

# Evaluating Poultry Litter as a Feed Supplement: Perspectives of Ghanaian Livestock Farmers

## ABSTRACT

Cattle, sheep, and goats are crucial to human development, serving as major protein sources, income providers, and as a hedge against economic risk in Ghana. Demand for protein from these animals has significantly outpaced supply, partly due to insufficient or unavailable feed resources. This study investigates the use of poultry litter as a feed supplement for livestock. Data were collected from 125 livestock farmers raising cattle, sheep, and goats, using a simple random sampling technique and a structured questionnaire. Results show that cassava husk is the primary feed source, with all respondents (100%) unaware of poultry litter as a potential feed supplement. Interestingly, a majority were aware of irradiation as a decontamination method for food products. Logit regression analysis indicated that farmers' likelihood of using irradiated poultry litter as feed is influenced by the number of animals they own. Based on these findings, it is recommended that farmers be educated on the nutritional and economic benefits of using poultry litter as a sustainable feed supplement.

*Keywords:* Livestock, Poultry litter, Feed supplement, Irradiation, Protein demand, Ghana, Logit regression, Farmer education

## 1. INTRODUCTION

Protein constitutes an integral part of human development. It can be derived from both plants and animals sources. When it comes to animals, cattle, sheep and goats cannot be left out. Cattle, sheep and goats, also provide finance, traction power and serve as a hedge against risk in many Sub-Saharan African countries including Ghana. The demand for services and protein from these sources over the years has increased geometrically more than the supply as a result of low or unavailability of feed for these animals. One of the cheapest ways of accessing feed which is high Poultry litter, consisting of poultry excreta, spilled feed, and bedding materials like sawdust or straw, has traditionally been utilized as fertilizer. However, its use as a livestock feed supplement is growing due to its low cost and nutritional benefits, especially for ruminants (Give reference).



Fig 1 A poultry farm showing birds in a deep litter system.

The litter is high in protein, with crude protein levels reaching up to 31%, making it a viable alternative to conventional feed ingredients (Bernejee, 1996). Additionally, poultry litter is a rich source of essential minerals like calcium and phosphorus, which further enhances its value as animal feed (McClure et al., 1978). Although it contains pathogens, when carefully treated, poultry litter can be made free of harmful microorganisms, allowing its safe use as a feed supplement (Bernejee, 1996).

Several studies have explored the efficacy of poultry litter as a protein source in animal feed. Asrat (1995) found that replacing up to 28% of conventional crude protein sources with poultry litter in the rations of Hararghe Highland goats had favorable results, indicating that it can replace costly protein sources such as noug seed cake. Similarly, Ferrara (2000) observed that goats fed a poultry litter-based diet showed lower feed efficiency compared to those fed a commercial goat diet, but the poultry litter-based diet was still a viable feed alternative.

In beef production, poultry litter has shown promising results. McClure, Fontenot, and Webb (1978) reported that beef cattle could consume up to 3 kg of poultry litter daily, achieving substantial live weight gains when the litter was mixed with corn silage. This combination resulted in a daily live weight gain of 1,190 g, demonstrating that poultry litter can be effectively used as part of a balanced diet for cattle. In experiments conducted by Virginia scientists, ensiling broiler litter with high-moisture maize grain was found to be more palatable than traditional soybean-based protein supplements (Caswell, Webb, & Fontenot, 1977). The results indicated better performance in terms of feed intake, live weight gain, and carcass quality, particularly when broiler litter was ensiled with maize-forage (McClure et al., 1971).

Research on the digestibility of nutrients in poultry litter-supplemented diets has also produced encouraging findings. Dethrow (1976) demonstrated that forage-maize silage supplemented with soybean meal and dried poultry waste resulted in satisfactory nutrient digestibility across all test groups. In a study involving 6-month-old lambs, McIntyre, Austin, and Jenkins (1968) reported that lambs fed a diet consisting of poultry litter and wheat meal performed as well as those on a wheat meal-only diet, highlighting the potential of poultry litter as a protein substitute in livestock production.

The impact of poultry litter on beef carcass quality has also been investigated. While Bossman (1973) and Arango and Perez-Buriel (1976) reported slightly lower carcass grades in cattle fed poultry litter, Drake, McClure, and Fontenot (1965) found significant improvements in dressing percentages among steers fed different poultry litter combinations. Their study showed that steers fed a diet of poultry litter mixed with maize cobs had a

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dressing percentage of 53.6%, compared to 49.9% for the control group. These findings suggest that poultry litter can enhance beef production when incorporated into cattle diets. However, despite the advantages of using poultry litter in livestock feed, there are concerns about its safety. Sall, Norman, and Featherstone (2002) highlighted the risk of mad cow disease (Bovine Spongiform Encephalopathy) when poultry litter, which may contain rendered tissues from ruminants, is fed to cattle. Poultry litter can also harbor bacteria such as *Campylobacter*, *Salmonella*, and *E. coli*, posing potential health risks to humans if these pathogens are transmitted through the food chain. In addition to pathogens, poultry litter may contain residues of veterinary drugs, heavy metals, and foreign objects like rocks or glass, necessitating strict treatment and monitoring before its use as livestock feed.



Fig 2 Poultry litter

Research conducted in various regions has demonstrated that including poultry litter in livestock feed can significantly increase crude protein levels, despite the potential risks associated with its use. For instance, Bernejee (1996) highlights that poultry litter can provide up to 31% crude protein, making it a valuable feed supplement, particularly in areas where conventional protein sources are expensive or scarce. Asrat (1995) also found that poultry litter could replace up to 28% of traditional protein sources in goat feed without compromising performance. Similarly, studies by McClure, Fontenot, and Webb (1978) show that beef cattle fed on a diet that includes poultry litter exhibit increased live weight gains. Despite these advantages, there are concerns about the potential side effects of poultry litter usage, including the risk of pathogen transmission and contamination from heavy metals and drug residues (Sall, Norman, & Featherstone, 2002). To mitigate these risks, proper treatment and handling of poultry litter are essential, as highlighted by Caswell, Webb, and Fontenot (1977), who emphasize the importance of ensiling poultry litter to improve its safety and palatability.

Given these mixed outcomes, it is important to explore the perspectives of farmers who are the primary users of this feed supplement. Understanding farmers' views on the economic benefits and potential risks of using poultry litter in the feed for sheep, goats, and cattle is critical. This research aims to address this knowledge gap by assessing the economic importance of poultry litter as a feed supplement in livestock production. By gathering data on farmers' experiences and practices, the study seeks to provide insights into how poultry litter can be safely and effectively integrated into livestock feeding strategies to enhance protein intake and reduce feeding costs, as demonstrated in earlier studies (Dethrow, 1976; Ferrara, 2000).

## 2. MATERIALS AND METHODS

This research utilized a structured questionnaire designed to capture detailed and relevant information from farmers regarding their knowledge, attitudes, and practices related to poultry litter as a feed supplement. The questionnaire sought information on respondents' demographics, such as age, occupation, marital status, educational level, and number of children. It also assessed the respondents' knowledge on feed supplements, the cost of

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feed, their awareness and understanding of irradiated poultry litter, and its potential as an economic alternative for livestock feed. Irradiation, a process known to eliminate harmful pathogens from poultry litter, was included as a focal point in the questionnaire to gauge farmers' perceptions and willingness to adopt this technology for their livestock (Shiyani et al., 2002). The inclusion of such detailed information ensured that the study could comprehensively address the research objectives.

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## 2.1 Research Setting

The research was originally intended to cover a broad geographical area; however, due to financial constraints, it was limited to four regions in Ghana: Greater Accra, Central, Eastern, and Volta. These regions were selected based on their significance in livestock production, particularly sheep, goats (small ruminants), and cattle (large ruminants). These areas also provided a diversity of farming practices and economic conditions, making them ideal for assessing the viability of irradiated poultry litter as a cost-effective feed supplement. Despite the limited geographical scope, the selected regions are representative of the broader farming communities in Ghana, thereby ensuring the reliability of the findings (Wabbi, Taylor, & Kasenge, 2006).

### 2.1.2 Sampling Technique, Sample Size, and Data Collection Method

A simple random sampling technique was employed to select participants for the study. The random selection process ensured that all farmers had an equal opportunity to participate, reducing bias and enhancing the generalizability of the results. A total of 125 farmers, all of whom had been engaged in animal rearing for a significant period, were interviewed. These farmers specialized in the production of small ruminants, such as sheep and goats, as well as cattle. The structured questionnaire served as the primary data collection tool, allowing for the systematic collection of quantitative data. This method ensured that the responses were uniform and could be easily compared across different variables (Akinola, 1987).

Data collection focused not only on demographic characteristics but also on key aspects of poultry litter usage, such as the types of feed used by the farmers, the cost of feed, the amount of time animals spent grazing, the number of animals owned, the knowledge of poultry litter, its source, and the respondents' awareness of irradiation as a method for treating poultry litter. Additional questions explored the farmers' views on the safety, cost-effectiveness, and environmental impact of using irradiated poultry litter (Feder & Shade, 1985).

## 2.2 Analytical Model: Logit Regression

To analyze the likelihood of farmers adopting irradiated poultry litter, the study employed the Logit regression model, a statistical method used to model binary outcomes. In this case, the dependent variable was whether a farmer would adopt irradiated poultry litter as a feed supplement. The decision to adopt this technology involves multiple factors, such as cost, perceived benefits, safety, and availability. The Logit model was chosen because of its effectiveness in predicting the probability of adoption based on these independent variables (Bamire & Manyong, 2003).

The Logit model is theoretically expressed as:

$$\mu = B_n \sum_1^N X_n + e$$

Where:

$\mu$  represents the likelihood of adoption;

$B_n$  are the estimated parameters;

$X_n$  refers to a set of independent variables (such as age, education level, cost, and knowledge of poultry litter);

e is the error term (Akinola, 1987; Feder & Shade, 1985).

### 2.2.1 Hypothesis Statements

The following hypotheses were formulated to guide the research:

**H<sub>0</sub>:** Factors under consideration have no significant effect on the adoption of irradiated poultry litter.

**H<sub>1</sub>:** Factors under consideration have a significant effect on the adoption of irradiated poultry litter.

These hypotheses are tested to determine the key factors influencing farmers' decision-making processes and the likelihood of adopting irradiated poultry litter as a viable feed supplement for livestock.

### 2.3 Data Analysis

The collected data were analyzed using the Statistical Package for Social Sciences (SPSS, version 16) and Microsoft Excel. These software packages were employed to generate descriptive statistics, such as percentages and frequencies, which provided insights into the demographic characteristics of the respondents. The data were also presented in tables and graphs to facilitate easy interpretation and comparison.

The regression analysis, facilitated by SPSS, was crucial in identifying the key determinants of the adoption of irradiated poultry litter. The independent variables used in the regression analysis included age, gender, marital status, educational background, occupation, knowledge of poultry litter, the cost of feed, and awareness of irradiation technology. The analysis also examined factors such as the source of information on poultry litter and the farmers' perceptions of the safety and cost-effectiveness of using irradiated poultry litter (Bamire&Manyong, 2003; Feder & Shade, 1985).

Furthermore, the study explored the economic feasibility of using irradiated poultry litter by examining the costs associated with its use and comparing it with traditional feed supplements. The analysis also assessed the impact of poultry litter on livestock productivity, focusing on factors such as weight gain, carcass quality, and overall animal health. These findings were critical in determining whether irradiated poultry litter is a cost-effective and viable feed supplement for Ghanaian farmers (Wabbi, Taylor, & Kasenge, 2006).

## 3.0 RESULTS

### 3.1 Introduction

This section presents comprehensive findings from data collected during interactions with and interviews of 125 farmers regarding their knowledge, experiences, and perceptions of poultry litter as a livestock feed supplement. The results include demographic information and respondents' opinions on the benefits and risks associated with using poultry litter. The results are presented through a combination of tables, charts, and direct quotations to ensure clear representation of the data.

#### 3.1.1 District Representation

The study covered four districts, with the majority of the respondents (64%) coming from Ga East District, followed by 20% from Cape Coast Metropolitan Assembly, 8% from Akwapim South, and 8% from Kpando District. The dominance of respondents from Ga East District is reflective of the district's significant involvement in livestock farming, particularly small ruminants, where poultry litter is being increasingly considered as an alternative feed supplement. The distribution of respondents by district is illustrated in Figure 1, which emphasizes the geographic focus of the research. Poultry litter use in these areas correlates with increasing pressure on traditional feed sources, particularly during dry seasons, leading farmers to explore cost-effective alternatives like poultry litter (Feder & Shade, 1985).

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### **3.1.2 Age, Sex, and Marital Status of Respondents**

Out of the 125 respondents, the largest age cohorts were 37 years (12%), 43 years (12%), and 48 years (8%). The average age was 44.1 years, with a standard deviation of 10.6 years, reflecting a predominantly middle-aged respondent group, which is in line with findings that middle-aged farmers are more likely to engage in livestock farming and adopt new feed supplements due to their stability and experience (Wabbi et al., 2006).

The gender breakdown showed that 85 respondents (68%) were male and 40 (32%) were female. Livestock farming, especially involving ruminants like goats, sheep, and cattle, is traditionally male-dominated, though women also play a crucial role, particularly in managing smaller livestock (Asrat, 1995). Of the 125 respondents, 110 (88%) were married, while 15 (12%) were single. Marital status was identified as a key factor in technology adoption, with married individuals being more likely to adopt innovative practices to ensure long-term family welfare, particularly with regard to feed security and livestock productivity (Shiyani et al., 2002).

### **3.1.3 Number of Children**

When examining family size, 30 respondents (24%) reported having three children, 25 respondents (20%) had four children, and 20 respondents (16%) had five children. Additionally, 10 respondents (8%) had one child, and 5 respondents (4%) reported having no children. The average number of children per household was four, with a standard deviation of two. Larger families are often more inclined to adopt cost-effective and sustainable agricultural practices, including using poultry litter as a feed supplement, to ensure food security and financial stability (Feder & Shade, 1985). Farmers with more children are typically concerned about securing income sources to support their families, making innovations like poultry litter attractive.

### **3.1.4 Education, Religion, and Occupation of Respondents**

In terms of education, 45 respondents (36%) had completed junior high school (JHS), while 30 respondents (24%) had completed middle-level secondary education (MLSC). Fifteen respondents (12%) had completed senior high school (SHS), another 15 (12%) had only primary-level education, and 10 respondents (8%) had attended tertiary institutions. Meanwhile, 5 respondents (4%) had received Arabic education, and 5 (4%) reported no formal education. Education plays a critical role in farmers' ability to understand and adopt new agricultural technologies, including the safe and effective use of poultry litter as feed (Akinola, 1987).

In terms of religion, 94 respondents (76%) were Christian, and 31 (24%) were Muslim. Religion can influence livestock management decisions, especially in terms of species selection and farming practices. For instance, many Muslim farmers refrain from pig farming due to religious restrictions but are heavily involved in sheep, goat, and cattle production, where poultry litter could be a viable feed supplement (Shiyani et al., 2002).

With regard to occupation, 120 respondents (96%) were engaged in small ruminant production (sheep and goats), while 5 respondents (4%) were cattle farmers. However, 45 respondents (36%) also engaged in part-time trading, 33 respondents (26%) were drivers, 15 respondents (12%) were masons, and 10 respondents (8%) were involved in other forms of farming. Other occupations reported included security work, hairdressing, medical laboratory work, and plumbing. The diversification of income sources is common among rural farmers, enabling them to cope with financial uncertainty and to invest in new technologies (Wabbi et al., 2006).

### **3.1.5 Knowledge and Perceptions of Poultry Litter as Feed Supplement**

When assessing the knowledge and perceptions of poultry litter, most respondents were familiar with the use of poultry litter as a fertilizer but were less informed about its potential

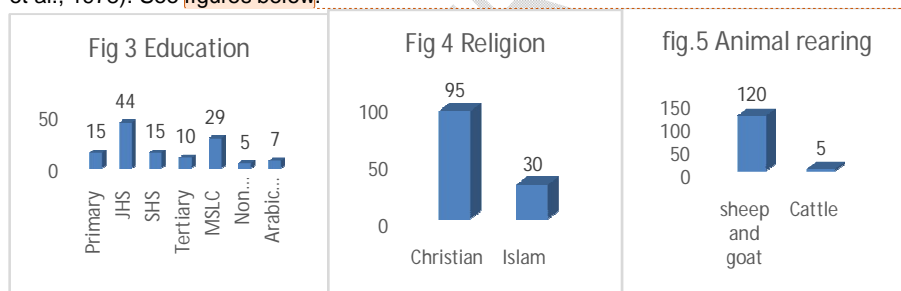
as a livestock feed supplement. Only a few respondents (approximately 25%) had used poultry litter in their livestock feed. However, many expressed interest in using irradiated poultry litter due to its potential to reduce feed costs and enhance animal growth. Irradiation was seen as an essential safety measure, as it eliminates pathogens and improves the safety of poultry litter for livestock consumption (Bamire&Manyong, 2003).

Additionally, concerns about the safety of poultry litter, particularly regarding the risk of bacterial contamination and residual antibiotics, were expressed by a significant portion of the respondents. Farmers familiar with irradiation technology were more open to adopting poultry litter as a feed supplement, seeing it as a cost-effective alternative to conventional feedstock (Akinola, 1987). Some respondents also mentioned concerns about the potential environmental impact of poultry litter use, noting that its adoption could reduce pollution from poultry waste, aligning with environmental sustainability goals (Feder & Shade, 1985).

### 3.1.6 Adoption of Poultry Litter and Factors Influencing Decision

The results indicate that the decision to adopt poultry litter as a feed supplement is influenced by several factors, including family size, educational background, and knowledge of irradiation technology. Farmers with larger families were more likely to adopt poultry litter as a means of reducing feed costs. Educated farmers, particularly those with tertiary education, were more likely to understand the benefits and risks of poultry litter, making them more inclined to adopt it.

The use of poultry litter also had positive implications for animal health and production, with respondents reporting improvements in the growth rates and overall health of their livestock when supplemented with poultry litter. These findings are consistent with prior research, which highlights the economic benefits of using poultry litter in livestock production (McClure et al., 1978). See figures below.



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### 3.1.7 Type of Feed

Respondents utilized a variety of feed types for their livestock, reflecting the diversity of farming practices in Ghana. Forty-five respondents (36%) indicated that they employed cassava husk and free-range systems as their primary feeding method, 20 respondents (16%) relied exclusively on a free-range system, and 15 respondents (12%) combined grass and cassava husk. Additionally, another 15 respondents (12%) reported using a mix of cassava husk, grass, and plantain husk, while 15 respondents (12%) adopted a combination of free-range, cassava husk, and grass. A small percentage, 5 respondents (4%), indicated using cassava husk, grass, and plantain husk, and 15 respondents (12%) exclusively used cassava husk.

The use of cassava husk and plantain husk is a prevalent practice among small-scale livestock farmers in Ghana due to their availability and low cost. Cassava husk, in particular, is a by-product of cassava processing and is widely available in rural areas, making it a convenient feed option for farmers (Apori et al., 1995). Additionally, the free-range system is common, where animals are allowed to graze on natural vegetation. However, this method

can be labor-intensive, as farmers need to spend considerable time overseeing the grazing process (Sumberg, 2001). The use of a feed supplement that is cost-effective and protein-rich, such as poultry litter, would be a welcome innovation for these farmers, as it could reduce their reliance on less nutritious feed types like cassava husk and lower their feed costs.

### 3.1.8 Weekly Expenditure on Feed and Number of Hours Animals Graze (Free Range)

The study also explored the amount of money farmers spent on feed each week and the time they dedicated [inte](#) allowing their animals to graze. Thirty respondents (24%) reported spending GH¢10.00 weekly on feed, while 10 respondents (8%) spent GH¢15.00 and another 10 (8%) spent GH¢5.00. Interestingly, 58 respondents (46%) chose not to disclose the amount they spent on feed, which could indicate variations in feeding practices or a reluctance to share financial details.

Regarding the free-range grazing system, 20 respondents (16%) stated that they spent 2 hours per day managing this process, another 20 respondents (16%) dedicated 6 hours to grazing, and 15 respondents (12%) reported spending 8 hours. The remaining 82 respondents (65%) used similar time allocations. The time-intensive nature of the free-range system highlights a key challenge for farmers, as significant portions of their day are dedicated to grazing activities. The adoption of poultry litter, which has a higher protein content than many traditional feed types, could reduce grazing time and improve livestock productivity (McClure et al., 1978).

### 3.1.9 Total Number of Animals, Number Slaughtered, and Sold Last Year

The number of animals owned by respondents varied significantly, with 15 respondents (12%) reporting ownership of 5, 8, or 13 animals, while 10 respondents (8%) had 7, 14, or 28 animals. A smaller group, 5 respondents (4%), had larger herds, with ownership of 3, 9, 10, 16, 20, 23, 37, 54, and even 105 animals. These numbers reflect the wide range of herd sizes in Ghana, where some farmers operate on a small scale while others engage in more intensive livestock production (Smith et al., 2003).

In terms of slaughtering and selling animals, 20 respondents (16%) reported slaughtering 1, 2, or 4 animals over the past year, while 10 respondents (8%) slaughtered 3, 5, or 10 animals. A smaller group, 5 respondents (4%), indicated slaughtering 11 animals, and 15 respondents (12%) did not provide information on the number of animals they slaughtered. The frequency of animal slaughter highlights the importance of livestock as a source of both food and income for these farmers.

Regarding sales, 20 respondents (16%) sold their animals for GH¢100.00, another 20 (16%) for GH¢150.00, and 15 respondents (12%) for GH¢120.00. Another 15 respondents (12%) reported selling their livestock for GH¢130.00, while 10 respondents (8%) sold theirs for between GH¢60.00 and GH¢80.00. Notably, one respondent reported selling an animal for GH¢1000.00, reflecting the potential for high-value transactions in certain cases. Thirty respondents (24%) did not respond to the question regarding sales. The fact that some respondents were able to sell large numbers of animals at higher prices suggests that livestock farming in these regions can be a significant source of income, warranting further attention to practices that could enhance productivity, such as the introduction of high-protein feed supplements like poultry litter (Manyong&Bamire, 2003).

**Table 1 Mean, Std. Dev., maximum and minimum values of some variables**

Variables	Mean	Std. Dev.	Min.	Max.
Weekly feed Expenditure in Cedis	9.30	4.0	2.0	15.0
Number of hours animals graze	4.40	2.50	0.5	8.0
Number of animals	18.0	22.0	3.0	105.0
Number slaughtered	4.0	3.0	1.0	11.0
Amount sold	112.1	29.0	61.0	150.0

Age in years	44.2	10.6	18.0	65.0
Number of children	4.0	2.0	1.0	8.0

### 3.2 Knowledge on Poultry Litter

In the study, none of the 125 respondents, representing 100% of the sample, had any prior knowledge about poultry litter as a feed supplement. This lack of awareness extends even to the more general farming community, where poultry litter is not widely recognized or utilized as animal feed. It is not entirely surprising that none of the selected farmers had heard about poultry litter for feed, as a previous survey conducted in a scientific environment revealed that only a handful of scientists were familiar with its use in animal production. This highlights the need for targeted educational campaigns to inform farmers about the potential benefits of poultry litter as an affordable and nutritious feed option (McClure et al., 1978).

Given the knowledge gap, there is an urgent need to disseminate research findings about poultry litter more broadly. Publications in national newspapers, agricultural journals, and extension programs could be instrumental in bringing this valuable information to farmers. Such educational efforts could encourage the adoption of poultry litter, which could significantly reduce feed costs and improve the overall efficiency of animal husbandry operations (Smith et al., 2003).

#### 3.2.1 Farmers' Opinions on Poultry Litter

When asked about their opinions on using poultry litter as feed, 45 respondents (36%) expressed a willingness to adopt it if provided with proper education, and 30 respondents (24%) indicated that they would consider using poultry litter if it were cost-effective. Conversely, 20 respondents (16%) stated they would not use poultry litter, while 10 respondents (8%) expressed concerns about its safety. The remaining 20 respondents (16%) had different views but generally lacked strong opinions due to limited exposure to the concept.

Interestingly, some respondents were already familiar with the concept of irradiation as a method for decontaminating food products, which suggests that the use of irradiated poultry litter could be introduced without significant resistance. Poultry litter, when irradiated, could offer a pathogen-free, nutrient-dense feed option that is cheaper than conventional feeds, especially for small-scale livestock farmers who often struggle with the high costs of feeding (Bagley, 1996).

#### 3.2.2 Familiarity with Irradiation

Among the respondents, 110 (88%) were unfamiliar with the concept of irradiation, while only 15 respondents (12%) had some knowledge of it. Of those who were familiar, 10 respondents (8%) had learned about it via the internet, and 5 respondents (4%) had encountered it in school. Despite this low level of knowledge, 100 respondents (80%) expressed a willingness to use irradiation for poultry litter, while 25 respondents (20%) indicated they would not apply it.

The lack of familiarity with irradiation among the majority of farmers presents a potential barrier to the adoption of irradiated poultry litter. However, the willingness of 80% of the respondents to use it suggests that, with proper education and awareness campaigns, farmers could be convinced of its benefits. The advantages of irradiation, such as eliminating pathogens and enhancing the nutritional quality of poultry litter, could make it an attractive option for farmers looking to improve their livestock feed (Wang et al., 1997).

#### 3.2.3 Perceptions of Poultry Litter's Affordability

When asked about the potential cost of poultry litter as feed, 65 respondents (52%) anticipated that it would be cheaper than other feeds, while 50 respondents (40%) expressed skepticism, citing the time and inconvenience required to access poultry litter. The remaining 10 respondents (8%) did not provide an opinion. Despite the uncertainty, 75

respondents (60%) indicated that they would recommend poultry litter to other farmers, while 30 respondents (24%) said they would not, and 20 respondents (16%) said they would consider it.

The perception that poultry litter could be a cost-effective feed is significant, particularly for small-scale farmers who often face high feed costs. However, the logistical challenges involved in accessing and transporting poultry litter, as noted by some respondents, need to be addressed. Developing efficient supply chains and distribution networks could make poultry litter more accessible to farmers, thus increasing its adoption (Park & Dinc, 2015).

### 3.2.4 General Comments on Poultry Litter

Many respondents were hearing about poultry litter as feed for the first time. Several expressed surprise, with one respondent remarking, "It's a surprise to me," and another stating, "It's news to me." Some respondents indicated a need for more education on how poultry litter can be used as feed. One respondent, for instance, mentioned, "I don't see how poultry litter can be used as feed." Nevertheless, others were hopeful about its potential, with 10 respondents indicating that they would give it a try, and 5 respondents noting that due to irradiation, they believed it would be safe for animals.

One respondent expressed skepticism about whether poultry litter could provide a pathogen-free supplement, while another suggested that it would be particularly beneficial during the dry season when feed resources are scarce. Several respondents voiced concerns about the potential cost, with one noting that while they were willing to try poultry litter, they anticipated it would be expensive. Overall, the general sentiment was one of cautious optimism, with many farmers open to the idea but requiring more information and assurance about safety and efficacy (Sumberg, 2001).

### 3.3 Logit Regression Results: Factors Influencing the Adoption of Poultry Litter

The logit regression analysis revealed that the number of animals owned by farmers was the only factor significantly affecting the decision to use irradiated poultry litter. Contrary to the researchers' expectations, as the number of animals increased, the likelihood of farmers adopting poultry litter decreased. This finding suggests that farmers with larger herds may be less inclined to adopt poultry litter due to the perceived logistical challenges of handling large volumes of feed.

The result implies that farmers with smaller herds may be more receptive to using poultry litter, potentially due to the lower volumes of feed required and the relative ease of handling. For farmers with larger herds, strategies such as developing bulk delivery systems or providing incentives for large-scale adoption may be necessary to overcome these barriers (Fafchamps & Hill, 2005). The findings underscore the importance of tailoring educational and promotional efforts to the specific needs and concerns of different farming demographics.

**Table 2 Logit regression model 1**

	B	S.E.	Sig.
Grazing time	-0.01	0.666	0.988
Numbers animals	-0.374	0.22	0.09
Sex dummy	2.429	3.036	0.424
Marital dummy	-15.93	2.72E+04	1.00
Age of respondent	0.065	0.217	0.764
Dummy free range	0.891	4.388	0.839
irradiation dummy	4.226	70.137	0.952
Constant	16.992	2.72E+04	1

Cox & Snell R square = 0.57, Nagelkerker R square = 0.81

Cox & Snell R square = 0.57, Nagelkerker R square = 0.81

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Definition of Variables: Dummy for poultry litter irradiation, 1 for yes and 0 otherwise as dependent variable, Do you know of irradiation dummy, 1 for yes and 0 for no, Hrs = Number of hours animal graze Sex dummy, 1 for male and 0 for female, Msd = Marital status dummy, 1 for married 0 for otherwise, Dummy for free range, 1 for preference, 0 for otherwise, Edudm = Education dummy, 1 for JHS and 0, otherwise as independent variables.

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### 3.3.1 Discussion of Logit Regression Model Results

The coefficient for grazing time ~~wasis~~ negative, indicating a minimal decrease in the likelihood of adopting irradiated poultry litter as grazing time increases. However, the magnitude of the effect is negligible due to the coefficient being close to zero. With a p-value of 0.988, this variable does not significantly influence the adoption decision. This result is consistent with the findings of Shiyani et al. (2002), who suggested that while time spent grazing is part of livestock management, it may not be a key determinant in the adoption of feeding technologies like irradiated poultry litter. This could be because farmers relying heavily on grazing might not prioritize additional feed solutions.

The negative coefficient (-0.374) implies that as the number of animals increases, farmers are less likely to adopt irradiated poultry litter. This may be due to the increased logistical challenges and costs associated with scaling the use of such feed innovations across larger herds. Although the p-value (0.09) is slightly above the traditional threshold of significance (0.05), it suggests a trend worth considering. Wabbi, Taylor, and Kasenge (2006) found that larger farms tend to face more barriers when adopting new technologies, as they often need to account for greater financial and operational risks. Akinola (1987) also highlighted that larger-scale operations introduce complexities, which can deter farmers from experimenting with untested feed solutions.

A positive coefficient for the sex dummy suggests that male farmers may be more inclined to adopt irradiated poultry litter. However, with a p-value of 0.424, this finding is not statistically significant. Feder and Shade (1985) similarly found that gender differences in agricultural technology adoption do exist, though they may not always be pronounced. In many agricultural contexts, men might have more access to resources or decision-making power, potentially influencing their likelihood to adopt new technologies. Nonetheless, the high p-value in this case reflects the complex and often context-dependent nature of gender influences on technology adoption.

The extremely negative coefficient and large standard error for the marital status dummy indicate that marital status does not have a meaningful effect on the decision to adopt irradiated poultry litter in this context. With a p-value of 1.00, the effect is statistically insignificant. This contrasts with findings by Bamire and Manyong (2003), who suggested that in certain contexts, marital status could play a role in adoption decisions due to factors like joint decision-making within households and access to pooled resources. The large standard error could imply that marital status is either uniform within the sample or is not an important factor in this particular analysis.

The positive coefficient suggests a slight increase in the likelihood of adoption with increasing age, though the effect is not statistically significant, with a p-value of 0.764. This suggests that age does not play a major role in determining whether a farmer adopts irradiated poultry litter. Shiyani et al. (2002) found that age often yields mixed results in adoption studies. Older farmers may be more resistant to change due to established routines, while younger farmers might be more open to experimenting with new technologies. In this case, age does not appear to significantly impact decision-making, potentially reflecting an overall acceptance or rejection of the technology across age groups.

The positive coefficient for the free-range dummy indicates that farmers engaged in free-range livestock practices may be more likely to adopt irradiated poultry litter. However, the high p-value (0.839) shows that this effect is not statistically significant. This finding aligns with Wabbi, Taylor, and Kasenge (2006), who highlighted that the specific farming system

(e.g., free-range versus intensive) might not be as important in adoption decisions as other factors, such as feed cost and ease of use. Farmers in free-range systems may already rely on natural foraging, which could explain why feed supplements like irradiated poultry litter are not a primary consideration.

The large positive coefficient suggests that awareness or knowledge of irradiation might increase the likelihood of adoption. However, the p-value of 0.952 indicates that this effect is not statistically significant. Akinola (1987) pointed out that knowledge and awareness are crucial for technology adoption. In this case, the high p-value suggests that awareness of irradiation alone is insufficient to drive adoption; other factors, such as cost, perceived benefits, and access to the technology, may also play a critical role. This highlights the need for better education and information dissemination about the advantages of using irradiated poultry litter.

The constant term has a large coefficient and a p-value of 1.00, indicating no practical significance. In many statistical models, the constant term represents the baseline likelihood of adoption when all other variables are held at zero. In this case, its lack of significance suggests that the baseline likelihood is not a key consideration in explaining adoption behavior. This finding is consistent with other studies where the constant often has limited interpretative value (Feder & Shade, 1985).

The Cox & Snell R square of 0.57 and Nagelkerke R square of 0.81 indicate that the model explains a substantial portion of the variability in adoption decisions. The Nagelkerke R square, in particular, suggests a strong model fit, implying that the variables included in the analysis capture the key factors influencing adoption decisions. However, as Bamire and Manyong (2003) noted, additional unmeasured factors, such as access to credit, extension services, and market infrastructure, could also play significant roles in technology adoption and may need to be explored further in future studies.

## **4. SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **4.1 Summary**

This study presents findings from interactions and interviews with 125 farmers regarding their understanding, experience, and views on using poultry litter as a feed supplement for livestock. Data were gathered from four districts: Ga East District (64% of respondents), Cape Coast Metropolitan Assembly (20%), Akwapim South (8%), and Kpando District (8%). The high representation from Ga East District reflects the area's active livestock farming industry, particularly with small ruminants, and the increasing exploration of poultry litter as a cost-effective feed alternative.

Respondents were primarily middle-aged, with an average age of 44.1 years and a male majority (68%). Married individuals constituted 88% of respondents, which aligns with previous studies showing that married farmers are more likely to adopt new technologies to enhance family welfare. Family size was also examined, with an average of four children per household. Farmers with larger families were more inclined toward adopting sustainable practices like poultry litter supplementation to support food security and financial stability.

Education levels among respondents varied, with 36% having completed junior high school and 8% reaching tertiary education. Education played a notable role in technology adoption, as more educated farmers tended to better understand and accept poultry litter as a feed. The majority of respondents identified as Christian (76%), with Muslims making up 24%. Livestock farming was the primary occupation (96%), with some farmers engaging in additional income-generating activities like trading, driving, and construction work, illustrating the common diversification among rural farmers to manage financial risks.

Knowledge of poultry litter was limited, with most farmers associating it with fertilizer use rather than feed supplementation. Only about 25% had experience using poultry litter in livestock feed, but many showed interest in using irradiated poultry litter, which is pathogen-free and can improve animal growth. However, concerns about bacterial contamination and residual antibiotics were common among respondents unfamiliar with irradiation technology.

Despite this, 80% expressed a willingness to consider using irradiated poultry litter after receiving adequate education on its benefits and safety.

Farmers' responses to the potential affordability of poultry litter as a feed supplement were mixed. While 52% believed it would be cheaper than other feeds, 40% cited logistical issues as a barrier. Many were open to recommending poultry litter to other farmers if cost-effective supply chains were established. Farmers noted that a high-protein supplement like poultry litter could decrease their reliance on traditional, less nutritious feed sources such as cassava husk, which could reduce the time needed for free-range grazing and improve livestock productivity.

Results also indicated that the likelihood of adopting poultry litter as a feed supplement decreased as herd size increased, suggesting logistical challenges with large herds. Farmers with smaller herds seemed more open to adoption due to the manageable volume of feed required.

#### **4.2 Conclusions**

The study reveals that while farmers exhibit limited initial knowledge of poultry litter as a livestock feed, there is notable openness to adopting it, particularly if safety, nutritional benefits, and affordability are clearly demonstrated. The limited understanding of irradiation technology presents a hurdle, but targeted educational initiatives could address these concerns and potentially improve acceptance rates.

Farmers expressed both practical and logistical concerns, particularly regarding large-scale adoption, yet interest remains strong in finding affordable, nutritious feed supplements to improve livestock productivity. Addressing logistical challenges and providing necessary support could enhance poultry litter's viability as a sustainable option for livestock feed in these communities. This study highlights the importance of continued research, education, and collaboration among stakeholders to integrate poultry litter safely and effectively into livestock feeding practices in Ghana.

#### **4.3 Recommendations**

It is recommended that targeted educational campaigns be conducted to raise awareness among farmers regarding the nutritional benefits, cost-effectiveness, and safety of using poultry litter as livestock feed. Disseminating this information through agricultural extension programs, local media, and farmer workshops could address knowledge gaps effectively.

It is also recommended that the benefits of irradiation technology be highlighted, as this process significantly enhances the safety of poultry litter by eliminating pathogens. Establishing demonstration sites can further build confidence among farmers and promote wider adoption.

To address logistical challenges, it is recommended that accessible supply chains for poultry litter be developed. Collaborations with local businesses can enable efficient distribution, making poultry litter a feasible option for more farmers.

Incentives or support systems, such as bulk delivery options or subsidies, are recommended to encourage adoption, particularly among farmers with larger herds. Such strategies could help overcome logistical challenges and support large-scale livestock producers.

Finally, further studies are recommended to evaluate the long-term impacts of poultry litter on livestock health and productivity. Continuous research and development can guide policies and foster confidence in poultry litter as a sustainable and reliable feed option for livestock farming.

#### **DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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**Comment [PS12]:** References are very poorly written. In most of the references, volume and page number is missing.

Many references are double. Even if they are different with same author name then a, b etc should be used for identification.

**Comment [PS13]:** Which one is right? Both are Akinola 1987

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