GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 8 NO. 1 2009: 71 - 75
 ISSN 1596 – 2903

ENVIRONMENTAL RISK MANAGEMENT STRATEGIES: HOUSEHOLD RESPONSE TO RICE YIELD VARIABILITY IN EBONYI STATE, NIGERIA.

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(Received 5 February, 2009; Revision Accepted 25 May, 2009)

ABSTRACT

The environmental risk management strategies used by farmers in response to rice yield variability in Ebonyi State, Nigeria was examined. A total of 108 rice farmers were interviewed using structured questionnaire. Data analysis shows that the mean age of the farmers was 45.9 years and majority (63%) had only primary school education. Rice production was at the peasant level with majority of the respondents cultivating between 0.6 and 1.0 hectare. The results show that farmers use mostly *ex ante* strategies, involving diversification and flexibility to manage environmental risk. The major constraints facing environmental risk management in the area include non-accessibility of fund to purchase inputs at the appropriate time, ($\overline{X}$ = 3.69), inadequate information on weather situation ($\overline{X}$ = 3.36), inadequate extension services ($\overline{X}$ = 3.07), lack of irrigation facilities ($\overline{X}$ = 3.01), and non-availability of improved rice varieties ($\overline{X}$ = 3.00). The research suggests, among others, the provision of irrigation facilities and adequate extension services to farmers to enable them effectively manage the environmental risks affecting rice farming in the area.

KEYWORDS: Environmental risk, Management strategies, Households, Rice yield variability, Ebonyi State.

INTRODUCTION

The environment, either physical or biological, plays vital roles in agricultural production, especially in the area of crop production. It strongly influences crop yield and yield variability, which are defining characteristics of agriculture (Adams, 2000). Eboh *et al* (2006) noted that variations in crop yield are a product of interplay of several factors including agro-ecological, socio-economic, institutional and farm level management conditions. From historic times, smallholder farmers have adapted their farming systems to climate variability, changing economic situations, technologies and resource availability. According to Randhawa *et al* (1961), the experience of centuries has taught the traditional farmer an empirical art of practicing agriculture that is in tune with nature's vagaries.

In order to cope with climatic variability, farmers use a series of indicators to plan production activities. Indicators are developed by observations and experiences and information passed down by previous generations constitute a local knowledge base, which still plays a role in climate risk management (Hatch, 1984; Selvaraju, et al, 2004). Farmers have also incorporated modern practices into their local practices by a process of revising local knowledge systems, reinterpreting apriori ideas and incorporating the new system. Revision and modifications demonstrate the dynamic nature of production strategies and the ability of farmers to adjust to given circumstances (Bebbington, 1991; Markowitz and Valdivia, 1999).

From the planting of rice, it is exposed to the vagaries of weather, which affect yield and consequently the return to the farmers. Reports have shown a continuous inter-annual variation in rice production especially in Ebonyi State. Generally noted as a rice producing state in Nigeria, Ebonyi State has great potentials for rice production. Mbah, *et al* (2000) noted that the unique environmental conditions of the state allow for both upland and lowland productions.

In spite of these potentials, rice production seems not to have faired very well as expected, when viewed against the backdrop that the present production level can be surpassed with better production management. This research is therefore needed primarily to identify the various management strategies employed by farmers to improve yield and the variability of rice yield in Ebonyi State, Nigeria. Attention was also paid to the socio-economic characteristics of the respondents and the constraints to effective environmental risk management in the study area.

METHODOLOGY

The Study Area

The study area is Ebonyi State, which lies approximately $7^0 3^1$N, and longitudes $5^0 4^1$E and $6^0 45^1$E. It has a land mass of approximately 5,932 square kilometers (EBMOI, 2005) and a population of 2.1 million people (NPC, 2006).

Ebonyi state is located in the southeast zone of Nigeria, which is characterized by mean annual rainfall of between 2250mm in the south and 1500mm in the northern part of the zone, average annual temperature of about 27^0C with relative humidity of 85% (Nwakpu, 2003). The vegetation of the state is a mixture of savanna and semi-tropical forest with agriculture as the mainstay of the economy. The underlying parent materials consist of shales inter-bedded with sand and limestone. The soil is texturally clay loam, fairly to poorly drained with gravely sub-soil in some locations especially the upland adjacent to lowland areas (Ekpe *et al*, 2005).

Two main seasons prevail in the area – the

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rainy season, which spans from late April to early November, and the dry season, which lasts from late November to early April. However, short dry spell is usually experienced during the month of August, and this is termed the August break. Lowland areas popularly called fadamas are largely available and serve as good sites for rice and dry season vegetable farming. Major crops grown in the area include rice, yam, groundnut, cocoyam, vegetables, cassava, maize and cowpea.

Sampling Procedure

A multistage sampling procedure involving random sampling techniques was adopted for this study. The first stage involved a random sampling of six (6) out of the thirteen (13) Local Government Areas (LGAs) in the state. This was followed by a random selection of three (3) communities from each of the local government area randomly sampled, giving a total of eighteen (18) communities. Next, a list of farming households in each of the 18 communities as compiled by EBADEP served as the sample frame. From this, a simple random sampling was used to select six (6) rice farmers from each of the 18 communities to give a total of one hundred and eight (108) respondents for the study. A structured questionnaire was used to collect information from the farmers.

Analytical Technique

Descriptive statistics were used to analyse the data obtained based on the objective of the study. Such tools include frequency distribution tables, percentages, means and Likert scale.

RESULTS AND DISCUSSION

Socio-Economics Characteristics of Respondents

Table 1 shows the socio-economic characteristics of rice farmers in the study area. The result indicated that the mean age of the respondents was 45.9 years with 67.69% of respondents between 20 and 50 years of age. This result probably shows that majority of the farming population were young and in the active age group. This could have great implications for environmental risk management. Young farmers are expected to be more enthusiastic in the adoption and use of more efficient farm management practices.

The survey also indicated that the level of education of the farmers is low. About 63% of the respondents had the first school-leaving certificate (primary education) as the highest academic qualification and 11.11% had tertiary education. This limits the farmers' opportunity to reduce yield variability through better risk management. Eboh *et al* (2006) noted that better education promotes the adoption and use of new yield-increasing technologies/inputs and more efficient farm management practices. Majority (about 55%) of the respondents were involved in changing of occupations/jobs. They combined their primary occupation with farming. Studies (Shijun et al, 2005; Alimba, 1995; Olayide, 1980) show that most rural people combine farming with non-farming activities in various degrees; and occupational diversification can be a good coping method for the impact of environmental risk.

Experience in rice production expresses farmer knowledge, which could affect ability to assimilate risk management related information effectively. Result in this show that the respondents have a mean farming experience of 20 years in rice farming with 38.89% (42) having between 11 and 20 years of experience in rice farming. This may give majority of the farmers good knowledge in the indigenous methods of environmental risk management. Most (54.63%) of the farmers cultivated a total farm size of between 0.6 and 1.0 hectare. However, the mean farm size cultivated for rice last cropping season was 0.91 hectare showing peasant level of production. The small farm size cultivated could impair the use of costly environmental risk management methods like irrigation practices. The average number of plots cultivated for rice was about 3 plots. Seventy five percent of the respondents cultivated between 1 and 3 plots while 25% cultivated between 4 and 9 plots. This high land fragmentation coupled with their small sizes has negative effects on farmers' response to invest in modern environmental risk management practices.

Furthermore, the study equally showed that the mean income from rice farming last cropping season was ₦50,314.80. However, 32.41% earned above ₦70,000.00. Farm income is expected to have positive influence on farmers' response to manage environmental risks. The level of access to extension services in the area was low. About 69% of the respondents had no form of access to extension services while about 31% was visited at least once by an extension agent last cropping season to discuss methods of increasing rice yield on their farms.

Environmental Risk Management Methods Used by Rice Farmers

The various environmental risk management methods used by the farmers in rice production are shown in Table 2. The major environmental risk management methods used by the farmers include early land preparation and planting (92.59%), adoption of crop diversification (81.48%), use of improved rice varieties (74.07%); use of drainage practices (66.67%) and engaging in non-farm activities for income generation (54.63%). The least environmental risk management practices adopted by farmers were the agroforestry practices (4.63%) followed by the use of irrigation practices (9.26%) and postponing rice transplanting (9.26%).

The result indicated that the farmers used more of diversification and flexibility methods, which reduce the environmental risks, than those methods which reduce impact of the risk after production shortfalls have occurred. This implies that the farmers were more interested in the reduction of environmental risk associated with rice yield variability. However, farmers who are exposed to environmental risk use the management methods in different combinations to ensure their survival despite all odds. Some of these strategies are employed under certain risky situations and are easier to identify as response to risk.

Farmers plant various crops on separate plots (Spatial and crop diversification). This may be to diffuse environmental risk. Shijung, *et al* (2005) noted that land allocation procedure helps to reduce the production risk through diversification of land type. They also noted that crop diversification is an important strategy used by

farmers to diffuse climate risk. Early land preparation and planting coupled with the use of improved rice varieties could help farmers to reduce yield variability in the rice farms. Early planting enables rice plants to utilize resources such as rainfall for increased development and better yield. Also, improved rice varieties are able to withstand the vagaries of weather when compared to local varieties.

The high use of drainage practices may not be unconnected with the type of farmland cultivated. Farmers who cultivate lowland (swampy) areas may be concerned with good water flow system on the farm. Drainage prevents water logging, encourages proper air flow and reduces the impact of excessive rainfall causing flooding of rice field. However, the low number of farmers practicing agroforestry shows that it is unpopular among rice farmers in the area. Agroforestry has great potentials in reducing environmental risk and improving rice yield. Tapp (1984) quoted by Umeh (2005) found a 10% increase in rice yield behind a permeable windbreak.

Low use of irrigation practices shows that rice production in the area is mostly rainfed. Variations in rainfall have been adjudged a critical factor in the variability of rice yield. The non-significant use of irrigation practices by the farmers may be due to such factors as land fragmentation, and low income to purchase irrigation equipments. Other environmental risk management methods not highly utilized include the insurance policy and the R-box technology.

Constraints to Environmental Risk Management

Some problems were identified to constrain the effective management of environmental risk in the study area. These problems are presented on Table 3. The problems identified include: non-accessibility of fund to purchase required inputs at the right time, insecure land tenure system, low literacy level, lack of irrigation facilities, and inadequate information on weather situation. Others were lack of modern drainage facilities, inadequate extension (support) services, adopting inappropriate technologies, and non-accessibility to improved rice varieties. It was however established that the most critical environmental risk management constraints were non-accessibility of fund to purchase required inputs on time ($\overline{x}$ =3.69), inadequate information on weather situation ($\overline{x}$ =3.36), inadequate extension (support) services ($\overline{x}$ =3.07), lack of irrigation facilities ($\overline{x}$ =3.01), and non-availability of improved rice varieties ($\overline{x}$ =3.00). Lack of modern drainage facilities was rated least.

CONCLUSION

The research shows that rice farmers operate largely on subsistence level. That the farmers depend on *ex ante* (adaptive) strategies such as diversification and flexibility methods implies that they are more concerned with reducing the environmental risks than reducing the impacts of these risks. However, their efforts to achieve this are thwarted due to non-accessibility of fund to purchase inputs at the appropriate time, lack of irrigation facilities, inadequate supply of improved rice varieties and inadequate extension services, among others. It is therefore suggested that water supplementation strategies, improved rice varieties that can withstand water stress and extension services be provided to rice farmers. These will enable them to manage environmental risk factors effectively, reduce variability in yield and increase the predictability of returns.

Table 1: Socio-Economic Characteristics of Respondents

Variables	Frequency	Percentage
Age range (years)		
20 – 3 0	16	14.81
31 – 40	19	17.59
41 – 50	38	35.19
51 – 60	15	13.89
61 – 70	20	18.52
Educational Level		
No formal education	34	31.48
Primary education	34	31.48
Secondary education	28	25.93
Tertiary	12	11.11
Occupation		
Farming alone	49	45.37
Private Job + Farming	17	15.74
Government job + Farming	15	13.89
Trading + Farming	19	17.59
Hunting and Fishing	8	7.41
Farming Experience (years)		
1 – 10	22	20.32
11 – 20	42	38.89
21 – 30	25	23.15
31 – 40	14	12.96
41 – 50	5	4.63
Farm size (ha)		
0.1 – 0.5	17	15.74
0.6 – 1.0	59	54.63
1.1 – 1.5	24	22.22
1.6 – 2.0	8	7.41
Number of Rice Farms cultivated		
1 – 3	81	75.00
4 – 6	24	22.22
7 – 9	3	2.78
Farm Income last cropping season (₦)		
Less than 31,000	32	29.63
31,000 – 50,000	26	24.07
51,000 – 70,000	15	13.89
Above 70,000	35	32.41
Access to Extension services		
Yes	34	31.48
No	74	68.53

Source: Field Survey, 2006.

Table 2: Distribution of Respondents According to Risk Factor Management Methods Used

Methods Used	Frequency	Percentage
Early land preparation and planting	100	92.59
Adopting crop diversification	88	81.48
Use of improved rice varieties as recommended by EBADEP	80	74.07
Use of drainage practices	72	66.67
Sub-soiling with organic manure before planting rice	55	50.93
Adopting spatial diversification	50	46.30
Use of mixed cropping system in rice farms	26	24.07
Adopting recommended plant spacing	24	22.22
Insuring rice farm with NAIC	12	11.11
Use of cover crops in rice farms	10	9.26
Postponing rice transplanting	10	9.26
Use of irrigation practices	10	9.26
Adopting agroforestry practices	5	4.63
Total	**542***	

Source: field Survey, 2006.

*Multiple Responses Recorded.

Table 3: Constraints to Environmental Risk Management

Constraint	Means Score X
Non-accessibility of fund	3.69
Inadequate information on weather situation	3.36
Inadequate extension services	3.07
Lack of irrigation facilities	3.01
Non-availability of improved rice varieties	3.00
Low management skills due to low literacy	2.94
High cost of labour	2.94
Non-accessibility of crop yield insurance scheme	2.83
Adapting inappropriate technologies	2.80
Insecure land tenure system	2.70
Conservative attitudes of farmers	2.70
Lack of drainage facilities	2.55
Overall mean Rating	**2.97**

Source: Calculated from field data, 2006.

NB: Any mean score, X greater than the decision rule, DR, of 2.50 shows that the constraint affects environmental risk factor management.

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