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Saw Dust and Refuse Tea as Alternative Litter Materials for Broilers

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ABSTRACT. *Bird performance, carcass quality and welfare are affected by the litter quality. Objective of this study was to evaluate the suitability of saw dust (SD) and refuse tea (RT) as alternative litter materials for paddy husk (PH) for broiler chicken. Day old chicks were brooded on paddy husk based litter in an electric brooder upto day 14 and fed on a commercial broiler starter diet until day 23. On day 23, birds (n = 216) were weighed, divided into 18 groups of 12 birds and randomly allocated into 18 floor pens (1.47m^2). Each of the three different litter materials (PH, SD and RT) was applied to six pens. A commercial broiler finisher feed and water were given ad libitum until day 42. Birds were weighed on day 23, 30, 36 and 42. Scoring technique was used to evaluate the hook burning damage and cleanliness of the birds. On day 42 one bird was randomly taken from each cage, sacrificed and dissected to determine the crop contents. Chick mortality was 0, 2 and 3% for RT, SD and PH litters, respectively. Growth performance parameters such as live weight on day 42, weight gain, feed intake and feed conversion ratio were not significantly ($p>0.05$) affected by the type of litter material. Birds reared on RT and PH showed significantly better cleanliness scores than those on SD. Hook burn damage was significantly low when broilers reared on SD and PH than when they were reared on RT. Birds raised on all three litter materials were healthy and dissection showed no abnormalities in organs. Litter moisture contents were also not affected by the type of litter. Regardless of the litter type, the average moisture content varied from 43 - 58%. Litter pH values were also not affected by the kind of litter and were alkaline. The N% of the RT litter on 42 day (6.7%) was significantly higher ($p>0.0001$) than that of SD (3.3%) and PH (3.7%). It was concluded that both SD and RT could successfully be used as alternative litter materials for PH. Higher N content in RT based litter may be advantageous as an organic fertilizer and ruminant feed.*

INTRODUCTION

Quality of chicks, feed and water are all of great concern to broiler producers but quality of litter in broiler houses is seldom given sufficient emphasis. Since birds are in continuous contact with litter, litter conditions directly influence broiler performance, behaviour, welfare and carcass quality. Casey *et al*. (2005) defined the litter as combination of bedding material, excreta, feather, wasted feed and wasted water.

An effective bedding material must be an absorbent, lightweight, inexpensive and non-toxic. Ideal materials will have moisture absorption and release qualities to minimize litter caking. In addition, a bedding material must be compatible as a fertilizer or soil amendment after it has served its purpose in the broiler house (Casey *et. al.,* 2005).

A range of materials such as wood shavings (Brake *et al*.,1992), shredded paper (Griffith, 1993), saw dust, corn cobs (Chaloupka *et al*., 1967), recycled paper (Lien *et al*., 1992), paddy husk (Hester *et al*., 1987, 1985), refined gypsum (Wyatt and Goodman, 1992) and leaves (Willis *et al*., 1997) has been used as bedding.

Under Sri Lankan conditions, paddy husk (PH) is probably the most popular litter material for poultry. The physiochemical properties of PH make it an ideal litter material for poultry (http://www.agric.nsw.gov.au/reader/poultry/alt-litter). However, PH is now highly demanded by other industries mainly to be used as a fuel. Saw dust (SD) is a by product of timber industry. Disposal of SD has become a problem for the industry and indiscriminate disposal of the same has become an environmental problem in some areas of the country. Refuse tea (RT) is a by product of black tea manufacturing process. Disposal of RT has also become a problem for tea industry. It was hypothesized that both SD and RT could be used as alternative litter material for poultry in place of commonly used PH. Objective of the present experiment was to evaluate the suitability of SD and RT as an alternative to PH.

MATERIALS AND METODS

Assessment of chick performance

Day old broiler chicks (Indian River) were obtained from a local commercial hatchery. Chicks were brooded until 14 days on an electric floor brooder and fed with commercial broiler starter diet. Eighteen cages (1.47m^2) either with PH, RT or SD litters were arranged so that each treatment had six replicates. On the day 23, chicks were weighed and 12 birds were allocated into each cage. Each cage was provided with a feeder and a bell-shaped drinker. During day 23 - 42 birds were fed with commercial broiler finisher diet *ad libitum.* Daily feed intake was recorded. Light was continuous. Birds were weighed on day 23, 30, 36 and 42 and sacrificed on the day 42. On the 42nd day, one bird was randomly taken from each cage and crop contents were examined for the presence of RT, SD and PH particles. Hook burning damage and cleanliness were determined by using a score scale.

Analysis of litter materials

RT, PH and SD (mainly *Albezea* spp.) were first analyzed to determine their moisture content, pH, water absorbability and bulk density (BD) as previously described by Brake *et al.* (1992). Thereafter, three random litter samples were taken from each cage using a core-sampler on day 30, 36 and 42 for the determination of the BD (Brake *et al.* (1992), moisture content (at 105^{o}C for 24 hrs) and nitrogen contents (AOAC, 1990).

Statistical analysis

Data were analyzed by using GLM procedure of SAS (1995). Pen means served as replicates in the analysis of performance criteria [live weight, weight gain, feed intake and feed conversion ratio (FCR)] and litter quality data. For carcass data, individual birds dissected served as replicates giving six replicates for each treatment. Effects were considered statistically significant at $P<0.05$. Score analysis was done by Kruskal-Wallis test of Minitab package.

RESULTS AND DISCUSSION

Effect of litter on zootechnical parameters

The average final live weight gain, feed intake, feed conversion ratio (FCR), and mortality of birds in the different treatments are shown in Table 1.

Table 1. Bird performance parameters with different type of litter materials

Parameter	Litter type		
	Refuse Tea	Saw Dust	Paddy Husk
Mortality (%)	0	2±3.8	3±4.2
Live weight (g)			
Day 23	633±53*	616+49	626+29
Day 30	1260±100	1209±124	1225±80
Day 36	1754±93	1674±131	1683±80
Day 42	2115±103	2159±107	2067±145
Weight gain (g) Day 23-42	1482±77	1543±153	1441±218
Feed intake (g/bird/day)			
Day 23 - 42	125±5	130±7	123±6
Feed conversion ratio	1.7±0.12	1.72±0.04	1.74±0.09

Note: *Mean±SD.

Chick mortality was 0 for RT litter whereas it was 2 and 3% for SD and PH, respectively, which were within acceptable limits. There was no significant difference between weight gain, final live weight and FCR among treatments. Hence, type of litter did not have any significant effect on performance. Previous studies (Brake *et al.*, 1992; Lien *et al*., 1992; Wyatt and Goodman, 1992; Peacock *et al.*, 1984) have also reported that growth performance were not affected by the type of litter used. Visible health problems, abnormalities or behavioral changes were not observed with any of the litter type. These findings are in accordance with those of Brake *et al*. (1992), Lien *et al*. (1992) and Willis *et al*. (1997). The dressing % and weights of liver and the gizzard were also not affected by the type of litter.

Though water intake was not significantly affected by the type of litter, in general the water intake per bird was comparatively higher than the values reported by NRP (1994). Many authors (Nickolson *et al*., 2004; Tucker and Walker, 1992) have reported that spillage of water from bell drinkers was higher than the nipple drinkers. In addition, higher ambient temperature with high relative humidity might have increased the water intake. Effect of type of litter on cleanliness and hook burning damage of birds are shown in Figures 1 and 2.

Birds that were reared on SD litter showed significantly higher cleanliness score compared to those reared on RT and PH. As SD consists of fine particles they may mix well

and cover the feacal materials produced. Similarly hook burning damage was significantly less with SD ($p<0.001$) than with RT and PH (Figure 2).

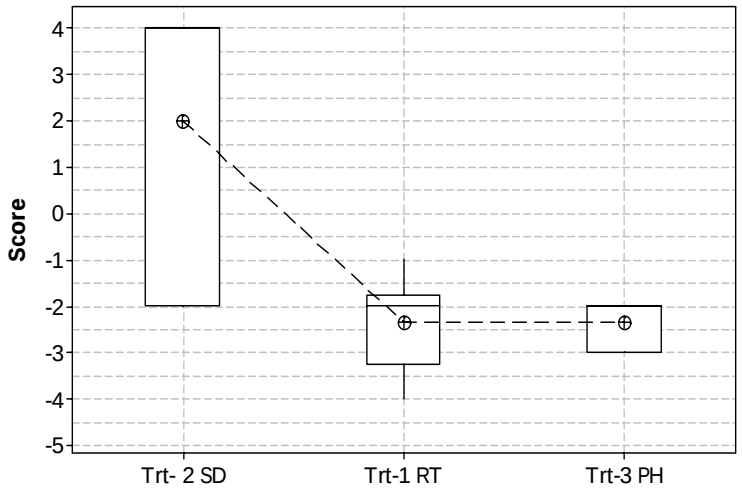

Figure 1. Effect of type of litter on birds cleanliness.

Note: 4:very clean, 2: clean, -2: dirty , -4: very dirty. SD: saw dust, RT: refuse tea, PH: paddy husk.

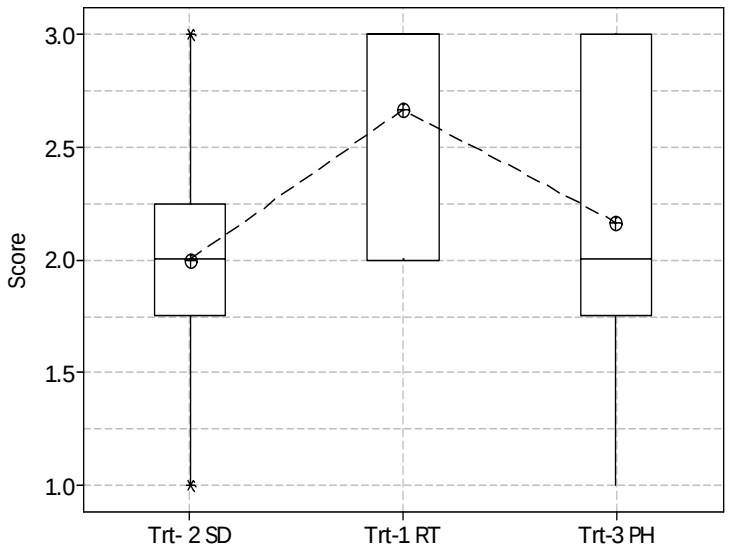

Figure 2. Effect of type of litter on hook burning damage of birds.

Note: 1: no damage, 2: moderate damage, 3: high damage. The reason for the less hook burning damage with SD may be due to the smaller particle size and softness of SD.

Physical and chemical analysis of alternative litter materials

Physical and chemical characteristics of RT, SD and PH are shown in Table 2.

Table 2. Physical and chemical characteristics of different litter materials on fresh matter basis.

Litter Material	Litter Type		
	Refuse Tea	Saw Dust	Paddy Husk
Temperature (^oC)			
Day 30	30.9±0.6*	31.2±0.8	31.3±0.3
Day 36	32.4±0.8	31.8±0.6	32.8±1.0
Day 42	32.5±0.8	32.4±0.4	33.0±0.8
Moisture %			
Day 30	43.7±3.7	55.8±0.34	57.5±4.0
Day 36	53.3±7.6	53.7±3.5	54.5±9.0
Day 42	57±4.8	56.2±2.9	58.5±8.0
pH			
Day 30	8.4±0.16	8.5±0.16	8.6±0.15
Day 36	8.7±0.13	8.6±0.13	8.7±0.07
Day 42	8.6±0.17	8.6±0.13	8.7±0.10
Bulk density (kgm^{-3})			
Day 30	$153±20^{b}$	$196±18^{a}$	$121±14^{c}$
Day 36	198±46	168±35	184±65
Day 42	$225±56^{ba}$	$250±11^{a}$	$187±38^{b}$
Litter N %			
Day 30	$7.3±0.8^{a}$	$2.5±0.9^{c}$	$3.7±0.3^{b}$
Day 36	$6.6±0.7^{a}$	$2.3±0.4^{b}$	$2.9±02^{b}$
Day 42	$6.7±0.9^{a}$	$3.3±0.3^{b}$	$3.7±0.3^{b}$

Note: * Mean±SD, Means within the raw followed by different letters are significantly different at $p<0.001$ for bulk density and $p<0.0001$ for litter N% at day 42.

There was no significant difference in temperature between the litter materials. With the time, temperature increased in all types of litter. Wet litter provides a favorable environment for the microbial proliferation and may be the reason for temperature increment.

Different kinds of litter had different moisture contents, but there were no significant difference between the three types. Moisture contents observed in this experiment, irrespective of the type of litter were higher than the ideal moisture content, 20 - 25% (Casey *et al*., 2005). PH reported the highest moisture content (58.5%) at the day 42. However, higher litter moisture conditions did not adversely affect the performance and health of the birds in the experiment. Ruszler and Carson (1968) reported that litter of small particle size absorbed less moisture than larger particle size. Excess moisture in the litter increases the incidence of breast blisters, skin burns, scabby areas, bruising, condemnation and downgrades (Casey *et al.*, 2005). The wetter the litter, the more likely it will promote

the proliferation of pathogenic bacteria and moulds. Wet litter is also the primary cause of ammonia emission, one of the most serious environmental pollutants of broiler production. The Litter that is excessively dry and dusty can also lead to problems such as dehydration of new chicks, respiratory diseases and increase condemnations.

Bulk density of RT litter (84 kg/m^3) was significantly higher ($p<0.001$) than SD (50 kg/m^3) and PH (97 kg/m^3) after 23 days of the commencement of experiment. But at the 42 days the BD of both; SD and PH were not significantly different from RT. Where the lowest BD showed with PH (187 kg/m^3). RT, SD and PH reported lower BD values than the same of other litter materials such as pine wood shaving (192 kg/m^3) and for hard wood bark (403 kg/m^3) (Brake *et al*., (1992). Low BD of these materials indirectly reflect the high porosity and thus conducive for better water holding ability, air circulation through the litter and to release moisture.

Table 2 shows that though there was no significant ($p>0.001$) difference in pH among the three types of litter materials, there was a trend of increasing pH from day 30 to 42 in all the litter types may be due to faecal accumulation. RT and SD showed comparatively lower pH values compared with PH. For a litter material, it is an added advantage to have a lower pH level since the conversion of excretory uric acid into ammonia is reduced at acidic pH levels (Moor *et al*., 1996).

In addition to the N contained in the litter materials, each litter type was enriched with excretory N and feed spillage. Meanwhile a part of litter N is converted to NH_3 and released in to the atmosphere. The N% of RT based litter on day 30, 36 and 42 were significantly higher ($p<0.0001$) than other two litter materials. It was hypothesized that RT may have an ability to bind NH_3. Further investigations are suggested to test this hypothesis.

It was visually observed that the litter caking was very high with RT than with SD and PH. As the cake formed litter RT can be rolled and removed and it does not affect the lower layers of the litter.

CONCLUSION

It is concluded that as the litter type did not influence the performance of the animals and also the quality of the carcass. Therefore, SD, RT could be identified as alternative litter materials for PH for rearing broilers. Further a higher N content in RT based spent broiler litter would make it to be a better organic manure and ruminant feed compared to SD and PH based litter.

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