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Adoption of Rice Technologies Introduced by the United States Agency for International Development in Anambra and Ebonyi States, Nigeria

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Abstract
The study determined the levels of adoption of improved rice technologies introduced by USAID MARKETS project phase one in Anambra and Ebonyi States, Nigeria. The population of the study included all project participant rice farmers of USAID MARKETS project in both Anambra and Ebonyi States. A total sample of 80 respondents (40 project farmers from each state) were selected using purposive and simple random sampling techniques. An interview schedule was used for data collection, while percentage and mean statistics were used to analyze data. The results of the study revealed that mean ages of the project farmers (PFs) was 46.56years while 86% of the PFs were literate and the mean rice farming experience was 22 years. The mean total rice farm land owned by PFs was 2.99 hectares mainly on rented basis, while majority got information on rice production and processing from the project. The project farmers highly adopted the following innovations; use of FARO 44 seed variety, carrying out a seed germination test before planting, carrying out appropriate land preparation using either manual or machinery (tractor), seed broadcasting on wet field and upland rice, use of herbicide and storage of paddy produce (packing bagged rice grains in cool dry, fumigated and aerated conditions).
Keywords: Adoption, USAID, Rice Project.

Introduction

Rice (*Oryza sativa*) is the most important staple food for about half of the human race (Akpokodje, Lançon and Erenstein, 2001; National Cereals Research Institute (NCRI), 2004). The demand for rice in sub-Saharan Africa is growing much faster than for any other grain, with both the rich and poor relying on it as a major source of calories (Kormawa and Akande, 2004). The country has a potential land area of between 4.6 to 4.9 million hectares suitable for rice production, but only 1.7 million hectares or 35% is being cropped (Ojehomon, Adebayo, Ogundele, Okoruwa et. al., 2009). The small number of hectares under cultivation is an indication that food sufficiency through rice production has not yet been realized as rice production is left in the hand of

smallholders whose output is inadequate and paddy processing is substandard (Longtau, 2003a; Federal Republic of Nigeria (FRN), 2006). The domestic production is also constrained by low-input and crop management techniques by small scale rice farmers, as well as lack of water

Longtau (2003b) recalled various efforts that have been made to improve rice production in Nigeria by federal government of Nigeria with collaboration of national and international organizations. The current programmes include Rice Box(R-Box) package, the United States Agency for International Development (USAID) Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites (MARKETS) and the National Rice Development Strategy (NRDS) (launched in May 2008) among others (Okpe, 2010). The United States Agency for International Development (USAID) is the United States government agency primarily responsible for administering civilian foreign aid (Wikipedia, 2010). The agency's recent intervention in food and agriculture production is known as Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites (MARKETS) (USAID-MARKETS, 2010).

USAID MARKETS began as a US $24,000,000, five-year project designed to support USAID/Nigeria's Strategic Objective. The project was initiated in 2005 and ended in 2010. It was designed to expand economic opportunities in Nigeria's agriculture sector by increasing sales and jobs through commercialized agriculture, value-added processing, and improved on-farm productivity. It has a mandate to work along the entire rice value chain in order to improve on-farm productivity and sales and income. It provided technical assistance, training, and access to production technology through small farmer/producer associations. It is partnering with some credible rice processors and the public sector to develop an efficient commercial rice industry model that benefits smallholder farmers, while introducing best farming and processing practices, which aim to make Nigerian rice compete with imported rice.

After more than five years of operation, the assessment of the USAID MARKETS project phase one in terms of adoption of improved rice production of the rice farmers become pertinent and the foregoing question becomes imperative. What are the levels of adoption of improved rice production and processing practices introduced to the farmers by the project?

Purpose of the study

The main purpose of the study was to determine the levels of adoption of improved rice technologies introduced by USAID MARKETS project phase one in Anambra and Ebonyi States, Nigeria. Specifically, the study was designed to:

1. identify socio-economic characteristics of the farmers; and

2. determine levels of adoption of improved rice technologies (production practices, processing and marketing) introduced by the project.

Methodology

The study was carried out in Anambra and Ebonyi States in the south-east zone of Nigeria. The two states participated in the first phase of USAID MARKETS project. Anambra State of Nigeria is made up of 21 Local Government Areas (LGAs) and four Agricultural Zones (AZs) - Aguata, Anambra, Awka and Onitsha. It is located in the South-East region of Nigeria between longitude 6^0 36'E and 7^0 21'E and latitude 5^0 38'N and 6^0 47'N. Major crops grown in the state among others include rice, cassava, yam, maize, okra and cocoyam. The first phase of USAID-MARKETS project in the state covered 2 LGAs. Twenty-two rice farmer cooperatives with a total population of about 440 farmers were registered under the project (USAID-MARKETS, Anambra State 2010 Report). Ebonyi State is made up of thirteen LGAs. It lies on latitudes 5^0 40'N and 6^0 45'N and longitudes 7^0 30'E and 8^0 46'E. The major occupation of the State is farming. The first phase of USAID-MARKETS project in the state covered 12 LGAs. Sixty-eight rice farmer cooperatives with a total population of about 1,360 farmers were registered under the project (USAID-MARKETS, Ebonyi State 2010 Report).

The population of the study included all project participant rice farmers (PPFs) of USAID MARKETS project in both Anambra and Ebonyi States. The project operates in two local government areas (LGAs) out of the 21 LGAs in Anambra State and these included Anambra East and Ayamelum LGAs. In Ebonyi State it operates in 12 LGAs out of the 13 LGAs. In Ebonyi State, two LGAs (Ikwo and Izzi) out of the 12 participating LGAs were purposively selected based on their high rice production activities in the State, while the two participating LGAs in Anambra State were used. The list of registered USAID co-operatives for each selected LGA was collected from the project's state head office, Awka (Anambra State) and Abakaliki (Ebonyi State). From the list, a total of 10 out of the 22 registered cooperatives in Anambra State and 10 out of the 68 registered cooperatives in Ebonyi State were selected using simple random sampling techniques. Four cooperative members or project farmers each from the 10 selected cooperatives in each State were selected by the use of simple random sampling technique. This gave a total of 40 project farmers selected from each State, giving a total sample of 80 respondents. An interview schedule was used for data collection, while percentage and mean statistic were used to analyze data.

The adoption levels of the improved rice production practices, processing and marketing technologies introduced by the project were determined. To achieve this, the farmers were asked to indicate their adoption level on a 5-point Likert-type adoption scale. Their response categories and the corresponding weighted values were as follows: Aware = 1; Interest = 2; Evaluation = 3; Trial = 4; Adoption = 5. The adoption indices and levels of the farmers were calculated as follows:-

a) Computation of the total mean (M) adoption score. This was computed by dividing the total adoption scores by the number of respondents involved.

b) Computation of the grand mean (M) adoption score. This was calculated by adding all the mean adoption scores and dividing them by the number of innovations considered.

c) Computation of the adoption index was carried out by dividing the grand mean (M) adoption score by 5 (i.e. the 5-stage of adoption process).

Results and Discussion

Socio-economic characteristics of the respondents

Data in Table 1 show that greater proportion (35%) of the project participant farmers (PPFs) were between 40-49 years of age and the mean was 46.56 years, implies that they were at their middle and productive age. This finding is in line with that of Nwalieji and Uzuegbunam (2012) which reported that majority of rice farmers are still within their middle, active and productive ages and hence can engage efficiently in rice production. Majority (68.8%) of the PPFs were male, implies that rice production enterprise in the area is dominated by male since they are said to have stronger aspiration to invest in rice production enterprise than females. Table 1 also shows that majority (88.8%) of the PPFs were married, implies that there are more married rice farmers in the study area. greater proportion (31.2%) of the PPFs completed primary school and about 86% were literate and could read and write by having attended formal education. majority (58.8%) of the PPFs had household sizes of 6-10 persons and the mean household size was 8, implies that farmers had very large household size which could provide cheaper source of farm labour. greater proportion (38.7%) of the PPFs had 10-19 years of rice farming experience and the mean rice farming experience was 22.20, implies that the farmers had very long years of rice farming experience. greater proportion (37.5%) of the PPFs had both less than 2 hectares and 2.0-3.9 hectares and the mean total rice farm land owned by PPFs was 2.99 hectares, implies that the rice farmers are generally relatively small holders.

Table 1: Percentage distribution of respondents according to their socio-economic characteristics

Variable	PPF (n=80)	
	%	M
Age (years)		
20-29	03.8	
30-39	22.4	
40-49	35.0	46.5
50-59	27.6	6
60-69	11.2	
Sex		
Male	68.8	
Female	31.2	
Marital status		
Single	05.0	
Married	88.8	
Widowed	05.0	
Separated	01.2	
Educational level		
No formal education	13.8	
Primary school attempted	02.5	
Primary school completed	31.2	
Secondary school attempted	02.5	
Secondary school completed	25.0	
Tertiary education (OND/NCE)	16.2	
HND/First Degree holder)	06.2	
Higher degree (PGD/M.Sc./Ph.D)	02.5	
Household size (number)		
1-5	20.0	
6-10	58.8	
11-15	18.7	8.00
16-20	02.5	
Rice farming/work experience (years)		
0-9	03.8	
10-19	38.7	
20-29	31.3	
30-39	20.0	
40-49	06.2	22.2
Total rice farm size (hectare)		0
0-1.9	37.5	
2.0-3.9	37.5	
4.0-5.9	13.8	
6.0-7.9	02.4	
8.0-9.9	03.8	
10.0-11.9	05.0	2.99

Source: Field survey, 2013

Adoption levels of the improved rice production practices, processing and marketing technologies introduced by USAID MARKETS project 1

Selection of rice varieties

Table 2 shows that the selection of improved rice varieties, FARO 44 (Sipi 692033) had highest mean adoption score of 5.00, FARO 52 (WITA 4) had 2.02, FARO 46 (ITA 150) had 1.14 and FARO 55 (Nerica 1) had mean adoption score of 1.16. Their grand mean adoption score was 2.33, with adoption index of 0.47. This implies that majority of the project farmers were still at the interest level of the adoption process in the use of the rice varieties recommended to them by the project. Also 47% of these farmers were involved in the adoption processes of the selection of various rice varieties disseminated to them. The below average adoption of these rice varieties might be that farmers had inadequate knowledge of all the varieties in respect of quality and popularity except FARO 44 variety which was at adoption stage. This shows that FARO 44 variety is high quality variety and had gained popularity. This is in line with Nigeria MARKETS (2012) which noted that availability of high quality rice paddy is sure way to compete with imported rice, and farmers must therefore grow the long-grain, high-quality rice paddy (FARO 44) for processors to produce high quality rice.

Preparation of seed

Data in Table 2 reveal that the mean adoption score of PFs in carrying out a seed germination test before planting was 4.52, while seed treatment with acceptable insecticide before sowing had mean adoption score of 4.20. The grand mean score was 4.36 and the adoption index was 0.87 which means that 87% of the farmers were involved in the adoption processes of preparation of seed innovations disseminated to them. The high adoption is an indication that majority of farmers are aware of the advantages of carrying out seed germination test and seed treatment before planting.

Land preparation

Entries in Table 2 show that the mean adoption score of PFs in carrying out good land preparation using either manual or machinery (tractor) was 5.00, while zero tillage- use of systemic herbicide such as *Glyphosate* had mean adoption score 3.50. The grand mean score of the two innovations under land preparation was 4.25, while the adoption index was 0.85. This means that 85% of them were involved in these various adoption processes. The high adoption is an indication that majority of farmers are aware of the benefits of carrying out good land preparation before

planting rice. The finding is in line with Adeola, Adebayo and Oyelere (2008) that manual preparation of land is very common among the participating farmers.

Planting method

Data in Table 2 reveal that direct seed broadcasting on wet field and upland rice had the highest mean adoption score of 4.56. This was followed by random transplanting method that had mean adoption score of 4.25, while row/straight line transplanting method and direct seed sowing/dibbling of seed rice in beds or on flat surface, had mean adoption score of 1.41 each. This implies that only broadcasting method was adopted among the planting methods recommended. The grand mean score of the four innovations under planting method was 2.91, while the adoption index was 0.58. This implies that 58% of them were involved in these various adoption processes of planting methods. The high adoption could be that majority of the project farmers are quite aware of the advantages of the planting methods recommended especially broadcast method which was widely adopted compared to other methods. USAID MARKETS (2009) reveals that farmers made highest profit per hectare using broadcast method followed by transplant method. However, farmers obtained highest income per hectare using transplant method. Therefore, for profitability realization in rice production, transplant and broadcast techniques are recommended.

Fertilizer application/ha for basal and top dressing

Table 2 also shows that the mean adoption score of PFs in lowland rain-fed and irrigated rice fertilizer application was 4.10, while lowland rain-fed rice and high risk of African Rice Gall Midge fertilizer application had mean adoption score of 4.19. Upland rice fertilizer application had mean adoption score of 2.17 and foliar fertilizer mix application (2 litres/ha) had mean adoption score of 1.54. Further analysis shows that the grand mean score of the four innovations on fertilizer application was 3.00, while the adoption index of the farmers was 0.60. This implies that 60% of them were involved in these various adoption processes of fertilizer application. The high adoption is an indication that majority of the project farmers apply fertilizers in their farms, although there could be dosage/quantity differences of fertilizer application by individual farmers which could be attributed to high cost from market dealers. This is in line with Adeola, Adebayo and Oyelere (2008) which reported that all the respondents apply chemical fertilizers to their rice plots; however, there are differences in the quantity of the fertilizer applied owing to differences in their abilities to purchase the input. This action according to them may greatly influence their yields

Weed control

Entries in Table 2 show that the adoption mean scores of PFs in weeding manually and use of herbicide were 2.86 and 4.96, respectively. Table 8 further reveals that the grand mean score was 3.91, while the adoption index was 0.78. This means that 78% of them were involved in these various adoption processes of weed control. The high adoption is an indication that majority of the project farmers are aware of the benefits of weed control especially use of herbicide which was at adoption stage. This is in line with Ogudele and Okoruwa (2006) which had a similar view that in the face of scarcity and increasing wage rate of farm labour, the use of herbicides has been observed as a major labour saving device as the labour requirement for weeding always accounts for a high proportion of the total farm labour cost in rice production.

Insect/disease and pest control

Data in Table 2 reveal that the mean adoption score of PFs on use of insecticides and pesticides for controlling insect, pest and diseases was 4.03 and use of Integrated Pest Management (IPM) strategy was 3.53. Also, the grand mean score of the two innovations on insect, pest and disease control was 3.78, while the adoption index of the farmers was 0.76. This implies that 76% of them were involved in these various adoption processes of insect, pest and disease control. The high adoption is an indication that majority of the project farmers are aware of the advantages of insect, pest and disease control using insecticide or IPM strategy. This is in line with Ogudele and Okoruwa (2006) which noted that rice, like other grains, requires prompt application of agrochemicals such as insecticides and herbicides to check the menace of pest and disease infestation that may occur as a result of overgrowth of weeds. Among common problems are caused by the African rice gall midge (ARGM) and rice blast.

Harvesting and post-harvest handling of rice

Table 2 also shows that the PFs had 3.72 mean adoption score for manual threshing, 2.42 for mechanical threshing and 4.78 for paddy storage. The table further reveals that the grand mean score was 3.64, while the adoption index of the farmers was 0.73. This implies that 73% of them were involved in these various adoption processes of harvesting and post-harvest handling of rice produce. The high adoption shows that majority of the project farmers are aware of the benefits of harvesting and post-harvest handling innovations recommended, apart from mechanical threshing innovation that was at interest stage. The implication of this is that mechanical threshing which takes care of large paddy harvesting is not widely adopted in most part of the area or by most of the respondents, thereby creating much hardship in rice harvesting. This may be

attributed to high cost and non provision of the machinery by government and other relevant donor agencies.

Marketing

Data in Table 2 also show that the mean adoption score for sale of paddy to credible processors/buyers linked by MARKETS under price setting and buy-back arrangements was 2.45. Also, the grand mean score of the rice marketing innovation was 2.45, while the adoption index of the farmers was 49.0%. This implies that the project farmers were at interest level of the adoption process and 49% of them were involved in this adoption process of marketing rice produce. The below average adoption of the marketing innovation might be that farmers had inadequate knowledge of the innovation. This shows that the new and improved marketing strategy/arrangement introduced to ensure that what farmers produced are marketed at right time and at better price, is yet to be fully adopted.

Table 2: Adoption levels of some of the improved rice technologies

Improved rice production practices	Mean (M) score	Grand mean (M) score	Adoption index
Selection of varieties:			
FARO 44 (Sipi 692033) for lowland rain-fed & irrigated rice	5.00		
FARO 52 (WITA 4) for lowland rain-fed & irrigated rice	2.02	2.33	**0.47**
FARO 46 (ITA 150) for upland rice	1.14		
FARO 55 (Nerica 1) for upland rice	1.16		
Preparation of seed: Carry out a germination test	4.52	4.36	0.87
Treatment of seeds with acceptable insecticide before sowing	4.20		
Land preparation*:*			
Good land preparation using either manual or machinery (tractor).	5.00	4.25	**0.85**
Zero tillage: use of systemic herbicide such as *Glyphosate*	3.50		
Planting:			
Row/straight line transplanting method spacing at 20cm x 20cm for FARO 44, or 20cm x 25cm or 25cm x 25cm for FARO 52	1.41		
Random spacing at 20cm x 20cm and 25cm x 25cm for FARO 44 and FARO 52 respectively	4.25	2.91	**0.58**
Direct seeding: broadcasting on wet field and upland rice.	4.56		
Direct seeding: sowing/dibbling of seed rice in beds or on flat surface	1.41		
Fertilizer application/ha for basal and top dressing			
Lowland rain-fed & irrigated rice- 4 bags of NPK 15:15:15 & 2 bags of urea.	4.10		
Lowland rain-fed rice & high risk of African Rice Gall Midge- 2 bags of NPK 15:15:15 followed by 2 bags of urea.	4.19	3.00	**0.60**
Upland rice- 2 bags of NPK 15:15:15 followed by 2 bags of urea	2.17		
Foliar fertilizer mix application- 2 litres/ha	1.54		
Weed control:-			
Weed manually at least 2 times: at 2-3 weeks and 5-6 wks after transplanting	2.86	3.91	**0.78**
Use of herbicide- Apply *Propanil* plus *2,4-D* (e.g. *OryzoPlus*) 3 to 4 weeks after transplanting, or at 3 to 4 leaf stage of weeds at the rate of 4 liters/ha	4.96		
Insect/disease and pest control:			
Use of insecticides and pesticides- at 1 liter in 150 liters of water/ha	4.03	3.78	**0.76**
Use of Integrated Pest Management (IPM) strategy	3.53		
Harvesting and Post-harvest handling of rice:			
Manual threshing by packing the panicles in a bag, and beating with stick	3.72		
Mechanical threshing using threshers that can thresh and winnow paddy.	2.42	3.64	**0.73**
Storage: Packing bagged rice grains in cool dry, fumigated & aerated place.	4.78		
Processing:			
Use of improved stainless parboiling rice drum	1.62	1.47	0.29
Use of complete set of rice milling machines & equipment	1.31		
Marketing:-Sale paddy to credible processors/buyers linked by MARKETS under price setting and buy-back arrangements	2.45	2.45	**0.49**

Source: Field survey, 2013

Conclusion and Recommendations

The project farmers adopted the following innovations; use of FARO 44 seed variety, carrying out a seed germination test before planting, carrying out good land preparation using either manual or machinery (tractor), seed broadcasting on wet field, use of herbicide and storage of rice produce. This signifies low adoption since only six out of the 26 innovations considered were fully adopted by the project farmers. The need to improve productivity by encouraging increased use of modern technologies and ensuring markets for the rice crop to encourage more farmers to take up the enterprise is recommended. This could be achieved by USAID MARKETS operators and initiators by intensification of adequate or comprehensive training of farmers on rice technologies and equally provide them with suitable and necessary incentives and facilities matched with the technologies introduced. Also, good marketing situation should be created such as strengthening the sale of paddy to credible processors/buyers linked by MARKETS under price setting and buy-back arrangements. Here, farmers should be well-trained on this arrangement for adoption.

References

Adeola, R. G., Adebayo, O. O. and Oyelere, G.O. (2008). Effects of the federal government special rice programme on rice yields and farmers' income in Oyo State. *International. Journal of Agricultural Economics & Rural Development (IJAERD)*, Vol. 1 (1), pp, 1-6.

Akpokodje, G., Lançon, S.O. and Erenstein, O. (2001). Nigeria's rice economy: State of the art. Paper presented at the NISER/WARDA Nigerian Rice Economy Stakeholders Workshop, Ibadan, 8-9 November 2001. Bouake: WARDA.

Federal Republic of Nigeria (FRN) (2006). Accelerated rice production in the Niger River basin, tcp/nir/3303. *Main Report And Working Papers*, Federal Ministry of Water Resources and Food and Agriculture Organization of the United Nations – Rome, July 28, pp.1-12.

Kormawa, P. and Akande, T. (2004). The configuration of comparative advantage in rice production in West Africa: a survey of empirical studies. Rice Policy and Food Security in Sub-Saharan Africa. http://www.wardacgar.org/publications/policy

Longtau, S.R. (2003a). Multi-agency partnerships in West African agriculture: A review and description of rice production systems in Nigeria. Retrieved on 16th September, 2011 from http://www.odi.org.uk/resources/download/3045.pdf

Longtau, S.R. (2003b). Multi-agency partnerships for technical change in West African agriculture: Nigeria case study report on rice production. Eco-systems development organization (edo), Jos, Nigeria. Retrieved on September 1, 2011 from www.odi.org.uk/rpeg/maps/nigeria.pdf

National Cereal Research Institute (NCRI) (2004). Training manual on rice production produced for the Presidential Initiative on Paddy Production for Abakiliki and Omor rice mills and other rice processors in south east zone of Nigeria held at Umudike, Abia State, pp.1-128

.

Nigeria MARKETS (2012). Rice. Retrieved on 10th September, 2011 from http://www.nigeriamarkets.org/Rice.mht

Nwalieji, H.U. and Uzuegbunam, C.O. (2012). Effect of climate change on rice production in Anambra State, Nigeria. *Journal of Agricultural Extension,* Vol. 16 (2), December 2012, pp. 81-91.

Ogundele, O.O and Okoruwa, V.O. (2006). Technical efficiency differentials in rice production technologies in Nigeria. *AERC Research Paper 154*, African Economic Research Consortium, Nairobi. http://www.aercrafrica.org/documents/RP154.pdf

Ojehomon,V.E.T., Adebayo, S.B., Ogundele, O.O., Okoruwa, et al. (2009). Rice data systems in Nigeria: National rice survey 2009. Building a rice data system for sub-saharan Africa.

Okpe, E. (2010). Nigeria: Nation plans to triple domestic rice production. *Daily Champion*, April 6. Retrieved on 16th September, 2011 from http://www.champion.com/

USAID MARKETS (2009). Opportunities for Investment in Cassava, Rice & Sorghum. Nigerian Agricultural Sector Workshop Lagos, June 9-10, http://nigeria.usembassy.gov/uploads/

USAID-MARKETS (2010). *Improved package of practices for rice production*. Nigeria: Abuja, pp. 1- 31.