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Buying Habits and Cross Price Elasticity of Demand for Certified Maize and Rice Seeds in Ondo and Ekiti States, Nigeria

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Abstract –**The study examined the buying habits; identified reasons for growing certified maize and rice seeds and estimated the cross price elasticity of demand for certified maize and rice seeds in Ekiti and Ondo states. This study used a multi stage random sampling techniques to collect data from 196 maize and rice growers. Descriptive statistics and the coefficient of cross price elasticity were applied to estimate and analyse the data. Results showed that higher yield per hectare, early maturity; resistant to diseases, better consumer preference and taste were major reasons for growing certified seeds. Six buying habits were identified and examined namely: (1) buying the quantities needed at the time of planting every year; (2) buying quantities in excess of immediate requirement and storing them for subsequent years; (3) buying annual requirements of the seeds a few weeks to the planting season; (4) making forward contracts for the supply of seeds needed at planting period; (5) buying little quantities of certified seeds and supplementing with traditional seeds and (6) buying quantities needed in one season and planting the progenies for subsequent season before making fresh demands. The results of cross price elasticity showed that certified maize and rice seeds were substitutes and complementary commodities.**

Keywords **– Buying Habits, Cross Price Elasticity, Demand.**

I. INTRODUCTION

Maize and rice are very important food crops in the economy of Nigeria. In terms of area coverage. Maize is the third, most important cereal crop in Nigeria next to sorghum and millet. It is the single most important grain crop in the southern parts of the country because of its relatively higher protein content which makes it nutritionally superior to roots crops which are predominantly cultivated in these areas.

Rice, on the other hand, is among the least important cereal crops in terms of area coverage and food crop output. Nevertheless, rice crop commands much higher value than any other grain crop in the country. Presently, in Nigeria a bowl of rice worths about twice the value of other cereals. Until recently, rice was widely regarded as a superior food commodity which was consumed mainly by city dwellers. Before that time, rice consumption was limited to festive occasions such as Christmas, Idel Maloud and New Year celebrations. Suffice to say that these two crops and other cereals are very important in Nigerian food economy. However, changes in population size, increased national per capita, income; rapid urbanization, changes in tastes and preferences, shortage of traditional food stuffs, such as yam, maize, guinea corn and millet in the early 70s and 80s coupled with availability of cheap, well processed and easily prepared imported rice discouraged local production thus creating supply-demand gap. This gap needs to be filled urgently considering the huge drain food import bills constituted to the dwindling and scarce foreign exchange earnings of the country. To reduce food import bills, the Federal Government has banned the importation of some commodities such as rice, frozen chickens, turkeys and the like so as to encourage local farmers to commence investment of productive resources into the production of food crops. The use of improved production technologies is indispensable in this regards because there cannot be a revolution in agricultural productivity without a breakthrough in agricultural innovations (preferably indigenous). Such a breakthrough may be biological, chemical or mechanical or a combination of two or all of these innovations (Cavatasi, Lipper and Natlock 2011). For instance, the increases in Japan's agricultural productivity were due to a combination of biological and chemical innovations which resulted in the substantial increase in crop output per unit of land, thereby loosening the constraints imposed by land scarcity and high land process. Similarly, the dramatic increases in the USA's agricultural productivity resulted from the introduction of mechanical power (Essang 1975) which being labour saving, loosened the constraint imposed by labour scarcity and high wages.

Certified seeds as biological innovations are very important input for boosting crop production and without them, no country can achieve a revolution in agricultural productivity not only because it improves the economy of growers but because it is one of the best means of transferring technology. IISTA (2011) claimed that certified seeds were not only the cheapest and basic means of increasing crop yield, it is also fundamental to raising the efficiency of other agricultural inputs. In this connection, an efficient input delivery system must make high quality seeds available to farmer at the right place and in the adequate quantity together with other complementary inputs necessary for increased food crop production.

Although a number of HYVs of seeds have been developed and tested by various Research Institutes, Universities and colleges of Agriculture, many of these seeds are either not available to farmers or are not accepted because they do not conform with the socio-cultural background of the farming communities to which they are introduced. Also, the quantity supplied is usually inadequate and untimely simply because of the dearth of

information/data on farmers buying habits and the competitive nature of seed demand (Chisinga, 2011). In addition, the National Seed Supply (NSS) has once lamented that there is no reliable information on actual demand for improved seeds in the country. This implies that the projection for high quality seed in Nigeria has not been based on reliable data.

The study will answer the following research questions:

1. What are the socioeconomic characteristics of the growers of certified seeds of maize and rice in the study area;
2. What are the habits exhibited by the growers of certified seed of maize and rice in the area;
3. How does the demand for certified seeds of maize respond to the change in the price of certified seeds of rice.

It is against this background that the following objectives were formulated:

i. To describe the socio-economic characteristics of the growers of certified maize and rice seeds.
ii. To identify and examine habits of the growers of certified maize and rice seeds.
iii. To determine the cross price elasticity of the demand for certified maize and rice seeds in the study area.

II. Meaning and Procedures for Seed Certification in Nigeria

Seed certification is defined as the system designed to assure desired seed quality through third party checking and control on seed multiplication (Blount, Quesenberry, Chemblissand and Stadsklev 2012). It is the process by which a third party guarantees the quality of the seed by the issuance of a certificate of fitness certifying that all attributes of the parent seed are maintained after carrying out the tests to ensure that both field and laboratory standards are met. According to Encyclopedia (2010) dictionary, Seed Certification is a set of measure used to check the quality of seeds in the course of their production, procurement, storage and preparation for planting. After the release of an improved cultivar by the breeder, the seed is multiplied through a few cycles of reproduction namely Breeder Seed (BS), Foundation Seed (FS) and Certified Seed (CS) (Wisconsin Seed certification Standards, 2014)

The Breeders Seed (BS) is the first generation of seeds generally produced by the plant breeder who evolves the variety. In Nigeria, it is produced by the research Institutes, Faculties of Agriculture or any individual that has the facilities. It is usually produced in small quantity (about 10-15kg) and supplied to the NSS for multiplication. The second stage is the Foundation Seed (FS) production. Its production is restricted to the suitable ecological areas under close supervision of NSS. According to the Nigeria seed decree 72 of 1992 the production, processing and distribution of FS are the responsibilities of NSS. Maize and rice seeds constitute the largest of the quantity of FS produced and distributed in Nigeria over a 12 year period (1992-1980) contributing 44% and 29.7% respectively.

The last stage in the seed multiplication process is the Seed Certification. Certified Seed is the direct progeny of FS so handled to maintain satisfactory genetic purity and identity acceptable to the certificating agency. After certification, the next stage is seed tagging. This involves attachment of a label containing seed analysis or information on the seed. According to USDA (2009) the basic information that should be included in each seed tag is kind and variety, lot number, origin or source, net weight or total bulk weight, percentage purity, germination dormancy, inert matter, other crop seed and weed seeds, germination test date, name of restricted noxious weed, prohibited noxious weeds and name and address of the producer or grower of the seed.

In Nigeria, certified seeds are multiplied by the out-growers appointed by ADP in accordance with decree number 72 of 1992 under close supervision of the Quality Control Officer (QCO) and the certification officer from NSS. The Output of the out-growers i.e. certified seeds are supplied to the Agricultural Input Supply Agency (AISC) of each state for sale to the public. However, certified seeds are also available at the ADP for sale.

III. Research Method

The study was carried out in Ekiti and Ondostates, Nigeria. Data were collected through the use of a pre-tested and well-structured questionnaire administered on farmers buying certified seeds of maize and rice in Ekiti and Ondo states of Nigeria. Multistage sampling technique was used in selecting the respondents. Two agricultural zones were randomly selected in each state, two local governments randomly selected from each zone, three towns/villages randomly selected from each local government and twenty respondents were randomly selected from the list of certified seed growers obtained from the state Agricultural Input Supply Agenc(AISCA) making a total 240 farmers. One hundred and ninety six copies of questionnaire were accepted for analysis representing 81.7%

Descriptive statistics were used in discussing farmers' socio-economic characteristics and their buying habits while the coefficient of cross price elasticity of demand for certified maize and rice seeds was determined mathematically using the formula proposed by Jhingan (2009).

$$E_{,A,B} = \frac{\%\text{ change in quantity demanded of product A}}{\%\text{ change in price of product B}} \quad \ldots\ldots(1)$$

OR

$$E_{A,B} = \frac{P_{B,1} + P_{B,2} \times \Delta Q_A}{Q_{A,1} + Q_{A,2}\Delta P_B} \quad \ldots\ldots(2)$$

$$= \frac{\delta Q_A P_B}{\delta P_B Q_A} \quad \ldots\ldots(3)$$

Applying this to Cross price elasticity of demand for certified Maize and rice seeds, we have

$$E_{mr} = \frac{\delta Q_m . P_r}{\delta P_r P_m} \quad \ldots\ldots(4)$$

$$E_{rm} = \frac{\delta Q_r . P_m}{\delta P_m P_r} \quad \ldots\ldots(5)$$

Where

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E_{mr} = Cross price elasticity of demand for certified maize seeds.
E_{rm} = Cross price elasticity of demand for certified rice seeds.
Q_m = Quantity demanded of certified seeds of maize.
Q_r = Quantity demanded of certified seeds of rice.
P_m = Price/kg of certified maize seeds.
P_r = Price/kg of certified rice seeds.

i. When XED = -Negative, the goods are complements
ii. When XED = Zero, the two goods are independent
iii. When XED = Positive, the goods are substitutes
iv. When XED = infinity, the goods are perfect substitutes

XED= Elasticity of demand for commodity X

IV. Results and Discussion

Socio-Economic Characteristics of the Respondents

Age

Table 1 shows that the modal age of the respondents lied within the age bracket of 60-69 years. However, 77 (38.3%) of the interviewees were below 50 years of age which could be said to have the stamina for manual work. With the mean age of 52.3 years, the respondents were skewed towards the aged and ageing. Since farm work was labour intensive, the respondents may not have sufficient stamina to do farm work and may not be seriously interested in earning their highest possible income from farming.

Table 1: Age Distribution of the Respondents

Age (yrs)	Frequency	Percentage
Below 30	6	3.1
30-39	31	15.8
40-49	40	20.4
50-59	42	21.4
60-69	57	29.1
70 and above	19	9.7
Total	196	99.5*

Less than 100% because of rounding-up errors
Source: Data Analysis

Household Size

The most predominant household size among the respondents was that of 5-8 members which accounted for 46.0% of the sample. Large household sizes of adult membership could be advantageous if they are willing to contribute to family labour otherwise, they could constitute serious constraints to the provision of adequate investment funds to farm business.

Table 2: Household Size Distribution of the Respondents

Size of Household	Frequency	Relative Frequency (%)
1-4	71	36.2
5-8	91	46.4
9-12	31	15.8
Above 12	3	1.5
Total	196	99.5*

Source; Data Analysis
Less than 100% because of rounding-up errors

Major Occupation and Proportion of Annual Income from Farming

The maize and rice growers in Ekiti and Ondo states had multiplicity of occupations with majority of them (87.7%) having farming as their major occupation (table 3). The finding was corroborated by the fact that 154 (78.6%) of the respondents earned more than 50.0% of their annual incomes from farming while 21.5% earned less than 40% of their annual income from farming.

Table 3: Frequency Distribution of the Respondents' Major Occupation

Major Occupation	Frequency	Relative Frequency
Trading	7	3.6
Tailoring	2	10
Farming	168	85.7
Teaching	4	2.0
Civil Service	6	3.1
Others*	9	4.6
Total	194	99.9

Source: Data Analysis

Farm Size

The farm sizes of the growers of certified seeds of maize and rice are presented in tables 3 and 4. The tables show that the farm sizes for both crops were generally small. For instance, 73.5% of maize farmers had less than 2.0ha while a rice farmer was 85.6%. Tables 3 and 4 shows that generally farm sizes of rice farmers were smaller than those of maize probably because rice cultivation is more labour intensive and proned to pest attack.

Table 4: Frequency Distribution of Respondents' Maize Farm Sizes

Farm Size (ha)	Frequency	Relative Frequency
Less than 1	85	43.4
1-1.99	59	30.1
2.00-2.99	29	14.8
3.00-3.99	6	3.1
4.00-4.99	5	2.6
5.00-5.99	2	1.5
6.00-6.99	1	0.5
7.00 and above	7	3.6
Total	196	100.0

Source: Data Analysis

Table 5: Frequency Distribution of Respondents' Rice Farm Sizes

Farm Sizes (ha)	Frequency	Relative Frequency (%)
Less than 1	91	46.4
1.00-1.99	77	39.2
2.00-2.99	13	6.6
3.00-3.99	8	4.1
4.00 and Above	6	3.0
Total	196	99.3*

*Less than 100.0 because of rounding-up errors
Source: Data Analysis

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Farming Experience and Cropping System Used

Results show that the modal class for respondents farming experience was between 11 and 20 years approximately 31% while those who have been farming for more than 50 years constitute 7% of the sample. Thirty nine respondents (about 20%) had less than 10 years of farming experience. The mean farming experience was 23.5 years. With respect to the type of cropping system adopted by the respondents, results showed that both sole and mixed cropping were used for the two crops with the sole cropping being more predominant for rice cultivation. For instance, 10.9% of the farmers planted maize sole with 81.6% of them cultivated rice as a sole crop. Cassava was the most popular crop grown with maize. Other crops like pepper, cocoa yam, okro etc are also grown in a maize farm while maize was the only crop grown with rice for strategic reasons. Maize was planted scatterdly on rice farms to reduce birds attack.

Sources of Information on Certified Seeds to the Respondents

AISA was the most popular source of certified seeds in Ekiti and Ondo states as presented in table 6. Findings showed that of the six sources of supply of certified seeds in the states, AISA had the highest frequency of 112 (57.1%) followed by influential farmers (30.6%). The interaction between ADP and AISC is very important in the supply and demand of certified seeds in the states. Although both organizations are different and autonomous, there was a rivalry between them. The ADP multiplies certified seeds and bears the cost of production while AISC undertakes the marketing and enjoy the profit. Reports showed that the ADP therefore usually retained part of the seed produced for direct sale to farmers. This probably explains the reason the quantity of seeds available at AISA was not always enough as reported by the AISA officials. In times of short supply AISA usually make a "stop-gap" arrangement with private seed companies. Other sources include cooperative society (17.5%) and private seed sellers (7.5%).

On available sources of information, extension agents were the most regular source of information on certified seeds in the two states as consented to by 61.2% of the farmers probably because the extension agents had a direct link with the farmers. Radio was another important source as consented to by 50% of the respondents. Other sources of information were television and friends.

Buying Habits of Growers of Certified Seeds

The most common buying habits (table 6) of respondents were that of buying little quantities of certified seeds and supplementing them with traditional seeds. This implied that the respondents were growing traditional seeds alongside with certified seeds due to the following reasons: (1) traditional seeds were better adapted to local conditions thereby reducing the risks of crop failure (2) ease of availability (3) socio-economic preferences (4) compatibility to cropping pattern and (5) certified seed were more expensive and they could not afford buying the required quantities and [6] buying the quantities needed and planting the product therefrom for some seasons before making a fresh demand. Eighty respondents fell into this group. These respondents probably wanted to save themselves the problem of looking for certified seeds every season or probably lived far away from the source or point of sale. About 31% of them would buy just the quantities needed for planting annually. Tenable reasons were lack of good storage facilities, accessibility to regular supply of certified seeds or due to financial constraint.

One hundred and twenty six respondents representing 44.4% claimed they stored certified seeds for future seasons. The reasons for this habit were (1) the fear of not getting to buy when needed (44.4%) (2) the seeds may not be available early enough (3) anticipation of increase in price and (4) not having enough money when seeds are available. Official information from the AISA confirmed that seeds were not always available at the commencement of growing season due to late supply from the ADP. This was also confirmed by the ADPs in the two states on the strength it was risky to plant when the rain was not yet stable to forestall crop failure and seed wastage.

Table 6: The Buying Habits of Growers of Certified Maize and Rice Seeds in Ondo andEkitiStates, Nigeria

	Buying Habits	Frequency	Relative Frequency %
1.	Buying just the quantities needed at the time of planting every year	60	30.6
2.	Buying quantities in excess of immediate requirements and storing them against the subsequent years	8	4.1
3.	Buying annual requirements of the seeds a few weeks to the beginning of planting season	17	8.7
4.	Making forward contract for the supply of improved seeds needed at planting period	15	7.7
5.	Buying little quantities of improved seeds and supplementing with traditional seeds	100	51.0
6.	Buying quantities needed in one season and planting the product therefrom for subsequent seasons before making fresh demand	85	43.4

Source: Data Analysis

The last of the buying habits was anticipatory purchase i.e. making prior arrangements and making advance payment for seeds before the commencement of the season. These were large scale farmers who appreciated certified seed and would not want disappointment in seed supply. About 8% of the respondents fell into this category.

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V. Reasons for Growing Certified Maize and Rice Seeds in Ondo and Ekiti States

Maize and rice are the major food grains grown in the two states. Various ADP reports from the two states showed that maize was the most commonly grown food grains in the states while rice was assuming an economically important position. Judging by these reasons, a rational farmer in the state would like to increase his output either by increasing the farmland under activation through the use of modern farm implements and machines or increasing the output per unit area of land through biological innovation. The latter is preferred because of high cost of modern farm implements. This was the motivating factor for the demand for certified seeds in the states. Another motivating factor was that the demand for certified seeds is a derived demand which depends on the demand for grains (Jhingan 1977) meaning that if there were no demands for maize and rice grains as food commodities, maize and rice farmers would have no cause demanding for seeds.

The primary reasons for growing maize and rice in the two states were for sale and consumption. Sixty nine (69%) of the respondents grew rice for sale while maize was about 40%. This proportion was smaller because maize was produced primarily for consumption in the two states. It is the only crop available during the "hunger period" that is the beginning of the season when other food crops are not yet ready for harvest. About 59.2% grew maize primarily for family consumption while rice was 31%. Another major reason discouraging the commercial production of maize is the fact that almost all farmers grow maize at the same time leading to high supply and low price. Farmers therefore learn to convert it into many forms for family food consumption. On the other hand, the availability of imported rice that is neat, parboiled and easy to prepare discourages local rice production and consequently discouraging the demand for its certified seeds. However the major reasons for growing certified maize and rice seeds were presented in table 8. The table showed that high yield per land area was a major reason (61.2%) the respondents demanded for improved seeds probably due to the small crop output characterized by farmers in the states. About 46.0% grew certified seeds of maize and rice because of early maturity which increases the number of times the crop can be grown in a year. Also it encourages early supply to satisfy early grain consumers thereby increasing farmers income. Seventy respondents adopted certified seeds of maize and rice because of their resistance to pest and diseases. This may be due to the incidence of downy mildew disease earlier reported by International Institute of Tropical Agriculture (IITA) in these states about two decades ago. Other reasons for growing certified maize and rice seeds were better storability, taste better than traditional seeds and shorter cooking time.

VI. Cross Price Elasticity of Demand for Certified Maize and Rice Seeds in Ondo and Ekiti States, Nigeria

This is a measure of how the quantity demanded of one commodity responds to changes in the price of another community ceteris paribus. Applying equations (3) and (4) the estimated cross-price elasticity of demand for certified seeds of maize and rice are presented below:

Emr = -0.119

Erm = 0.238

These values of cross price elasticities indicated that certified maize and rice seeds were both substitutes and complementary goods i.e. the demand for rice seeds was complementary to maize implying that an increase in the price of one could bring a fall in the demand for the other. Similarly, a fall in the price of one would bring fall in the demand for the other. The practice of planting some maize seeds on rice farms to discourage bird pest could serve as a tenable explanation for the complementarity. The results also indicated that these two commodities are substitutes probably because both are common food crops grown in the area of study. Since sampled farmers gave proportions of both food crops to household consumption, they could serve as substitutes because they tend to satisfy the same household need, though in varying degrees. However, the small value of 0.238 is an indication that they were no close substitutes. These findings were supported by the theoretical underpinning of Jhingan (2009) that the cross price elasticity between two goods whether substitutes or complementary is only a one way traffic. The cross elasticity between commodities A and B may not be the same as the cross elasticity of B and A.

Summary, Conclusion and Recommendations

Findings in this study show that the growers of certified seeds of maize and rice were aged and aging. Since farming in the study area relies heavily on the use of human muscles, the respondents may not have sufficient stamina for farm work and may not be seriously interested in earning their highest possible monies from farming. This is corroborated by the fact that an overwhelming majority of the respondents had their farm sizes (for maize and rice) less than two hectares. Government should facilitate tractor mechanization services to maize and rice farmers for land preparation and planting operations in order to make production less labour intensive in the study area.

The buying habits identified in this study can be attributed to small farm holdings, fear of untimely availability of seeds, lack of cash to buy certified seeds and the attachment to traditional seed varieties. These buying habits must be properly understood with the intent to make desirable changes if government's desire to increase the outputs of those food crops through the use of improved seeds is to be accomplished. Also the fact that farmers were still growing improved seeds alongside with traditional seeds is an indication that the certified seeds had not been totally adopted by farmers in the selected states. Although this practice might be a strategy to forestall total crop failure, it points to serious lapses in

agricultural extension services in the two states. Besides the untimely availability of certified seeds could have tacitly encouraged these practices. Also the rivalry between ADP and AISA in the supply of certified seeds was inimical to regular seed supply to farmers. Government should therefore put its spotlight on the respondents' buying habits as a means of scheduling production to meet seed demand of farmers in terms of quantity and time of supply. The supply organizations in the two states must be re-organized and roles properly stated to avoid duplication of efforts.

Finally, the coefficient of the cross price elasticity of demand for certified seeds of maize and rice indicated that the two commodities were complements and substitutes. This competitive nature of the demand for certified seeds of maize and rice must be seriously considered in scheduling seed production and marketing by relevant organizations.

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