QUALITY EVALUATION OF ALTERNATIVE LITTER MATERIALS AND THEIR EFFECTS ON PERFORMANCE OF BROILER CHICKEN IN HUMID TROPICAL ENVIRONMENT.

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Abstract
Feeding trial was conducted for eight-weeks to evaluate the quality of alternative litter materials and their effects on the performance of broiler chicken in a humid tropical environment. One hundred and twenty Ross 308 day-old-chicks (broilers) were used for the experiment. There were three treatment groups namely T_1 (Wood Shaving) T_2 (Groundnut Husks) and T_3 (Coconut Husks). Each treatment had four replicates, R_1, R_2, R_3 and R_4. Forty birds were allotted to each treatment group with each replicate having ten birds in a completely randomized design (CRD).
At the starter phase, the birds were placed under the same management conditions with difference only in litter materials. After four weeks of feeding trial, results of starter performance parameters showed no significant differences (P> 0.05) among treatment groups in average initial weight, average final weight, average body weight gain, average feed intake and feed conversion ratio (FCR). Results of economics of production showed no significant differences (P>0.05) among treatment groups in feed cost, cost of feed consumed and feed cost per Kg weight gain. Also at the finisher phase, the birds were kept under the same management conditions with difference only in litter materials. Similarly, statistical analysis (analysis of variance, ANOVA) which was carried out during the starter phase was also done at the finisher phase. Results of finisher performance parameters showed no significant differences (p>0.05) among treatment groups in average initial body weight, average final body weight gain, average feed intake and feed convention ratio. Finally, the physico-chemical properties of the litter materials were determined throughout the experiment. It was concluded that the alternative litter materials-groundnut husks and coconut husks can conveniently be used for broiler production.

Keywords: Feeding trial; performance; broiler chicken; litter materials.

Introduction

In confinement or intensive rearing of poultry, litter materials are used as bedding and fecal moisture absorbent materials, giving rise to the term deep litter production system (Oluyemi and Roberts, 2000). The used litter is made up of poultry droppings, spilled feed, feathers and bedding materials (Anisuzzaman and Chowdhury,1996).Under this production system, breeders and broilers are raised exclusively on deep litter system (Durojaiye *et al.,* 1991; Embury, 2004), while laying birds may be raised on battery cages (Oluyemi and Roborts, 2000). It is the concern on how to manage poultry waste under intensive production systems that led to the introduction of suitable poultry bedding and moisture absorbents called litter material (Asaniyan *et al.,* 2007). Such bedding and moisture absorbent materials can therefore, significantly affect growth performance and carcass quality of broilers (Bilgili *et al.,* 1999). Musa *et al.* **(**2012) also reported that as cage system becomes more and more unethical because of animal welfare concerns, and wood shavings and saw dust become increasingly used to manufacture other wood products in Nigeria, their demand and price will magnify.
Dafwang (1990) reported periodic shortage in wood shavings availability due to demand from increasing number of poultry producers. Field observations however show that availability of wood shaving as a by-product of wood processing industry is presently being limited by dwindling forest reserves, attempts to divert it into other beneficial wood products processing and higher demand due to increasing population of poultry on deep litter.

The objectives of the study were to;

- **i.** evaluate the suitability of coconut husk and groundnut husks as litter materials for broiler chicken production.
- **ii.** determine the physicochemical characteristics of litters from the use of coconut husk and groundnut husks in broiler production.
- **iii.** determine the growth performance of broiler chicken raised on coconut husk and groundnut husks.

Materials and Methods

The Study Area

The work was carried out at Poultry Unit of Federal University of Technology, Owerri Teaching and Research Farm, Imo State, South East, Nigeria.

Study Outlay

The study was divided into 1 and 2. Study 1 determined the physico chemical characteristics of coconut husk and groundnut husks as litter materials, while study 2 determined the effect of coconut husk and groundnut husks on the growth performance of broiler chicken.

Study 1: Determination of physico chemical characteristics of coconut husk and groundnut husks as litter materials

Collection and processing of Litter Material: Coconut husk was obtained from coconut sellers in Orji, Owerri North and Afor Obazu Mbieri Market in Mbaitolu Local Government Area Imo State. Wood shavings were obtained from timber dealers at Naze Timber Market, Owerri North. Groundnut husks were obtained from Mgbidi in Oru West L.G.A Imo State. The coconut husk was manually chopped to extract the fibres which were used as litter materials.

Analysis of Litter Quality: The following qualities were analyzed from wood shaving, coconut husk, and groundnut husks:

Moisture analysis: Moisture was determined through moisture litter analysis using the method of Association of Official Analytical Chemist (AOAC 2006).

Dry matter analysis: Determination of dry matter was easily calculated once the moisture content has been determined. The dry matter was also determined using (AOAC 2006).

Fibre: Fibre analysis was done using Association of Official Analytical Chemist Procedures (AOAC 2006).

Ash: Determination of ash content: This was done using Association of Official Analytical Chemist method of Analysis (AOAC 2006).

Bulk density: The method described by Makinde and Sonaiya (2007) and modified by Omede (2010) was adopted.

Water Holding Capacity: The filtration method described by Makinde and Sonaiya (2007) was adopted with slight modification (Omede, 2010).

Determination of P^H of the Litter material: The P^H was determined with the aid of a pH meter (HANNA Combo pH Meter, Model: HI 98129). It is a measure of hydrogen ion activity in solutions.

Study 2- Determination of Effects of Coconut Husk and Groundnut Husks as Litter Materials on Growth Performance of Broiler Chicken

Experimental Site

The experiment was carried out at the poultry unit of Federal University of Technology, Owerri teaching and research farm. The laboratory analysis was carried out in the Department of Animal Science Laboratory, Michael Okpara University of Agriculture, Umudike, Abia State.

Treatment materials: The litter / treatment materials were wood shaving, coconut husk and groundnut husks.

Source of Feed Ingredients: Feed ingredients were purchased from reputable dealers in Owerri, Imo State, Nigeria.

Procurement and Management of Experimental Broiler Birds

Two weeks before the arrival of the chicks, the brooding pens were thoroughly scrubbed, cleaned and disinfected with Izal and left empty. Three days to the arrival of the chicks, litter materials were spread on the floor to the depth of 2cm. The materials needed for the brooding and rearing such as drinkers, electric bulbs, feeders, etc. were put in place. On the day of arrival, the brooding pens was heated two hours before the arrival of the chicks to avoid cold shock. Water and feed were provided immediately.

Experimental Birds and Design

One hundred and twenty (120) broilers were placed in an open-sided, concrete-floor and natural ventilated broiler house. Three pens were used for treatments 1, 11, and 111 with forty birds in each treatment. Each treatment was replicated four (4) times with ten (10) birds in each replicate in a completely randomized design. Except for the type of litter, all birds had a common environment. The pens were equipped with identical number of feeders and drinkers.

Data Collection

Determination of Growth Performance: The initial live weights of the birds were recorded at the beginning of the experiment and subsequent weighing was done weekly on individual basis in the morning hours (7.00 - 9.00 am) till end of the experiment. Weekly weight gain was obtained by subtracting the initial live weight from the current weekly live weight. Feed intake was determined on a daily basis by subtracting the weight of the leftover feed from the weight of the feed initially offered. Feed conversion ratio (FCR) was calculated by dividing the total feed intake by final weight gain while the feed efficiency was derived as the inverse of the FCR. The mortality was evaluated by subtracting number of live birds from the initial total of birds used for the study. This was done at the end of the experiment. Pathological lesions were investigated by visual observation means.

Data Analysis

The data collected were subjected to analysis of variance (ANOVA) and differences between the treatment means were compared using the Duncan's Multiple Range Test using Statistical Package for Social Sciences (SPSS) User's Guide, Version 20.00 (SPSS, 2012).

Results and Discussion

Results of Physicochemical Properties of Litter Materials

Results of Physicochemical Properties of Litter Materials are shown in Table 1 (before experiment) and Table 2 (after experiment).

Moisture has been identified as an indicator of a suitable litter material as reported by Brake *et al.*

(1992). Litter moisture increased significantly from initial values in all the treatment; as a result of increased deposition of waste and accumulation of moisture from birds respiration.

The P^H of all litter types increased significantly during the experiments, at the end of which all litter had similar P^H values. These data were in agreement with the findings of Huff *et al*. (1984) who reported a maximum litter P^H value of approximately 8.0 after a 7 week broiler experiment .One week additional fecal build up had little effect on P^H as reported by Brake *et al*. (1993). However, the maintenance of litter P^H below 7 is important in ammonia control in the poultry house because ammonia release increases above P^H 7 and is highest at P^H 8 as reported by Huff *et al.* (1984).

Results of Physicochemical Properties of Litter Materials

Table 1
(Before Experiment)

Parameters	Tl WS	T2 GH	T3 CH	SEM
DM (%)	95.87^a	94.49^b	93.39^C	0.31
Moisture (%)	4.13^C	5.51^b	6.61^a	0.31
Ash (%)	1.86^C	2.10^b	3.88^a	0.27
P^H	7.52	7.34	7.30	0.08
BD(g)	0.39^b	0.41^a	0.36^b	0.09
CF (%)	40.6P	38.92^b	25.54^C	2.03
WHC	2.00^b	1.58^C	3.38^a	0.23

ab means within the same row with different superscripts are significantly different (P<0.05)

Ti= wood shaving, T2 = Groundnut husks, T3= Coconut husks.

DM = DRY MATTER
BD = BULK DENSITY
CF = CRUDE FIBRE
WHC = WATER HOLDING CAPACITY

Results of Physicochemical Properties of Litter Materials

Table 2
(After Experiment)

Parameters	Tl WS	T2 GH	T3 CH	SEM
DM (%)	96.18	94.86	93.76	0.28
Moisture (%)	3.82	5.14	6.24	3.80
Ash (%)	10.68	9.65	15.96	3.74
P^H	7.55	7.48	8.61	3.66
BD (g)	0.42	0.53	2.07	3.96
CF (%)	34.39	29.67	37.07	2.91

WHC	2.32	2.34	4.40	3.88

Ti= wood shaving, T2 = Groundnut husks, T3= Coconut husks.

DM = DRY MATTER
BD = BULK DENSITY
CF = CRUDE FIBRE
WHC = WATER HOLDING CAPACITY

Broiler Trials

Numerous studies carried out by Brake *et al.* 1992, Lien *et al.* (1992), Wyatt.*et al.*, 1992 and Brake *et al.* (1993) in which alternative litter materials were tested have reported that the type of litter material used does not affect bird performances. Results are consistent with those of earlier studies (Brake *et al.* 1992, Lien *et al.* (1992), Wyatt.*et al.* (1992) and Brake *et al.* (1993).

Results of starter performance of broiler chickens are summarized in Table 3.

The birds had the same initial weight among the treatment groups. There was no significant difference ($P>0.05$) among the wood shaving, groundnut husk and coconut husk in all the parameters considered. Average final body weight and average body weight gain are more or less the same.

Feed consumption of the birds reared among the treatment materials was almost the same. However, average feed intake in treatment 1 (wood shaving) was slightly higher than that of treatment 2 (groundnut husk) and treatment 3 (coconut husk). This is in agreement with the findings of Davasgaium et al. (1998) and Karousa et al. (2012).

Table 3: Starter Performance of Broiler Chickens Raised on Litter Materials

Parameters	Tl WS	T2 GH	T3 CH	SEM
Average initial weight (g)	48.00	48.00	48.00	0.29
Average final body weight (g)	800.83	801.08	804.17	10.74
Average body weight gain (g)	752.83	753.08	756.17	10.91
Average feed intake (g)	1709.33	1585.42	1595.96	40.77
Feed Conversion Ratio(FCR)	2.27	2.11	2.11	0.05
Feed cost (₦/kg)	140.00	140.00	140.00	
Cost of feed consumed (N/kg)	239.31	221.96	223.43	5.71
Feed cost per kg weight gain (₦/kg)	317.78	295.65	295.28	7.29
Mortality	1	1	1	

Broiler Trials

Performance of the Finisher Broiler Birds Raised on Litter Material.

Results of finisher performance of broiler chickens are summarized in Table 4.

There was no significant difference (P>0.05) in all the parameters investigated among the treatment groups. Although, the average body weight gain of birds in treatment 3 (coconut husk) is slightly higher than that of treatments 1 and 2. The results of average feed intake, feed conversion ratio, feed cost and mortality are more or less the same among the treatment groups.

Litter type had no significant influence on the body weight, feed intake, feed conversion ratio (FCR), feed cost and mortality.

Table 4 Finisher Performance of Broiler Chickens on Litter Materials

Parameters	Tl WS	T2 GH	T3 CH	SEM
Average Initial weight (g)	800.83	801.08	804.17	10.74
Average Body weight (g)	1846.03	1788.98	1975.40	98.06
Average Body weight gain (g)	1045.20	987.90	1171.23	95.16
Average feed intake (g)	3851.98	4008.54	4036.98	113.62
Feed Conversion Ratio (FCR)	3.69	4.06	3.45	0.38
Feed cost (₦/kg)	143.33	143. 33	143.33	-
Cost of feed consumed (₦/kg)	552.12	574.56	578.63	16.29
Feed cost per kg weight gain(₦/kg)	552.84	672.85	507.17	55.07
Mortality	1	1	1	

Conclusion and Recommendation

It can therefore be concluded that:

Groundnut husks and Coconut husks can serve as alternative litter materials for broiler chicken production.

All the alternative litter materials tested did not statistically affect bird performance, feed intake, body weight or mortality rates and their use did not contribute to a higher incidence of defects in live animals.

Litter moisture content, P^H. bulk density, fibre, ash, dry matter and water holding capacity did not show any consistent effect associated with a specific material.

It is recommended that litter materials such as groundnut husks and coconut husks should be used as alternative litter materials for poultry production under dry condition. Also, the coconut husks should be properly chopped before use.

References

A.O.A.C. (2006). Association of official Analytical Chemist. Official method of Analysis (W.Horwitz, Editor). 20th Edition. Arlington VA, U.S.A.

Anisuzzamaan, M. and Chowhury, (1996). Use of four types of litter for rearing broilers. *Poult. Sci.*, 37:541-545.

Asaniyan, E.K., Agbede, J.O. and Laseinde, E.O.A. (2007). Impact assessment of different Jitter depths on the performance of broiler chicken raised on sand and wood shaving litters. *World Poult. J.* 2001., 2:67-72.

Bilgili, S.E., Montenegro, G.I., Hess, J.B. and Eckman, M.K (1999). Sand as litter for rearing broiler chickens. *J. Appl.Poult. Res.* 8: 345 - 351

Brake, J. D., Boyle, C. R., Chamblee, T. N., Schultz, C. D. and Peebles, E. D. (1992).Evaluation of the chemical and physical properties of hard wood bark usei as broiler litter material. Poultry Sci. 71: 467-472.

Dafwang I.I. (1990). Rural poultry production in Nigeria. A report prepared for the

presidential task force on alternative formulations of livestock feeds (taskforce II: product development, quality evaluation and health implications. Lagos, Nigeria. Pp: 40-47)

Davasgaium, M.M. and Boodoo, A.A., (1998). Litter Management: use of bagasse as a potential source of litter material for broiler production. Insecond Annual Meeting of Agricultural Scientists; 139.

Duncan, D. B. (1955). The Multiple Range and Multiple F Test Biometrics 11:1- 42

Durojaiye, A. O., Ahmed, A. S. and Adene, D. F. (1991). Poultry production in Nigeria. *Trop. Vet.*, 44: 37-38.

Embury, I. S., (2004). Alternative litter materials for poultry. Poultry divisions of Animal production NSW agriculture.

Huff, W. E., Malone, G. W. and Chaloupka, G. W. (1984). Effect of litter treatment on broiler performance and certain litter quality parameters. Poultry Sci. 63: 2167-2171.

Karousa, M.M., Meneeh, I.S., Ahmed, S.A., Ahmed, E.A. and Youseif, H.A. (2012). Effect of litter material on broiler behavior and performance. Benha Veterinary Medical Journal; 23 (1): 142-9.

Lien, R.J., Conner, D.E. and Bilgili. S.F. (1992). The use of recycle paper chips as litter material for rearing broiler chickens. *Poult. Sci.*, 71:81-87

Musa, I.W. and Sai'du, L. (2012). Report of disseminated aspergillosis associated with poor litter in Zaria, Nigeria. *Vet. Clin. Bull J. Vet. Teaching Hospital.*

Oluyemi, J.A. and Roberts, F.A.(2000). Poultry production in warm climate.Spectrum Books Limited, 2nd Rev.Ed, pp: 140-153.

Omede A.A (2010). The use of physical characteristics in the quality evaluation of commercial feeds and feedstuffs. MSc Thesis, Federal University of Technology Owerri, Nigeria. SPSS. Statistical Package for Social Sciences (1996). SPSS/STAT version 7.5 foi windows, 1996.

Wyatt, C.L. and Goodman, T.N. (1992). The utilization of recycled sheetrock (refined gypsum) as a litter material for broiler houses. *Poultry Sci.* 71:1572-1576.