FACTORS INFLUENCING THE ADOPTION OF AGRO-CHEMICAL TECHNOLOGY BY SMALL-SCALE FARMERS IN KWALI AREA COUNCIL OF ABUJA FCT, NIGERIA

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ABSTRACT

The study was conducted to determine factors influencing the adoption of agro-chemicals technology by small-scale farmers in Kwali area council, of the Federal Capital Territory Abuja, Nigeria. Structured interview schedule was used to collect data for the study. Ten respondents were randomly selected from each of the eight districts making the area council giving a total of eighty respondents. Statistical tools involving means, frequency and percentage were used to analyze the data. Ordinary least square linear regression was used to determine factors influencing the adoption of agro-chemicals technology in the study area. The results of the study revealed that gender, age, farm income, marital status and years of farming experience have positive influence on the adoption of agro-chemicals in the study area. Management of Abuja Agricultural Development Project should endeavour to encourage farmers to form strong coherent group such as cooperatives to control agro-chemicals prices supplied by input representatives.

Key words: *agro-chemicals, agriculture, technology, Nigeria, productivity*

INTRODUCTION

Agricultural practices in Kwali Area Council (KAC) of Federal Capital of Abuja are virtually un-mechanized, while human labour accounts for about 90% of all farm operations. Mixed cropping is a common practice among farmers in KAC. Ogungbile and Olukosi (1991) described most of the cropped land in Nigeria as being devoted to growing crops in mixtures. This system of mixed cropping, they maintained had evolved over generations in the entire environment. In part of the study area where partial mechanization was practiced, human labour still prevailed in such operations as weeding and harvesting (Chattopadhyay, 2000). Studies by Shetty and Krantz (1980) and Unamma et. al., (1986) had shown that weed control in crop mixtures involving land weeding was labour-intensive, uneconomical and more difficult than weed control in sole crop. In this regard, 32% of the farmers' time was expended in hand hoeing of mixtures (Anonymous, 1972). The effectiveness of this method of hand weeding might also encroach into the critical period of weed interference (Akobundu, 1980). Also farmers in the study consistently stuck to their crop mixtures possibly because mix cropping was said to give high yields hence higher monetary returns than sole cropping. Crop mixtures made more efficient use of environmental resources (light water, nutrients) and labour. Pests and diseases might not spread as rapidly in mixtures due to differential susceptibility to pests and pathogens (Ogungbile and Olukosi, 1991).

Labour productivity in the study area has also been generally low due to the application of low level traditional method of weed control and other agro-chemicals technology in their farming operations. Abulu and Yayock (1980) reported that technology adoption by Nigerian farmers was known to be generally low. Mijindadi and Njoku, (1985) identified inappropriate recommended practices, low literary levels and inadequate extension services among factors that tended to constrain technology adoption. However, the importance of agro-chemicals as essential inputs for eliminating drudgery, excessive operations cost, problem of scarcity of labour at the time required for weed control, and low usage of crop protection chemicals such as rodenticides, fungicides and insecticides by farmers in the study area make this study relevant. Through the study factors which constrain the adoption level of agro-chemicals technology

would be identified, thus enhancing farmers' production and productivity.

This study further aimed at determining the level of agro-chemicals technology adoption by farmers and to identify the factors which influence the adoption level of agro-chemical technologies in the study area. Specific objectives of the study were to (i) describe the socio-economic characteristics of farmers in the study area; (ii) determine level of adoption of agro-chemicals technology among farmers; and (iii) determine factors influencing the adoption of agro-chemicals technology among farmers.

METHODOLOGY

The study was conducted at Kwali Area Council (KWAC) It is among the six (6) area councils, that make up the Federal Capital Territory (FCT) Abuja. The area council is situated at the South-Western part of the FCT. KWAC lies between Latitude 80 and 90 South and Longitude 70 and 80 East. It is boardered to the North by Gwagwalada, to the East by Kuje and to the West by Abaji area councils respectively. The area comprises of eight (8) districts and has a total land area of 1,700,400 km2. The area has clayish and sandy loam soil texture with occasional swampy areas used for Fadama (irrigated) farming. The area has distinct wet (March - October) and dry (November - February) seasons with average annual rainfall of 102.5mm and mean temperature range of between 20.70C - 30.80C (Metrological Department, 2006). The area is mainly occupied by small scale farmers who grow crop such as yam, rice, melon seed, cocoyam, cassava, baniseed and millet. The council area has population of the area is 85,837 (NPC, 2006). The main ethnic groups in the area include: Bassa, Gbagi, Hausa/Fulani and Ganagana (Kwali Spotlight, 2007).

Ten farmers were randomly selected from each of the eight districts to give a total of 80 respondents (farmers). Primary data were used for the study, the data were collected with the aid of interview schedule which was administered to the respondents by the authors over a period of 2 weeks. Data were collected on respondent socio-economic characteristics, and agro-chemicals usage. Simple descriptive statistics and ordinary least squares (OLS) model were used for data analysis. The OLS model was expressed as follows:

Y = f(GENDER; AGE; FINC; MS; HS; FS; FE; EDUC; U)

Where:

Y	=	Number of agro-chemicals Technology adopted by respondents (actual number)
GENDER	=	(Dummy, 1 = Male 0 = Female
AGE	=	Age of respondent (years)
FINC	=	Farmers' income (Naira)
MS	=	Marital Status (Dammy, 1 = married; 0 = single
HS	=	Household size (actual number)
FS	=	Farm size (Ha)
FE	=	Farming Experience (years)
EDUC	=	Highest Level of Education of the respondents (years)
U	=	Error term

RESULTS AND DISCUSSION

A prior expectation: Age is expected to vary positively with technology adoption due to the fact that adoption of a technology is generally related with acceptable level of risk while older people tend to be more risk - averse than young people. Years of formal education are also expected to influence adoption positively because education enhances access to important information. In the same vein, a negative relationship is expected between household size and adoption to the extent that households generally emphasize on more resources to food security to satisfy household's food security needs. Furthermore, farm size is expected to relate positively to adoption due to the fact that large scale farmers are expected to be high capital based farmers and can therefore easily afford to use inputs and practices. Farming experience is expected to relate positively to adoption because management skills improve with years of experience.

Socio-economic Characteristics of Respondents: The result in table 1 revealed that 82.5% of respondents were male and 17.5% female, suggesting male domination of crop production in the study area. This implies possible women's constraint to access and control over resources available and the benefits they received. The table also showed that the average age of respondents was 35 years, suggesting that the respondents were generally young. Mean farm income was N13,000 per annum suggesting that surveyed farmers earned low income from farming. The finding depicted

poor capital formation, low productivity and inability to adopt modern technology. Ninety percent of respondents obtained their land through inheritance/purchase. Inheritance/purchase inferred ownership in perpetuity which confirmed security of tenure and served as an incentive to permanent investment in land. About 64% of the respondents were single while 38.75% were married. Average household size was seven (7) and regarded as large. Average farm size was 2.6 hectares which inferred that farmers in the study area were small scale farmers. Average year of farming experience by farmers was ten (10) years. This depicted that farmers were old enough to understand management of farming business. About 64.0% of the respondents were illiterate and semi-illiterate respectively. Level of education of the respondents depicted their inability to understand scientific basis of agricultural technologies and the superiority of improved farm practices over their traditional practices.

Level of Adoption of Agro-chemical Technology: The level of adoption, defined as types of agro-chemicals used by farmers varied among farmers. The types of Agro-chemicals technology available to small-scale farmers in the study area included insecticides, rodenticides, fungicides and herbicides (Table 2). The adoption level for herbicides was highest (50.6%) followed by insecticides (28.9%). The least adopted technology was rodenticide (4.0%).

Factors Influencing Adoption of Agro-chemical Technology: The result of the OLS regression analysis is presented in Table 3. On the basis of value of the coefficient of multiple determinations (R2), the number of significant variables that conformed to priori expectations, the results of the exponential function were chosen and used for further analysis (Table 3). The results showed that gender, age, farm income, marital status, farm size, years of farming experience household size and education were all significant at 5% and accounted for about 71.1% of the variability in the level of adoption of agro-chemical in the study area.

Gender had positive and significant relationship ($p = 0.05$) with adoption of agro-chemical technology probably because male-headed farm households were more favourably disposed to adoption than their female counterpart. In the study area only 17.5% of the surveyed farmers were female and by tradition female farmers do not own the land they till even

though they are required to cultivate it and produce food from it. Such sexual discrimination manifested by unequal access to agricultural production technologies is unhealthy for agricultural development especially when women are estimated to constitute significant proportion of agricultural labour force and their output into agriculturally related decision-making process. Due at al., (1987) observed that the Training and Visit extension introduced into Tonga region of Tanzania in 1980/81 did not meet the needs of female-headed farm households. Also Akpabio and Ekpe (2001) opined that women were constrained by systemic gender biases in form of customs, beliefs and attitudes and confined them to domestic sphere, and restricts their access to resources that would have enhanced their productive capacity.

The age variable had positive and significant relationship with adoption ($p = 0.05$) suggesting that age was an important motivating factors for the adoption of agro-chemicals in the study area. The finding showed that older farmers with higher income tended to adopt agro-chemicals more than younger farmers with less income. Expert opinion, however, differ on relationship of age with adoption. Feaster (1968) reported that age was an important determinant of positive attitude towards change. Sanoria and Sharma (1983), also, opined that age has significant association with adoption. However, other authors (Okoye, 1989; and Igodan et al., 1988) believed that age of a farmer did not contribute to adoption of a farm practice. While Agbamu et al. (1996) cautioned that the issue of age must be viewed with respect to that farmer's location - whether in a hamlet cut-off from civilization or in a suburban dwelling where farming has been modernized.

Farm income had positive and significant relationship to adoption of agro-chemicals ($p = 0.05$) probably because income constitutes an important element in an integrated approach which also covers advisory services for improving production and productivity. Surveyed farmers in the study area were resource-poor earners of low income. Their ability to adopt new agro-chemicals technology, therefore depended on what was left out of income after basic family commitments has been taken care of. However, Ogunfiditimi (1981) and Agbamu (1995) argued further that economic status of farmers which showed positive and significant relationship with adoption portrayed the fact that the more the farmers are

well-off economically, the more they are proned to adoption of new practices. Marital status had positive and significant relationship with adoption ($p = 0.05$). In the study area, level of attainment of responsibility has been associated with marriage. Also marriage institution is recognized as the key to uniting individuals and groups while wives are expected to play an important role in both agricultural production, and food processing.

Household size variable had negative and significant relationship ($p = 0.05$) with the adoption of agro-chemicals technology probably because to the farmers, size of the family exerts pressure on farm size which becomes fragmented and therefore small holdings becomes prevalence. This implies any extension package that requires large-scale farming may not be easily adopted by such farmers who are faced with a limited farm size. This is in agreement with Voh (1982) who established that household size was not significantly related to adoption ($p = 0.05$). According to him, positive explanation for the absence of the relationship might be that rural households were generally known to be poor, thus the little they had in terms of resources might not be sufficient to purchase inputs after other family commitments has been taken care of. His study showed that innovative farmers tended to have smaller families.

Omuruaye (1987) reported that size of farm holding has no relationship with family size but by virtue of family size there is pressure on land which has become fragmented and hence small holdings abound. However, Njoku (1991) described households with larger size as tending to attach greater importance to food security than those that were small in size. This according to him, extension package that required large-scale farming may not be readily adopted by such farmers who were constrained by adequate land area.

The coefficient of farm size had positive and significant relationship to agro-chemical technology in the study area ($r = 0.05$) suggesting the adoption level of agro-chemicals technology was higher among farmers with larger farm sizes. Resource-poor farmers, in the study area tended to attach importance to food security and spared part of their income for acquisition of agro-chemicals only after meeting most of their family commitment. This is in agreement with Williams (1984) who reported that the larger the farm business, in terms of acreage, number of livestock or labour requirements and more specialized the nature of farm business,

the earlier the farmer tends to adopt those new and improved practices which are applicable to his farm enterprises. In literature, however, opinion is divided on the effect size of holding on adoption.

In India, Abd - Ella et al., (1981) established that the size of farm holdings was positively related to adoption. Ogunfiditimi (1981) found negative relationship between size of cassava farm and adoption in the study of rural areas of Oyo and Ondo States. On the other, Agbamu (1995) found a positive relationship between farm size and adoption of soil management practices but the relationship, according to him was not significant.

Years of farming experience was significant at 5% level and also positively associated with adoption of agro-chemical technology; probably because the more the farming experience, the more is the adoption level of recommended packages due to the fact that management skills of farmers improves with experience. The results of this study showed that average age of farming experience of respondents was ten (10) years; old enough to make them understand the value of farming business. Furthermore, it would enable the farmers appreciate implication of contact with extension agents and subsequent adoption of improved farm practice. Nweke and Chedebili (1991) opined that farming experience and skills were largely determined by age of the operator which he described as a direct relationship between age and adoption of technologies. Idrisa et al., (2005) reported that farming experience as a good signal for adoption of improved technologies because experience farmers tend to understand the importance of technology in farming.

Education variable had negative but significant relationship to adoption of agro-chemicals technology ($p = 0.05$). Sixty four percent of the respondents were either illiterate or semi-literate respectively which inferred their inability to have adequate knowledge of the value of agro-chemicals technology on their farming operations and the superiority of such an improved technology over their traditional practices. The finding agreed with Basu (1996) and Patel and Anthonio (1971) who did not establish any significant relationship between education and adoption. Also Voh (1982) found that level of education was positively related to adoption but marked that the relationship was not a strong one as it accounted for only 4% of the variability in adoption. In the same vein, Agbamu et al.,

(1996) reported that farmer's formal education without adequate knowledge of recommended practices is not likely to adopt it.

CONCLUSION AND RECOMMENDATIONS

The results of the study showed that 78.7% of the respondents had adopted herbicides and insecticides. The most important factors influencing agro-chemicals technology adoption were: gender, age, farm income, marital status, farm size, household size, education and years of experience. All the factors with the exception of household size and education were positively related to agro-chemical technologies technology adoption. Based on the findings, the following are recommended;

1. Due to the resource-poor nature of the respondents and the household size pressure on land holding, the agro-chemicals technology to be made available to the study area should be emphasized on affordability so as not to endanger farmers' food security need and adoptability of the technologies.
2. The most important factors in influencing adoption of agro-chemical technology in the study area are non-institutional in nature. To be able to face the oligopolistic cartel of input suppliers farmers should be encouraged to organize themselves properly into coherent groups such as cooperatives. For the cooperatives to provide useful and lasting instruments for controlling agro-chemicals technology prices, the initiative for their formation needs to come from the farmers themselves.
3. Management of Abuja Agricultural Development Project should organize workshop/Training for small scale farmers to enhance their knowledge and awareness of the value and the appropriate applications procedure of agro-chemicals technology to their farming operations.
4. Efforts should be intensified to break the barrier of gender bias by raising the level of women participants in the agricultural programme in the study area with the view to realizing full potentials of agricultural resources for the development of the area and the nation at large.

TABLE 1: Social-economic characteristics of farmers in Kwali Area Council (FCT - ABUJA)

Variable	Percentage
Gender	
Male	82.50
Female	17.50
Age (years)	
<30	30.00
30 - 39	37.50
40 - 49	13.75
50 - 59	18.75
Farm Income (N)	
<N5000.00	32.75
N6000.00 - 10,000.00	18.75
N11,000.00 - 15,000.00	55.00
N16,000.00 and above	2.50
Land Tenure	
Inheritance/Purchased	90.00
Leased Hired	10.00
Marital Status	
Married	38.75
Single	61.25
Household Size	
1 - 5	22.50
6 - 10	33.75
11 - 15	37.50
16 - 20	3.75
21 and above	2.50
Farm Size	
0.1 - 1.5	21.25
1.6 - 2.5	43.75
2.6 - 3.5	31.25
3.6 and above	3.75
Experience (years)	
1 - 5	65.39
6 - 10	-
11 - 15	12.82
16 - 20	20 - 51
21 and above	1.28
Education	
Non-formal education	48.71
Adult education	15.39
Primacy	1.28
Secondary	26.93
Post-secondary	7.69

Source: Field Survey, 2009

Table 2: Distribution of farmers according to the level of adoption of agro-chemicals in Kwali Area Council (FCT - Abuja)

Types of Agro-chemicals	Percentage of Respondents who have adopted agro-chemicals
Insecticides	28.06
Rodenticides	4.00
Fungicides	17.33
Herbicides	50.67

Source: Field Survey, 2009

Table 3: Linear regression results of the factors influencing the level of technology adoption of agro-chemical technologies in Kwali Area Council (FCT - ABUJA)

Variable	Coefficient	Standard Error	t - value
Constant	-10.466	1886.25	.000
Gender	1.716	794.616	5.562
Age	.952	47.099	2.590
Farm Income	.001	.066	.999
Marital Status	.269	1103.39	1.309
Household Size	-3.196	109.010	.041
Farm Size	10.689	308.71	43855.626
Experience	.208	106.369	1.231
Education	-3.429	66.704	0.32

Source: Field Survey, 2009

** = Coefficient significance at 5% level; R2 = .710

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