Journal of Forestry Research and Management. Vol. 20(3).1-8; 2023, ISSN 0189-8418

www.jfrm.org.ng

DETERMINANTS OF CROP FARM WASTES UTILIZATION AMONG FARMING HOUSEHOLDS IN MANGU LOCAL GOVERNMENT AREA, PLATEAU STATE, NIGERIA

[1]Ademiluyi I. O., [2]Adebayo O. A., [2]Oyewo I. O. and [3]Bassey E.A

[1]Federal College of Forestry, Forestry Research Institute of Nigeria, P.M.B. 2019, Jos, Plateau State, Nigeria
[2]Federal College of Forestry, Forestry Research Institute of Nigeria, P. M. B. 5087, Ibadan, Oyo State, Nigeria
[3]Montane Forest Research Station, Jos, Plateau State, Nigeria
Corresponding Authors' E-mail: oriobatemyl@gmail.com
Tel.: 08062179072

ABSTRACT

Utilizing crop farm waste can be a valuable asset, significantly increasing the prospects for farming households when fully optimized. This study looked into the efficient utilization of crop farm waste in the Mangu Local Government Area of Plateau State, Nigeria. Employing a purposive sampling approach, data were generated from 150 heads of crop farming households through well-structured questionnaires and oral interviews. Data analysis encompassed descriptive statistics and a logit regression model. The study's findings indicated that the majority of household heads engaged in crop farming within the study area were male, constituting 69% of the sample. Additionally, a significant proportion (94%) had received some form of formal education. On average, the households had a size of 8 persons with 20 years of farming experience, and managed a farm spanning an average of 3.41 hectares. The result showed that the major farm waste in the area were soya bean waste (69%), and maize comb and husk (67%). Most farmers dispose of their farm waste through burning. It was revealed that education ($ß_3$ = 0.073; $p<0.01$), years of experience ($ß_4$ = 0.034; $p<0.01$), farm size ($ß_5$ = 0.908; $p<0.01$) and household size ($ß_6$ = 0.737; $p<0.1$) were the significant determinants of crop farming households' farm waste utilization. A major bottleneck faced by crop farming households on farm waste utilization is the low knowledge of crop farm waste utilization (77%). The study found that farmers primarily generated waste from crop weeds and disposed of it by burning in pits. It concluded that educational level, experience, household size, and farm size were key factors influencing how farmers utilized their farm waste, and identified low knowledge and awareness as major obstacles to effective waste utilization.

Keywords: crop, farm wastes, utilization, farming households

Introduction

Agricultural waste refers to the by-products of agricultural activities, which are not the primary products. These wastes include crop residues like stalks, straws, leaves, roots, husks, shells, and animal waste such as manure (Okey, 2023; Arun *et al*., 2012). Agricultural waste is a valuable resource as it is readily available, renewable, and often free of cost. It can be converted into various useful forms, including heat, steam, charcoal, methanol, ethanol, and biodiesel. Additionally, it serves as raw materials for animal feed, composting, energy production, biogas construction, and more (Japhet *et al*., 2020; Aruya *et al*., 2016). The quantity of waste generated can be transformed into both raw materials and energy (Viaggi, 2022).

Farm waste comprises residues resulting from various agricultural operations. The environmental impact of agricultural waste depends not only on the quantity generated but also on the disposal methods employed (Ameh and Lee, 2022; Mbam and Nwibo, 2013). Some disposal practices can harm the environment; for example, burning agricultural waste is a common practice in developing countries but contributes to

atmospheric pollution (Odejobi *et al*, 2022; Oladipo *et al*., 2017). Burning agricultural waste releases pollutants like carbon monoxide, nitrous oxide, nitrogen dioxide, and particulate matter (smoke carbon). These pollutants can lead to the formation of ozone and nitric acid, posing risks to human and ecological health.

To enhance food security and ensure sustainable environment, agricultural waste can be effectively utilized in several ways, such as bio-fertilizers, soil amendments, animal feed, and energy production. The substantial amounts of agricultural waste found in rural areas can be transformed into wealth. Recycling or further utilization of waste can create economic opportunities (Upadhyay and Harshwardhan, 2017). When properly utilized in the areas where they are generated, farm waste can become an asset that improves the livelihoods of farmers (Oladipo *et al*., 2017).

However, in many cases, agricultural wastes are underutilized and left to decay or openly burned in fields, particularly in developing countries. These wastes contain high levels of essential nutrients such as Nitrogen, Potassium, and Phosphorus, which can enhance soil fertility and increase crop yields, particularly for high-value crops like vegetables and maize (Upadhyay and Harshwardhan, 2017). It has been noted that rural farmers often lack knowledge about modern technologies for utilizing farm waste. This research aims to bridge this knowledge gap and contribute to advancing sustainable agricultural practices and environmental policy development.

The study therefore examined the crop farm waste utilization among crop farming households in Mangu Local Government Area, Plateau State, Nigeria with the view of describing the characteristics of respondents, identify the types of farm waste generated, methods of farm wastes management, source of information on the utilization of the farm waste generated, bottle-necks faced by the farmers on farm waste utilization and determining the factors influencing farm wastes utilization in the study area. The hypothesis was stated in its null form as "there is no significant relationship between the characteristics of crop farm households and their crop farm wastes utilization".

Methodology

Study Area

This study was carried out in Mangu Local Government Area (LGA), Plateau State which was created in June 1976. It has a land area of about 1653km^2 (Plateau State Diary, 2009). It also has a total population of about 300,520 (NPC, 2006), and the projected population estimate in 2018 is about 376, 744. It lies between latitude 8^o 28" N and 9^o 45" N and longitude 8^o 33" E and 9^o 20" E of the equator. Crops cultivated are maize, Irish potatoes, sweet potatoes, beans, millet, sorghum, cassava, cocoyam, yam, acha, cabbage, carrot, tomatoes, pepper, and cucumber. The animals kept include goat, sheep, cattle and poultry.

Source of Data

Primary data were used to generate information from the respondents with a well-structured questionnaire and oral interview.

Sampling Technique

A multi-stage sampling technique was used to select the respondents for the study. The sampling procedure is as follows.

Stage 1: The Mangu Local Government Area in Plateau State was chosen through a purposive sampling technique due to its predominant agricultural activities, which result in the significant generation of farm waste.

Stage 2: A simple random sampling technique was used to select three (3) districts out of five (5) districts in Mangu Local Government Area because of their population density.

Three (3) communities were randomly selected from each district, giving a total of nine (9) communities.

Stage 3: Following this, a disproportionate random selection of a total of 150 household heads of crop farming households were interviewed from a list of the Plateau State Agricultural Development Program (PADP) in the selected communities. A structured questionnaire with open and closed-ended questions was administered to the selected participants in the selected communities of the study area.

Analytical Technique

The result was analyzed with descriptive statistics (frequency counts, percentages and mean) and inferential statistics (logistic regression).

Logit model was used to determine the factors influencing farm waste utilization by the respondent. This model is widely used to analyze data with dichotomous dependent variables. The binary logit model is stated as:

$$Y_i = \beta_0 + \beta_1 X_1 + \cdots + \beta_6 X_6 + \varepsilon \quad \ldots (1)$$

Where

Yj is the binary variable with value 1 if farm waste is utilized and 0 if otherwise (if farm waste is not utilized).
$ß_0$ is the intercept (constant),
e is the independent and normally distributed random error
$ß_1$ to $ß_6$ are the regression coefficient of the predictor variables of X_1 to X_6 respectively, while
X_1 = Age (years)
X_2 = Marital status (dummy variable, 1=married; 0=single)
X_3 = Household size (number of persons)
X_4 =Educational level (years)
X_5 = Years of Experience (years).
X_6 = Farm Size (hectare)

Results and Discussion

Characteristics of the respondents

The results in Table 1 showed the distribution of respondents according to gender. It indicated that the majority of the respondents (69%) were male while (31%) were female. The result showed that most crop farming household heads in the study area are male. This is in agreement with Aruya *et al*, (2016) who estimated that most of crop farming household heads are male. This result agreed with the tradition that majority of the women manages the affairs and activities of the home. The mean age of the crop farming household heads showed that the crop farming household heads are still in their active age. This is in line with the work of Oladipo *et al*., (2017) who stated that crop farming household heads are still in their active age and which implies that they have a high tendency to have more ideas and innovations with respect to farm waste utilization. The results revealed that (58.67%) respondents were married while 41.33% were not married (single, divorced and separated). This implied that family responsibilities need financial commitment which would help maximize the benefit in utilization of waste. This agreed with the findings of Titus *et al.*, *(*2015) who stated that married people in rural areas of Nigeria are subsistence crop farming household heads.

The result revealed that the mean household size was 8 people. This implied that crop farming household heads could engage in family labour on the farm to generate more farm waste. This is agreement with Oladipo *et al*., (2017) whose mean household size was 8 persons. It was revealed that most of the respondents (94%) are literate. This implied that this attribute could help the crop farming household heads to seek for more information on innovation about waste disposal and recycling. It revealed that years of farming experience had a mean of 20 years. This implied that most of the crop farming household heads are well experienced and are well skilled in waste utilization and management. According to Nwofoke and

Udu, (2019), experience affects and influences the rate of adoption of new technology. The farm size of the respondents has a mean of 3.41 hectares. This implied that, more attention should be given to farming and more land should be allocated for crop farming household to maximize production and hence, maximum profit. This result is in line with the work of Aruya *et al.* (2016), who states that most crop farming households in Nigeria practice subsistent farming on a land less than five (5) hectares.

Table 1: Characteristics of crop farming households

Characteristics	Variables	Frequency	Percentage
Sex	Male	103	68.67
	Female	47	31.33
Marital status	Married	88	58.67
	Not Married	62	41.33
Education	Non formal	9	6.00
	Formal	141	94.00
Age of household head (Years) Mean = 36	=30	39	26.00
	31-50	92	61.33
	>50	19	12.67
Household size (Persons)	=5	31	20.67
Mean = 8	>5	119	79.33
Farming Experience (Years	= 10	56	37.33
Mean = 19.62	>10	94	62.67
Farm size (Ha)	= 5	124	82.67
Mean = 3.41ha	>5	26	17.33

Types of crop farm wastes generated on the farms

The findings of the results in Table 2 showed that soya beans waste (69.3%), maize cobs, husk (67.3%), millet waste (58.0%), weeds on farm (56.7%), sorghum waste (54.7%), vegetable waste (50.0%) and sugarcane waste (40.0%) were the major farm wastes in the study area. This means that, the respondents have the opportunity to generate more waste since they are engaged more in crop farming activities. However, Oladipo *et al*. (2017), confirmed that most the crop farming household heads were mostly involved in soya bean and maize farming.

Table 2: Distribution of the respondents based on the type of crop farm wastes generated

Farm wastes generated	Frequency	Percentage (%)
Weeds from farm	85	56.67
Maize cobs, husk	101	67.33
Yam peels	39	26.00
Vegetable waste	75	50.00
Fruit waste	43	28.67
Sorghum waste	82	54.67
Millet waste	87	58.00
Sugarcane waste	60	40.00
Soya beans waste	104	69.33
Others	4	2.67

Note: Multiple response allowed

Methods of crop farm wastes management on the farms

The results from Table 3 showed that the majority of the respondents dispose of their wastes generated from their farms through burning (81%) while a few of the respondents poured inside the streams (22%). This means that crop farming households had no knowledge about the proper way of disposing farm waste in the environment and the defects it's had on a constant method of waste disposal. This means that respondents need to understand how to avert the hazardous problems caused by disposal of farm waste, to enlighten them on the proper methods of waste management and efficient ways to utilize them that will improve the respondents' livelihood and environmental sustainability. This study agreed with Aruya *et al.* (2016) which stated that crop residue management effectiveness must maximize the economic benefits from the waste resource and maintain acceptable environmental standards.

Table 3: Estimate of the methods of crop farm wastes management

Methods of crop farm waste disposal	Frequency	Percentage
Dump site	113	75.33
Compost	109	72.67
Burning	122	81.33
Streams	33	22.00

** Multiple response allowed

Sources of information on the utilization of the crop farm wastes generated

The result in Table 4 showed that the most sources of information on the utilization of the crop farm wastes generated of respondents were from friends (85%), farmer cooperatives (78%), own experience (74%), family (69%) and extension agents (60%). This implied that crop farming households have multiple sources of information on the utilization of the farm wastes generated. This result agreed with Aruya *et al.* (2016) who stated that source of information on farm waste utilization greatly affect the way farm wastes are disposed.

Table 4: Source of information on farm wastes utilization

Sources of information	Frequency	Percentage
Friends	127	84.7
Other farmer	117	78.0
Own experience	111	74.0
Family	103	68.7
Extension agents	90	60.0
Radio	64	42.7
Television	65	43.3
Phone	48	32.0
Internet	42	28.0
Newspaper	28	18.7
Others	2	1.3

** Multiple responses allowed

Bottle-necks faced by the crop farming households on crop farm waste utilization

The major bottlenecks faced by crop farming households on farm waste utilization includes

low knowledge of crop farm waste utilization (77%), inadequate awareness of agricultural waste and low adoption of technology to utilize crop farm waste (73%), limited labour to process crop farm waste (71%) and inadequate farm facilities to store crop farm waste (68%).

The implication of this result is that effective extension services are required by the households which will help them to acquire more knowledge on various techniques to adopt for usage (Aruya *et al*., 2016).

Table 5: Bottlenecks faced by the crop farming households on crop farm waste utilization

Bottleneck of farm waste utilization	Frequency	Percentage	Ranking
Low knowledge	115	77	1st
Inadequate awareness of agricultural waste and low adoption of technology	109	73	2nd
Limited labour	106	71	3rd
Alternative products	97	65	5th
Inadequate facilities	102	68	4th
Bad odour from Wastes	92	61	6th
Inadequate access to extension services	88	59	7th

** Multiple responses allowed

Estimates of the factors influencing farm waste utilization

The results in Table 6 showed the results of the factors influencing respondents' farm waste utilization showed educational level, years of experience and household-size were significant at 1% while farm size was significant at 10%.

Education level: The coefficient of educational level (0.078) had a positive sign and statistically significant at 1% level. This means that there is a direct relationship between education and utilization of farm waste. This implies that an increase in the educational level of crop farming household heads would lead to an increase in adopting farm waste utilization innovations. This is in agreement with Oladipo *et al*. (2017) who reported that educational level of farmer influences adoption of farm waste utilization innovations.

Farm Size: The coefficient of farm size (0.908) had a positive sign and statistically significant at 10% level. This means that there is a direct relationship between farm size and utilization of farm waste. This indicated that an increase in the farm size of the respondent increases their expected output. This implied that increase in the output would generate more farm wastes which the crop farming households can utilize.

Years of Experience: The coefficient of farming experience (0.034) had a positive sign and statistically significant at 1% level. This means that there is a direct relationship between years of experience and utilization of farm waste. This indicated that years of experience enhances increase in the likelihood of the respondent to adopt farm waste utilization innovation. This is in agreement with Okoye *et al*. (2009), who stated that the more experienced crop farming household heads were the more efficient in their decision making processes and were more willing to take risks associated with the adoption of innovation.

Household Size: The coefficient of household size (0.737) has a positive sign and statistically significant at 1% level. This

means that there is a direct relationship between household size and utilization of farm waste. This indicates that an increase in the household size increases the likelihood of generating more waste from their farm in terms of more productivity. Oladipo *et al*. (2017) reported that household size was not significant indicating that the variable does not influence farm waste utilization.

Prob > Chi^2 = 0.082: This statistic is related to the Chi-squared test of the overall significance of the regression model. This means that a p-value of 0.082 suggests that there is an 8.2% chance that the observed relationship between the factors influencing farm waste utilization is due to random variation.

Pseudo R^2 = 0.790: Pseudo R-squared is a measure of how well the independent variables in the regression model explained the variation in the dependent variable. Thus, a value of 0.790 indicates that approximately 79% of the variation in farm waste utilization is explained by the factors included in the model. This suggests a relatively strong relationship between the independent variables and the dependent variable.

Table 6: Regression estimates of the factors influencing farm wastes utilization

Variables	Coefficient	Standard error	t-value
Constant	2.659	1.077	2.467
Age	0.003	0.003	0.831
Marital status	0.003	0.002	1.031
Education	0.073	0.009	7.720***
Years of Experience	0.034	0.008	4.019***
Farm size	0.908	0.469	1.934*
Household size	0.737	0.082	8.909***
Prob > Chi^2	0.082		
Pseudo R^2	0.790		

Note: *** and * Significant at 1% and 10% levels of probability

Conclusion

The findings from the study revealed that farmers generated most of their waste from weeds on the crop farm. Also, they dispose of their farm waste by burning it in the pits. The study concluded that educational level, years of experience, household size and farm size were the determinants of respondents' farm waste utilization. The major bottlenecks faced by the farmers on farm waste were low knowledge of crop farm waste usage, inadequate awareness of agricultural wastes and limited labour in which no benefit could be derived from the farm waste because of lack of awareness of its usage.

It was recommended that the government should provide modern agricultural waste processing facilities that could help the farmers to convert their farm waste into useful products. Relevant stakeholders should render their support to farmers in campaigns and training through which farmers can benefit from waste utilization. Also, by involving farmers and stakeholders government should come up with policy measures that would discourage the burning and dumping of crop waste..

References

Ameh, M., and Lee, S. H. (2022). Determinants of loan acquisition and utilization among smallholder Rice Producers in Lagos State, Nigeria. *Sustainability*, *14*(7), 3900.

Arun, K. C., Singh, V.K. and Tewari, M. (2012): Utilization of Waste Agriculture By-Products to Enhance the Economy of

Farmers. *Indian Research Journal of Extension Education,* 1, 89-92

Aruya, E.I. Yusuf, R.O and Yusuf, Y.O. (2016): An Assessment of Crop Residue Characteristics and Factors Militating against Efficient Management in the Ikara Local Government Area of Kaduna State, Nigeria. Proceedings of the 8th International Conference on Waste Management and the Environment (WM 2016) www.witconferences.com WIT Transactions on Ecology and the Environment, 202: 333-344.

Japhet, J. A., Luka, B. S., Maren, I. B., & Datau, S. G. (2020). The potential of wood and agricultural waste for pellet fuel development in Nigeria—A technical review. *Int. J. Eng. Appl. Sci. Technol*, *4*, 598-607.

Mbam B. N., Nwibo S.U, (2013): Entrepreneurship Development as a Strategy for Poverty Alleviation among Farming Household in Igbo – Eze Local Government Area of Enugu State Nigeria, *Greener Journal of Agricultural Sciences,* 3 (10):736 – 742.

NPC (2006) National Population Commission.

Nwofoke, C. and Udu, L. (2019): Socio-Economic Determinant of Rice Husk Utilization among Households in Ebonyi State, Nigeria. *IDOSR of Journal of Banking, Economics and Social Sciences.* 4(1) Pp34-45.

Obi.F., Ugwuishiwu, B., and Nwakaire, J. (2016): Agricultural Waste Concept ,Generation Uitlization and Management. *Nigerian Journal Technology* 35:957 doi:10.4314/njt.v35i4.34

Odejobi, O. J., Ajala, O. O., & Osuolale, F. N. (2022). Review on potential of using agricultural, municipal solid and industrial wastes as substrates for biogas production in Nigeria. *Biomass Conversion and Biorefinery*, 1-13.

Okey, S. N. (2023). The Use of Agricultural Wastes as Renewable Energy Resources: A Review. *Nigerian Journal of Animal Science and Technology (NJAST)*, *6*(2), 23-34.

Okoye, B. C., Okoye, A. C., Dimelu, M. U., Asumugha, G.N, Agwu, A. E., and Abaeze, C.C. (2009). Determinants of Gender Productivity among Small Holder Cocoyam Farmers in Nssuka Agricultural Zone of Enugu State, Nigeria. *Nigerian Journal of Rural Sociology*, 1(1), 101 – 106.

Oladipo F.O., Olorunfemi O.D, Adetoro O.D., and Oladele T.O. (2017). Farm Waste Utilization among Farmers in Irepodun Local Government Area, Kwara State, Nigeria: Implication for Extension Education Service Delivery. *Ruhuna Journal of Science*, .8:1-11.

Plateau State Diary (2009). Plateau Agricultural Development Programme (PADP) 2004-2009 Annual Report. *Planning, Monitoring and evaluation Department.* P.M.B 2119 Dogon Duste, Jos. Plateau State.

Titus, O.B, Adebisola O. A, and Adeniji A. O. (2015): Health-Care Access and Utilization among Rural Households in Nigeria. *Journal of Department and Agriculture Economics*, 7: 195 – 203

Upadhyay, K. and Harshwasrdhan, K. (2017): Effective Utilization of Agricultural Waste-Review Paper. *International Journal of Engineering Research and Technology (IJERT)*, 6 Issue 09 Pp52-59.

Viaggi, D. (2022). Agricultural waste management and valorisation in the context of the circular bioeconomy: exploring the potential of biomass value webs. *Current Opinion in Environmental Science & Health*, *27*, 100356.