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ANALYSIS OF AGRO-WASTE UTILISATION AS SOURCE OF ORGANIC MANURE BY VEGETABLE FARMERS IN KUMBOTSO LOCAL GOVERNMENT AREA OF KANO STATE, NIGERIA.

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ABSTRACT

Agricultural waste constitutes nuisance to environment thereby making the surrounding frowzy with the long-run effect on siphoning government expenditure and blighting the health status of farming households. This study investigated the utilization of agricultural waste by vegetable farmers in Kumbotso Local Government Area of Kano State, Nigeria. Structured Questionnaire was used to elicit one hundred and ten questionnaire used for the study. OLS regression analysis was used to analyse the data. The analysis of the farmers' age shows that 47% were within the age group of 35-45 years. Inferential statistics shows that Marital status had positive significance (P<0.01) on agro-waste utilizer. This implies that married farmers utilized agro-waste than single farmers. The age of the farmers was positively significant (P< 0.10) in increasing their utilization of agro-waste. Budgetary analysis indicates that the Rate of Return to Investment is 1.70. This implies that for every one naira invested there is a return to investment of seventy kobo. The study concluded that utilization of agro-waste is credible and plausible to improve farming practice in the study area. The study recommends that experienced farmers should share acquired knowledge with the younger farmers to boost vegetable production in the study area. Farmers' group discussion should be enhanced to encourage the female farmers and less experienced farmers on the need to use agricultural waste.

Key word: Agro-waste, Socio-Economic, Organic-manure, Vegetable-farmers, Kano-state.

INTRODUCTION

One of the main features of agricultural products today is waste, which is unavoidable on farmlands. Globally, 140 billion metric tons of waste is produced every year from agriculture (USDA, 2019). Agricultural wastes are the residues from the growing and processing of raw agricultural products such as fruits, vegetables, meat, poultry, dairy products, and crops. As defined by Shaban and Omaima (2010), farm wastes are residues produced as a result of various agricultural operations. They are the non-product outputs of production and processing of agricultural products that may contain material that can benefit man but whose economic values are less than the cost of collection, transportation, and processing for beneficial use. Their composition will depend on the system and type of agricultural activities and they can be in the form of liquids, slurries, or solids. Agricultural waste otherwise called agro-waste is comprised of animal waste (manure, animal carcasses), food processing waste (only 20% of maize is canned and 80% is waste), crop waste (corn stalks, sugarcane bagasse, drops and culls from fruits and vegetables, prunings) and hazardous and toxic agricultural waste: pesticides, insecticides and herbicides. (Oladipo *et al* 2017) Estimates of agricultural waste arising are rare, but they are generally thought of as contributing a significant proportion of the waste used by vegetable farmers. Agricultural wastes have been reported to be a large and an underexploited resource, almost always underestimated (Rosillo-Calle *et al.* 2007).

Recycling such as vegetation and food waste reduces the amount of waste going to landfill and is therefore a rapidly growing sector in Nigeria. Recycling is widely assumed environmentally beneficial, because allowing organic waste to decay in landfills has a negative impact both environmentally and economically (Ankidawa and Nwodo, 2012).

Arbitrary and illogical waste disposal and indiscriminate burning of agricultural waste has constituted a nuisance and imposed threats and hazard not only to the healthy living of farm household but also to the flora and fauna thereby upsetting the ecosystem and lessening soil potentials and productivity in developing countries especially Nigeria where the technology of waste conversion to useable product is at low ebb (Akinyemi et al 2020)

Agricultural wastes are left uncollected on the street each day blocking drainage canals and creating feeding ground for pests that spread diseases thereby creating health and infrastructural problems, which can also affect agricultural productivity. Bad roads cause problems of transportation also leading to improper distribution of Agricultural waste. (Mbam and Nwibo 2013).

The shortfall in supply of inorganic fertiliser to meet the demand of the crop farmers and challenges of soil infertility in food production has imposed a great concern to government at various tiers. (Usman and Bakar, 2013). According to Dangote industries (2019), Nigeria

government spends N302 billion annually on importation of inorganic fertilizer. It is on this premise that the fertility improvement study is set to investigate the analysis of agricultural waste utilisation for soil by vegetable crops farmers in Kano state. The specific objectives of this research include identifying the various types of agricultural waste utilized by vegetable farmers for soil fertility improvement; to estimate the factors influencing the Agricultural waste utilization and to estimate the profitability of the vegetable farmers.

MATERIALS AND METHODS

Study Area

The study was conducted Kumbotso Local Government Area in Kano state. Its headquarter is in the town of Kumbotso. It has an area of 158km2 and a population of 409,500 based on the 2016 population projection. It lies between latitudes 11^0 50' and longitude 8^0 24'. Kumbotso falls within the Kano settlement zone bordering the south and west by Madobi.northwest by Rimingado and North by Gwaleand East by Tarauni Local Government Area respectively. The vegetation of the area is Savannah and a hot semi-arid climate

Two-stage sampling technique was used for the study. The first stage involved a random selection of five (5) villages out of the 57 villages listed in the LGA namely: Yankusa, Tamburawa, Samegu, Kusaba and Gwazaya The second stage involved a random selection of twenty two (22) farmers from each village to make a total of 110 respondents. However, 100 respondents were used for the analysis while others were rejected because of the discrepancy in the response of the respondents.

Primary data was used for the study. This was collected with the aid of pretested structured questionnaire administered to the respondents by the researcher and trained enumerators. Focused group discussion (FGD) was also conducted to supplement the information supplied by the respondents.

Analytical Techniques

Descriptive statistics such as percentage, mean, median and frequencies were used to describe the socio-economic characteristics of the farmers such as sex, age, marital status, household size and extension contact.

Multiple linear Regression model specification

Multiple regression was used to achieve the factors influencing the agricultural waste utilization. The explicit form of the regression model is stated as:

$Y_1 = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \varepsilon$

Y = Number of agricultural waste

α = intercept

β= Regression parameter

X_1 =Age (years)

X_2 = Years of formal Education

X_3 = Farm size (Ha)

X_4 = Income from vegetable production (Naira)

X_5= Gender (1, if male and 0, if female)

X_6= Vegetable Farming experience (years)

X_7 = Household size (head count)

X_8 = No of Extension visit

X_9 = Access to credit (1, if access and 0, otherwise)

ε= error term

NET FARM INCOME: The Net Farm Income (NFI) was employed to estimate the profitability of vegetable farming in the study area. The formula for net farm income is stated as follows.

NFI= TR-TC

Where,

NFI= net farm income from the sale of vegetable

TR= total revenue from the vegetable farm.

TC= total cost of the vegetable production.

Likert Scale Model Specification

Likert Scale was used to identify the constraints faced by vegetable farmers on the use of Agricultural waste in the study area. A 5-point Likert scale was used. The five points scale was graded as strongly agree = 5, agree = 4, neutral= 3, disagree = 2 and strongly disagree = 1.

$$X_w = \frac{n_5(5) + n_4(4) + n_3(3) + n_2(2) + n_1(1)}{n}$$

- Where: $\ddot{X}_w$ = Weighted Mean Score of vegetable farmers.
- n = No of vegetable farmers.

The mean score of respondents based on the five points scale is 5 + 4 + 3 + 2 + 1 = 15/5 = 3.0 Using the interval scale of 0.05, the upper limit cut-off point was 3 + 0.05 = 3.05; the lower limit is 3 – 0.05 = 2.95. On the basis of the limit, any mean score below 2.95 (i.e. Ms< 2.95) was taken as "strongly disagree",

those between 2.95 and 3.05 was considered "Agree" (i.e. 2.95 <Ms ≤ 3.05), while any means score that is greater than or equal to 3.05 (i.e. ≥ 3.05) was considered "strongly agree"

RESULTS AND DISCUSSION

Analysis of Socio-economics Characteristics of the Respondent

The socio-economic characteristics of the vegetable farmers are as presented below in table 1. The study revealed that 30% of the vegetable farmers interviewed were within the age range of 26-35years. Majority (47%) of the farmers are within age group of 31-40 years while the mean age of respondents was 35 years. This suggests that most of the vegetable farmers in the study area are in their youthful age. This implies that most of the vegetable farmers are full of energy and have the strength required for vegetable farming. These findings support Canali *et al* 2016 where the youth demonstrated resourceful potential in organic vegetables living much cropping systems and management strategies on cash crop yield in European vegetables. The result also shows that (51%) of the respondents are male while (49%) of the respondents are female which implies that there is no gender bias in vegetable farming activities in the study area as both genders engaged and participated in the production of vegetable. This is line with the studies by Usman and Bakar (2013) who reported that males dominated vegetable production in Adamawa state of Nigeria exerted a greater influence in vegetable production.

Majority of the farmers (79%) have access to extension service delivery. This revealed that government is making effort to improve institution support through extension agents to vegetable farmers in the study area. The study corroborated the findings of Lamin and Idu (2018) where the activities of extension personnel was much-admired and celebrated because of their impactful exertion in changing the mindset of the vegetable farmers. The marital status of the respondents showed that 54% are married while only 18%, 9%, 5% and 12% are single, widows, widowers and divorced respectively. This displayed that majority of the respondents were married and would be more emotionally stable to display serious commitment in vegetable production. Married farmers also could enjoy the assistance of their wives in marketing activities. The result on table 1 further revealed that majority (62%) of the vegetable farmers do not have access to credit from either government or non-governmental organisation and only 38% of the vegetable farmers have access to credit. Financial supports through credit could expand the production horizon of the farmer which will eventually translate to improved livelihood of the farming household.

Education is an important socio-economic characteristic that enthuse and galvanize the usage of technology. The study, as presented in Table 1 also revealed that about 3% of the respondents have no formal education, those who had only primary school education were only 19%, while 32% of the respondents had Quranic education. Those who had secondary and tertiary education as their highest level of education were 42% and 4% respectively. This shows that majority of the vegetable farmers in the study area had at least secondary school education which implies that they are literate and should not find it difficult to adopt innovations.

The experience of the farmers in vegetable farming revealed that about 50% had between 10 and 16 years vegetable farming experience. Those who had 3-9years and 17-24 years of vegetable farming experience are 23% and 18% respectively. Also, about 11% of the respondents had between 25-45 years of vegetable farming experience. Skill acquisition is acquired over time though experience. Research carried out by Ayi, 2022 revealed that experienced farmers demonstrated better skills and more productive in farming. This is because the built-up skill and expertise enabled the farmers to circumvent slip-up and avert undesirable consequence and eventuality which may lead to obstructions in farming activities

Table1: Distribution of the Respondents by their Socio-economic Characteristic

Socio-economic Variables	Frequency	Percentage%
Age		
14 – 23	14	14
24 – 34	30	30
35 – 45	47	47
46 – 55	6	6
56 – 65	3	3
Gender		
Male	51	51
Female	49	49
Marital Status		
Single	18	18
Married	54	54
Widow	9	9
Widower	12	12
Divorced	5	
Access to Credit		
Yes	38	38
No	62	62
Access to Extension Services		
Yes	79	79
No	21	21
Level of Education		
No formal Education	3	3
Quranic Education	32	32
Primary Education	19	19
Secondary Education	42	42
Tertiary Education	4	4
Household size		
2 – 6	49	49
7 – 11	32	32
12 - 16	14	14
17 – 21	4	4
22 - 26	1	1
Years of experience		
3 – 9	23	23
10 – 16	48	48
17 – 24	18	18
25 – 31	9	9
32 – 38	1	1
39 – 45	1	1

Source: Field Survey 2021

Identification of Types of Agricultural Waste

Table 2 presents the types of agricultural wastes used by the farmers in the study area. The table shows that 93% of the farmers used poultry droppings, 92% used livestock manure and also 91% were using vegetable waste. Poultry dropping is mostly used because it provides a major source of Nitrogen, Phosphorus and Trace elements for crop production and is effective in improving physical and chemical composition of the soil (Egun, 2012). In Northern Nigeria rearing of livestock is quite popular, thus, the large use of livestock manure because it increases soil organic matter, provides nutrient to crops, increase Cation Exchange Capacity (CEC) and keeps PH in normal

levels and it is cheap and readily available since most of the vegetable farmers are also cattle rearers in the study area. Vegetable waste is also common attributed to intense production of vegetables. The decomposed poultry remains are utilized by about 87 % of the respondents in the study area. This is because it contains up to 12% Nitrogen, it's a source of slow-release, organic high Nitrogen fertilizer and can be used to increase green leaf growth. Fruit droppings, grasses, and leaves are used by 86%, 76%, and 73% of the respondent respectively as they contribute to the soil nutrient and fertility. (Amjad *et al* 2016) The respondents that were using Maize Cobs, Husk and Stalk were 52%.This is because maize is one of the popular food crops produced in the study area. They are excellent carriers of vitamin and other minerals needed by the vegetables. Table 2 also revealed that 42% of the respondents used Soya beans, straw and pods because they increase soil organic carbon content. It also improves soil fertility and soil tillage.

Table 2: Types of agricultural waste utilized in the study Area.

Types of Agricultural Waste utilize	Frequency	Percentage (%)	Rank
Grasses	7676	6	
Leaves	73	73	7
Cassava stalk & peels	16	16	11
Maize cobs, husk and stalk	52	52	8
Yam peels	18	18	10
Vegetable wastes	91	91	3
Soybeans straw & pods	42	42	9
Poultry droppings	93	93	1
Livestock manure	92	92	2
Poultry feathers 87	87	4	
Fruits (droppings)	86	86	5
Wood shaving 14	14	12	
Others 2	2	13	

Source: Field Survey 2021

Determinant of Agricultural Waste Utilization

The regression analysis in table 3 showed the relationship between number of agricultural wastes used by vegetable farmers and some socioeconomic, institutional and input variables The regression results shows that R^2 was 62.3%, which implies that the explanatory variables included in the model accounts for about 62% of the variability that occur in the explained variable in the model. The coefficients of age, marital status, income, experience and sex were significant in the model. The F- statistics was significant ($P<0.05$). This depicts a good fit and stability of the regression model

The coefficients of marital status (X_2) and income (X_3) were significant ($P<0.01$) and also positive and negative respectively. This implies that married farmers utilized agricultural waste than single farmers. The result also shows that the farmers with higher income utilized less of agricultural waste. This might be because farmers with higher income may prefer purchasing inorganic fertilizer with their money. They may also prefer using their labour to source for agricultural waste instead of using their money.

The coefficients of age (X_1) was positively significant but at ($P< 0.10$). This indicates that as the age of the farmers increase, the more they utilize agricultural waste. It is expected that the aged farmers are more skillful because of their day to day practice of farming systems. The farmers' experience (X_6) was positively significant ($P< 0.05$) It reveals that the more the years of farming experience in the vegetable farming the more they utilize agricultural waste. This result agrees with the *apro-ri* theoretical expectations that years of experience improve farm performance and make

farmers to be more competent and adapt to farming activities.

The coefficient of sex (X_9) was positively significant ($P< 0.05$). This implies that the male vegetable farmers utilized agricultural waste than their female counterparts. Male farmers are more ground-breaking to use the state-of-the-art farming skills and practice, besides male are more active and spirited to explore means of getting agricultural wastes than female counterparts

Table 3: Factor influencing the Agricultural waste utilization

Variable	Coefficients	Std. Error	T-value	Significant .level
(Constant)	5.594	0.614	9.113	0.000
AGE	0.029*	0.015	1.848	0.068
MAST	0.306***	0.102	3.013	0.003
INCOME	-0.0287***	0.008	-3.523	0.001
HHS	0.012^{NS}	0.025	0.487	0.627
EDU	-0.003^{NS}	0.023	-0.134	0.893
EXP	0.040**	0.021	1.915	0.059
ACC	0.196^{NS}	0.257	0.762	0.448
COOP	0.269^{NS}	0.222	1.211	0.229
SEX	0.569**	0.240	2.370	0.020

Source: Computed from field Survey, 2021 R^2=0.623*** Significant at 1%, ** Significant at 5%, * significant at 10% R^2= 0.623

Budgetary analysis

The budgetary analysis showed the difference between total revenue and total cost of production. This difference is the profit. The average revenue from the sales of Spinach, Lettuce and other vegetables produce was ₦1,113,727.85 and it covered 100% of the total revenue generated in the study area. The total fixed Cost is the average cost of acquiring Hoe, Cutlass, Basket, Sprayer, renting Plough and Pumping machine in the study area was ₦3,307.22 and this covered 100% of the total fixed cost and 0.30% of the total cost of production.

The variable cost incurred during vegetable (Spinach, Lettuce and others) farming were cost of seed, fertilizer, chemicals (herbicides and pesticides), cost of hiring labour and other cost like cost transportation, packaging and purchase of agricultural waste products. The average cost of purchasing seed in the study area was ₦16,412.12 and it covered 1.50% of the total variable cost of production, the average cost of purchasing fertilizer in the study area was ₦81,885.79 and it covered 7.13% of the total variable cost of production. The average cost of purchasing chemical (herbicides and pesticides) in the study area was ₦87344.84 and it covered 8% of the total variable cost of production, the average cost of hiring labour in the study area was ₦707676.88 and it covered 65% of the total variable cost of production, the average cost of transportation, packaging, and purchasing agricultural waste in the study area was ₦108375, ₦56774.15 and ₦31334.96 and it covered 9.93%, 5.20% and 2.87% of the total variable cost of production. The total average variable cost production was ₦1,091803.74, which covered 99.7% of the total cost of production incurred by vegetable (Spinach and Lettuce) farmers in the study area. Gross margin is the difference between the total revenue generated and the total variable cost.

Table 4 shows that budgetary analysis of Spinach and Lettuce to have the Rate of Return to Investment as 1.70. This implies that for every one naira invested there is a return to investment of 70 kobo. The Rate of Return to fixed cost was estimated ₦562.92. This means that for every naira expended on every fixed capital item, there is a return of 562.92 naira. This suggested that vegetable (Spinach, Lettuce and other vegetables) production in the study area is a very profitable enterprise. This result is in agreement with the findings of Shaban and Omaima (2010)) who concluded that vegetable farming in Jakara River Kano states, Nigeria was found to be a profitable business.

Table 4: Cost and Returns of vegetable/Ha in the study area

Description Revenue ((₦'000))	Values		Percentage (%)
Sales of Spinach(Price x Qty)	380.00034		34.1252.98
Sales of Lettuce(Price x Qty)	590.0005		
Others	143.72701	12.90	
Total Revenue	1,113.72785		
Variable Cost (₦'000)			
Cost of inputs			
Vegetable seeds (kg)	16.41212		1.50
Cost of fertilizer(kg)	81.88579		7.13
Herbicides (litres)	46.83867		4.29
pesticides (litres)	40.50617		3.71
Labour (man/days)	707.67688		65.00
Other cost (₦'000)			
Transportation cost	108.375		9.93
Packaging	56.77415		5.20
Waste products	31.33496		2.87
Total Variable Cost (TVC)	1,091.80374		
Fixed cost (₦)			
Hoe	221.40		6.69
Cutlass	570.90		17.27
Basket	985.48		29.80
Plough	342.15		10.34
Sprayer	987.58		29.86
Pumping machine	199.71		6.04
Total fixed cost (TFC)	3,307.22		62.26
Total cost (TFC+TVC)	1,095,110.96		
Gross margin (TR - TVC)	21,924.11		
Profit (GM - TFC)	18,616.89		
Rate of return on Investment $RROI = \frac{\text{Profit}}{\text{Total Cost}} \text{X } 100$	1.70		
Rate of return on fixed cost $RRFC = \frac{\text{Profit}}{\text{Total Fixed Cost}} \text{X } 100$	562.92		

Source: Computed from field Survey, 2021

CONCLUSION AND RECOMMENDATION

Agricultural waste application by vegetable farmers is a useful technique and practice of soil convalescence in the study area. The study revealed that the most utilised agricultural waste in the study area were poultry droppings, livestock manure and crop debris. Vegetable farming is very profitable farming in the study area. Income, years of farming, age, sex and marital status influenced the number of agricultural waste utilization in the study area. Base on the above conclusion therefore, the following recommendations can be made:

The aged farmers should create a forum for acquired knowledge-sharing with the younger farmers on the application of vegetable waste to boost their productivity; Agricultural waste should be packaged in attractive ways so as to stimulate the interest of the farmers and facilitate monetary exchange from the farmers; Farmers' discussion group should encourage the female and the less experienced farmers on the need to use agricultural waste.

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