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## MODERN FEEDING REGIME FOR THE CONTROL OF AMMONIA GAS PRODUCTION FROM POULTRY LITTER IN BROILER PRODUCTION

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### ABSTRACT

The study was conducted to determine the effects of Rosemary leaf meal (RLM) and Sodium Bentonite (SB) on litter characteristics of broilers. A total of 180 day-old chicks of Cobb 500 strain of broilers were used for the study. The birds were randomly grouped and allocated to six (6) dietary treatments, which contained, T1(0g RLM+0g SB) and served as Control, T2(0g RLM+15g SB), T3(3g RLM+0g SB), T4(3g RLM+15g SB), T5(6g RLM+0g SB) and T6(6g RLM+15g SB), respectively, per kilogramme of feed, with 30 birds per treatment. Each treatment was replicated 3 times with 10 birds per replicate in a 2\*3 factorial arrangement in a completely randomized design (CRD). The experiment lasted for 8 weeks. At the end of the experimental period, litter samples were collected and analyzed according to treatments, to determine the pH, moisture and ammonia contents. The results showed that there were significant ( $p < 0.05$ ) decrease in pH level, from (7.75 to 7.07), and ammonia gas content (11.8 to 9.62ppm). The interaction effect of RLM and SB on litter characteristics at 8weeks of the experiment showed significant ( $p < 0.05$ ) decrease in ammonia (12.37 to 8.13ppm), pH level (7.80 to 6.23), and moisture content (16.47 to 13.73) in T4. It was concluded that, 15g SB and 3g RLM per kg feed improved litter characteristics by reducing ammonia gas production in the litter, and thus, recommended that 15g SB and 3g RLM should be used by farmers to improve litter characteristics in order to control odour in poultry houses.

**Keywords:** Modern feeding, ammonia gas, odour control, litter, broilers.

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### INTRODUCTION

Environmental pollution has been one of the greatest challenges militating against the poultry industry across the globe. The pollution is facilitated by ammonia gas production which occur through volatilization from the litter (Ezenwosu and Udeh 2022). The microorganisms in the litter degrade the protein rich substances to produce ammonia gas which is emitted to the environment. Ammonia gas (NH<sub>3</sub>) causes environmental pollution and contribute to the global climate change and global warming through the formation of nitrous oxide (N<sub>2</sub>O) in the atmosphere and creating a vicious circle (Brind'Amour and Lee, 2022). Considering these challenges, it is pertinent to develop a modern feeding regime that will proffer lasting solution to ammonia gas production, without increasing cost of production, while, maintaining quality output and environmental friendliness in poultry production. Some feed additives have proven to proffer the needed remedy.

Rosemary is an aromatic plant and one of the most commonly used medicinal plants in folk recipes. Rosemary is important for fighting bacterial infections and reducing heat stress because of its antioxidant nutrient (Begum, 2013). Rosemary works as a detoxifier, pain reliever, and respiratory support for birds. In other words, Rosemary is seen as an ideal supplement whose primary importance is to preserve egg quality, especially in laying birds, helps reduce heat stress, regulate microbial loads in the gut of birds and also, helps to maintain a careful level of digestibility in broilers (Zhang *et al.*, 2023).

Sodium Bentonite are clays with strong colloidal properties that absorbs water quickly, which means they swell and multiply in volume creating a gelatinous substance (Atman, 2020). Studies have shown over the years that poultry birds are always in contact with their litter, and sodium bentonite has been used as a litter treatment (Safaeikatouli *et al.*, 2011). The amount of Sodium Bentonite used in animal production is not expected to have a negative impact on the environment (Guido *et al.*, 2017). Wet litter and foul odour in poultry farms are growing problems worldwide. The use of rosemary leaf meal and sodium bentonite as feed additives in broiler production is a novel practice with limited literature support. Thus, the aim of this study was to determine effect of rosemary leaf meal and sodium bentonite as modern feeding regime for the control of ammonia gas production from poultry litters.

## MATERIALS AND METHODS

### Location of the Study

The experiment was carried out at the Poultry Unit, Department of Animal Science, Teaching and Research Farm, University of Nigeria, Nsukka. The Experiment lasted for 8 weeks.

### Experimental Animals and Management

A total of 180 day-old broiler chicks of Cobb 500 strain were used for the experiment. The chicks were randomly assigned to six (6) treatment group. Each treatment contained 30 birds and was replicated (3) times. Each replicate was assigned 10 birds in a 2×3 factorial arrangement in completely randomized design (CRD). The birds were managed in deep litter system. Prior to the arrival of the day-old chicks, the pens were thoroughly washed, dried and covered with dry wood shavings as the litter materials. The pens were equipped with feeders and drinkers, and preheated with solar system heater to a temperature of 37°C. On arrival, the chicks were weighed individually using an Electronic digital weighing scale. Feed and water were provided *ad libitum*. Vaccination and medications were employed as at when due.

### Laboratory Procedures for Determination of Ammonia, pH and Moisture content of the litter

Ammonia and pH were determined according to the procedures described by Ivančič and Degobbi, (1984), whereas, moisture content was determined according to the procedure described by A.O.A.C (1990).

### Litter Sample, Data collection and analysis

Litter samples were collected from 6 random sites in each treatment. Samples obtained were subjected to laboratory analysis to determine moisture, pH and ammonia content of the litter materials. Data collected were subjected to a two-way analysis of variance (ANOVA), in a completely randomized design (CRD), using statistical package of social science (SPSS version 26). Significant different means were separated using Duncan New Multiple Range Test (Duncan, 1955).

### Statistical Model

$$Y_{ijk} = \mu + A_i + B_j + (Ab)_{ij} + \sum_{ijk}$$

Where;  $Y_{ijk}$  = individual observation

$\mu$  = population mean

$A_i$  = effect of rosemary

$B_j$  = effect of bentonite

$(Ab)_{ij}$  = interaction effect

$\sum_{ijk}$  = random effect

## RESULTS AND DISCUSSION

The results of the effect of Rosemary leaf meal and sodium bentonite on litter characteristics of broiler birds at 8 weeks of experimental period are presented in table 2. The results indicated that pH and ammonia content are significantly ( $p < 0.05$ ) affected by the levels of Rosemary inclusion, while, moisture content of the litter was not significant ( $p > 0.05$ ). The pH level decreased from 7.75 to 6.07, as the inclusion level of Rosemary increased from 0 to 6g/kg feed. Similarly, ammonia content of the litter decreased from 11.18 to 9.62ppm. The litter pH values in this study at 8 weeks of study were lower than 8.4, reported by Tabler *et al.* (2020), who studied broiler litters on 3 years basis at University of Arkansas. In another study Miles *et al.* (2004) reported litter ammonia of 9.1mg of Nitrogen, when he considered sand and vermiculite as litter materials in broiler production. The results obtained in this study were not in similar range with that reported by Maliselo and Mwaanga (2016), who reported an increase in ammonia to be 20 to 27ppm. The findings indicated that Rosemary leaf meal have the ability to decrease ammonia, because of Romarinic acid in rosemary, which inhibited the activity of urease, which is an enzyme that produces ammonia (Ghasemzadeh and Hosseinzadeh, 2020).

The result of the effect of Sodium Bentonite on litter characteristics of broiler birds at 8 weeks indicated that pH, moisture and ammonia content were significantly ( $p < 0.05$ ) affected by the inclusion levels of sodium bentonite. The results showed that pH decreased as the rate of inclusion increased. Similarly trend also, occurred on moisture and ammonia content of the litter. Consequent to previous studies, it has been noted that Sodium Bentonite improves litter characteristics of poultry litter (de Toledo *et al.*, 2020). The results obtained in this study were not in similar range with results reported by Dim *et al.*, (2020), who used dietary bentonite to improve the litter quality of broiler birds and

reported that at 54 weeks of age, litter pH level decreased from 7.24 to 6.53, and Nitrogen level from 4.04 to 3.65.

**Table 1: Effect of Rosemary leaf meal on litter characteristics of broiler birds at 8 weeks of experimental period**

Treatments	pH	Moisture (%)	Ammonia (ppm)
<b>Effect of RLM</b>			
0g/kg	7.75 <sup>a</sup>	17.40	11.18 <sup>a</sup>
3g/kg	7.42 <sup>a</sup>	16.61	10.32 <sup>b</sup>
6g/kg	6.07 <sup>b</sup>	16.60	9.62 <sup>c</sup>
SEM	0.10	0.43	0.15
P-Value	0.02 (*)	0.24	0.01 (*)
<b>Effect of SB</b>			
0g/kg	7.60 <sup>a</sup>	10.21 <sup>a</sup>	11.76 <sup>a</sup>
15g/kg	6.56 <sup>b</sup>	7.45 <sup>b</sup>	8.90 <sup>b</sup>
SEM	0.08	0.35	0.13
P-Value	0.03 (*)	0.01 (*)	0.02 (*)
<b>Interaction of RLM/SB</b>			
0gRLM+0gSB/kg	7.80 <sup>a</sup>	16.47 <sup>a</sup>	12.37 <sup>a</sup>
0gRLM+15gSB/kg	6.34 <sup>cd</sup>	15.53 <sup>cd</sup>	10.00 <sup>cd</sup>
3gRLM+0gSB/kg	7.27 <sup>bc</sup>	16.26 <sup>ab</sup>	11.80 <sup>ab</sup>
3gRLM+15gSB/kg	6.23 <sup>de</sup>	13.73 <sup>d</sup>	8.13 <sup>d</sup>
6gRLM+0gSB/kg	7.10 <sup>cd</sup>	14.90 <sup>c</sup>	11.10 <sup>ab</sup>
6gRLM+15gSB/kg	7.73 <sup>ab</sup>	16.20 <sup>bc</sup>	8.83 <sup>de</sup>
SEM	0.15	0.60	0.22
P-Value	0.00 (**)	0.01 (*)	0.02 (*)

Means on the same row with different superscript are significantly different ( $p < 0.05$ ), RLM = Rosemary leaf meal, SB = Sodium bentonite, SEM = Standard error of the mean.

The results of the interaction effect of Rosemary Leaf meal and Sodium Bentonite on litter characteristics of broiler birds at 8 weeks of experimental period indicated that pH, moisture and ammonia contents were significantly ( $p < 0.05$ ) decreased pH value from 7.80 to 6.23, moisture content of the litter from 16.47 to 13.73% and ammonia content of the litter from 12.37 to 8.13ppm, at inclusion level of 3g/15g per kg feed. The interaction of Rosemary and Sodium Bentonite could have created some unexpected chemical reactions that affected the pH, moisture and ammonia contents of the litter. It could be possible that the inclusion levels of the two additives come into play, even though, the combination may have different effects at different concentrations, but, the combined effects gave significant reductions across the parameters. These results of this study were in agreement with Hafez *et al.*, (2016) who reported that poultry litter moisture, pH and ammonia contents were reduced by rosemary leaf meal inclusions. Miles *et al.* (2004) reporting on the negative effect of moisture, stated that presence of high moisture in poultry litter leads to clumping or caking of the litter, which culminates to increased ammonia level in the litter. In similar vein, Kristensen, and Wathes (2000) reported that increased ammonia level in poultry litter causes toxicity and constitute health challenges on the poultry birds.

## CONCLUSION

It was concluded that inclusion of 15g SB and 3g RLM per kg feed improved litter characteristics by reducing ammonia gas, moisture and pH levels; and thus, controlled odour production in the broiler birds' litter, it was therefore, recommended that 15g SB and 3g RLM should be used by farmers to improve litter characteristics in order to reduce ammonia gas production and control odour in poultry houses, hence, maintain environmental friendliness.

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