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Evaluation of Different Litter Materials for Broiler Performance, Coccidial Oocyst Population and Level of N, P and K During Winter

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Abstract: The two commonly used litter materials in Bangladesh, wheat straw and sugarcane bagasse were examined for their suitability in broiler rearing. Chicks reared on wheat straw had a significantly higher ($P<0.01$) feed conversion ratio compared with others. Coccidial oocysts counts per gram of litter reached a peak at 5th week, and except a significantly higher ($P<0.01$) count in sawdust litter at 4th week the counts were not different between the groups. The birds were apparently healthy and did not have any physical abnormalities. Nitrogen content of different used litter did not vary significantly ($P>0.05$) but the potassium and phosphorus contents in wheat straw were significantly higher ($P<0.01$) as compared with other litters. Considering the broiler performance sawdust was found to be the best litter, although wheat straw had a better manureal value but with poor broiler performance. Therefore it is suggested that during winter sawdust litter may be used for broiler rearing in Bangladesh.

Key words: Litter, broiler performance, coccidial oocysts and manureal value

Introduction

Litter provides a comfortable environment in floor pen rearing of chicks. Different litter materials like chopped straw, rice husk, sugarcane pulp, oat hulls, corn cobs, ground corn cobs, paper mill by products, sawdust, wood shavings, sand, peat moss etc. have been investigated as to their suitability in broiler rearing in different parts of the world (Oliveira *et al*., 1975; Ranade and Rajmane, 1990). The importance of a good quality litter for floor-reared birds is well recognized, although the performance is unlikely to be severely affected by the type of litters (Brake *et al*., 1993; AL Homidan *et al*., 1997). Moisture content in the litter affects the sporulation and viability of coccidial oocysts (Tomhave, 1949) and therefore it is an important factor in the development of Eimeria infections. Davies and Joyner (1955) reported that the number of litter oocysts in commercial poultry houses is correlated with moisture in the litter. Used litter is a good source of manure for crop production; it provides important essential nutrient elements required by the plant (Rao, 1986). Rice husk and sawdust are the two most commonly used litter materials for broiler rearing in Bangladesh. Although wheat straw and sugarcane bagasse are easily available in Bangladesh, these are not usually used as litter materials in broiler rearing. The cost of these litters mainly depends on their quality and availability, which cost lower in peak and are cheaper in comparison with other litter. The present study was therefore undertaken to investigate the performance of broilers and coccidial oocyst population in different litters, and the manureal (NPK) value of these used litters during winter.

Materials and Methods

Chicks and maintenance: The experiment was carried out at Bangladesh Agricultural University Poultry Farm, Mymensingh for a period of 42 days from 23rd December 1999 to 3rd February 2000. One hundred and sixty eight, seven-days-old Arber Acres chicks divided into four groups were reared on four different types of fresh litter materials (rice husk, sawdust, wheat straw and sugarcane bagasse) at the depth of 5cm. Each group was divided into four subgroups. The pans were cleaned and disinfected with Potassium Permanganate solution. The chicks were given a broiler starter ration for 7 to 28 days and finisher ration for 29 to 49 days and water *ad libitum*. Birds were provided with a temperature of 32^{0}C at second week of age, then reduced gradually at the rate of 2.7^{0}C per week up to 7th week. Chicks were vaccinated against newcastle infectious bronchitis and bursal disease as per recommendation of the manufacturer. For coccidiosis control, DOT ® (3,5-Dinitro-O-Toluamide) was added to the feed at the rate of 0.05kg/100kg feed till the end of the experiment.

Sampling of litter: Litter samples were collected every week from four corners and a central position of each of the pans and then were mixed thoroughly. Half of the samples were used for counting coccidial oocysts and the remaining half was further processed for determination of nitrogen (N), potassium (K) and phosphorus (P).

Litter oocysts count: The number of coccidial oocysts per gram of litter was counted, following the method of Karim *et al*. (1994). Ten grams of litter were soaked in 100ml of water for 24 hours and mixed thoroughly by vigorous shaking in a screw capped bottle and subsequently sieved through a tea strainer to remove the coarse particles. After centrifugation at 1100g for five minutes, supernatant was discarded, the sediment was re-suspended in 100ml of saturated salt solution. Two chambers of McMaster counting slide were filled with the suspension using a plastic transfer pipette and allowed 3 to 5 minutes for floatation of the oocysts before examination. The number of oocysts was counted using a X 6-eye piece and X 10 objective of a compound microscope.

Determination of N, P and K: Nitrogen content was estimated by Kjeldahl method (Banerjee, 1978). For determination of phosphorus and potassium contents, extract was prepared by taking 1g of used litter with 10ml Di-acid mixture heated at 180^{0}C temperature for half an hour and filtrating after cooling and making volume of the filtrate up to 100ml with distilled water. The phosphorus content was determined spectrophotometrically from the prepared extract by developing blue colour of phosphomolybdate complex as described by Jackson (1973). Potassium content of used litter materials was determined with the help of flame emission spectrophotometer (Jackson, 1973).

Table 1: Performance of broilers (7 to 49 days of age) reared on different types of litter materials

Variables	Types of litter					
	Rice husk	Saw dust	Wheat straw	Sugarcane bagasse	SED of means	Statistical results
Live weight (g/bird)	1442.34 ±34.18	1492.69 ±19.53	1426.69 ±6.52	1479.76 ±37.85	22.45	NS
Feed consumption (g/bird)	3337.21 ±144.31	3402.78 ±58.97	3462.11 ±24.20	3397.38 ±101.57	76.60	NS
Feed conversion ratio (FCR) (g food/g gain)	2.45a* ±0.06	2.41a ±0.06	2.58b ±0.01	2.43a ±0.01	0.04	**
Survivability %	95.24 ±4.12	97.62 ±4.12	97.62 ±4.12	100.00 ±0.0	2.91	NS

* Values with different superscripts in the same row are significantly different.
** Significant (P<0.01), NS insignificant (P>0.05) and values indicate mean ± SD

Table 2: Coccidial oocyst population (x10^3) in different types of litter materials

Age in weeks	Types of litter					
	Rice husk	Saw dust	Wheat straw	Sugarcane bagasse	SED of means	Statistical results
2nd	0.020±0.02	0.033±0.04	0.030±0.00	0.043±0.02	0.026	NS
3rd	0.20±0.07	0.177±0.05	0.177±0.11	0.190±0.07	0.063	NS
4th	1.223a* ±0.23	1.753b±0.17	1.033a±0.29	1.133a±0.18	0.181	**
5th	2.977±0.47	3.00±0.42	2.77±0.36	2.453±0.24	0.312	NS
6th	0.877±0.34	0.643±0.14	0.713±0.14	0.743±0.24	0.190	NS
7th	0.333±0.07	0.467±0.12	0.323±0.07	0.357±0.08	0.068	NS

* Values with different superscripts in the same row are significantly different.
** Significant (P<0.01), NS insignificant (P>0.05) and values indicate mean ± SD

Table 3: Manure values (N, P, K) of different litters used

Parameters	Types of litter					
	Rice husk	Saw dust	Wheat straw	Sugarcane bagasse	SED of means	Statistical results
Nitrogen (N) Content (%)	3.486±0.1	3.45±0.1	3.444±0.1	3.413±0.9	0.04	NS
Phosphorus (P) Content (%)	0.875a* ±0.00	0.915a±0.1	1.115b±0.1	0.765a±0.1	0.04	**
Potassium (K) content (%)	0.111a* ±0.00	0.123a±0.00	0.163b±0.00	0.113a±0.1	0.04	**

* Values with different superscripts in the same row are significantly different.
** Significant (P<0.01), NS insignificant (P>0.05) and values indicate mean ± SD

Record on weight gain and feed consumption: The chicks were weighed individually at the end of each week and averaged. A definite quantity of feed was given everyday and the unutilized feeds were weighed to calculate the actual feed consumption. FCR was then calculated by the formula:

$$FCR = \frac{\text{feed consumption}}{\text{body weight gain}}$$

Statistical analysis: The principles of experimental design were in accordance with Steel and Torrie (1980). Completely Randomized Design (CRD) was applied for statistical analysis of data collected for different variables. Significant differences between means were separated by Least Significant Difference (LSD).

Results

The details on production performance of broiler chicks reared on four different types of litter materials are shown in Table 1. Although there were apparent differences in live weight and feed consumption among different groups, these were not significantly (P>0.05) different. However, the FCR in chicks reared on wheat straw was significantly higher (P<0.01) as compared with all other groups, which were not different between them.

The results of litter oocyst counts are shown in Table 2. Very few oocysts were detected in all samples collected at second week. Then the numbers of oocysts were gradually increased and reached a peak at 5th week, then gradually declined. The mean oocyst counts in different litters were not significantly (P>0.05) different except at 4th week when sawdust litter contains significantly higher (P<0.01) oocysts as compared with three other litters. However in all cases the number of oocysts in litter remained lower and was not enough to produce clinical coccidiosis. The chicks also had no leg abnormalities or breast blister during the experimental period. The details on nitrogen, phosphorus and potassium content of different used litter have been shown in Table 3. Nitrogen content in different used litters did not vary significantly (P>0.05). But both the phosphorus and potassium contents in wheat straw were significantly higher (P<0.01) as compared with all other litters.

Discussion

The performance of broilers reared on different conventional litter materials is unlikely to differ significantly. Lack of difference in live weight gain of broilers reared on different

litter materials was not unexpected. This is in agreement with the findings of Anisuzzaman and Chowdhury (1996) and Oliveira *et al*. (1975). Similarly lack of significant difference in feed consumption among the different groups is in agreement with the findings of Martinez and Gernat (1995) and Lien *et al*. (1992). Lack of significant difference in FCR of chicks reared on rice husk, sawdust and sugarcane bagasse is contradictory with the findings of Anisuzzaman and Chowdhury (1996), who reported that FCR value on rice husk was higher than those on sawdust, chopped straw and sands in a study conducted during summer. Absence of leg abnormalities and breast blisters in chicks is in agreement with the findings of Haque and Chowdhury (1994). This suggests that types of litter had no direct effect on the physical health of the birds. The number of oocysts per gram of litter from different groups was generally lower than the figures reported earlier by Mizu *et al*. (1998). The pattern of coccidial oocysts population at different chicks is in agreement with the results of Karim *et al*. (1994) and Mizu *et al*. (1998).

Despite vigorous cleaning there has always been few residual oocysts on the floor to initiate the infection. In the absence of chemoprophylaxtis these residual oocysts after recycling can lead to clinical coccidiosis with eventual fatality. The chemoprophylactic regime using DOT in the feed successfully controlled the occurrence of coccidiosis. However the small number of oocysts detected in all groups was due to leakage. Even with the best anticoccidial drugs a proportion of the parasites managed to complete the life cycle. Similar result was also reported by Mizu *et al*. (1998) from their winter study and Haque and Chowdhury (1994) from their summer study.

Significantly higher phosphorus and potassium content in used wheat straw litter is in agreement with the findings of Allison and Anderson (1970), who found that wheat straw contained more P_2O_5 and K_2O than sawdust. The significantly higher phosphorus and potassium content might be due to a relatively higher fermentation and decomposition rate of wheat straw, which is responsible for higher rate of absorption of phosphorus and potassium from broiler droppings. Considering the production performances, especially the FCR value, rice husk, sawdust and sugarcane bagasse are better than wheat straw. On the other hand considering the manureal value wheat straw was the best, but the over all performance was poor. Sawdust is the cheapest compared with other litters. Utilization of used poultry litter for increasing the fertility of soil for crop production will be an excellent idea. This will also minimize the environmental hazards created by dumping of litters here and there. But before recommending the wide scale use of the used litter it is necessary to examine the possibility of any negative effect on soil fertility. After careful investigation, wheat straw litter proves to be beneficial in crop production compared with other used litters. It can be recommended as the litter of choice for broiler production. But before that it is suggested that during winter sawdust litter may be used for broiler rearing in Bangladesh.

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References

AL Homidan, A., J. F. Robertson and A. M. Petchey, 1997. Effects of temperature, litter and lighting intensity on ammonia and dust production and broiler performance. British Poult. Sci., 38:55.

Allison, F. E. and M. S. Anderson, 1970. The use of sawdust for Mulches and Soils Improvement, U. S. D. A. Cir. 891-1951.

Anisuzzaman, M. and S. D. Chowdhury, 1996. Use of four types of litter for rearing broilers. British Poult. Sci., 37: 541-545.

Banerjee, G. C., 1978. Animal Nutrition. Oxford & IBH Publishing Co., New Delhi, 518-521.

Brake, J. D., M. J. Fuller, C. R. Boyle, D. E. Link, E. D. Peebles and M. A. Latour, 1993. Evaluation of whole chopped kenaf and kenaf core used as a broiler litter material. Poult. Sci., 72: 2079-2083.

Davies, S. F. M. and L. P. Joyner, 1955. Observations on the parasitology of deep litter in poultry houses. Vet. Record. 67: 193-199.

Haque, M. I. and S. D. Chowdhury, 1994. Use of rice husk litter at different depths for broiler chicks during summer. British Poult. Sci., 35: 809-812.

Jackson, M. L., 1973. Soil Chemical Analysis. Printice Hall of India Private Limited, New Delhi, 106-190.

Karim, M. J., N. Begum and M. S. R. Khan, 1994. Prevalence of coccidiosis in broilers on two farms in Bangladesh. Pak. J. Sci. Ind. Res., 37: 339-341.

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

Long, P. L. and J. G. Rowell, 1974. Sampling Broiler House Litter for Coccidial Oocysts. British Poult. Sci., 16: 583-592.

Long, P. L., R. V. Tompkins and B. T. Millard, 1975. Evaluation of infection by the examination of broiler house litter for oocysts. Avian Pathol., 4: 287-294.

Martinez, D. F. and A. G. Gernat, 1995. The effect of chopped computer and bond paper mixed with wood shavings as a litter material on broiler performance. Poult. Sci., 74: 1395-1399.

Mizu, M. M. R., S. D. Chowdhury, M. J. Karim and S. C. Debnath, 1998. Influence of rice husk litter on broiler performance, litter dampness and its coccidial oocysts population during winter. Asian Australian J. Anim. Sci., 11: 450-454.

Oliveira, S. C., A. C. L. Cavalheiro, D. S. Trindade and J. Lopez, 1975. Comparison between types of litter in broiler production in Rio Grandedo Sue, Brazil. Poult. Abst., 1: 300.

Ranade, A. S. and B. V. Rajmane, 1990. Comparative study of different litter materials for poultry. Poult. Adviser, 13: 21-26.

Rao, V. S. R., 1986. Litter- It's Management and Utility in Broilers. Poult. Adviser of July, 31-36.

Steel, R. G. D. and J. H. Torrie, 1980. Principles and procedures of statistics. McGraw Hill book Co. London.

Tomhave, A. E., 1949. Effect of litter moisture on outbreaks of coccidiosis. Annals of New York Academy of Sciences, 52: 460-463.