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Full Length Research Paper

Determinants of vegetable farmers' decision to use poultry litter in the southern region of Nigeria

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This study specifically modeled poultry litter equation among Telfairia occidentalis farmers in Ikot Ekpene area of Akwa Ibom State in Southern Nigeria. One hundred and twenty Telfairia (fluted pumpkin) farmers were randomly sampled and used for this study. Structured questionnaires were used to collect the data needed for the analysis. Logit model regression based on the maximum likelihood estimation was specified and used to analyze the data collected. The choice of the Logit model was based on the nature of the dependent variable which was a probability or decision based variable. The explanatory variables used in this study were derived following a careful review of the literature and observed characteristics of the respondents. The result of the empirical estimation revealed that age, education, farm size, previous year's harvest, farming practice adopted, farming experience, soil management practice, farm income, off-farm income and household expenditure were important determinants of the Telfairia farmers' decision to use poultry litter in the study area. Based on the findings, it was recommended that Telfairia farmers in the study area should be exposed to more years of formal education so as to enhance organic manure technology adoption. Efforts should be channeled towards sensitizing the Telfairia farmers on the need to embrace the family planning programme so as to reduce the household size and expenditure. This will enhance increase farm budget allocation and hence organic manure utilization. This study also advocated mixed crop farming system among Telfairia farmers as this will reduce production risk and increase the tendency of poultry litter usage. In addition, the study supported agricultural income diversification among Telfairia farmers; this will guarantee increase in aggregate income of farmers and hence poultry litter usage even in the face of increased household expenditure.

Key words: Telfairia, farms, poultry litter, farmers, fluted pumpkin.

INTRODUCTION

The long history of African food insecurity has worried concerned minds; to avert this prevailing hunger situation in Africa, especially in the sub Saharan region, food production must be increased to meet up with the teeming population. This could be achieved through expansion of land area or improving the yields of crops on the cultivated land area (Ugbomeh, 1991; Udoka and Idiong, 2006). As a result of population pressure on land, expansion is difficult; moreover, after cropping for some years, soil depletion sets in, resulting in low crop productivity. This could be checked by the use of sustainable soil improvement materials such as the organic manure (poultry litter) to improve crop outputs. According to Emuh and Agboola (2000), and Bamire and Ola (2004), population pressure exacerbates and intensifies land degradation and this has resulted in the use of different intensification technologies by farmers to improve yields. Soil is usually degraded due to its constant use and there is need to replenish it either by the use of organic matter or fertilizer (Alegria et al.,

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1991). Chemical fertilizers often produce plants products quickly and in large quantities, but over time they become less effective and eventually intoxicate the land with some unwanted chemicals resulting in increased soil depletion (Ekop and Eddy, 2007). Bray and Kurtz (1945) observed that the rapid decline of plant nutrients, low organic content and poor physical condition of the soil constitute strong limitation to crop production. Consequently, attention is gradually shifting towards organic manure as soil amendment material for crop production (Ano et al., 2003; Ekop et al., 2011).

In Nigeria, crop production is mostly practiced on subsistence scale and most farmers are poor, and as a result they are faced with several constraints in the use of fertilizers. Some of the constraints include among others: escalated price of fertilizers, unavailability or late arrival of fertilizers, cultural barriers, insufficient quantities of fertilizers, political interference in distribution, zero soil test, poor fertilizer recommendation or lack of appropriate information on correct usage, lack of incentives and unintended subsidies (Fertilizer Development Centre, 1995; Adeniyan and Ojeniyi, 2005; Akpan and Aya, 2009; Emuh, 2010; Emuh et al., 2011). Several studies have revealed that inflated price of fertilizers have deteriorating effects on the arable crop output in developing countries (Olwande et al., 2009; Akpan and Aya, 2009). Recognizing the myriad of deficiencies inherent in the use of fertilizer in developing countries, many agricultural based agencies have advocated the use of organic manures as alternatives to inorganic fertilizer (Adeoye, 1995; Emuh et al., 2011).

Empirical researches have shown that nature-based organic manures are economically viable alternative soil enhancing materials that have positive impact on soil quality and crop outputs (Adepetu, 1977; Agboola, 1988; Serna and Pomares, 1991; Adeoye, 1995; Kato et al., 1997; Bamire and Ola, 2004; Egbuchua, 2007; Akpan and Aya, 2009; Emuh et al., 2011). Issues of underground water pollution by some of the inorganic fertilizers and the need to have a less polluted environment also justify the use of organic manure.

Many studies have identified the increasing use of organic manure in vegetable cultivation in Nigeria (Udoh, 2005; Akpan and Aya, 2009). The commonly used organic manures by vegetable farmers in the country are: cow dung, goat droppings, pig and poultry dropping. Poultry dropping (poultry litter) seems to be the most preferred among them probably due to its relative affordability and availability on demand. Poultry manure is the organic waste material from poultry consisting of a mixture of poultry excreta, spilled feed, bird's feathers, and material (wood shavings or sawdust) used as bedding in poultry operations.

Vegetable crops are usually described as the tender edible shoots, leaves, fruits and roots of plants that are eaten whole or partly raw or cooked as a supplement to starchy food (Udoh, 2005). Currently, there are no restrictions on the use of poultry manure for vegetable crop cultivation. Vegetable production is popular in Nigeria because of its short gestation period, easily affordable, nutritive value and high gross margins (Akpan and Aya, 2009). These crops are consumed in relatively small quantities as a side dish with the staple food. In recent times, there has been a tremendous interest and increase in vegetable crop production in the country. In the South-South region of Nigeria, prominent vegetable crops include water leaf, fluted pumpkin (*Telfairia occidentalis*), Cucumber, *Amaranthus spp* and okra. In this region of the country, fluted pumpkin has become the most popular cultivated vegetable crop (Akpan and Aya, 2009). The crop is cultivated on upland during rainy season and in wetland or *fadama* area during dry season. It is the most preferred homestead crop among the Ibibios and Efiks in the region. The green succulent leaves are used to prepare the most popular traditional delicacy of the Ibibios and Efiks called "Edikan Ikong". The medicinal activities of *Telfairia occidentalis* has been reported by many researchers. In Nigeria, the herbal preparation of the plant has been employed in the treatment of several diseases such as anaemia, chronic fatigue and diabetes (Ajibade et al., 2006; Oboh et al., 2006; Alada, 2000; Dina et al., 2006; Idris, 2011; Kayode and Kayode, 2011). Research reports have shown that the leaves of *Telfairia* contain essential oils, vitamins; the root contains cucubitacine, ses-quiterpene, lactones (Iwu, 1983; Oyewole and Abalaka, 2012). Gbile (1986) reported that the young leaves of fluted pumpkin (*Telfairia occidentalis*) are useful in the treatment of convulsion. The leaf extract is also useful in the management of cholesterolemia, liver problems and impaired defense immune systems (Eseyin et al., 2005). Research reports by Okokon et al. (2007), Odoemena and Onyeneke (1998), Oluwole et al. (2003) and Kayode and Kayode (2011) have shown that the ethanol root extract of *Telfairia occidentalis* possess antiplasmodial potential, inhibitory effects on some enterobacteriacae and anti-inflammatory potentials.

Several empirical works have attested to the importance of organic manure in arable crop production and also examined the socio economic factors that influence manure usage among farmers especially in developing countries. Makokha et al. (2001) has examined the determinants of fertilizer and manure use for maize production in Kenya. They discovered that, the most used manure by farmers in Kenya was cow dung. Also, they identified major constraints to manure usage to include high cost of labour, unavailability and untimely delivery of the manure. Other variables that influenced the use of manure were: farmer's membership in a social organization, household size, hired labour for manure application, livestock ownership and off-farm income. The logistic regression showed that extension contact and off-farm income were significant factors that influenced the adoption of manure technology. In a related study, Palm

et al. (1997) found out that there are benefits of combining organic manure and fertilizer but they reported that guidelines are needed for farmers to manage such combinations. Emuh et al. (2011) worked on the analysis of the adoption of farm yard manure among small scale farmers in Delta State of Nigeria. They reported that factors which influenced the decision of the farmers to adopt farm yard manure were farming experience, high cost of inorganic fertilizers, level of education attainment, estimated yield from farm yard manure adoption and frequency of extension contact. Working on the determinants of the decision to adopt integrated soil fertility management practices by small holder farmers in Central highlands of Kenya, Jayne et al. (2008) found out that farmer's age has a mixed relationship with the probability of adoption of soil enhancing technology. The negative influence of age on adoption of soil enhancing technology is consistent with the findings of Odera et al. (2000) in Kenya. This finding corroborates the previous findings by Bekele and Holden (1998) in Ethiopia, Lapar and Pandy (1999) in Philippines and is also supported by Gockowski and Ndoumbe (2004) in Cameroun. Ofuoko et al. (2005) and Ofuoko et al. (2008) identified frequency of extension contact, level of formal education, age, farm size and farm income as the major determinants of adoption among farmers in Nigeria.

Limited information exists on manure utilization among arable crop farmers in the South-South region of Nigeria especially in Akwa Ibom State area. Given the present escalated price of fertilizer, and the need to increase food production and advantages of using manure in place of fertilizer, there is an overwhelming need to identify factors that can promote manure (poultry litter) utilization among arable crop farmers in the area. The identification of these factors would help to address the constraints faced by vegetable farmers in using manure in the area. In addition, it would help policy makers with facts to design effective policy framework upon which a sound farm level policy on soil enhancement could be based. To achieve this purpose, the study empirically identified determinants of fluted pumpkin (*Telfairia occidentalis*) farmer's decision or probability to use poultry litter in Ikot Ekpene area in Akwa Ibom State located in Southern Nigeria.

RESEARCH METHODOLOGY

Study area

The study was conducted in Ikot Ekpene Local Government of Akwa Ibom State in Southern Nigeria. Ikot Ekpene is the political headquarter of the Annang extraction; it has a land area of about 125 km^2 or 48 square miles and a population of about 225,000 (NPC, 2006). Fluted pumpkin cultivation is very common among farmers in this area. It is cultivated on uplands during rainy season and in wetlands as well as home-stead during dry season. The study focused specifically on the *Telfairia occidentalis* (fluted pumpkin) farmers in Ikot Ekpene Local Government Areas.

Sampling techniques and data collection

A two-stage simple random sampling procedure was used to select respondents (*Telfairia* farmers). First, ten villages were randomly selected from the total number of villages that make up the local government area. In the second stage, twelve *Telfairia* farmers were randomly sampled from each of the selected villages. A total of 120 *Telfairia* farmers were randomly sampled and used in this study. Structured questionnaires complemented by personal interviews were used to collect data needed for the analysis. We considered *Telfairia occidentalis* (fluted pumpkin) farmers in the study as those that plant *Telfairia* (fluted pumpkin) as sole crop farming or as mixed crop farming. The study was conducted during the 2012 cropping season.

Method of data analysis

A multivariate logistic regression analysis was used to determine factors that influenced the use of poultry litter among *Telfairia* farmers in the study area. The model employed in the analysis is specified as follows:

$$\text{Ln } Y = \text{Ln } (P_i/1\text{-}P_i)$$
$$\text{Ln } (P_i/1\text{-}P_i) = b_0 + b_1 X_1 + b_2 X_2 + \ldots\ldots b_{15} X_{15} + e \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where Y = is a binary variable defined as 1 if a *Telfairia* farmer uses poultry litter and 0 if a farmer does not; P_i = Probability of use of manure; Ln = Natural logarithm function; b_1 - b_{15} = Logistic regression coefficients.

Xs are explanatory variables and are defined as follows:
AGE = age of *Telfairia* farmer (years);
GEN = gender of *Telfairia* farmer (1=Female, 0 otherwise);
EDU = formal educational level of *Telfairia* farmers (years);
HHS = household size of *Telfairia* farmer (number);
MAR = marital status of *Telfairia* farmer (1 for married and 0 otherwise);
LAN = *Telfairia* farm size of farmer (hectare);
PRI = perceived price of fertilizer (1 for high price and 0 otherwise);
FIN = farm income (₦);
EXP = farming experience (years);
PYH = previous year harvest (Kg);
OFI = off farm income (₦);
MEM = membership of a social group (1 = Yes and 0 = No);
HHE = household expenditure (₦);
SMG = soil management practice (1 for bedding/tillage and 0 = flat land or zero tillage);

Table 1. Logit Model estimates of the *Telfairia* farmers' decision to use poultry litter in Ikot Ekpene Local Government Area of Akwa Ibom State in Southern Nigeria.

Variable	Coefficient	Standard error	Z-Value	Odd Estimates	Marginal Effect	P- Value
Constant	-3.494	2.418	-1.445	-	-	0.149
AGE	0.047	0.011	4.273	1.048	6.25^{e}-07	0.001***
GEN	0.037	0.466	0.080	1.038	4.95^{e}-07	0.936
EDU	0.038	0.016	2.375	1.039	5.11^{e}-07	0.045**
MAR	-1.476	0.903	-1.635	0.229	-2.63^{e}-05	0.102
HHS	0.198	0.279	0.707	1.219	2.62^{e}-06	0.479
LAN	-2.139	1.208	-1.771	0.118	-2.84^{e}-05	0.077*
PYH	1.765	1.003	1.759	5.842	0.0056	0.089*
FFP	0.977	0.494	1.977	2.656	1.74^{e}-05	0.048**
SMG	1.823	0.572	3.187	6.190	2.86^{e}-05	0.001***
EXP	1.909	0.607	3.143	6.746	4.18^{e}-05	0.001***
MEM	1.087	0.678	1.603	2.965	1.75^{e}-05	0.109
OFI	-5.38^{e}-05	1.84^{e}-05	-2.921	0.999	-7.13^{e}-010	0.004***
FIN	1.08e-05	1.13^{e}-06	9.558	1.000	1.43^{e}-010	0.000***
HHE	-4.83^{e}-05	2.81^{e}-05	-1.719	0.999	-6.41^{e}-010	0.093*
PRI	-0.203	0.460	-0.441	0.816	-2.82^{e}-06	0.659

Note: *, ** and *** represent 10, 5 and 1% significant levels respectively. Variables are as defined in Equation 1.

FFP = farming practice adopted (1 for mixed cropping and 0 for sole cropping).

RESULTS AND DISCUSSION

Table 1 presents the maximum likelihood estimates of the logit model described in equation 1. The estimated logit regression model gave the McFadden R – square of about 0.712, which implies that all the explanatory variables included in the model were able to explain about 71.20% of the probability or decision of the fluted pumpkin farmers to use poultry litter in the study area. The log-likelihood ratio (LR) statistic (-79) is significant, meaning that the explanatory variables included in the model jointly explain the probability of *Telfairia* farmers that decide to use poultry litter. The information criteria also attest to the reliability of the logit model in this study. This implies that factors that influence the *Telfairia* farmers' decision to use poultry litter are better expressed in the specified logit model.

The empirical result revealed that the slope and the log odd coefficients of farmer's age (AGE at 1%), education (EDU at 5%) and previous year's harvest (PYH at 10%) are positive and statistically significant with respect to the decision or probability of *Telfairia* farmers to use poultry litter in the study area. The odd interpretations imply that for every unit increase in the farmers' age, education and previous year harvest, the odd in favour of using poultry litter increase by 1.048 or about 4.80%, 1.039 or about 3.9%, and 5.842 or 484.20% respectively. The result implies that as the poultry farmer's age, education and previous year's harvest increase, the chance to use poultry litter increases too. The result satisfied the *a priori* expectations because increase in the farmer's age implies increase in exposure and probably farming experience. Ofuoko et al. (2005, 2006) have reported similar result in Nigeria. However, this result contrasts some other studies which reported negative influence of age on adoption, such as: Bekele and Holden (1998) in Ethiopia, Lapar and Pandy (1999) in Philippines, Odera et al. (2000) in Kenya, and Gockowski and Ndoumbe (2004) in Cameroun. Increase in the previous year's harvest of the farmers serves as an incentive to use more poultry litter. This result agrees with the report of Emuh et al. (2011) in Nigeria. Also, the increase in the farmer's education means increase exposure to new technologies or innovations. Emuh et al. (2011), and Ofuoko et al. (2005, 2006) in Nigeria have reported similar result for education.

Also, farming practice adopted (FFP at 5%), soil management practice (SMG at 1%), farming experience (EXP at 1%), and farm income (FIN at 1%) have positive log-odd coefficients and marginal effects, hence they are positive determinants of the probability to use poultry litter by *Telfairia* farmers in the study area. This means that mixed crop farming among *Telfairia* farmers increases the tendency to use poultry litter as compared to the sole cropping system. This further implies that a unit increase among *Telfairia* farmers that practice mixed crop farming instead of sole cropping increases the odd in favour of using poultry litter by 2.656 or about 165.6% in the study area. In a similar way, tillage and bedding as forms of soil management practices increase the chance of poultry litter utilization among respondents. This result indicates

that a unit increase in adoption of tillage and bedding as a form of soil management technique by *Telfairia* farmers increase the odd in favour of poultry litter utilization by 6.190 times or about 519% compared to non-adoption. The result for farming experience can be attributed to the increase tendency of innovation adoption over the years. This is consistent with the findings of Emuh et al. (2011). The odds of experience by *Telfairia* farmers who adopt poultry litter were 6.746 times or 574.6% higher than those without experience. In a similar manner, the relationship between poultry litter adoption and farm income could be linked to the lower cost of production incurred by farmers due to poultry litter purchases. However, a unit increase in the *Telfairia* farmers' farm income increases the odd in favor of using poultry litter by 9.558 times or about 855.8% more than a unit decrease in income. Ofuoko et al. (2005, 2006) have reported similar result on farm income in Nigeria.

On the contrary, the slope coefficients of the farmers' *Telfairia* farm size (LAN at 1%), off-farm income (OFI at 1%) and household expenditure (HHE at 10%) are statistically significant and negatively related to the probability of poultry litter usage in the study area. This means that as the farm size increases, the chance of poultry usage among respondents reduces. The result implies that a unit increase in farm size reduces the odd of increasing poultry liter usage by 0.118 times or about 88.20% compared to the reduction in the farmer's land size. Alternatively, a unit increase in the farm size increases the odds of reducing poultry litter utilization among *Telfairia* farmers by 88.20%. It is suggested that, this result might be due to the purpose of cultivation of *Telfairia* in the study area. It is basically subsistence crop farming. Most of the farmers cultivate *Telfairia* on small scale basis, so commercialization will increase land area and soil management technique. This result is in consonance with the empirical reports of Ofuoko et al. (2005, 2006) in Nigeria.

Increase in off-farm income implies increase in agricultural income diversification. Actually, increase in the off-farm income implies diverting much attention from agricultural activities to non-agricultural activities and thus minimal poultry litter usage. Similarly, increase in household expenditure will imply decrease in farm resource allocation and consequently poultry litter usage. The odds interpretations denote that one additional unit increase in non-farm income and household expenditure reduce the odds of increasing poultry litter utilization by 0.999 times or about 0.1% each, respectively. These results corroborate the research findings of Makokha et al. (2001) in Kenya.

CONCLUSION AND RECOMMENDATIONS

This study has uncovered several policy variables that will be useful to formulate farm based policies that can promote manure (poultry litter) utilization among vegetables farmers in Akwa Ibom State in the Southern region of Nigeria. The need to look inwards and promote as well as improve our indigenous farm technology among farmers is inevitable. Considering the pollution level of most mineral fertilizers and insufficient ability to sustain this technology in the country, there is an over whelming need to search for alternative policy options. The study has identified economic factors (such as farm income, off-farm income, previous year's harvest, farm size and household expenditure), social factors (such as farmer's age, education and farming experience), and environmental factors (such as soil management practice and farming practice) and adopted them as important determinants of the *Telfairia* farmers' decision to use poultry litter in the study area.

To improve on the current probability of poultry manure usage among vegetable farmers in the Southern region of Nigeria, the following recommendations will be of immense use:

- *Telfairia* farmers in the study area should be exposed to more years of formal education through enhanced adult education programme as this will promote organic manure technology adoption.
- Efforts should be channeled towards sensitizing the *Telfairia* farmers on the need to embrace the family planning programme so as to reduce the household size and household expenditure. This will enhance increase farm budget allocation and hence organic manure utilization.
- This study also advocated the mixed crop farming system among *Telfairia* farmers as this will reduce production risk and increase the tendency of poultry litter usage. In addition, the study supported agricultural income diversification among *Telfairia* farmers; this will guarantee increase in household and farm income and subsequently the poultry litter usage even in the face of increased household expenditure.
- The local government councils should collaborate with extension agents to establish demonstration farms within the councils where this technology is practiced as this will induce faster adoption rate of the technology.

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