TROPICULTURA, 2014, **32**, 2, 67-72

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Adoption of On-farm and Post-harvest Rice Quality Enhancing Technologies in Nigeria

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Keywords: Technology- Adoption- Rice quality- On-farm and post-harvest- Nigeria

Summary

This paper examines the rate and determinants of adoption of improved rice quality enhancing technologies among a randomly selected sample of 150 farmers and 18 rice processors from six rice producing areas of Niger State. Data were collected through interview schedule using questionnaires. Descriptive statistics and regression model were adopted to analyze data. Results show that adoption of quality enhancing technologies was low among the selected sample of these rice value chain actors. The adoption indices of on-farm and post-harvest quality enhancing practices were 0.46 and 0.37 respectively. Some socioeconomic attributes including: Age, level of education, contact with extension, access to credit and level of commercialization were statistically significant determining factors (P≤0.05) influencing adoption at farm level, while post-harvest technology adoption was determined by level of education, access to credit and membership of cooperatives. Promotion of quality enhanced technologies among these actors in the rice value chain is recommended.

Résumé

Adoption de technologies de pré- et de post-récolte d'amélioration de la qualité du riz au Nigeria

L'étude examine le taux et les déterminants de l'adoption de technologies d'amélioration de la qualité du riz à partir d'un échantillon aléatoire de 150 agriculteurs et de 18 transformateurs du riz en provenance de six régions productrices du riz de l'état du Niger au Nigeria. Les données ont été collectées à travers des interviews stratifiées à l'aide de questionnaires. Les statistiques descriptives et les modèles de régression ont été utilisés pour analyser les données. Les résultats montrent que l'adoption des technologies d'amélioration de la qualité était faible dans l'échantillon sélectionné des acteurs de la chaîne de valeur du riz. Les indices d'adoption des pratiques de pré- et post-récoltes d'amélioration de qualité étaient de 0,46 et 0,37 respectivement. Certains attributs socio-économiques incluant l'âge, le niveau d'éducation, le contact avec les vulgarisateurs, l'accès au crédit et le niveau de commercialisation étaient des facteurs statistiquement significatifs (P≤0,05) qui influent sur l'adoption au niveau de la ferme, tandis que l'adoption des technologies post-récolte est expliquée par le niveau de l'éducation, l'accès au crédit et l'appartenance à une coopérative. La promotion des technologies d'amélioration de la qualité parmi les acteurs de la chaîne de valeur du riz est donc encouragée.

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Received on 14.05.2013 and accepted for publication on 22.08.2013.

Introduction

Rice production is an agricultural enterprise which provides household income to a large proportion of farmers in Nigeria. It is produced in all agro-ecological zones of the country under various production systems including irrigated, rain-fed lowland and upland, deep water and mangrove. An average Nigerian consumes 30 kg of rice *per annum*. At present only two-third of the national rice demand is met by rice producers. The recognition of the importance of rice in national food security and the need to reduce the amount of foreign exchange spent on rice importation has made increased rice production a major priority of the government. A disturbing situation about the issue of self-sufficiency in rice is the increasing rate of consumers' preference for imported rice (3). The major factor influencing consumers' preference in favor of imported rice is the grain quality (3). This factor makes the locally produced rice less price competitive particularly in urban markets. The price differential arising from poor quality has made it difficult for rice farmers to make maximum profit from their resources allocated to rice production. In order to improve the competitiveness of locally produced rice and keep farmers motivated to increase production, grain quality management has to be brought to the forefront of rice improvement programs.

A number of rice quality-enhancing production and processing technologies have been developed and disseminated to extension agents in Nigeria (6). It is expected that these technologies have been introduced to farmers and processors for adoption. However, no empirical studies have been carried out to ascertain the extent to which these technologies have been adopted. In this study, the level and determinants of adoption of quality enhancing technologies among major actors in the rice value chain was investigated, with a view to finding means of raising the quality of locally produced rice to international standards. Specifically, the objectives are to determine the rate of adoption and to identify those factors that influence adoption of the quality-enhancing technologies with a view to making appropriate policy recommendation.

Methodology

The study was carried out in Niger State located in the guinea savanna zone of Nigeria. Primary data were collected from sample survey of 150 rice farmers and 18 parboilers who were randomly selected from six villages in two local government areas (LGAs) of the State. These were Gbako and Lavun LGAs. The choice of the LGAs was based on long history of rice cultivation and closeness to National Cereals Research Institute (NCRI) headquarters, Badeggi, where rice production and processing technologies are developed. Farmers in this area have been exposed to these technologies through various training activities organized by NCRI. Information pertaining to rice production and processing was obtained through personal interviews using questionnaires. Data collected were analyzed using descriptive statistics and ordinary least square (OLS) regression model. Respondents were assessed on the basis of their adoption of recommended rice grain quality techniques as follows:

Recommended on-farm seed quality enhancing practices such as:

i. Growing of suitable varieties of good-quality seeds

ii. Growing of the same varieties together

iii. Harvest matured grain at the right time

iv. Draining of fields prior to harvesting

v. Avoiding the heaping of harvested panicles on the field for a long time

vi. Avoiding the cross-contamination of seed during threshing, winnowing and drying

vii. Prevent paddy from touching the ground during heaping, threshing, winnowing, drying and packing

Recommended post-harvest seed quality enhancing practices include:

i. Use of clean water to wash paddy

ii. Removal of floating immature grains, residual dirt and stones

iii. Soaking of paddy overnight in boiled water

iv. Completely covering of grain with hot water during soaking

v. Draining of water and steaming of the paddy (avoid boiling)

vi. Cover with cloth while steaming and steam until 25% of grains have split open

vii. Spread on a clean surface to dry and turn frequently

viii. Avoid very hot sun during drying

ix. Avoid contamination with dirt or stone

Technology adoption indices for individual farmers/parboilers were developed as the proportion of improved methods he/she adopted out of the total package recommended (2, 4, 9). For example, if a farmer adopted 4 recommended practices, his/her adoption index is 4/7 or 0.57; if he/she adopted all the recommended practices is adoption index is 7/7 = 1.

If he/she did not adopt any of the recommended practices, his/her adoption index is 0/7 = 0. Computation of technology adoption indices for parboilers follows similar procedure.

Adoption indices of individual farmers and parboilers were regressed separately against some socioeconomic characteristics using OLS technique. The OLS regression equations are expressed as follows:

$$Y = b_o + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_nX_n + ei$$

Where Y= technology adoption index, X_1= age of farmer/parboiler in years, X_2= education in number of years spent in schools, X_3= years of rice farming/perboiling experience, X_4= income from the previous year's rice farming/parboiling activities, X_5= household size, X_6= number of contacts with extension agent per cropping season, X_7= membership of association (1 for member, 0 otherwise), X_8= amount of credit used (in naira), X_9= extent of commercialization (fraction of total output offer for sale).

The choice of these variables (X_n) was based on the findings of previous studies on technology adoption (1, 5, 7, 8) which identified these variables as significant factors affecting agricultural technology adoption in developing countries.

Results and discussion

Assessment of on-farm quality management techniques among farmers

The technology adoption indices of respondents ranged from 0.2 to 0.7, with mean of 0.46 (Table 1). An average technology adoption index of 0.46 indicates that 46 percent of the recommended technology packages were adopted by farmers. Seventy four farmers representing 49.3% score above the average indicating that less than half of the sample farmers were able to use half of the technology package. The implication is that adoption of improved grain quality management technologies among rice farmers is just half-way. The result explains the reason behind the poor quality state of most locally produced rice in the country. Something has to be done to improve adoption if the quality of paddy produced by farmers is to meet international standard. No matter how well controlled the processing stages are, good-quality milled rice will not come out of poor-quality paddy.

The socioeconomic variables that have influence on adoption indices are presented in table 2. All the variables in the model except farm income had the expected signs and six were significant (P≤0.05) in explaining adoption of improved rice quality management technologies. The significant variables were: level of education, extension visits, credit use, commercialization rate and membership of association. The positive sign on the education variables implies that those farmers with higher education level adopt more quality enhancing technologies. The results conform to apriori expectation, since education expose farmers to

Table 1
Summary of descriptive statistics of technology adoption index of farmers.

Technology index	Frequency	Percentage	Cumulative
0.2	6	4.0	4.0
0.3	35	23.3	27.3
0.4	38	25.4	52.7
0.5	16	10.6	63.3
0.6	44	29.4	92.7
0.7	11	7.3	100

Table 2
Regression estimates.

	Coefficient	SE	*T*	*P**
Intercept	–0.03466	0.046174	–0.75058	0.454163
Age	–0.00068	0.000345	–1.97693	0.050014
Education	0.005092	0.001099	4.632.845	8.17E–06
Experience	0.000612	0.00107	0.571897	0.568309
Income	–1.1E–05	7.11E–05	–0.15939	0.873595
Household size	0.000506	0.001331	0.38048	0.704166
Extension	0.014021	0.001789	7.836.026	1.06E–12
Association	0.01374	0.006562	209.434	0.038032
Credit	0.022261	0.010714	2.077.743	0.03956
Commerce	0.58817	0.043478	1.352.786	3.42E–27

*any P-value greater than 0.05 is not significant at 5% level.

Table 3
Summary of descriptive statistics of technology adoption index of parboilers

Technology index	Frequency	Percentage	Cumulative
0.22	7	38.9	38.9
0.33	4	22.2	61.1
0.44	4	22.2	83.3
0.56	3	16.7	100

Table 4
Regression estimates of the parboilers' technology indices and socioeconomic variable.

Variable	Coefficient	SE	*t*	*P**
Intercept	–0.22382	0.158506	–1.41206	0.195626
Age	–0.00442	0.005697	–0.77594	0.460105
Education	0.016095	0.003713	4.334.542	0.002497
Experience	0.00155	0.005659	0.273868	0.791125
Income	0.001299	0.000834	1.557.329	0.158007
Household size	0.009449	0.008594	1.099.526	0.303522
Extension	0.00393	0.015523	0.253184	0.80651
Association	0.013757	0.004802	2.864.766	0.020997
Credit	0.001463	0.000661	2.213.114	0.0578
Commerce	0.42729	0.280506	152.328	0.166191

*any value greater than 0.05 is not significant at 5% level.

information on new improved practices. This suggests that improvement of farmers' education level will enhance the quality of paddy produced by them. The focus of extension activities should therefore be concentrated on training of those with little or no education in order to increase awareness and adoption of rice quality-enhancing technologies.

The positive sign on farmers contact with extension agents implies that those farmers whose contact is more frequent have higher adoption indices. This result is expected, because the aim of extension visits is to bring improved technologies to the door step of farmers. More contacts with extension agents will increase farmers' adoption of technologies. The positive sign on membership of association implies that most of those who have higher adoption indices are members. This result is expected because membership of association enables individual members to be exposed to new technologies through interactions with other members who have the knowledge. It also empowers them to obtain credit to purchase improve inputs by using the group as collateral for the loan. Formation of such groups will increase adoption of improved technologies. The positive sign on credit variable is expected because the more the credit available to farmer the higher his capacity to purchase improved inputs. The positive sign on commercialization is expected because the motive of commercializing agriculture is to generate cash income. This reason pushes the farmers towards all avenues that will enhance his capacity to make more profit including the use of improved technologies.

Assessment of post-harvest quality management techniques among rice parboilers

The technology adoption indices of rice parboilers are presented in table 3. The indices ranged from 0.22 to 0.56, with a mean of 0.37. An average technology adoption index of 0.37 indicates that 37 percent of the recommended post-harvest quality-enhancing technology packages are adopted by parboilers. The low adoption level of improved parboiling practices further explains the generally poor quality of local rice. This is because good-quality milled rice will not come out of poor-quality parboiled rice, no matter how well controlled the milling stage is.

The results of OLS regression analysis of technology adoption indices against some socioeconomic variables of parboilers is presented in table 4. All the variables in the model had the expected signs and two were significant ($P<0.05$) in explaining adoption of improved rice quality management technologies among parboilers. The significant variables were: level of education and membership of association. The positive sign on the level of education variables indicated that the more educated a parboiler is the more he uses the recommended technology packages and *vice versa*. Improving education level of parboilers would lead to higher levels of technology adoption. The positive sign on the membership of association variable indicate that members use more of the recommended technology packages than non-members. Enlisting parboilers into the membership of association would lead to higher levels of technology adoption.

Conclusion

The study determines the levels and socioeconomic factors that influence adoption of rice quality management techniques among sample of farmers and parboilers in Niger State, Nigeria. About half of the on-farm technology package is adopted by farmers while only one-third of the post-harvest technology packages is adopted by parboilers. The low adoption of technology packages explains the poor grain quality of locally produced rice and its inability to compete with imported rice. The significant socioeconomic factors influencing farmers' adoption include: level of farmers' education, credit use, membership of association, extension contact and level of commercialization, while the level of education and membership of association influence adoption of post-harvest technology packages. To improve adoption of technology packages, it is therefore recommended that extension activities on both the on-farm and post-harvest technologies should focus on training of more farmers and parboilers especially those with little educational level. Policy that will make credit available and accessible to famers should be formulated by policy makers. Formation of rural cooperatives should be encouraged. Funding of research, training and extension activities is also necessary.

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