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Endogenous Determinants of Adoption of Improved Rubber Production Technologies among Farmers in Akwa Ibom State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study examined the determinants of adoption of rubber production technologies by farmers in Akwa Ibom State, Nigeria. The specific objectives of the study were to; describe the socioeconomic characteristics of rubber farmers and to identify factors affecting adoption of improved rubber production technologies by farmers in Akwa Ibom State. The study investigated reasons why farmers hesitates adoption of improved rubber production technologies and some endogenous problems such as age, income, farming experience, lack of appropriate technologies and illiteracy amongst others associated with adoption of improved rubber production technologies in the study area. A simple random sampling technique was used in selecting 192 farmers in the study area. Primary data generated from the survey were analyzed using descriptive statistics such as percentages, frequencies, averages and ordinary least square multiple regression analysis. The result showed that mean age of rubber farmers were 50 years. Respondents were shown to be

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fairly educated at various levels. The average rubber farmer had 20 years experience. Also, about 15 different improved technologies were identified by farmers from the regression result, R^2 value was 0.717 with five variables being the major endogenous determinants of adoption of improved rubber production technologies. These include age, household size, farming experience, contact with extension agents and labor input. They were also statistically significant at various levels of probability. This calls for concerted effort by both researchers and government to ensure adequate and timely adoption of technologies that suit the needs and interests of farmers. Government should support the enterprise with financial grants to make grassroots agriculture attractive to farmers, hence creating employment and enhancing the general livelihood of the rural poor.

Keywords: Determinants; innovation; adoption; rubber; Akwa Ibom.

1. INTRODUCTION

Rubber cultivation engages about 10.0% of the Akwa Ibom Youths in gainful employment [1]. Majority of people employed are rural-based small scale farmers who are educationally and economically backward but produce rubber with *traditional and indigenous technologies* [2,3,4]. Some Nigerian industries and organizations depend on latex products for industrial use. [5] recommends an average of 20,000 metric tons of rubber production per hectare per annum. These level of productivity in rubber is far from being achieved by the inhabitants in Akwa Ibom State [1]. According to [6], in the 1980s only 400 hectares of land with a corresponding latex yield of 45 metric tons per hectare were cultivated with rubber in three Local Government Areas of the Akwa Ibom State, namely Uyo, Itu and Ikot Ekpene Local Government Areas. These have been attributed to use of local knowledge and tools by farmers in the area. Furthermore, [6] reported that only 36,595 metric tons of latex are currently produced in Akwa Ibom State. These low level of production has compelled the government to encourage rubber farmers to adopt improved production technologies. Producing rubber technologies capable of improving and raising the living standard of rubber farmers is useless if they are not related to the actual needs of farmers [7].

The generation, transfer and adoption of improved rubber production technologies in Akwa Ibom State stand to be questioned. This is because some of the technologies transferred from research to farmers have hardly been adopted. The Orchestrated budded stump techniques, which have been extended to farmers for more than ten years have not achieved the desired result. Akwa Ibom State cannot be mentioned among the list of major rubber producing areas in Nigeria [6]. It is not clear whether farmers in Akwa Ibom State are using or even aware of these technologies, hence the need for this study. In Akwa Ibom State, the actual problems associated with adoption of innovation in rubber production are insufficient land, finance, lack of man power, erosion, pest, diseases, absence of good clone varieties, lack of knowledge by farmers, low capital base, old age of farmers, illiteracy, lack processing equipment, inadequate market, poor weather condition and lack of appropriate technologies. Several adoption awareness had been made over the years by Rubber Research institutes and organizations to enlighten farmers on benefits of adoption of improved rubber production technologies, it is not expected of farmers to hesitate the adoption [8]. Yet farmers to some extent have exhibited a cautious attitude towards adoption of these technologies. This raises some fundamental issues concerning the appropriateness of technologies being introduced to farmers. Hence, the need to improve crop productivity and processing [9]. It is necessary therefore to study the endogenous factors associated with adoption of improved rubber production technologies by farmers in Akwa Ibom State, Nigeria.

Frequency and level of contact between farmers and the extension agent is considered a very significant factor influencing adoption of innovation [10]. This view was supported by [11], where they found a positive relationship between contact with extension workers and adoption. The decision to adopt or reject an innovation lies on the farmer who is expected to undergo series of mental processes before taking the opinion to accept or reject an innovation. [12,13], posits that while early maturing, high yield potentials, high latex quality and quantity as well as disease resistant are some of the qualities that continue to encourage farmers towards adopting the improved rubber varieties, unavailability of improved planting materials as well as inadequate inputs seriously militate against the

distribution and adoption of these improved rubber varieties [14], stated that the factors that facilitate the adoption and diffusion of innovation will inhibit them, if they are deficient or absent. These factors according to [15], include inadequate knowledge or information concerning an innovation, perceived attributes of an innovation, use of wrong communication channels and incompatible client needs.

1.1 Objectives of the Study

The general objective of the study was to analyze the endogenous determinants of adoption of improved rubber production technologies by farmers in Akwa Ibom State.

1.1.1 The specific objectives of the study are to;

i. Describe socio-economic characteristics of rubber farmers in the study area,
ii. Identify factors affecting adoption of improved rubber production technologies by farmers in the study areas,

1.2 Research Hypothesis

To achieve the objectives of this study, the hypothesis stated in the null was tested.

Ho: Socio-economic characteristics of rubber farmers (Age, Income, Education, Occupation, Size of farm, House hold size, Sex, etc) do not influence the adoption of improved rubber production technologies in the study area.

2. RESEARCH METHODOLOGY

The study area was Akwa Ibom State, Nigeria. The State was created on 23rd September, 1987, out of the old Cross River State. Akwa Ibom State lies between Longitudes 4°32¹ and 8°25¹ East of the equator and Latitudes 4°32¹ and 5°31¹ North of the Greenwich Meridian. Akwa Ibom State is located South/West of Cross River State and shares common boundaries with Abia State to the North, South by the Atlantic Ocean, Rivers State in the East, Cross Rivers State in the West respectively. It occupies a landmass of 6721, 15 km^2 [1]. Akwa Ibom State has a total population of 3,920, 208 people (NPC, 2006). The State is located in the forest belt of Nigeria.

A simple random sampling technique was used to select six (6) Local Government Areas from the high and low rubber producing areas of the state. Sixteen (16) farmers who adopted improved rubber production technologies were randomly selected from each of the local government areas giving a total of 96 adopters of the innovations. Non-adopter farmers were also selected from the same areas to give a sample size of one hundred and Ninety-two (192) farmers.

2.1 Analytical Technique

Objectives i will be obtained using frequency tables while Objective (ii) was realized using the ordinary least square multiple regression model.

2.2 Model Specification

Multiple regression analysis was used to determine factors that affected adoption of improved Rubber production technologies by farmers. The Four functional forms of regression model viz linear, semi-log, exponential and Cobb-Douglas was tried in accordance with [15]. The best fit was chosen as the lead equation based on its conformity with econometric and statistical criteria such as the magnitude of R^2, F-ratio and number of significant variables.

2.3 The Four Functional Forms are Expressed as Follows:

i. **Linear function:**

$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + e_i \quad (i)$$

ii. **Semi log function:**

$$Y = Logb_0 + b_1L_{og}x_1 + b_2L_{og}x_2 + b_3L_{og}x_3 + b_4L_{og}x_4 + b_5L_{og}x_5 + b_6L_{og}x_6 + b_7L_{og}x_7 + b_8L_{og}x_8 + b_9L_{og}x_9 + e_i \quad (ii)$$

iii. **Cobb-Douglas function:**

$$L_nY = L_nb_0 + b_1L_nx_1 + b_2L_nx_2 + b_3L_nx_3 + b_4L_nx_4 + b_5L_nx_5 + b_6L_nx_6 + b_7L_nx_7 + b_8L_nx_8 + b_9L_nx_9 + e_i \quad (iii)$$

iv. **Exponential function:**

$$L_nY = b_0 + b_1x_2+b_2x_2+b_3x_3 +b_4x_4 +b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + e_i \quad \text{(iv)}$$

Where Y = Adoption level

x_1 = Age of Rubber Farmers (in years)
x_2 = Household Size (Number of people)
x_3 = Sex of farmers Dummy (male =1, female = 0)
x_4 = Farming Experience (in years)
x_5 = Educational Status (years of schooling)
x_6 = Farm Size (in hectares)
x_7 = Extension Contact (No. of Visits)
x_8 = Labor (Mandays)
x_9 = Membership of Cooperative Society(member = 1, Non member = 0)
e_i = Error term.

This model is expected to identify variables and address factors affecting adoption of improved Rubber Production Technologies in Akwa Ibom State, Nigeria.

3. RESULTS AND DISCUSSION

This section contains the socio-economic characteristics of farmers. They include age, sex, household size, level of education, years of farming experience and farm size.

The distribution of the respondent according to age is shown is Table 1. The results shows that a proportion 42.19% of the rubber farmers in Akwa Ibom State were within the age range of 51-60years.These was followed by 19.79% that are within the age bracket of 61-70years. Quite a low proportions 11.98% of the respondents were aged 41-50years while yet a smaller proportion 09.89% were aged between 21- 30years.The average age of the rubber farmers was 50years.The age distribution of the rubber farmers implies that rubber farming is practiced by active and productive farmers in the study area. These were in consonance with the findings of [16], that members of farmers association in Akwa Ibom State, Nigeria were mostly within the productive ages.

Majority 81.77% of the rubber farmers in Akwa Ibom State were males while 18.23% of them were females. This is because rubber production is seen as male activity in the area. This implies that males dominated rubber farming in the study area. It could also be attributed to the stress and tediousness involved in rubber farming. This result does not conform with the findings of [11], who asserted that majority of the farmers who participate and produce bulk of agricultural produce in Nigeria were women. A larger proportion of the respondents 83.85% had household sizes ranging from 6 to 10 persons. The remaining proportions10.42% had persons within 1 to 5 as household size while 5.7% often had 11 to 15 persons in their household. Large household size will enhance labor availability since rubber production is labor intensive. This result supported the findings of [17] that large family size is the most important input for unpaid labor. The distribution of respondents according to adoption status is shown in the table. The result indicates (50.00%) adopters and another (50.00%) non-adopters of improved rubber production technologies in the study area. This result agrees with the research findings of [16] which asserts that for any given innovation, a certain percentage of the population will adopt while others will not adopt the innovations. The respondents 59.89% used hired labor for their rubber farming activities. Another 21.88% of them made use of family labor while 18.23% others used friends as labor for production activities. This indicates that hired labor was the dominant source of labor in the study area. This result is in disagreement with the research findings of [13], who asserted that reliance on non-family labor reduces agricultural productivity because the hired labor is unaffordable and impedes farm expansion and adoption of improved rubber production technology. Greater proportion of the respondents (77.60%) had contact with extension agents. A lower proportion (22.40%) of farmers did not have contact with extension agents. The implication is that most farmers are aware of the improved rubber production technologies due to frequent extension contacts. [18] noted that frequent contact with extension agents enhance adoption of technologies and increase farm productivity.

Table 1. Socio-economic characteristics of rubber farmers in Akwa Ibom State

Variables	Frequency	Percentage (%)
Age (years)		
21-30	19	09.89
31-40	31	16.15
41-50	23	11.98
51-60	81	42.19
61-70	38	19.79
Total	**192**	**100.00**
Mean $\overline{X}$ = 50		
Sex		
Male	157	81.77
Female	35	18.23
Total	**192**	**100.00**
Household size		
1-5	20	10.42
6-10	161	83.85
11-15	11	5.73
Total	**192**	**100.00**
Adoption status		
Adopters	96	50.00
Non-adopters	96	50.00
Total	**192**	**100.00**
Labor type		
Hired	115	59.89
Hire/family	35	18.23
Family	42	21.88
Total	192	100.00
Extension contact		
Yes	149	77.60
No	43	22.40
Total	**192**	**100.00**
educational status		
No formal Education	8	04.17
Primary Education	77	40.10
Secondary Education	65	33.85
Tertiary Education	42	21.88
Total	**192**	**100.00**
farming experience (years)		
1 – 10	44	22.92
11 – 20	58	30.20
21 – 30	60	31.25
31 – 40	30	15.36
Total	**192**	**100.00**
Mean $\overline{X}$ = 20		

Source: Field survey data, 2013

A good proportion of the respondents (40.10%) had primary school education. This was followed by 33.85% of those that attained secondary school education. Those that attended tertiary school education constituted 21.88% of the entire sample. Only 04.17% of the farmers had no formal education. This implies that almost all the rubber farmers had formal education at different levels. This is desirable because according to [19], the level of education of a farmer not only increases productivity but also enhances his ability to understand and evaluate new production techniques. Educated farmers as in the study area are expected to be receptive to improved farming techniques [20]. A low proportion of rubber farmers (31.25%) had between 21 and 30 years of farming experience. While 30.20% others comprised of those who had farming experience ranged between 11 and 20years.The mean years of farming experience was 20years. The implication of this is that farmers in the study area could be adjudged experienced in rubber production. This also agrees with the findings of [20] that farmers in Akwa Ibom State have experience in rubber production.

The result in Table 2 shows the OLS multiple regressions of factors affecting adoption of improved rubber production technology in the study area. Four functional forms were fitted to the data and linear function was chosen as the lead equation based on a high R^2 value, number of significant variables and agreement with *a priori* expectation. The R^2 value of 0.717 indicates that 71.7% of the variations in the adoption of improved rubber production technology were accounted for by the included variables. The F-statistic (41.950) was highly significant at 1.0% level of probability indicating a regression of best fit. The coefficient of age (0.196) was positively signed and highly significant at 1.00% level of probability. This implies that any 1.00% increase in age will bring about a 0.196% increase in the level of adoption of improved rubber production technology. This was in agreement with *apriori* expectation. Age of the farmer can have a profound effect on technology adoption [21]. The effect is thought to stem from accumulated knowledge and experience of farming systems obtained from years of education and experimentations with various technologies. The coefficient for education (0.107) was positively signed and significant at 1.00% level of probability. This implies that any increase in level of education will lead to a 0.107% increase in level of adoption of improved rubber production technology in consonance with *a priori* expectation. This findings agrees with that of [22] who asserted that higher literacy level increases the chance of adoption of technology.

Table 2. OLS estimates of determinants of adoption of improved rubber production technologies in Akwa Ibom State

Variables	*Linear function	Double log	Semi-log	Exponential
Constant term	1.488	15.856	0.494	26.622
	(0.805)	(1.450)	(0.583)	(1.118)
Age	0.196***	3.597***	0.089***	8.089***
	(5.293)	(2.972)	(5.259)	(3.069)
Household size	0.059*	-0.299*	-0.026*	-0.622*
	(1.694)	(-1.867)	(-1.6117)	(-1.783)
Sex	0.154	0.111	0.077	0.249
	(0.710)	(0.576)	(0.777)	(0.596)
Farming experience	-0.153***	-0.636**	0.067***	-1.533**
	(-4.296)	(-2.145)	(-4.130)	(-2.374)
Educational status	0.107***	0.387	0.045***	0.816
	(2.708)	(1.389)	(24.62)	(1.345)
Farm size	-0.039**	-0.103	0.022	-0.137
	(-1.000)	(-0.944)	(-1.220)	(-0.578)
Contact with extension	0.646***	-0.766***	0.293***	-1.745***
agent	(3.278)	(-3.135)	(3.243)	(-3.279)
Labor	-0.002**	-3.366**	0.000***	-6.347*
	(-2.609)	(-2.157)	(-2.752)	(-1.867)
Membership of	-0.056	0.297*	-0.016	0.685*
cooperative society	(-0.345)	(1.758)	(-0.221)	(1.865)
$\underline{R}^2$	0.717	0.602	0.500	0.614
R	0.706	0.590	0.470	0.604
F statistic	41.950***	4.975***	5.642***	6.463***

*Source: Field survey data, 2013; *** Significant at 1%; ** Significant at 5%; * Significant at 10%*
*Variables in parenthesis are t-values; * Lead equation*

The coefficient for household size (0.059) was positively signed and significant at 10.00% level of probability. This implies that 1.00% increase in household size will lead to 0.59% increase in adoption of improved rubber production technology. This is in agreement with *a priori* expectation. [23] stated that larger households are more likely to provide the labor that might be required by improved crop technologist. The coefficient of extension contact (0.646) was positively signed and significant at 1.00% level of probability. This implies that any increase in extension contact will lead to 0.646% increase in adoption of improved rubber production technology. Frequent extension contact enhance adoption. [18] noted that extension enhance adoption of improved technology. The coefficient of farm experience (-0.153) was negatively related to adoption. This implies that any 1.00% increase in farm experience will bring about 0.153% decrease in adoption. Experienced farmers find it difficult to try new ideas. This is in agreement with [24] who noted that older farmers have wealth of experience which they find difficult to expel or substitute, hence they create little or no chance for new ideas. The coefficient of Farm Size (-0.039) was negatively signed and significant at 5.00% level of probability. This implies that 1% increase in farm size will lead to 0.03% decrease in adoption of improved rubber production technology. This is against *a priori* expectation. With small farms, adoption of improved technology becomes a constraint [25].

Finally, the R^2 value of 71.7% shows that 28.3% of the variations in the adoption of improved rubber technologies were not accounted for by the included variables and so could be because of exogenous factors such as government policies and culture.

4. CONCLUSION

The endogenous determinants of adoption of improved rubber production technologies as shown in the study were, age of the practicing rubber farmers, labor input, farm experience and educational status. The least square regression result showed that R^2 value was 0.717, indicating that 71.7% of the variation in the adoption of improved rubber production technologies were accounted for by the included variables. Labor input showed a negative relationship with adoption of technologies. Government should therefore encourage the formation of cooperative groups that will generate cooperate labor effort for members and also make access to mechanization easy. This is because the cost of hiring tractors and other implements are high but when farmers pool resources together, they can

afford it. Government should integrate rubber production enterprise in agricultural reform policy programmes. This will help in the fight against poverty, enhance food security and employment. Several adoption awareness had been made over the years by Rubber Research Institutes and other organizations to enlighten farmers on benefits of adoption of improved rubber production technologies, farmers in Akwa Ibom State, Nigeria are not expected to hesitate in the adoption of these technologies for increase rubber production in the state.

5. RECOMMENDATIONS

The study showed that:

i. Increase in age led to a decline in the adoption of improved rubber production technology since aged people are risk averse, government should focus on polities such as the integrated Agricultural development programmes, tree crop development programmes and the agricultural research development programme that will reposition grass root agriculture making it look attractive and encouraging for the rural farmers .

ii. Labour input also showed a negative relationship with adoption of improved rubber production technologies. Government should encourage the formation of cooperative groups that will generate cooperative labour effort for members and also make access to mechanization easy. This is because the high cost of hiring tractors and other inputs are high but when farmers pool resources together, they can afford it.

iii. Government should integrate rubber production enterprise (the crop production) into agricultural reform policy programmes. This will help in the fight against poverty and unemployment.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Akwa Ibom State Ministry of Agriculture and Natural Resources (AKSMANR). Annual report. Akwa Ibom State Government Press. 2010;8-10.
2. Olowu TA. Agricultural extension and poverty alleviation in Nigeria. Proceedings of the 12th Annual National Conference of the Agricultural Extension Society of Nigeria. 2003;39–40.
3. Onunka BN. A survey of the Adoption of Sweet Potato (*Ipomea batata*) Production Technologies in Abia State. Unpublished M.Sc. Thesis of Agric. Econs and Extension Department, ABSU Nigeria; 2005.
4. Ndifon HM, Echua RO, Nrar NM. Corporate social responsibility and community development. A case study of PAMOL (Nig.) Rubber Estate, Cross River State, Nigeria. The Social Sciences Journal. 2007;3(2):14-18.
5. Food and Agriculture Organization (FAO). Rubber revolution in Nigeria. The potential for industrial development. Rome Italy. 2004;30.
6. Akwa Ibom State Planning Commission. Akwa Ibom State Economic Empowerment Development Strategy Report. 2011;20-25.
7. Rubber Research Institute of Nigeria (RRIN). Rubber production in Nigeria. A Monograph Produced by RRIN. 2004; 13-16.
8. Rubber Research Institute of Nigeria (RRIN). Rubber production in Nigeria. A Monograph by Rubber Research Institute of Nigeria. 2002;5-7.
9. Okunola JO. Determinants of soybean utilization and consumption pattern among rural dwellers in South Western Nigeria. Proceedings of 2nd International Workshop of Food base Approaches for a Healthy Nutrition in West Africa, the Role of Food Technologists and Nutritionists, Ouagadougou, Burkina Faso, 23rd – 28th November. 2003;191-195.
10. Egwu NJ. Adoption potentials of IITA black sigatoka resistant hybrid plantain (PITA-14) in south Eastern, Nigeria. M.Sc Thesis Department of Rural Sociology and Extension Michael Okpara University of Agriculture, Umudike, Abia State. 2003; 52-56.
11. Chinaka CC, Ogbuokiri LC, Chinaka EC. Adoption of improved agricultural technologies by farmers in Abia agricultural zones of Abia State. Proceedings of Ita 41st Conference held at Institute of Agric. Research Samaru, ABU Zaria, 22-26 October. 2007;530–533.

12. Unamma RPA. Agricultural technology generation and transfer strategies for food security. Proceedings of the 6th Annual Zonal Research and Extension Farmers Input Linkage System (REFILS) Workshop South and South Zone of Nigeria, 12-13 November; 2004.
13. Apu U. Adoption of two improved cassava varieties TMS 30572 and NR8082 by farmers in Ohafia agriculture Zone of Abia State, Nigeria. M.Sc. Thesis Department of Rural Sociology and Extension, Michael Okpara University of Agriculture, Umudike. 2004;12-14.
14. Rogers EM. Diffusion of innovation. 6th ed. New York: Free Press; 1995.
15. Nwaobiala CU. Appraisal of farmers participation in IFAD / FGN / NDDC Community-based natural resource management programme in Abia and Cross River States, Nigeria. Unpublished Ph.D Thesis Submitted to Department of Agric-Econs and Extension, ABSU, Nigeria; 2012.
16. Ekong EE. An introduction to rural sociology. Third Edition, Dove Educational Publishers, Uyo, Nigeria; 2010.
17. Effiong EO. Efficiency of production in selected livestock enterprises in Akwa Ibom State. Unpublished Ph.D Dissertation, Dept. of Agric. Economics, MOUA, Umudike. 2005;51-54.
18. Udom ER. Problems of agricultural development in Nigeria, our collective amnesia. A Paper Presented at the Annual Conference of the Rectors of the Colleges of Agriculture held at the Michael Okpara College of Agriculture, Umuagwo, Imo State. 2006;71-72.
19. Obasi PC. "Resource use efficiency in food crop production. A case study of the Owerri Agricultural Zone of Imo State, Nigeria. M.Sc. Thesis Submitted to University of Ibadan; 1991.
20. Okoye BC, Onyenveaku CE, Asumugha GN. Allocative efficiency of small holder cocoyam farmers in Anambra State, Nigeria: Agricultural Journal. 2006; 4(38):70-81.
21. Onyenweaku CE, Okoye BC, Okorie KC. Determinants of fertilizer adoption by rice farmers in Bende Local Government area of Abia State, Nigeria. Agricultural Journal. 2010;41(2):1-5.
22. Onumadu FN, Nwosu IE, Nwaobiala CU. Appraisal of social benefits of adoption of agro forestry practices by small-scale farmers in Katsina State, Nigeria. Journal of Food and Fibre Production. 2008;1(1): 65–70.
23. Udom FA. Adoption of selected crop based technologies by crop farmers in Akwa Ibom State, Nigeria. M.Sc. Thesis Department of Rural Sociology and Extension, Michael Okpara University of Agriculture, Umudike; 2009.
24. Dung EA, Akinkpenu OA, Olojede AO, Asumugha GN, Ibrahim HY, Lenka DM, Amadi CO. Technical efficiency of Hausa potato production in Southern, Kaduna State, Nigeria. The Nigerian Agricultural Journal. 2010;41(1):52–56.
25. Dung EA, Akinkpenu OA, Olojede AO, Asumugha GN, Ibrahim HY, Lenka DM, Amadi CO. Technical efficiency of Hausa potato production in Southern, Kaduna State, Nigeria. The Nigerian Agricultural Journal. 2010;41(1):52–56.

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