THE EFFECT OF VARYING LEVELS OF SALT AND SUGAR MIXED WITH LITTER MATERIALS ON THE GROWTH PERFORMANCE OF COBB-VANTRESS BROILERS AND ON THE REDUCTION OF ODOR AND FLY INFESTATION

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ABSTRACT

This study was conducted to determine the effect of different levels of salt and sugar mixed with litter materials on the growth of broilers and on the reduction of odor and fly infestation. Treatments were laid out in a randomized complete block design (RCBD) replicated thrice. Determination of the presence of odor and flies was done by a panel of evaluators two weeks after the birds were introduced in the pen and two days before the study was terminated. Results showed that there was no significant difference ($P>0.05$) on the feed consumption, liveweight gain, dressing percentage, feed efficiency and water consumption of broilers on different levels of salt and sugar mixed with sawdust. The treatment with sawdust had the lowest ($P<0.05$) organic and moisture content but had the highest mineral matter in their feces. Furthermore, treatments with litter had no odor to undistinguishable odor with zero to less than 10 flies present as detected by the majority of the evaluators on both periods of evaluation. Most of the evaluators reported that pens without litter had recognizable to very distinct and annoying odor with significant number of flies present. Relatively, the use of pure sawdust gave a higher profit of P74.97 attributed to the production of potting materials out of the litter.

INTRODUCTION

Background and Rationale

Odor and fly infestation are the common problems in livestock industry today. Urban folks could not raise livestock in their yard because of the odor that is most likely to be emitted by the animal manure. This foul odor may create nuisance among nearby houses and trigger a malady, which maybe harmful to human health. Aside from these, the presence of flies may worsen the situation, for flies serve as carriers of various pathogens.

Studies had been conducted to solve the phenomenal problem that affects not only the local animal industry but also those in other countries that produce animals. As a result, many alternative technologies had been developed to reduce odors. Some technologies need a lot of investment while others require small investment but are labor intensive. One of these is the use of enzymes (Badi Farm, 2003; Natures Novel, 2002) which are now available in the market but are expensive.

Usage of sawdust or wood shavings as litter materials had been found to reduce odor in buildings (Bliss Haven, 2003; Badi Farm, 2003; Jacobson, Schmidt, Nicolae, Bicudo,1998). These materials are readily available in any of the lumberyards in the city. Sawdust used as cover to poultry composting (carcasses of dead poults piled in a compost pit) effectively minimizes the odor and fly infestation (Carr, et al., 1998). Considered as the most popular broiler litter materials are the sawdust and pine shavings used to reduce odor emitted by birds during the production period (Brake, et al., 2001& Bliss Haven, 2003).

Sawdust have an aromatic compound that absorbs ammonia present in the fecal matter (Badi Farm,2003). The sodium and chloride present in salt at the right amount serves as bactericidal agent in the litter materials. However, the salinity brought about by salt decreases the usefulness of decomposed litter materials when used as organic fertilizer for plants. It is of general knowledge that salt increases salinity, which in high amount is harmful to growing plants.

Molasses as by-product of sugar has been also found to increase palatability of feeds; therefore, there is a possibility that broilers will eat some of their litter if it has been mixed with sugar. So far, no study had been conducted that deals with different proportions of salt and sugar in the litter material, therefore, there is a need to conduct this study.

Objectives of the Study

Generally, the objective of this study was to determine the effect of salt and sugar mixed in the litter materials on the growth performance of broilers and in controlling odor and fly infestation. Specifically, it aimed to answer the following questions:

1. What is the influence of different levels of salt and sugar on the feed consumption, feed efficiency, water intake, liveweight gain, dressing percentage and financial returns of experimental birds?
2. What are the effects of the different levels of salt and sugar in litter materials on the moisture, organic matter and mineral contents?
3. Will the mixture of salt and sugar in the litter materials effectively control odor emission and fly count ?
4. Which of the two litter materials will effectively control odor, sawdust alone or sawdust added with salt and sugar?

Significance of the Study

The results of this study may give raisers and other individuals the idea of various alternative litter materials to effectively control odor emission and lessen fly infestation. The output of the study may also be used as basis for future studies to further understand the importance of sanitation and proper care of our environment without prejudice to our livelihood. For students, the results may serve as reference for their researches and studies in their respective fields.

METHODOLOGY

Research Treatments and Design

The CPU College of Agriculture Poultry Project Grower House was utilized as site during the conduct of this study from December 24, 2003 to January 25, 2004.Three days before the experiment proper, the whole premises was disinfected with Lysol.

Each pen was divided into seven compartments with an area of 6 sq ft. Electrical devices were installed to ensure that enough light and heat were provided during the brooding period.

Litter materials were mixed correspondingly based on the prescribed treatments. A mixture of sawdust and sand was used as litter materials. Varying levels of salt mixed with brown sugar were added to the litter materials as the experimental treatments of this study.

The mixture of the litter materials was comprised of 91% sawdust, 8.97% sand, and 0.30% experimental treatments (salt and molasses mixture) of total litter weight per treatment (Korea Nature Farming System, 2001). The varying levels of salt mixed with molasses were as follows: 100% salt; 75% salt with 25% sugar; 50% salt with 50% sugar; 25% salt with 75% sugar; and 100% sugar. Birds raised in pure sawdust and birds raised on slatted floor served as control.

About one-foot thick litter materials were spread on the designated compartments prior to the introduction of broiler chicks.

These treatments were arranged in a randomized complete block design (RCBD). The seven experimental treatments were replicated thrice.

Care and Management

Chicks were placed directly in the experimental pens upon their delivery. Two days later, NCD vaccine was administered to prevent the occurrence of new castle disease (NCD) in the flock. For the first two weeks, they were fed with chick booster mash after which, they were fed with broiler starter crumble until the termination of the study.

In the morning, the waterers were filled with clean water. Intermittently, water-soluble vitamins were mixed in their drinking water. Feeding was done daily; one in the morning and another at 3 o'clock in the afternoon.

Data Analysis and Presentation

All the data gathered except those on odor emission and fly count were analyzed using the analysis of variance for a randomized complete block design (RCBD). Significant differences among treatments were analyzed using the Duncan's multiple range test (DMRT). Data on odor emission and fly count were analyzed using the frequency and percentage for nominal value.

MAJOR FINDINGS

Growth Performance

Results showed that different levels of salt and sugar mixed in the litter materials have no significant ($P>0.05$) effect in the feed consumption (Table 1), liveweight gain (Table 2), dressing percentage (Table 3), feed efficiency (Table 4), and water consumption (Table 5) of broilers. The birds from the different treatments consumed 2.501 to

2.828 kg of feeds for the whole duration of the study, had a liveweight gain that ranges from 1.730 to 1.854 kg and had a dressing percentage of 81.83% to 89.64%. The birds required 1.481 to 1.803 kg of feeds to produce a kilogram of meat and can drink from 6.000 to 8.663 liters of water in 32 days of rearing.

Table 1. Feed Consumption per Bird

Treatment	Replication I	II	III	Treatment Mean
	----------	----------	kg ----------	----------
100 % Salt	2.408	2.564	2.585	2.519 ns
75% Salt & 25% Sugar	2.294	2.591	2.618	2.501
50% Salt & 50% Sugar	2.245	2.790	2.706	2.580
25% Salt & 75% Sugar	2.585	2.516	2.625	2.575
100% Sugar	3.263	2.703	2.518	2.828
Purely Sawdust	3.060	2.688	2.650	2.799
W/out Litter	2.789	2.820	2.820	2.810

cv = 5.85%
ns not significant at the 5% level of probability

Table 2. Liveweight Gain per Bird

Treatment	Replication I	II	III	Treatment Mean
	----------	----------	in kg ----------	----------
100 % Salt	1.694	1.748	1.764	1.735 ns
75% Salt & 25% Sugar	1.714	1.780	1.696	1.730
50% Salt & 50% Sugar	1.550	1.848	1.890	1.763
25% Salt & 75% Sugar	1.852	1.664	1.740	1.752
100% Sugar	1.795	1.858	1.908	1.854
Purely Sawdust	1.681	1.902	1.835	1.806
W/out Litter	1.815	1.780	1.670	1.755

cv = 5.60%
ns not significant at the 5% level of probability

Table 3. Dressing Percentage per Bird

Treatment	Replication I	II	III	Treatment Mean
	----------	----------	% ----------	----------
100 % Salt	86.11	85.71	97.10	89.64 ns
75% Salt & 25% Sugar	87.62	87.32	85.51	86.82
50% Salt & 50% Sugar	85.94	88.61	83.15	85.90
25% Salt & 75% Sugar	89.47	87.88	84.93	87.43
100% Sugar	83.56	85.00	76.92	81.83
Purely Sawdust	89.32	86.08	80.26	85.22
W/out Litter	85.33	90.04	92.86	89.41

cv = 4.86%
ns not significant at the 5% level of probability

Table 4. Feed Efficiency per Bird

Treatment	Replication			Treatment Mean
	I	II	III	
100 % Salt	1.554	1.709	1.543	1.602 [ns]
75% Salt & 25% Sugar	0.997	1.672	1.775	1.481
50% Salt & 50% Sugar	1.633	1.594	1.463	1.563
25% Salt & 75% Sugar	1.521	1.735	1.694	1.650
100% Sugar	2.140	1.590	1.679	1.803
Purely Sawdust	1.380	1.581	1.738	1.566
W/out Litter	1.743	1.790	1.735	1.756

cv = 13.84%
[ns] not significant at the 5% level of probability

Table 5. Water Consumption per Bird

Treatment	Replication			Treatment Mean
	I	II	III	
	---------- in li----------			
100 % Salt	5.955	6.525	6.562	6.347 [ns]
75% Salt & 25% Sugar	7.493	6.991	11.505	8.663
50% Salt & 50% Sugar	5.713	6.682	6.419	6.271
25% Salt & 75% Sugar	6.544	6.299	6.320	6.388
100% Sugar	8.845	6.706	6.699	7.417
Purely Sawdust	8.777	6.606	6.835	7.406
W/out Litter	6.360	5.550	6.090	6.000

cv = 17.24%
[ns] not significant at the 5% level of probability

A significant (P>0.05) difference was observed in water and feed ratio as shown in Table 6. Data revealed that broilers under 75% salt and 25% sugar drank the most volume (3.453) of water per kilo of feed consumed while the broilers in the treatment without litter drank the lowest (2.136) among the treatments but is comparable with those in the 25% salt and 75% sugar, 50/50 sugar and salt, and 100% salt.

Table 6. Water and Feed Ratio

Treatment	Replication			Treatment Mean
	I	II	III	
100 % Salt	2.473	2.545	2.538	2.519 [bc]
75% Salt & 25% Sugar	3.266	2.698	4.395	3.453 [a]
50% Salt & 50% Sugar	2.545	2.395	2.372	2.437 [bc]
25% Salt & 75% Sugar	2.532	2.504	2.408	2.481 [bc]
100% Sugar	2.711	2.481	2.660	2.617 [b]
Purely Sawdust	2.868	2.458	2.579	2.635 [b]
W/out Litter	2.280	1.968	2.160	2.136 [c]

cv = 12.85%
[bc] Treatment means with the same letter superscript are not significantly diefferent at the 5% level of probability

Moisture, Organic, and Mineral Matter Content of Litter Materials

As shown in Table 7, the excreta of broilers on slatted floor had the highest ($P<0.05$) moisture content of 3.325%. However, the differences on the mean moisture content of different litter were not significant. The same treatment had significantly ($P<0.05$) the highest organic matter content of 6.782% (Table 8) but had the lowest mineral matter content of 93.218% (Table 9). All treatments were comparable from the above-mentioned parameters.

Table 7. Percentage Moisture of Litter Materials per Treatment

Treatment	Replication			Treatment Mean
	I	II	III	
	---------- % ----------			
100 % Salt	0.858	1.180	1.373	1.137[b]
75% Salt & 25% Sugar	0.892	1.432	0.929	1.084[b]
50% Salt & 50% Sugar	0.965	1.231	1.544	1.247[b]
25% Salt & 75% Sugar	1.593	1.139	0.866	1.206[b]
100% Sugar	1.309	1.667	1.024	1.333[b]
Purely Sawdust	1.717	1.352	1.207	1.425[b]
W/out Litter	2.974	3.420	3.580	3.325[a]

cv = 20.46%

[bc] Treatment means with the same letter superscript are not significantly diefferent at the 5% level of probability

Table 8. Percentage of Organic Matter in Litter Materials

Treatment	Replication			Treatment Mean
	I	II	III	
	---------- % ----------			
100 % Salt	3.055	3.625	5.027	3.902[b]
75% Salt & 25% Sugar	3.850	4.306	2.926	3.694[b]
50% Salt & 50% Sugar	2.707	4.029	4.418	3.718[b]
25% Salt & 75% Sugar	4.680	4.267	3.401	4.116[b]
100% Sugar	4.575	3.571	3.804	3.983[b]
Purely Sawdust	3.697	4.176	4.248	4.040[b]
W/out Litter	6.046	6.870	7.431	6.782[a]

cv = 17.21%

[bc] Treatment means with the same letter superscript are not significantly diefferent at the 5% level of probability

Table 9. Percentage of Mineral Matter in Litter Materials

Treatment	Replication I	II	III	Treatment Mean
	---------- % ----------			
100 % Salt	96.945	96.375	94.973	96.098 [a]
75% Salt & 25% Sugar	96.150	95.694	97.074	96.306 [a]
50% Salt & 50% Sugar	97.293	95.971	95.582	96.282 [a]
25% Salt & 75% Sugar	95.320	95.733	96.599	95.884 [a]
100% Sugar	95.425	96.429	96.196	96.017 [a]
Purely Sawdust	96.303	95.824	95.752	95.960 [a]
W/out Litter	93.954	93.130	92.569	93.218 [b]

cv = 0.78%
[bc] Treatment means with the same letter superscript are not significantly diefferent at the 5% level of probability

Odor Emission and Fly Infestation

Treatments that utilized sawdust as litter materials, emitted no odor to undistinguishable odor with zero to less that 10 flies present as detected by the majority of the evaluators from two weeks after the birds were introduced in the treatments and two days before the study terminated (Table 10 - 13). On the other hand, most of the evaluators noted a recognizable odor on broilers raised on slatted floor with more than ten but less than 50 flies present. The odor became more recognizable to very distinct and annoying on the last evaluation during which more than 50 flies present to cannot be counted.

Table 10. Evaluation of Odor Two-weeks (1st evaluation) After the Start of the Study and Two-days (last evaluation) Before the Study was Terminated

Treatment	Odor Evaluation Category: No odor detected		Undistinguishable odor		Recognizable odor		Very distinct and annoying odor	
	1st	Last	1st	last	1st	last	1st	last
	---------- % of evaluators ----------							
100 % Salt	38.89	33.33	55.56	60.00	5.50	6.60	0	0
75% Salt & 25% Sugar	38.89	40.00	61.11	46.67	0	13.33	0	0
50% Salt & 50% Sugar	33.33	6.60	50.00	73.33	16.67	20.00	0	0
25% Salt & 75% Sugar	27.78	40.00	55.56	53.33	16.67	6.60	0	0
100% Sugar	27.78	40.00	61.11	53.33	11.11	6.60	0	0
Purely Sawdust	27.78	6.60	50.00	80.00	22.22	13.33	0	0
W/out Litter	0	0	16.67	0	72.22	66.67	11.11	33.33

Table 11. Fly Count Two-weeks (1st evaluation) After the Birds were Introduced to Treatments and Two-days (last evaluation) Before the Study Terminated

Treatment	Fly Count Categories									
	No fly present		Less than 10 flies present		More than 10 flies present but less than 50		More than 50 flies present but less than 100		Cannot be counted because of large number	
	Evaluation Sequence									
	1st	Last	1st	Last	1st	Last	1st	Last	1st	Last
	----------% of evaluators----------									
100 % Salt	55.56	53.33	44.44	46.67	0	0	0	0	0	0
75% Salt & 25% Sugar	72.22	73.33	27.78	26.67	0	0	0	0	0	0
50% Salt & 50% Sugar	38.89	26.67	61.11	73.33	0	0	0	0	0	0
25% Salt & 75% Sugar	44.44	80.00	55.56	20.00	0	0	0	0	0	0
100% Sugar	27.78	60.00	72.22	40.00	0	0	0	0	0	0
Purely Sawdust	50.00	86.67	50.00	13.33	0	0	0	0	0	0
W/out Litter	0	0	33.33	0	50.00	0	16.67	66.67	0	33.33

Table 12. Cross Tabulations of Percentage Evaluators who Rated Odor Emission and its Corresponding Fly Count Two Weeks after the Broilers were introduced in the Experimental Pens

Treatment	Odor emission scale	Fly count		Total
		No fly present	Less than 10 flies present	
100% salt	No odor detected	22	17	39
	Undistinguishable odor	20	35	55
	Recognizable odor	2	4	6
	Total	44	56	100
75% salt & 25 % sugar	No odor detected	28	11	39
	Undistinguishable odor	26	35	61
	Recognizable odor	0	0	0
	Total	54	46	100
50% salt & 50 % sugar	No odor detected	17	18	35
	Undistinguishable odor	19	30	49
	Recognizable odor	4	12	16
	Total	40	60	100
25% salt & 75 % sugar	No odor detected	18	12	30
	Undistinguishable odor	22	31	53
	Recognizable odor	6	11	17
	Total	46	54	100
100% sugar	No odor detected	11	17	28
	Undistinguishable odor	17	44	61
	Recognizable odor	0	11	11
	Total	28	72	100
Pure sawdust	No odor detected	9	19	28
	Undistinguishable odor	28	22	50
	Recognizable odor	13	9	22
	Total	50	50	100
		Less than 10 flies present	More than 10 flies present but less than 50	Cannot be counted because of large number	Total
W/out litter	Undistinguishable odor	0	11	6	17
	Recognizable odor	26	35	11	72
	Very distinct and annoying	7	4	0	11
	Total	33	50	17	100

Table 13. Cross Tabulations of Percentage Evaluators who Rated Odor Emission and its Corresponding Fly Count Two Days before the Study Terminated

Treatment	Odor emission scale	Fly count scale		Total
		No fly present	Less than 10 flies present	
100% salt	No odor detected	23	11	34
	Undistinguishable odor	29	31	60
	Recognizable odor	2	4	6
	Total	54	46	100
75% salt & 25 % sugar	No odor detected	31	9	40
	Undistinguishable odor	40	9	49
	Recognizable odor	4	7	11
	Total	75	25	100
50% salt & 50 % sugar	No odor detected	11	22	33
	Undistinguishable odor	16	38	54
	Recognizable odor	0	13	13
	Total	27	73	100
25% salt & 75 % sugar	No odor detected	38	2	40
	Undistinguishable odor	38	16	54
	Recognizable odor	4	2	6
	Total	80	20	100
100% sugar	No odor detected	20	20	40
	Undistinguishable odor	7	47	54
	Recognizable odor	0	6	6
	Total	27	73	100
Pure sawdust	No odor detected	0	7	7
	Undistinguishable odor	16	64	80
	Recognizable odor	4	9	13
	Total	20	80	100

		Less than 10 flies present	>50 but <100 flies present	Cannot be counted because of large number	Total
W/out litter	Recognizable odor	7	40	20	67
	Very distinct and annoying	0	13	20	33
	Total	7	53	40	100

Financial Returns

Financial returns revealed that treatment under purely sawdust gained somewhat a higher profit of P74.97 with a slight difference of P1.86 in 75% salt and 25% sugar. Treatment without litter had the lowest profit of P41.04. The difference in peso gained between treatment with litter and without was attributed to the production of potting materials.

Table 14. Financial Returns per Bird

Treatment	Gross income			Cost of Production						Profit
	Price/ chicken	Potting materials	Sales	Cost of chick	Feeds	Labor	Electricity	Vet drug	Other	Total expense	
	P										
100 % Salt	149.63	20	169.63	28	37.79	15	10	10	15	115.79	53.84
75% Salt & 25% Sugar	168.63	20	188.63	28	37.52	15	10	10	15	115.52	73.11
50% Salt & 50% Sugar	157.54	20	177.54	28	38.70	15	10	10	15	116.70	60.84
25% Salt & 75% Sugar	148.83	20	168.83	28	38.63	15	10	10	15	116.63	52.20
100% Sugar	149.63	20	169.63	28	42.42	15	10	10	15	120.42	49.21
Purely Sawdust	174.96	20	194.96	28	41.99	15	10	10	15	119.99	74.97
W/out Litter	153.19	3	156.19	28	42.15	15	10	10	10	115.15	41.04

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the study, it is concluded that the use of pure sawdust as litter materials in growing broilers had no significant effect on their feed consumption, liveweight gain, feed efficiency, water consumption, and dressing percentage. Significant differences were observed in water and feed ratio, moisture content, organic matter content, and mineral matter content. The treatments significantly reduced odor and fly count.

Further study should be conducted on various alternative litter materials aside from sawdust. This is to determine further up to how many production cycle of broilers litter materials could be used without detrimental effect on birds raised on it.

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