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Assessment of Rural Farming Households WTP for Fertilizers and Agrochemicals in Kwawara State, Nigeria

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Abstract

Given the specific geographic and spatial location of rural areas in developing countries, to bring agrochemical to the rural farming households, it is argued, may have to come at a cost over and above the normal price it is sold in market. To this end, this work focuses on the willingness of rural farming households to pay more than the mean average regional retail price for agrochemicals in Kwara state, North Central Nigeria. Questionnaire was administered to 100 randomly sampled in the two agricultural development zones (ADP) in the study area. Descriptive statistics and the Logistic Binary Regression model were fitted to examine factors that influence respondents' decision to pay more than the prevailing average prices for access to agrochemicals in the study area. Findings indicated a high level of awareness of agrochemical use and modal responses to quantities used include: fertilizers (41-50Kg/ha), herbicides (<10liters/ha), and pesticides (<10liters/ha) on the cultivation of yam, cassava and maize, which were the dominant arable crops in the study area. About 90% of the respondents purchase agrochemicals from their personal savings and less than 10% of the respondents got their agrochemicals from other sources (governmental, developmental agencies, ADP and farmers' cooperative). Furthermore, 88% ($p<0.01$) of the respondents indicate willingness to pay more than the current average price to have access to agrochemicals and the logistic regression reveals that level of education ($P<0.01$), had a positive relationship with respondents' to willingness to pay more for agrochemicals in the study area. Recommendations were made towards encouraging expanded use of agrochemicals throughenhanced marketing strategies that will facilitate contact of marketing agents to prospective customers located in the rural communities.

Keywords:
WTP, Agrochemicals, Fertilizers contingent valuation

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INTRODUCTION

Agrochemicals refer to substance use to help manage an agricultural ecosystem or the community of organism in a farming area. They are important agricultural input useful for sustaining and increasing yields of agricultural products. Agrochemicals include fertilizer, pesticide, herbicide and rodenticide to eliminate the presence of living things that causes injury or disease to crops and also to increase soil nutrient (fertilizer addition) for improve crop production (Ayoola, 1990; Morris *et al.,* 2007).

However, low fertilizer use is a serious constraint to agricultural productivity growth in Nigeria. In Nigeria, consumption of fertilizer was only seven kilograms per hectare (kg/ha) of arable land in 2005, significantly lower than India's rate of about 121 kg/ha or Pakistan's 184 kg/ha (World Resources Institute, 2010). In addition, rural-based farmer demand for and utilization of fertilizer and agro-chemicals is still lower than what is experienced in advanced countries. This low use could be as a result of rural small scale farmers not being aware, unable to afforddue to higher cost attributed to longer distances or lack of access resulting from geographic and locale specific imposed constraints. Therefore, to effectively get agrochemicals to rural farmers it is argued, will have to come with an additional cost that will add up to its composite cost.

As agrochemical suppliers and marketers constantly seek for market outlets for the sales of their commodities, however, the geographic and spatial location of small-scale rural based farmers, who constitutes a significant portion of the agrochemical market, suggest that getting these products to them may come at a cost over and higher than the prevailing regional retail price. To estimate potential producers' demands, suppliers and marketers often rely on stated preference methods such as Contingent Valuation.

Initially, contingent valuation, a survey-based methodology, was developed to elicit the WTP for non-market goods and services like environmental services (Boyle, 2003; Carson and Hanemann, 2005; Zapata *et al*., 2012), health economics (Diener *et al*., 1998; Krupnick *et al*., 2002), real estate appraising (Banfi *et al*., 2008; Lipscomb, 2011), art valuation (Thompson *et al.,* 2002), and in agribusiness (Lusk and Hudson, 2004).

While majority of studies in the study area have holistically focused more on the adoption of fertilizers and agrochemicals, none of such studies critically examined farmers willingness to pay an extra cost that may be associated with getting the agrochemical inputs to them (Owusu *et al*., 2007; Lagat *et al*., 2007; Irene, 2012; Moser and Barret, 2003). In view of this, the purpose of this study was to identify the factors that determine rural farming households' willingness to pay an additional cost to have access to agrochemical in the Kwara State, Nigeria.

Specifically, it:

1- examines the rural farmers level of awareness about knowledge of the benefits of agrochemicals;

2- examines the quantity and cost of fertilizers and agrochemicals used by the rural farmers;

3- investigates the level of the farmers willingness to pay more for the access to the use of agrochemicals; and

4- identifies determinants of rural farmers willingness to pay to have access to agrochemicals.

Findings emanating from this study will add to the body of knowledge and assist governmental and non-governmental agencies with sound policy formulation particularly as its relates to agricultural development in Nigeria.

MATERIALS AND METHODS

The study was conducted in Kwara State of Nigeria. It is located in the guinea savannah region of Nigeria and falls within latitudes 7^0 45! N and $9^0$30!N and longitudes $2^0$30!E and 6^0 25!E. Farming is the predominant occupation of residents in Kwara while some engage in craft activities such as weaving, blacksmithing, bricklaying, carpentry, welding etc. Fishing is also prominent along the lower River Niger Basin. The target respondents were rural small-scale farming households. A three stage sampling procedure was used in selecting our respondents. In the first stage, the list of four ADP zones in Kwara state was collected from ADP (Agricultural Developmental Program) of which two out of the four zones were randomly selected.At the second stage, 50 respondents were randomly sampled from each of the two zones. At the end, a total of 100 respondents were randomly se-

lected and interviewed with a structured questionnaire.

Descriptive statistical analysis and the Logistic regression was fitted for to assess determinants of farmers' willingness to pay for access to agrochemicals, using the function:

$Y = \alpha + \beta X_1 + \beta X_2 + \beta X_3 + \beta X_4 + \beta X_5 + \beta X_6 + \beta X_7 + \beta X_8 + \beta X_9 + \beta X_{10} + e$

Where

Y is a dichotomous response variable (1 for farmers that are willing to higher than the current determined market price for agrochemicals and 0 for otherwise). The study determined the hypothesized independent variables to include in the model after a review of relevant literatures on factors that influence WTP. The independent variables include:

X_1= age (years)

X_2= Yield of yam (kg/ha)

X_3= farming experience (years)

X_6= educational status (formal=1 and informal= 0)

X_7= income (Naira)

X_8= mode of action of pest

X_9= cost of agrochemicals (Naira)

X_{10}= yield of cassava (tonnes/ha)

α= constant; e=Error term, it is assumed to be normally distributed with zero and constant variance and β is the parameter to be estimated.

Socio-economic characteristics of the respondent

As shown in the Table 1 86% of our respondents are male compared to the 14% female. Accordingly, from the Table it reveals that 14% of the respondents are single, 79% are married, and 5% are widows while 2% are widowers. This could indicate that married people are more engaged in farming probably because they have support from their family members, in terms of labour unlike the rest of the respondents. The modal household size of our respondent was 6-9 (51%). Households with smaller sizes were more engaged in farming activities than those with larger farm sizes. The Table reveals that greater percentage (90%) of the respondents has one form of formal education and that about 10% that are with informal education. This makes it easier to conclude that the farmers in this area could improve on their ability to embrace new innovations if all their problems of availability and affordability of agrochemicals are solved.

Furthermore, the survey revealed that 25% of the respondents were engaged in farming alone while 75% of the respondents combine farming with other businesses (Table 1). Rural farmers always find it difficult to get capital required to buy inputs such as fertilizer and agrochemicals, and as such, they prefer to combine farming with other businesses so that they can source for funds. Capital earned by farmers in current production season would determine the extent to which the farmers would invest in the next session. The modal income class of the respondents ranges between 51,000-60,000 and the average income of the respondents is N 73,530 annually. This will enable the farmers to invest more in the next farming season (Table 1).

The survey showed that those that had experience less than 10 years were more in the study area which shows that they will be willing to accept or embrace new ideas ,since they will be looking for ways to improve their productivity (Table 1).

Respondents Perception of the Benefits of Fertilizers and Agrochemicals

The result of the respondents' awareness of the perceived benefits of agrochemicals was presented as their percentage response on the strongly agree, agree, disagree and strongly disagree.

The respondents' awareness of the benefits of agrochemicals would to an extent determine their willingness to pay for agrochemicals and their utilization of these agrochemicals. As shown in the survey (Table 2), about 69% of the respondents strongly agree that agrochemicals help to increase their yield while 27% agree, 2% disagree and 2% strongly disagree to this.

Also according to the Table, 62% of the respondents strongly agreed that control of pest and diseases is a benefit that can be gotten from the use of agrochemicals, while 35% agreed and 3% disagreed to this fact (Table 2).Majority of the rural farmers don't believe that use of agrochemicals provides for recreational areas, which is clearly shown from the response of the respondents with just having 1% of the respondents strongly agreeing and 33% agreed and another 33% disagree, with

Table 1: Socio economic distribution of respondents.

Socio Economic variables		Frequency	Percentage
Educational status	No formal	10	10
	Quranic	9	9
	Adult	15	15
	Primary	30	30
	Secondary	30	30
	Tertiary	6	6
Occupation	Farming alone	25	25
	Farming &others	75	75
INCOME(N)	≤ 30,000	6	6
	31,000-40,000	16	16
	41,000-50,000	18	18
	51,000-60,000	22	22
	61,000-70,000	10	10
	71,000-80,000	12	12
	81,000 >	16	16
Experience (Years)	1-10	33	33
	11-20	19	19
	21-30	16	16
	31-40	10	10
	41-50	8	8
	51 >	14	14
Sex	MALE	86	86
	FEMALE	14	14
Marital status	Single	14	14
	Married	79	79
	Widow	5	5
	Widower	2	2
Household size	≤ 5	25	25
	6-9	51	51
	10-13	21	21
	14-17	2	2
	≥ 18	1	1
Age (Years)	21-30	11	11
	31-40	16	16
	41-50	18	18
	51-60	28	28
	61-70	13	13
	71-80	14	14

Source: Field Survey

24% strongly disagreeing (Table 2). The survey showed that 45% of the respondents were of the opinion that the use of agrochemicals eliminates storage pest, 31% agreed, 11% disagreed and 13% strongly disagreed probably due to the fact that some of these farmers are not accessible to the use of these agrochemicals which could be used for the elimination of pest that destroys their stored crops (Table 2).

Estimation of Quantities and Cost of Fertilizers and Agrochemicals used by Respondents /ha

As revealed in the Table, fertilizers remains the most widely used as shown by its spread among the respondents. Quantity of fertilizer (Table 3) purchased and used could be dependent on the farm size of the respondents as well as affordability and availability .The table shows that a larger percentage of the respondents use

Table 2: Respondents' awareness of perceived benefits of agrochemicals.

Perceived benefits	Strongly agree (%)	Agree (%)	Disagree (%)	Strongly disagree (%)
Yield increase	69	27	2	2
Control of pest and diseases	62	35	3	0
Decrease in cost	49	32	17	2
Saves farmers money	46	32	21	1
Reduces drudgery	28	35	25	12
Helps farmers to grow more per unit area	21	44	28	7
Safe guard public health	13	4	32	15
Provides for recreational areas	1	33	33	24
Eliminates storage pest	45	31	11	13

source: Field survey

Table 3: Estimation of total cost of production equation for greenhouse cucumber in Khahsh.

Agro chemicals	Qty (kg, litre/ha)			Cost range (N/ha)		
		Freq	%		Freq	%
Fertilizer	≤10	33	33	≤1000	32	32
	20-Nov	8	8	1100-2000	1	1
	21-30	7	7	2100-3000	5	5
	31-40	9	9	3100-4000	12	12
	41-50	22	22	4100-5000	11	11
	51-60	3	3	5100-6000	10	10
	≥61	18	18	6100-7000	3	3
				7100-8000	1	1
				8100-9000	3	3
				9100-10,000	5	5
				10,000 >	17	17
Total	100	100			100	100
Herbicide	≤10	77	77	≤1000	57	57
	11-20	16	16	1100-2000	16	16
	21-30	6	6	2100-3000	12	12
	31-40	1	1	3100-4000	9	9
	-	-	-	4100-5000	6	6
Total		100	100		100	100
Insecticide	≤10	93	93	≤1000	93	93
	11-20	7	7	1100-2000	2	2
				2100-3000	2	2
				3100-4000	3	3
Total		100	100		100	100

Source: Field Survey

less than 10kg of fertilizer per hectare and a larger percentage of the respondents spend less than N1000 on the use of fertilizer per hectare which could largely be due to the fact that the fertilizer are either expensive or are not accessible to the respondents. The mean or average usage of fertilizer per hectare is 36.65kg and the average cost per hectare is N5148.07.The average use of herbicide and insecticide per hectare by the respondents is 6.28 litres and 2.58 litres respectively. While the average cost of usage is N1261.64 and N316.49 respectively (Table 3).

Sources and accessibility of agrochemicals by respondents

Table 4 shows the sources and accessibility of agrochemicals to the respondents'. From the table it shows that 58% of the respondents' re-

Table 4: Perception of accessibility of sources of agrochemicals by farmers.

Accessibility	Very accessible (%)	Accessible (%)	Poorly accessible (%)	Not accessible (%)
Savings accessibility	58	33	7	2
Government accessibility	1	6	1	92
Developmental agencies accessibility	0	0	12	88
ADP accessibility	1	3	1	95
Farmers' cooperative	4	11	1	84

Table 5: Statistical test to determine significance of respondents willingness to pay more.

Willingness to pay	Frequency	Percentage	Standard error
Yes	88	88	0.32
No	12	12	0.32
Total	100	100	

vealed that agrochemicals gotten from their personal savings were very accessible, 33% said it was accessible, 7% said it is poorly accessible and 2% said their personal savings were not accessible at all to get the agrochemicals. The table also reveals that accessibility of agrochemicals from other sources are poor, majority of the respondents were of the opinion that they are not accessible at all.

Assessment of farmers willingness to pay for more for access to fertilizers and agrochemical

Respondents were asked to state the price they bought their agrochemicals and fertilizers outside the rural areas. They were then asked to indicate if they would be willing to pay more to buy the inputs at their bases. About 88% indicated the affirmative and 12% of the respondents were negative. A test was carried out to examine the significance of there response. The result is presented in Table 5.

The Logistic regression was used to determine the respondents' willingness to pay for agrochemicals. The model parameters as shown by the Pseudo R^2 and the significance of the model chi ^{2} (<0.01) affirms the relative strength of the model as a good fit. As shown in the Table, possession of education is positively related to willingness to pay and it is significant at 1 % which indicates that the more educated

Table 6: Logistic regression analysis for the determinants of farmers willingness to pay.

Predictor variable	Average Marginal Effect	Standard error	p>/z/
Formal Education	14.76	5.40	0.01***
Income	0.00	0.00	0.07
Farming experience	-0.34	0.19	0.07*
Control of pest and disease	14.65	8.55	0.09*
Saves farmers money	2.36	1.29	0.07*
Drudgery	2.42	1.62	0.14
Cost of herbicide	0.00	0.00	0.13
Cassava yield	0.00	0.00	0.06*
Yam yield	0.00	0.00	0.10

Note: single asterisk refers to 10% significance and three asterisks refer to 1% significance.
Prob>chi=0.0023
Pseudo R^2=0.6326
Source: Field Survey

the farmers, the more they are willing to pay for agrochemicals. Income and knowledge of the benefit of control of pest and disease function of agrochemical are positively related to willingness to pay and significant at 10% which indicates that the higher the income and knowledge of benefits of agrochemicals, the more willing they will be to pay for it. Equally, respondents who record a higher yield from cassava are more likely to pay more for access to agrochemicals.

Conversely, farming experience shows a negative relationship with willingness to pay ($p<0.1$). This indicates that the higher the farming experiences of the farmer, the lower their willingness to pay.

CONCLUSION AND RECOMMENDATION

The study was carried out to assess rural farming households' willingness to pay more than the central market price for agrochemicals. It was conducted in two ADP zones (Zone C and Zone D) in Kwara state. Findings show that majority of the respondents are aware of the benefits of fertilizers and agro chemicals and source it primarily from their savings.The mean or average usage of fertilizer per hectare is 36.65 kg and the average cost per hectare is N5148.07. The average use of herbicide and insecticide per hectare by the respondents is 6.28 litres and 2.58 litres respectively. While the average cost of usage is N1261.64 and N316.49 respectively.

Findings imply that a higher proportion of respondents (88%) are willing to pay higher prices if fertilizers and agrochemicals can be made available to them at their vicinity. This decision is however premised on certain socio-economic variables of which education, income from farming, knowledge of mode of action of agrochemical, farming experience and cassava yield were all significant in explaining this willingness decision.

Based on the findings of the study, the following recommendations were made:

1- The problem of bureaucracy should be eliminated by the government in distributing agrochemicals, so that the rural farmers can have equal access to it both at farm centres and Agricultural Development agencies.

2- Private business owners can take advantage of this willingness and situate marketing outlets at strategic locations across rural areas.

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