Vol. 35 · January 2019
DOI: https://doi.org/10.7719/jpair.v35i1.651

Print ISSN 2012-3981
Online ISSN 2244-0445

Broiler Performance and Meat Quality in Response to Different Kinds and Levels of Bio-Organic Supplements

ALEX F. JAYA
http//orcid.org/0000-0002-2228-023x
aljay.jrmsutc@gmail.com
Jose Rizal Memorial State University-Tampilisan Campus,
Znac, Tampilisan, Zamboanga del Norte, Philippines

Originality: 99% • Grammar Check: 100% • Plagiarism: 1%

ABSTRACT

The study determined the production performance and meat quality of broilers using different kinds and levels of bio-organic supplements. Four hundred fifty broiler chicks were randomly distributed to fifteen dietary treatments. Five birds in each treatment were used for meat quality evaluation following a 3 x 5 factorial in Completely Randomized Design (CRD). No significant differences were observed in the production performance of broilers supplemented with different kinds of bio-organic fertilizers except average daily gain and final live weight. Broilers supplemented with higher levels of bio-organic supplements including antibiotic significantly affected the production performance except for average daily water intake and dressing percentage. Feed cost per kilogram of broiler produced, feed cost per average daily gain and return above feed, chicks and supplement costs were not significantly affected by the different kinds of bio-organic supplements but significantly affected by the different levels of bio-organic supplements. Meat quality was significantly affected by the different kinds of bioorganic supplements except for taste and overall acceptability but was not significantly affected by increasing the levels of bio-organic supplements

including those broilers supplemented with antibiotics in the drinking water. Better production performance was observed on broilers supplemented with different kinds and levels of bio-organic supplements in the drinking water but did not affect the meat quality.

Keywords **—** Broiler, Production, Meat Quality, Bio-Organic Supplements, Performance Evaluation, Philippines

INTRODUCTION

The increasing population poses an increasing demand for food. The world's quest for food security and economic development is being obscured by environmental threats, i.e., climate change and global warming (Lester & Hodges, D. M. 2008).

According to the Philippine Statistics Authority, the poultry subsector has increased its production by 5.45 percent this year. It contributed 18.44 percent to the total agricultural production. Chicken, chicken eggs and duck eggs contributed much to the increased. The gross value of poultry production at current prices amounted to Php 56.1 billion, higher by 19.19 percent over the last year's earnings.

Despite the level of sophistication, it has achieved, the local industry is still faced with problems that deter its further development. The Philippine broiler industry is now faced with the challenge of beefing up production through importation of chicken meat and chicken meat cuts contend PCAARD.

Chang in 2007 stressed out that the Philippine broiler industry must aim for more efficient systems of production and marketing, and the government must provide an environment conducive to productivity improvement.

Poultry is the fastest growing agricultural subsector, especially in developing countries (Mottet and Temio, 2017). It makes a substantial contribution to food security and nutrition providing energy protein and essential micro-nutrients to humans with short production cycles and the ability to convert a wide range of agri-food by-products and wastes into meat and eggs edible by humans.

The 2016 Global Industry Trend Rarobank International in Barcelona Spain predicted that 65% of global protein demand growth is in Asia. Asian chicken production is 30-50% more expensive as Brazilian production (Muldez, 2016)

Poultry experts and industry key players forecasted that poultry consumption would grow around 27 percent or 28 million tons by 2023. This growth is subsequently generated in Asia (Pelayo Casanova, 2016). However, even of a vast

and fast truck of modern poultry industry, food safety and quality issues are of great constraint. Integrity and ethics in production with the aid of an external audit gain importance stressing on the wide information awareness on reducing antibiotic supplementation among poultry species. "Antibiotic-free production has many challenges, but it is not going away according to Muldez (2016) report on Global Trend Rarobank International.

One of the shortcomings in the industry is the reality of so many food scandals-because dishonest companies were not punished and if not companies are not strictly supervised. However, according to Mottet and Tempio, 2017, poultry represents a threat to human health especially as a vector of infectious diseases and because of its role in antimicrobial resistance aside from its significant impact to natural resource depletion and climate change-inducing practices in feed production.

In response, the Philippine government through its policy-making bodies promulgated the Philippine Organic Agriculture Act of 2010 or the Republic Act 10068. This act encouraged farmers and stakeholders to promote organic farming thereby prohibiting the use of chemically promulgated and synthetically made farm inputs. This further emphasizes a natural way of farming by using indigenous and locally available resources in the production of goods and services most wanted by consumers.

The issue complicates upon the persuasive public awareness on the effects of antibiotics on human health. Thus, alternative bio-organic supplements were explored to lessen if not eliminate antibiotic and its derivatives in animal diets.

Limited studies if any have been done on the use of bio-organic water supplements on the production performance and meat quality of broilers fed with commercial ration. Hence, the study was conducted.

OBJECTIVES OF THE STUDY

Generally, the study was conducted to determine production performance and meat quality of broilers fed with commercial ration supplemented with different kinds and levels of bio-organic supplements. Specifically, the study will answer the following points (1) Determine the average daily feed intake, average daily gain, average daily water intake and average feed conversion efficiency, average final live weight, average dressing percentage of broiler fed with commercial rations supplemented with different kinds and levels of bio-organic supplements; (2)Compute the average feed cost per kilogram of broiler

produced, feed cost per average daily gain of broiler and return above feed cost, chick and supplement costs of broilers fed with commercial ration supplemented with different kinds and levels of bio-organic supplements; (3)Compare the effects of supplementing different kinds and levels of bio-organic supplements on meat quality in terms of color, odor, texture, tenderness, juiciness, and taste and overall acceptability.

METHODOLOGY

Research Design

This study made use of an experimental type of research design with 15 experimental units laid-out in two (2) Factorial Design.

Research Site

The study was conducted from January 4 to May 4, 2015, at the Poultry Project of Jose Rizal Memorial State University-Tampilisan Campus, Znac, Tampilisan, Zamboanga del Norte.

Instrumentation

Facilities such as incandescent bulbs, brooding and rearing pens, feeding trough and waterers, weighing scale, wood shavings, old newspapers (as bedding materials) and record book were provided and were used in the study. A total of 450 broiler chicks were used in this study.

Design and Treatments

Three kinds (Factor A) and five levels (Factor B) of bio-organic supplements resulting in 15 treatment combinations were considered in the study. Thirty (30) birds were assigned to each treatment with ten birds representing a replication making a total of four hundred fifty (450) randomly arranged in a 3 x 5 factorial completely randomized design (CRD).

The components of factor A consisted of three kinds of bio-organic supplements: and factor B consisted of 5 levels of bioorganic supplements: 0, 5, 10, and 15 ml per liter of water except treatment 2 (5 ml of antibiotic per liter of water).

The treatment combinations were as follows:

Table 1. Treatment Combinations of the Study Showing the Different Factors (A & B) Considered in the Study

Treatment No.	Factor A Kinds of Bio-Organic Supplements	Factor B Levels of Bio-Organic Supplements
T_1	FFJ	0
T_2	FFJ	5 ml antibiotic/liter of water
T_3	FFJ	5 ml/liter of water
T_4	FFJ	10 ml/liter of water
T_5	FFJ	15ml/liter of water
T_6	FPJ	0
T_7	FPJ	5 ml antibiotic/liter of water
T_8	FPJ	5 ml/liter of water
T_9	FPJ	10 ml/liter of water
T_{10}	FPJ	15ml/liter of water
T_{11}	IMO	0
T_{12}	IMO	5 ml antibiotic/liter of water
T_{13}	IMO	5 ml/liter of water
T_{14}	IMO	10 ml/liter of water
T_{15}	IMO	15ml/liter of water

The different kinds of bio-organic supplements were prepared using the standard procedures of the Bureau of Agricultural Research – Department of Agriculture.

Brooding Management

An hour before stocking, installed bulbs were turned on. When the chicks arrived, they were provided with dextrose powder dissolved in the water. An hour later, they were given with chick booster mash sprinkled on the newspaper matting. To determine whether the environmental temperature of the brooder was comfortable to the chicks, their behaviors were observed. When the chicks get crowded under near the source of heat, the temperature was cold and the height of the bulbs was reduced. When the chicks moved to the periphery and away from the source of heat, the temperature was too high and the bulbs were

raised. As soon as the chicks are able to withstand the ambient temperature, the bulbs were permanently raised to a height of five feet from the flooring and served as a source of light at night.

Feeding Management

The feeding program of the Animal Science Unity, Broiler Project was followed. Chick booster mash was given during the first two weeks. On the third and fourth week, the birds were fed with broiler starter crumble. Shifting from one class of feed to another was done gradually.

Medication Program

A Dextrose solution was given a few hours upon arrival of chicks. For Treatment 2, the antibiotic was given on the first three days and the 24th up to the 26th day. NCD B_1 B_1 was administered intranasal when chicks were seven days old. Vitamins ADEK were given after vaccination. In Treatments 2, 4 and 5, the medications of chicks were substituted with bio-organic supplements with the rate of 5 ml, 10 ml and 15 per liter of water, respectively. The control treatment was not supplemented with antibiotic and bio-organic supplements. The treatment preparations were given in the morning and in the afternoon.

Meat Quality Evaluation

Meat quality was evaluated utilizing the breast part of the carcass. The meat samples were oven-cooked and were placed on coded plates for the evaluation of color, taste, juiciness, odor/smell, tenderness, texture and overall acceptability. Meat quality was evaluated through a hedonic rating scale by the testing panel. The testing panel was composed of ten (10) persons; five (5) men and five (5) women, all of whom were experts from TESDA and major trained students who were non-smokers and drinkers.

Data Collected

Production Performance. The initial and final weights of the experimental birds were obtained and recorded. Feed consumed was determined by weighting the feeds given and feed refused.

The different parameters that were used to evaluate the production and profitability performance of the broiler fed with commercial ration supplemented with different kinds and levels of bio-organic supplements in the drinking water were computed as follows:

1. Average Daily Feed Intake

$$ADFI = \frac{\text{Average Feed Consumed}}{\text{Feeding Period (days)}}$$

2. Average Daily Water Intake

$$ADWI = \frac{\text{Average Water Consumed}}{\text{Feeding Period (days)}}$$

3. Average Daily Gain

$$ADG = \frac{\text{Average Weight Gain}}{\text{Feeding Period (days)}}$$

4. Average Feed Conversion Efficiency

$$ADFI = \frac{\text{Average Feed Consumed}}{\text{Feeding Period (days)}}$$

5. Average Final Live weight

$$AFLW = \frac{\text{Live weight/replication}}{\text{Birds/replication}}$$

6. Average Dressing Percentage

$$ADP = \frac{\text{Average Dressed Weight}}{\text{Average Final Live weight}} \times 100$$

Profitability Performance

The following were used to evaluate the profitability performance of broiler:

1. Feed cost per kilogram of broiler produced (₱/kg).
2. Feed cost per Average Daily Gain (P/g/d)

This was computed by dividing the cost of feed given by the computed average daily gain.

$$ADG = \frac{\text{Final Weight} - \text{Initial Weight}}{\text{Feeding Period}}$$

3. Return above feed, chicks and supplement cost (Php)

This was determined by subtracting the price of feed, chicks and supplement cost from the assumed sales of broilers.

RAFCCSC=sales-[(purchase period of feeds, chicks and supplement)]

Meat Quality

Data on color, odor, taste, juiciness, tenderness and overall acceptability were gathered using the hedonic rating scale by the testing panel

Statistical Analysis

Treatment effects on the production performance and meat quality were analyzed based on the procedure of Analysis of Variance (ANOVA) in a 3 x 5 factorial experiment in a Completely Randomized Design (CRD). Duncan's Multiple Range Test was used to determine statistical differences between treatment means.

Production Performance of Broilers. The average daily feed, average daily water, average daily gain, average final live weight and average dressing percentage of broiler chicken supplemented with different kinds of the bio-organic supplement is shown in Table 1 revealed no significant differences between kinds of bio-organic supplements except for average daily gain of broilers. Birds supplemented with fermented plant juice had the highest average daily gain significantly with the mean score of 53.19 (g/d), followed by birds supplemented with indigenous microorganism with the mean score of 51.38 (g/d). The lowest was obtained by birds supplemented with fermented fruit juice with a mean score of 50.84 (g/d). The result implied that the supplementation of the different kinds of bio-organic supplements in the drinking water affected the average daily gain. In terms of the levels of supplementation, statistical analysis indicated significant differences among means in almost all production parameters considered except for average daily water intake and dressing percentage.

Birds supplemented with antibiotic and different kinds of bio-organic supplements had higher average daily feed intake, average daily gain, average final live weight, and better feed conversion efficiency compared to those broilers with no supplementation. The results implied that the supplementation of the different kinds of bio-organic supplements in the drinking water affected these production parameters except for average daily water intake and dressing percentage.

There were no interaction effects between the kinds and levels of bio-organic supplements in terms of product performance.

The average feed cost per average daily gain of broilers was not influenced by the interaction between the different kinds and levels of bio-organic supplements.

RESULTS AND DISCUSSION

Table 2. Production Performance of Broilers Supplemented with Different Kinds of –Bio-Organic Supplements (Factor A)

	Parameters					
Kinds of Bio-organic Supplements	Average daily feed intake (g/d)	Average daily water intake (g/d)	Average daily gain (g/d)	Feed conversion efficiency (g/d)	Average final live weight (kg)	Average dressing percentage (%)
FFJ	88.50	243.88	50.04[b]	1.77	1.55	72.44
FPJ	89.96	255.85	53.19[a]	1.72	1.64	69.66
IMO	91.37	247.22	51.38[b]	1.80	1.59	70.15
F-test	ns	ns	**	ns	ns	ns
cv (%)	4.62	11.6	5.54	6.47	6.28	5.16

Table 3. Production Performance of Broilers Supplemented with Different Kinds of –Bio-Organic Supplements (Factor B)

Levels of Bio-organic Supplements	PARAMETERS					
	Average daily feed intake (g/d)	Average daily water intake (ml/l)	Average daily gain (g/d)	Feed conversion efficiency (g/d)	Average final live weight (kg)	Average dressing percentage (%)
0 (no supplementation	97.45[a]	226.52	43.55[b]	2.24[b]	1.35[b]	67.42
5 ml of bio-organic supplement/liter of water	88. 51[b]	252.50	53.37[a]	1.66[a]	1.66[a]	71.99
5 ml of bio-organic	86.88[c]	251.11	53.64[a]	1.61[a]	1.65[a]	71.37
10 ml of bio-organic supplement/liter of water	90.79[b]	261.83	54.14[a]	1.67[a]	1.67[a]	72.26
15 ml of bio-organic supplement/liter of water	86.31[c]	252.96	52.97[a]	1.63[a]	1.63[a]	70.70
F-test	**	ns	**	**	**	ns
cv (%)	4.62	11.6	5.54	6.47	6.28	5.16

Profitability Performance of broilers. The average feed cost (Php) per kilogram of broiler produced, average feed cost per average daily gain (Php/g/d) the return above feed, chick and supplement cost (Php) of broilers supplemented with different kinds of bio-organic supplements in drinking water is shown in Table 3. Analysis of variance (ANOVA) revealed no significant differences between kinds of bio-organic supplements in these parameters. The result implied that the supplementation of the different kinds of bio-organic supplements in the drinking water did not affect the profitability performance of broilers.

In terms of the levels of supplements, statistical analysis indicated significant differences among treatment means. The birds with antibiotic and different levels of bio-organic supplements had significantly higher average feed cost per

kilogram of broiler produced, lower average fed cost for average daily gain and higher return above feed cost, and chicks cost and supplement the cost of broilers. These suggest that the level of supplementation influenced the return above feed, chicks and supplement costs.

There were no interaction effects between the kinds and levels of bio-organic supplements in terms of profitability performance of broilers.

Table 4. Profitability Performance of Broilers Supplemented with Different Kinds of Bio-Organic Supplements (Factor A)

Kinds of Bio-organic Supplements	PARAMETERS		
	Average feed cost per kilogram of Broiler (Php)	Average feed cost per average daily gain (Php)	Return above feed chick and supplement costs (Php)
FFJ	88.53	1.64	48.68
FPJ	85.97	1.55	49.85
IMO	90.07	1.67	50.71
F-test	ns	ns	ns
CV (%)	6.39	10.18	13.34

Table 5. Profitability Performance of Broilers Supplemented with Different Kinds of Bio-Organic Supplements (Factor B)

Kinds of Bio-organic Supplements	PARAMETERS		
	Return above feed cost per kilogram of broiler Produced (Php)	Return above feed cost per average daily gain (Php)	Return above feed chicks and supplement cost (Php)
0	112.28[b]	2.08[b]	25.85
5	82.89[a]	1.54[a]	52.46
5	80.72[a]	1.50[a]	57.02
10	83.78[a]	1.56[a]	53.58
15	81.28[a]	1.50[a]	50.35
F-test	**	**	**
CV (%)	6.39	6.41	10.18

Meat Quality. The sensory evaluation of color, taste, tenderness, juiciness, texture, odor and overall acceptability is shown in Table 5. Analysis of variance (ANOVA) revealed significant differed between kinds of bio-organic supplements in terms of color, juiciness, texture and odor. The results implied that supplementation of different kinds of bio-organic supplements had affected then attributes of the meat of broilers. However, no significant differences were obtained for the taste, tenderness and overall acceptability of the meat of broilers which implied that the supplementation of the different kinds of bio-organic supplements did not affect the meat taste, tenderness and overall acceptability of the meat of broilers.

In terms of the levels of supplementation, statistical analysis indicated no significant differences among treatment means. There suggest that the levels of supplementation of bio-organic supplements did not affect the meat quality of broilers.

Table 6. Sensory Attributes of Broilers Supplemented with Different Levels of Bio-Organic Supplements

Kinds of bio-organic Supplements	Sensory Attributes						
	Color	Taste	Tenderness	Juiciness	Texture	Odor	Over-all Acceptability
FFJ	6.74[b]	7.16	7.16	6.52[b]	7.04[b]	6.92[b]	7.36
FPJ	6.92[b]	7.02	7.54	7.30[a]	7.46[a]	7.26[a]	7.50
IMO	7.30[a]	7.41	7.38	7.38[a]	7.48[a]	7.38[a]	7.72
F-test	**	ns	ns	**	**	**	ns
CV (%)	15.59	14.12	12.73	13.43	12.27	12.4	12.63

Table 7. Meat Quality of Broilers Supplemented with Different Levels of Bio-Organic Supplements (Factor B)

Kinds of bio-organic Supplements	Sensory Attributes						
	Color	Taste	Tenderness	Juiciness	Texture	Odor	Over-all Acceptability
0	6.50	6.90	7.17	6.90	7.00	6.90	7.10
5	7.17	7.18	7.53	7.10	7.43	7.33	7.57
5	7.03	6.97	7.20	6.90	7.33	7.10	7.73
10	7.15	7.40	7.40	7.07	7.40	7.30	7.57
15	7.08	7.53	7.50	7.37	7.47	7.30	7.67
F-test	ns	ns	ns	ns	ns	ns	ns
CV (%)	15.59	14.12	12.73	13.43	12.27	12.4	12.63

CONCLUSION

Based on the results of the study, better production performance was observed on broilers supplemented with different kinds and levels of bio-organic supplements in the drinking water. The quality of the broiler meat was not affected by the supplementation of the different kinds and levels of bio-organic fertilizers except for texture, odor, color and juiciness.

RECOMMENDATION

It is therefore recommended to the broiler grower to use different kinds and levels of bio-organic supplements to improve performance without affecting the quality of the broiler meat but still meeting the nutritional needs of the birds and safe to humans.

TRANSLATIONAL RESEARCH

The result of this study could give information to the farmers as to the most effective level and kind of bio-organic supplements to be used in broiler production. The University's extension office could reproduce brochures and Farmer's Production guide for technology dissemination and transfer.

LITERATURE CITED

Chang, H. S. (2007). Overview of the world broiler industry: Implications for the Philippines. *Asian Journal of Agriculture and Development*, *4*(2), 67-82. Retrieved from https://bit.ly/2TUGVjC

Lester, G. E., & Hodges, D. M. (2008). Antioxidants associated with fruit senescence and human health: Novel orange-fleshed non-netted honeydew melon genotype comparisons following different seasonal productions and cold storage durations. *Postharvest Biology and Technology*, *48*(3), 347-354. Retrieved from https://doi.org/10.1016/j.postharvbio.2007.11.008

Mottet, A., & Tempio, G. (2017). Global poultry production: current state and future outlook and challenges. *World's Poultry Science Journal*, *73*(2), 245-256. Retrieved from https://doi.org/10.1017/S0043933917000071

Muldez, N., (2016) Global Industry Trend Rarobank International, Barcelona Spain. Retrieved from https://bit.ly/2EiYRPr

PCAARD Poultry Information Network. Retrieved from http://www.pcaarrd.dost.gov.ph/home/momentum/poultry/index.php?option=com_content&task=view&id=76&Itemid=110

Philippine Statistics Authority. Performance of Philippine Agriculture,. Retrieved at: https://psa.gov.ph/ppa-main/livestock-poultry