
An Analysis of Waste Management Methods Used by Commercial Poultry Farmers in Kogi and Kwara States, Nigeria

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ABSTRACT

This study assessed the waste management methods used by commercial poultry farmers in Kogi and Kwara States, Nigeria. The aim of the study is to describe the socio-economic characteristics of the respondents, examine the pattern of waste generated by poultry farms in the study area, identify the methods of waste disposal practiced by poultry farmers, describe the waste treatment methods employed by poultry farmers and identify the constraints faced by poultry farmers in waste management. A well-structured questionnaire was used to elicit information from randomly selected 138 and 125 registered commercial poultry farmers from both states. Both descriptive and inferential statistics were used to analyze the data for the study. Results of the analysis show that mean age of the respondents was 46.7 years, farm size was 99birds and poultry farming experience was 11.24 years. Also, majority of the respondents were male (82.0 %), married (88.8%), had tertiary education (94.0%). The mean age of farm was 9.24 years. The most prevalent waste management methods used by poultry farmers were open dumping around the farm (mean=2.23); giving wastes free to the public as farmyard manure (mean=2.16); dumping wastes in nearby bushes (mean=2.09); burying dead birds in pit near the farm (mean=2.08), and throwing dead birds into nearby bush (mean=2.01) and burning dead birds in pit or heap near the farm (mean=2.01). Burning technique was the most (mean=1.91) popular method of treating wastes against odour and flies by the respondents. The major constraints faced by farmers in waste management practices were: lack of awareness on how to use the wastes productively (mean=4.06); No agricultural land nearby where the wastes can be used (mean=3.69); Excessive odour from waste (mean=3.66); High cost of chemical treatment (mean=3.56); High transportation cost (mean=3.24) and High cost of private waste management agencies (mean=3.01). Result of Multiple Regression Analysis shows that educational status ($\beta=-0.156$), main occupation ($\beta=-0.199$), farming experience ($\beta=0.258$), farm size ($\beta=0.152$), management type ($\beta= -0.239$), labour type ($\beta= -0.187$)

and land ownership ($\beta=0.184$) significantly influenced the waste management methods of the farmers. Also, constraints such as no agricultural land nearby where the wastes can be used ($\beta= 0.188$), lack of awareness on how to use the wastes productively ($\beta= -0.452$), high transportation cost ($\beta= 0.281$), high cost of chemical treatment ($\beta= 0.21$), and excessive odour from waste ($\beta= 0.285$) significantly influenced the waste management methods of the farmers. The study concluded that poultry waste management practices in the study area were confronted by high (mean=3.39) level of constraints. The study recommends among others the need for the poultry farmers' association to organise training and retraining programs for the farmers regularly; experts should be invited to train them in the areas of waste management and general environmental health.

Keywords: Poultry Farming, Waste Management, Constraints

INTRODUCTION

The poultry industry is one of the rapidly growing agro-based industries in the world today, growing at a global rate of 5 percent *per annum* with its share in world's meat production increasing from 15 percent three decades ago to 30 percent (FAO, 2006). The poultry industry according to Moreki (2007) turns out enormous amounts of wastes, which include both solid waste and wastewater. The solid waste consists of droppings, litter /bedding materials, hatchery waste, feathers, feed, abattoir waste (blood, offals, feathers and condemned carcasses) shells, sludge, and dead birds. Most of these wastes have been shown to be sources of high-quality nutrients that are of immense agronomic benefit if properly managed. Improper management of these wastes however can result in environmental and human health concerns. In view of the environmental hazards posed by poultry wastes, various enhanced methods of poultry wastes handling have been suggested towards correcting the effects of these wastes on the environment (Anon 2005; Nebraska Department of Environmental Quality, 2005). In Nigeria, however, in spite of these suggested approaches to poultry waste handling; farm owners do not care much about effective waste management and disposal. This is perhaps due to various constraints militating against effective waste management and utilization among poultry farmers. The consequence of

which is an increase in environmental pollution hazards due to improper poultry waste management.

Therefore, this study was conducted to analyse the waste management methods used by commercial poultry farmers in Kogi and Kwara States. Specific objectives are to:

- (1) Examine the pattern of waste generated by poultry farms in the study area
- (2) Identify the methods of waste disposal practiced by poultry farmers.
- (3) Describe the waste treatment methods employed by poultry farmers and;
- (4) Identify the constraints faced by poultry farmers' problem in waste management

The hypothesis stated and tested in the study were:

Hypothesis I: there is no significant relationship between selected socio economic characteristics of the poultry farmer and their waste management methods.

METHODOLOGY

The Study Area

This study was conducted in Kogi and Kwara States, Nigeria. Kogi State was created in August, 1991 out of Kwara and Benue states. Kogi state lies between latitude $6^{\circ}44'N-7^{\circ}36'N$ and longitude $7^{\circ}49'E-8^{\circ}27'E$. The state is bordered in the North by Plateau, Niger states, Federal Capital Territory (FCT) and Nasarawa states. It is also bordered on the south by Edo and Enugu States and in the west by Ondo and Ekiti States. The vegetation is guinea savannah with two major rivers, Benue and Niger passing through the state and converged at a point to form a confluence. Two main rivers run through the state, which are rivers – Niger and Benue, and meeting at Lokoja, the state capital. The state has about 2 million hectares of cultivable land with about 0.5 million

hectares currently under cultivation (KADP, 2003). The state is well supplied with river valleys and swamp lands for dry season farming.

Kwara State which was created on 27th May 1967 is located within the North Central zone of Nigeria, sharing boundary with Ondo, Osun, Oyo, Ekiti, Kogi and Niger states in Nigeria and an international border with the Republic of Benin along its north-western part (Kwara State, 2010). The state which lies between latitudes 7°45'N and 9°30'N and longitudes 2°30'E and 6°25'E has two distinct seasons (the wet and dry seasons). The annual rainfall extends across the state between the months of April and October and between 1,000 and 1,500mm while daily temperature ranges between 21.1°C to 25°C with maximum temperature ranges from 30°C to 35°C. The state has a population of about 2.59 million people and total land area of 32,500 square kilometers (Wikipedia, 2012). The state is made of sixteen (16) Local Government Areas (LGAs) which are grouped into four (4) agricultural zones – A, B, C and D - by the state's Agricultural Development Project (ADP) based on agronomic and cultural characteristics. Agriculture is the mainstay of the economy of the state.

Commercial poultry production is low in the state (Ameji, Abdul, Saidu, Kabir and Assam, 2012). Available statistics show that there are 2 million poultry in the state, 80 % of which are rural poultry kept under free-range management while the rest are exotic kept in backyard and commercial farms commercial farms (Adene and Oguntade, 2006).

Sampling Procedure and Sample Size

The study population consists of all commercial poultry farmers in Kogi and Kwara States. Lists of registered commercial poultry farmers were obtained from Poultry Association of Nigeria of both states. A random sampling of 50 percent of the total registered poultry farmers was employed to select 125 respondents from Kogi and 138 from Kwara respectively, giving an overall sample size of 263 for the study.

However, of the 138 copies of questionnaire administered in Kogi state, only 125 were retrieved, giving a response rate 90.58%.

Instrument for Data Collection

Primary data were obtained from respondents with the use of well-structured and validated questionnaire. Data were collected on the socio-economic characteristics of the poultry farmers, pattern of waste generated by the poultry farms, the methods of waste disposal practiced by the farmers, their waste treatment methods and the constraints faced by the poultry farmers in waste management.

Data Analysis

Data were analysed using both descriptive and inferential statistics. The descriptive statistics tools used were frequency counts, percentages and mean ranking. Multiple Regression Analysis was used to test the hypotheses of the study. The choice of this model was based on its proven adequacy in situations when there is the need to predict the value of a variable (the dependent variable) based on the value of two or more other variables called the independent, regressor or predictor variables [Berger, 2003]. The multiple regression analysis is represented by the following equation:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_p X_{pi} + e_i \dots\dots\dots(i)$$

Where:

Y_i is the dependent variable

β_0 is the constant term

β_1 to β_p are coefficients relating to p explanatory variables of interest

e_i is the error term

The model was used to determine the socio-economic factors influencing the waste management methods of the farmers.

MEASUREMENT OF VARIABLES

Dependent Variables

Pattern of Waste Generated by the Poultry Farms: This was measured using a 3-point Likert- type scale of large extent (3), small extent (2) and no extent (1).

Methods of Waste Disposal Practiced by the Poultry Farmers: This was also measured using a 3–point Likert -type scale of: Always (3), Sometimes (2), and Never (1).

Waste Treatment Methods of the Farmers: Respondents were asked to indicate the method of waste treatment they practiced whether it is by chemical or by burning. This was measured on a 3-point Likert- type scale of: Always (3), Sometimes (2) and Never (1).

Constraints Faced by the Poultry Farmers in Waste Management: These were obtained using a 5 – point Likert- type scale of: very serious (5), serious (4), not serious (3), undecided (2) and not a constraint (1).

Independent Variables

Gender (X_1) = measured as a dummy variable 1 for male, 0 for female

Age (X_2) = Age of respondents measured in years.

Marital Status (X_3) = measured as a dummy variable 1 if married, 0 otherwise

Highest Educational Attainment (X_4) = measured as a dummy variable for possession of formal education and 0 otherwise.

Main occupation (X_5) = as a dummy variable 1 for poultry farming, 0 for others

Farming Experience (X_6) = measured as number of years spent in farming

Age of farm (X_7) = measured as number of years farm had been in operation

Farm Size (X_8) = measured in number of birds

Bird type (X_9) = measured as a dummy variable Broiler/cockerel 1 or 0 otherwise

Type of management system (X_{10}) = measured as a dummy variable Battery cage 1 or 0 otherwise.

Land ownership (X_{11}) = measured as a dummy variable 1 for owned, 0 otherwise

RESULTS AND DISCUSSION

Socio- Economic Characteristics of Commercial Poultry Farmers

Table 1 shows the socio-economic profile of the respondents. According to Oke, Adeyemo, Adesiyon and Fadare (2014), age is an important socio-economic factor in farmer surveys. Age according to Oke *et al.* (2014) is a key to assessing the productivity of a farmer, and hence his income, savings and investment. Table 1 reveals that the modal age group of respondents was 40-49 for Kogi State and 50-59 for Kwara State respectively. The mean age of respondents for both states was 46.7 years. This implies that majority of the respondents are youthful and agile. These potentials are essential for efficient poultry production activities as the enterprise requires individuals who are economically energetic, innovative, motivated and adaptable (Yinusa, 1999). The table also reveals that majority (82.0%) of the respondents were male. This indicates that the female participation in poultry business in the two states was low. It may be because poultry farming needs more physical

strength which can be better obtained from men. The table shows that majority of the respondents (88.8%) are married. This implies a relative stability of the farmers on the farm, which is needed to enhance poultry production (Oladeebo and Ambe-Lamidi, 2007). Table 1 further reveals that majority (94.0 %) of the respondents had tertiary education. This implies that the literacy level of the respondents from the two states was very high. This is expected as modern poultry rearing requires people who are well-informed and can utilize technical information in the production and management of poultry farming. High level of education enhances farmers' level of innovation adoption and effective utilization of resources for optimum productivity.

Table 1 further reveals that 39.2 % of the respondents from both states had put in 5-10 years into poultry business, 29.2 % had 11-15 years of experience, 14.0 % were new entrants with less than 5 years experience in the business, 4.0 % had spent between 21- 25 years in poultry farming while only 3.6 percent had been keeping poultry for an upward of 26 years. The mean farming experiences for both States was 11.24 years. The implication of this finding is that majority of the respondents are still young in poultry farming business.

The table equally reveals that poultry farming was the primary occupation of majority (72.8 %) of the respondents from both states. This potential will enhance farmers' commitment and focus which are crucial to achieving profitability and efficiency in the poultry business.

Table 1 reveals that almost half (46.0%) of the respondents from the two states kept mixed birds that included both broilers and layers and some also cockerel (6.0 %). About 34.0% kept only layers and 14.0 % kept only broilers. The table reveals that about 42.4% of the respondents from the two states adopted mixed management types involving the use of both battery cage and deep litter systems while 37.2 percent made use of only battery cage and the remaining 20.4 percent ran deep litter system. This

result agrees with the earlier finding by Ja'afar-Furo and Gabdo (2010) that mixed farming is commonly practiced in poultry farming.

Table 1 also reveals that 38.0 percent of the respondents from both states depended on family labour. However, 23.2 and 20.8 percents respectively made use of self and hired labour for their poultry operations. Table 1 shows that aggregate mean farm size was 991 birds for both states. Following Omotosho and Oladele (1988); Ojo (2003) and Olasunkanmi (2008) classification of farms having less than 1000 birds as small scale farms, 1000-3000 birds as medium scale farms while those having 3000 birds and above as large scale farms, the result implies that poultry farming in the two states was still at small- scale level.

Table 1 reveals that 70.8% of the respondents from both states owned the land they are using for poultry farm. This result implies that more profits are expected by the farmers as most of them owned their lands. However, 22.0 % and 7.2 % from the two states rented and leased the land they were using for poultry farm respectively. The breakdown of farm age according to Table 1 reveals that the mean of farm age was 9.25 years. This implies that most poultry farms in the two states were still young in operation. Table 1 reveals that majority (65.2%) of the respondents from the two states kept farm records. This high percentage of respondents who kept farm records is expected due to the high level of literacy among the respondents in the study area. This implies that majority of the respondents in Kogi State and Kwara State were fully aware of the usefulness of farm records keeping in helping them make informed management decisions that will help maintain or improve their poultry business profitability.

Table 1: Socio economic Characteristics of Commercial Poultry Farmers in the Study Area

Socio-economic Characteristics	Kogi State		Kwara State		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Age (Year)						
Below 30	8	6.4	18	14.4	26	10.4
30-39	18	14.4	23	18.4	41	16.4
40-49	42	33.6	29	23.2	71	28.4
50-59	33	26.4	39	31.2	72	28.8
60 and above	24	19.2	16	12.8	40	16.0
Mean	48.2		45.3		46.7	
Gender						
Male	106	84.8	99	79.2	205	82.0
Female	19	15.2	26	20.8	45	18.0
Marital Status						
Single	7	5.6	21	16.8	28	11.2
Married	118	94.4	104	83.2	222	88.8
Educational Status						
Non formal	1	0.8	1	0.8	2	0.8
Primary	7	5.6	-	0	7	2.8
Secondary	4	3.2	2	1.6	6	2.4
Tertiary	113	90.4	122	97.6	235	94.0
Farming Experience						
Below 5	22	17.6	13	10.4	35	14.0
5-10	50	40	48	38.4	98	39.2
11-15	27	21.6	46	36.8	73	29.2
16-20	10	8	15	12	25	10
21-25	7	5.6	3	3.2	10	4.0
26 and above	9	7.2	-	-	9	3.6
Total	125	100	125	100	250	100
Mean	11.6			10.81	11.24	
Primary Occupation						
Poultry	86.0	68.8	96.0	76.8	182.0	72.8
Others	39.0	31.2	29	23.2	68.0	27.2
Types of Birds Reared						
Broiler only	25	20.0	10	8.0	35	14.0

Layers only	32	25.6	53	42.4	85	34.0
Cockerel only	9	7.2	6	4.8	15	6.0
Broiler, Layers and Cockerel	59	47.2	56	44.8	115	46.0
Management Type						
Battery cage	39	31.2	54	43.2	93	37.2
Deep litter	42	33.6	9	7.2	51	20.4
Both	44	35.2	62	49.2	106	42.4
Labour Type						
Self	28	22.4	39	31.2	58	23.2
Family	56	44.6	30	24.0	95	38.0
Hired	23	18.4	29	23.2	52	20.8
Combination	18	14.4	27	21.6	45	18.0
Farm Size						
1-999	98	78.4	70	56	168	67.2
1000-2999	25	20	42	33.6	67	26.8
3000 and above	2	1.6	13	10.4	15	6
Mean	661.8		1320		991	
Ownership of land	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Rented	25	20	30	24	55	22
Leased	2	1.6	16	12.8	18	7.2
Owned	98	78.4	79	63.2	177	70.8
Age of Farm(year)						
Below 5	40	32	23	18.4	63	25.2
5-10	55	44	56	44.8	111	44.4
11-15	12	9.6	41	32.8	53	21.2
16-20	11	0.8	4	3.2	15	6.0
21-25	1	0.8	1	0.8	2	0.8
26 and above	6	4.8	-	-	6	2.4
Mean	9.14		9.45		9.25	
Record keeping						
Yes	77	61.6	86	68.8	163	65.2
No	48	38.4	39	31.2	87	34.8

Source: Field survey, 2015

Type and Extent of Waste generated

Table 2 shows the mean distribution of commercial poultry farms in the study area based on type and extent of waste generated. Results in the table show that poultry droppings was the most (mean =2.36 and ranked first) generated waste in the study area followed closely by litter/ bedding material (mean= 2.19 and ranked second). Dead birds (mean =2.02) was ranked third. Judging by a mean rating which is above 2.00, waste feed, abattoir waste, damaged/rotten eggs, damaged crates, dead rats, feed bags/health care products, waste water from slaughter houses and waste water from poultry house disinfection were the wastes less generated from the farms. In all, poultry droppings, litter/ bedding material and dead birds were the most generated poultry wastes in the study area.

Table 2: Mean Distribution of Respondents from Study Area by the Type and Extent of Poultry Wastes generated on farm (N= 250)

	Type of waste	Mean Kogi State	Rank	Mean Kwara State	Rank	Pooled mean	Rank
1	Poultry droppings	2.25	1	2.47	1	2.36	1
2	Litter/bedding material	2.10	2	2.27	2	2.19	2
3	Dead birds	2.01	5	2.03	4	2.02	3
4	Waste water from poultry house disinfection	1.70	5	2.20	3	1.95	4
5	Feed bags/health care products	1.82	3	1.98	5	1.90	5
6	Waste feed	1.76	4	1.81	8	1.79	6
7	Waste water for slaughtering house	1.56	8	1.78	9	1.67	7
8	Damaged crates	1.48	10	1.90	6	1.69	8
9	Dead rats	1.49	9	1.82	7	1.66	9
10	Abattoir waste	1.58	7	1.62	11	1.60	10
11	Damaged/rotten eggs	1.46	11	1.71	10	1.59	11

Likert typed scale used: Large extent=3, Small extent=2, No extent=1

Source: Field survey, 2015

Method of Waste Disposal Practiced By Farmers

The results in Table 3 further reveal that six items were the most prevalent waste disposal methods practised by the farmers. This judgement is based on the mean ratings which are above 2.0. The results reveal that disposal methods such as poultry wastes are dumped around the farm (mean= 2.23) ranked first, poultry wastes are given free to the public to be used for farming (mean= 2.16) was ranked second. This is similar to the findings of Moreki and Keaikitse (2013) in Botswana that majority of the respondents disposed of poultry wastes by giving them away to other farmers to use in their arable fields. Poultry wastes are dumped in a nearby bush (mean=2.09) ranked third, Dead birds are buried in a pit near the farm with mean= 2.08 was ranked fourth. This corroborates the findings of Moreki and Keaikitse (2013) who reported that most poultry farmers in Botswana dispose their mortality through burial and composting.

Poultry wastes are used as farmyard manure with mean=2.03 was ranked fifth. This further corroborates the findings of Olumayowa and Abiodun (2011) who reported that adding poultry wastes to the soil as manure increases soil fertility through an increase in nutrient retention capacity, improvement in the physical condition, as well as an increase in the water-holding capacity and soil structure stability. Dead birds are thrown into a nearby bush and Dead birds are burnt inside a pit or in a heap near the farm with mean= 2.01 were ranked sixth respectively. A similar finding was reported by Alabiet *al.* (2012) who found that most poultry farmers in Edo State disposed off their poultry carcasses and other wastes through heaping and burning. This practice has however been reported to cause threats to the environment as reported by (Amejiet *al.*, 2012 and Guittet, LeCoq and Piccault, 1997).

Table 3: Mean Distribution of Respondents based on the Method of Waste Disposal Practised (N= 250)

	Waste disposal method	Mean Kogi State	Rank	Mean Kwara State	Rank	Pooled mean	Rank
1	Poultry wastes are dumped around the farm	2.15	3	2.30	1	2.23	1
2	Poultry wastes are used as farmyard manure	2.03	7	2.03	4	2.03	5
3	Poultry wastes are dumped in a nearby bush	2.08	5	2.10	3	2.09	3
4	Poultry wastes are dumped in a far bush or open wasteland	1.87	8	1.20	20	1.54	12
5	Poultry wastes are sold to the public to be used for farming	1.47	10	1.19	21	1.33	18
6	Poultry wastes are given free to the public to be used for farming	2.18	2	2.13	2	2.16	2
7	Dead birds are buried in a pit near the farm	2.12	4	2.03	4	2.08	4
8	Dead birds are thrown into a nearby bush	2.42	1	1.60	14	2.01	6
9	Dead birds are burnt inside a pit or in a heap near the farm	2.08	5	1.94	6	2.01	6
10	Dead birds are burnt inside an incinerator on the farm	1.29	18	1.30	16	1.30	19
11	Dead birds are given to animals such as dogs etc to eat	1.40	14	1.78	7	1.59	9
12	Dead birds are sold or given freely to interested members of the public	1.42	13	1.65	10	1.54	11
13	Dead birds are given freely to interested farm	1.34	16	1.68	8	1.51	13

workers							
14	Poultry wastes are sun-dried and burnt	1.38	15	1.56	13	1.47	14
15	Poultry wastes are sun-dried and sold to be used for farming	1.47	10	1.66	9	1.57	10
16	Poultry wastes are channelled into nearby stream or river through open canal	1.62	9	1.64	11	1.63	8
17	Slurry wastes are channelled into farmer's farm for irrigation	1.29	18	1.41	15	1.35	16
18	Poultry wastes are flushed into a soak away pit beside the farm	1.33	17	1.59	12	1.46	15
19	Poultry wastes are channelled to farmer's fish farm to be used as feed	1.24	20	1.26	17	1.25	20
20	Poultry wastes are sold to fish pond owners to be used as fish feed ingredient	1.44	12	1.23	18	1.34	17
21	Poultry wastes are dried and used as part of poultry feed ingredient	1.19	21	1.22	19	1.21	21
22	Poultry wastes are used for the generation of biogas	1.00	22	1.00	22	1.00	22

Likert type scale used: Always=3, Sometimes =2, Never=1

Source: Field survey, 2015

Methods of Waste Treatment

Table 4 presents the distribution of respondents from both states based on the methods of waste treatment used. The pooled analysis results reveals that burning was the most prevalent method used in treating waste with a mean of 1.91 as opposed to chemical method (mean= 1.61).

Burning of waste practice according to Akinbile (2012) has negative effects on the environment as burning results in air pollution and contributes to climate change. Obayelu (2010) reported that farmers found it difficult to obtain modern technology for waste treatment.

Table 4: Mean Distribution of Respondents from Study Area based on Method of Waste Treatment (N= 114)

Method of Waste Treatment	Mean Kogi State	Rank	Mean Kwara State	Rank	Pooled mean	Rank
Chemical	1.54	2	1.67	1	1.61	2
Burning	2.07	1	1.74	2	1.91	1
Combination	1.13	3	1.12	3	1.13	3

Likert type scale used: Always=3, Sometimes =2, Never=1

Source: Field survey, 2015

Constraints Encountered in Effectively Disposing and Utilizing Animal wastes (N= 250)

Table 5 shows various constraints among respondents in the study area on poultry waste management. The table reveals that lack of awareness on how to use the wastes productively (mean= 4.06) ranked first.. This finding is in agreement with the view of Ekong (2003) that awareness is the first stage in the adoption process and that the more awareness a farmer has on proper disposal and productive uses of farm wastes, the better its utilization. This was followed by no agricultural land nearby where the wastes can be used (mean=3.69), excessive odour from waste (mean 3.66), high cost of chemical treatment (mean=3.56), high transportation cost (mean= 3.24) and high cost of private waste management agencies (mean=3.01). The least serious constraints were insufficient farm labour (mean=2.98) and delayed removal by waste collection agents (mean=2.95).

Table 5: Mean Distribution of Constructs Used to determine Constraints Encountered in Effectively Disposing and Utilizing Animal wastes (N= 250)

	Constraints to waste disposal	Mean Kogi State	Rank	Mean Kwara State	Rank	Pooled mean	Rank	Implication
1	Lack of awareness on how to use the wastes productively	3.98	1	4.14	1	4.06	1	High
2	No agricultural land nearby where the wastes can be used	3.51	2	3.87	3	3.69	2	High
3	Excessive odour from waste	3.27	5	4.05	2	3.66	3	High
4	High cost of chemical treatment	3.30	4	3.81	4	3.56	4	High
5	High transportation cost	3.45	3	3.02	8	3.24	5	High
6	High cost of private waste management agencies	2.87	7	3.14	5	3.01	6	High
7	Insufficient farm labour.	2.85	6	3.10	6	2.98	7	Low
8	Delayed removal by waste collection agents	2.81	8	3.08	7	2.95	8	Low
	Grand mean					3.39		

Likert scale: Very serious=5, Serious=4, Not serious=3, Undecided=2, Not a constraint=1

Source: Field survey, 2015

Test of hypotheses

Table 6 shows the Multiple Regression Analysis to investigate the relationship between socio economic characteristics of the commercial poultry farmers and the waste management methods practiced by them. The multiple regression model with twelve predictors produced $R^2 = 0.257$, $F = 6.262$, $P < 0.01$. The variables that contributed to the regression model were the respondents' education status, farm experience, farm size, management type, labour type and land ownership.

These factors explained 25.7 percent of the observed variations in the waste management methods adopted by the farmers.

At 1% level of significance, farmers' educational status positively influenced their waste management practices. This result agrees with Fafioye and John-Dewole (2012) who reported that education of farm workers significantly affects the method of waste disposal being employed. Okunlola (2006) also supported this assertion by stating that "education influences various management practices among farmers". Educational status was positively related to waste management practices, implying that the less-educated poultry farmers do not diversify their methods of waste management. Increased education level tends to open more opportunities for different alternative use of poultry waste to generate more income. Education has been linked to widened intellectual horizons, awareness, exposure, and to predispose farmers to new ideas.

At 5 % level of significance, farming experience was shown to be positively related to the farmers' choice of waste management methods. This implies that the higher the years of experience of the farmer, the more choices of waste management methods they adopt. Farmers with higher years of farming experience would be more knowledgeable and efficient. They know the problems involved in waste management and

their strategy has an edge over those with little farming experience. Farming experience is expected to improve understanding and management practices of the farmers. The result is in line with the findings of Onyebinama, (2004). It is also supported by the findings of (Ike, and Ugwumba, 2011; Onubuogu, *et al.* 2014).

At 5 % level of significance, farm size was also shown to be positively related to the farmers' choice of waste management methods. This implies that the higher the farm size, the more choices of waste management methods they adopt. This is understandable as increase in farm size will lead to increase in waste generation from the farm, and when wastes are increased, the farmer may tend to devise alternative ways of disposing such wastes in order to reduce the inconveniences the resulting odour may cause.

Management type and labour type of respondents at 1% level of significance were also negatively related to the choice of poultry waste management methods of the respondents. The implication is that, the variables inversely influenced the choice of waste management methods of respondents. This means that improved management type and increase in labour type reduced their choice of selected waste management methods. Increase labourers of poultry farms means that there will be sufficient hands in the farm and so farmers' choice of waste management method may tend to be an appropriate practice. Likewise, the management practices of respondents be it deep litter or battery cage system will definitely have influence on the choice of practices as farmers may be convenient with a particular management practice when using battery cage or the deep litter system.

Results of the regression analysis further show that land ownership by respondents at 1% level of significance positively influenced the choice of poultry waste management practices of respondents. It therefore implies that the more the increase in land ownership, the more the choices of

waste management practices they adopt. According to Babatunde *et al.* (2007), land is a way of tying down wealth. It has a high financial value and this may give more opportunity for the establishment of several agro-related businesses through which waste generated from poultry may be used. With the above mentioned factors, other things being equal, increase in farm size would likely result in increased use of waste generated as different means of waste management practices, leading to improved farmers welfare. The hypothesis is therefore rejected: Socio-economic characteristics affect the waste management practices adopted by the commercial poultry farmers.

Table 6: Results of Multiple Regression to Investigate the Socio economic Characteristics of the Commercial Poultry Farmers and the Waste Management Methods practiced by them

Variables	Unstandardized Coefficients			
	B	Std. Error	t	p-Value
(Constant)		.558	3.428	.001
Gender	.039	.116	.661	.509
Age	-.078	.004	-1.088	.278
Marital status	-.278	.150	-4.384	-.183
Education	.156 ^{***}	.101	2.596	.010
status				
Farm	.258 ^{**}	.013	2.188	.030
Experience				
Age of farm	.031	.014	.260	.795
Farm size	.152 ^{**}	.000	2.349	.020
Bird type	.084	.059	1.343	.181
Management	-.239 ^{***}	.056	-3.577	.000
Labour type	-.187 ^{***}	.045	-2.796	.006
Land ownership	.184 ^{***}	.055	3.017	.003

$R^2 = .257$
 $F = 6.262, P < 0.01$

*** 1%, ** 5%, * 10%

CONCLUSION AND RECOMMENDATIONS

Based on findings in the study, it was concluded that poultry waste management practices in the study area were confronted by high level of constraints. Major constraints were lack of awareness on how to use poultry wastes productively, no agricultural land nearby where the wastes can be used, excessive odour from waste, high cost of chemical treatment, high transportation cost and high cost of private waste management agencies. Poultry dropping was the most generated waste in the study area while the most prevalent waste disposal method among farmers was open dumping around the farm and dumping of wastes in nearby bushes. Others prevalent waste disposal methods include burying of dead birds in a pit near the farm and throwing dead birds into nearby bushes. These were significantly influenced by education status, farming experience, farm size, management type, labour type and land ownership. Majority of the poultry farmers do not treat their farm wastes against odour. The study therefore recommends that:

Given the significant positive relationship between educational status and farming experience of the farmers and their waste management practices, the poultry farmers' association should organize training and retraining programs for the farmers regularly; they should invite experts to train them in the areas of waste management and general environmental health. This will cover the lapses on the part of farming experience and education which are very important in poultry production.

The foremost constraint militating against effective waste management as observed in this study was lack of awareness on productive uses of the wastes. Decisive actions should therefore be taken to educate farmers on better and environmentally safe ways of disposing and utilizing wastes. Use of poultry wastes as organic manure can improve

farm productivity as well as improving the environment while at the same time reducing fertilizer costs.

This study shows that the common waste treatment option in the study area was burning technique. This treatment option has however been shown to be detrimental to the environment. Modern technology for waste treatment should be made available to the poultry farmers at subsidized costs. Treatment of wastes with appropriate chemicals against odour and flies should be a regular practice as a way of environmental

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