
Married	55	68.8
Divorced/widowed	15	18.7
Age (years)		
20-30	11	13.5
31-40	20	25.0
41-50	25	31.3
51-60	18	22.5
61 and over	6	7.4
Years of formal education		
0	54	67.5
1-6	5	6.4
7-12	20	24.8
13 and above	1	1.3
Primary occupations		
Crop farming	45	56.3
Trading	13	16.2
Civil servant	10	12.5
Livestock/fish farming	12	15.0
Farming experience (years)		
1-10	26	32.5
11-20	15	18.7
21-30	16	20.0
31-40	18	22.5
40 and above	5	6.3
Farm size (ha)		
<1	44	55.0
1-3	34	42.5
3 and above	2	2.5

Source: Field survey, 2004, Mean age = 45.5 years, Mean of years of formal education = 2.8 years, Mean of years of farming experience = 21.5 years

of Germine *et al.* [7] that over 90% of rice farmers in Niger Republic were males, the few females engaged in rice farming were mostly widows. As shown in Table 1, the majority (68.7%) of the sampled rice farmers were married while others (31.2%) were either single or divorced or widowed. This conforms to Jibowo's [8] findings that vast majority of the adult population of any society consists of married people.

Table 1 further revealed that the mean age of the respondents was 45.5 years. The survey also revealed that all the respondents were within the age defined by FAO [9] as economically productive population, that is, 15-64 years.

The majority (67.5%) of the respondents were illiterate. The mean years of formal education was 2.8 years. This is in accordance with common fact that majority of peasant farmers are characterized by high rate of illiteracy [10]. This may not be in favour of technological change in rice production because low level of formal education foster poor technological changes by the farmers.

More than one half of the respondents (56.3%) indicated their primary occupation as crop farming. Others were in trade (16.2%), civil service (12.5%) and livestock and fish farming (15.0%). This result showed that majority of the respondents were engaged in farming as their primary occupations, in line with the findings of Jibowo's [8] that vast majority of rural people were engaged in agriculture.

The modal class of the responses on farming experience was 1-10 years with 32.5% of the respondents in this category. The mean of years of farming experience of the respondents was 21.5 years.

Furthermore, from Table 1, majority (55.0%) of the rice farmers cultivated less than 1 hectare with rice while 42.5% cultivated between 1 and 3 hectares with rice. This result showed that majority of the farmers owned relatively small rice farms.

Table2: Distribution of respondents according to rate of use of improved rice technology

	Number of items used							
	0	1	2	3	4	5	6	7
Improved items	F	F	F	F	F	F	F	F
Improved varieties	0 (0.0)	1 (1.3)*	2 (2.5)*	11 (13.8)	8 (10.0)	13 (16.3)	15 (18.8)	30 (37.5)
Pesticides	13 (16.3)	3 (3.8)	64 (80.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Herbicide	16 (20.0)	4 (5.0)	60 (75.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Fertilizer	0 (0.0)	0 (0.0)	80 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Source: Field survey, 2004, *Percentages in parentheses, F-Frequency

Sources of information of the respondents: The farmers in order of importance ranked the sources of information used by them. The respondents ranked farmers groups (86.3%) as their most important source of information followed by Extension Agents (56.3%) while television was ranked third after farmers groups and extension agents, radio and newspaper were ranked less important and least important sources of information respectively. The results showed that farmers' groups and extension agents are the important major sources of information on improved rice technology. This is due to the fact that the farmers were organized into cooperative groups and they relied mostly on the information spread among themselves.

Adoption of improved rice technology: As shown in Table 2, all the farmers used one variety or the other of improved rice varieties. Precisely, 96.2% cultivated more than two improved rice varieties. It may be implied that the rice farmers were still at the implementation stage of adoption of some of the improved rice varieties before the final confirmation stage. Eighty percent used two types of pesticides while 3.8% used at least one type of pesticide and 16.3% did not use pesticides at all. The farmers' adoption of pesticides would ensure effective control of pests and consequently improve their rice yield. Twenty percent of the rice farmers controlled weeds on their farms manually. Five percent of the rice farmers used only one recommended herbicide, while 70% used the two recommended herbicides, that is, Londax and Garyl. It was further revealed that all the rice farmers made use of both NPK and Urea fertilizers. The rice farmers satisfactorily applied the recommended fertilizers for basal dose (NPK) and top dressing dose (Urea).

Table 3: Frequency distribution of respondents according to adoption scores

Adoption scores	Frequency	Percentage
24-28	1	1.3
29-33	1	1.3
34-38	2	2.5
39-43	5	6.3
44-48	6	7.5
49-53	19	23.8
54-58	19	23.8
59-63	27	33.8

Source: Field survey, 2004, Mean score = 53.26points, Expected maximum score = 65 points, Expected minimum score = 13 points

Table 4: Frequency distribution of respondents according to rice yields

Rice yield (kg ha^{-1})	Frequency	Percentage
1000-2000	1	1.3
2001-3000	5	6.2
3001-4000	20	25.0
4001-5000	39	48.8
5001-6000	12	15.0
6001-7000	3	3.7

Source: Field survey, 2004, Mean rice yield = 4,316.61 kg ha^{-1}

The result revealed that majority (57.6%) of the respondents had their adoption score above the mean score of 53.26 points out of the expected maximum score of 63 points (Table 3). This showed that there is high level of adoption of improved rice technology among the majority of the farmers in the study area. It could therefore, be inferred that there were more innovative farmers engaged in rice production in the study area. This is contrary to the findings of Fatoba and Wudiri [11] that transformation in rice cultivation in developing countries occurred at a slow pace. The high level of adoption of improved rice technology among the farmers in the study area is due to the success of SPFFS demonstration in Niger Republic [3].

Table 5: Frequency distribution of respondents according to the extent of use of sources of information on improved rice technology

	Ranks of sources of information according to extent of use				
	1	2	3	4	5
Sources of information	F	F	F	F	F
Extension agent	29 (36.3)*	45 (56.3)*	5 (6.3)	1 (1.3)	0 (0.0)
Farmers group	0 (0.0)	6986.3)	8 (10.0)	3 (3.8)	0 (0.0)
Television set	0 (0.0)	0 (0.0)	57 (71.3)	22 (27.5)	1 (1.3)
Radio	0 (0.0)	0 (0.0)	0 (0.0)	66 (82.5)	14 (17.5)
Newspapers	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	80 (100.0)

Source: Field survey, 2004, *Percentages in parentheses, F-frequency, 1 = most important, 2 = important, 3 = moderately important, 4 = less important 5 = least important

Table 6: Result of correlation test showing relationship between selected variables and level of adoption of improved rice technology

Variables	Coefficient (r)
Age	0.401*
Formal education	-0.061
Farm size	0.039
Farming experience	0.446*
Source of information	0.221**
Yield	0.325*

Source: Field survey, 2004, **Significant at p<0.01 levels, *Significant at p<0.05 levels

Table 7: Result of regression analysis of independent variables and level of adoption of improved rice technology

Form of equation	Sample size	Constant	X_1	X_2	X_3	X_4	X_5	X_6	X_7	R^2
Linear	80	62.76	-8.11	-0.12	-0.44	0.24	-1.34	2.29	0.47	0.51
t-value			-2.51*	-0.81	-0.35	0.66	-2.15*	1.79*	3.49**	

Source: Field survey, 2004, Multiple R = 0.713, *Significant at 5%, **Significant at 1%, Legend: X_1 = Sex, X_2 = Age, X_3 = Marital status, X_4 = Formal education, X_5 = Primary occupation, X_6 = Farm size, X_7 = Farming experience

The high level of adoption of improved rice technology among the farmers in the study area might lead to improved rice yield. The result of correlation analysis in Table 6 revealed that there is positive and significant relationship between the respondents' levels of adoption of improved rice technology and their rice yields ($r = 0.325$, $p<0.05$). It implies that the higher the respondents' levels of adoption of improved rice technology, the higher their rice yields. This confirms the observation of Onwueme and Sinha [12] that the adoption of improved technology boosts crop yield. The mean yield of threshed rice in Niger Republic is 4, 316.61 kilogrammes per hectare. This yield falls between 4 and 4.5 tonnes per hectare for farmers who adopted improved rice technology as observed by the FAO [3], Germaine *et al.* [7].

Evidence from the data Table 4 shows that about one half (48.8%) of the respondents had rice yields between 4,001 and 5,000 kilogrammes per hectare with the mean yield of 4,316.61 kilogrammes per hectare. This result is supported by FAO [3], Germaine *et al.* [7] that average rice yield of farmers who adopted improved varieties was between 4,000 and 4,500 kilogrammes per hectare. The average yield of 4,316.61 kilogrammes per hectare in the study area is a true reflection of adoption level of improved rice technology by the rice farmers. The adoption level of improved rice technology by the rice farmers was relatively high and consequently the farmers got high rice yields.

Relationships between respondents' socioeconomic characteristics and their adoption of improved rice technology: Table 6 revealed that there is positive and significant relationship between the respondents' levels of adoption of improved rice technology and their age ($r = 0.401$, $p<0.05$), farming experience ($r = 0.446$, $p<0.05$), yield ($r = 0.325$, $p<0.05$) and source of information ($r = 0.221$, $p<0.05$) while formal education ($r = -0.061$, $p<0.05$) showed negative but non-significant relationship with level of adoption of improved rice technology. The implication of this result is that as the farmers advance in age and farming experience and exploring various sources of information, the higher their levels of adoption of improved rice technology.

Results of regression analysis in Table 7 showed that multiple correlation exists between the socioeconomic characteristics of the respondents and their levels of adoption of improved rice technology with multiple R of 0.713. The results of the multiple regression analysis further showed that the respondents' sex and primary occupation show negative and significant relationships with their levels of adoption while the respondents' farm size and farming experience show positive and significant relationships with their levels of adoption of improved rice technology. This implies that variation in the respondents' levels of adoption of improved rice technology could be accounted for by the their sex, primary occupations, farm size and farming experience.

The regression equation containing variables that made significant contribution to adoption levels of the rice farmers is as given below:

$$Y = 62.76-8.11X_1-1.34X_5+2.29X_6+0.47X_7$$

Where,

Y = Level of adoption of improved rice technology.

a = Constant

X_1 = Sex
X_5 = Primary occupation
X_6 = Farm size
X_7 = Farming experience

CONCLUSIONS

The study examined the adoption of improved rice technology and its effects on rice productivity in Niamey area, Rive Droite area of Niger Republic. The frequency distribution shows that majority of the respondents were males (92.5%), married (68.8%) and within the age range of 41-50 years, 67.5% were illiterate with primary occupation been farming. The level of adoption of improved rice technology was moderately high among the farmers. The major sources of information used by the farmers are farmers' groups and Extension Agents. Multiple regression analysis showed that the farmers' sex, primary occupations, farm size and farming experience contribute significantly to their levels of adoption of improved rice technology.

Based on the results of the study, the following recommendations were advanced for continued adoption of improved rice technology and increased yield among the rice farmers:

- Farmers should be encouraged to attend adult literacy classes so as to be able to read and write because education play critical role in the adoption and diffusion of innovations.
- There should be adequate provision of necessary support for utilization of interpersonal media by the farmers in order to further improve the farmers' adoption of improved technology.
- Incentives such as credit facilities should be made available to rice farmers by the government to enable them procure necessary improved inputs for rice production.

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