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Quail Laying Efficiency with Vermicast and Lactic Acid Bacteria Serum (LABS) as Feed Additives

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Abstract. This study assessed the laying performance of quails fed with commercial feeds mixed with different levels of vermicast and lactic acid bacteria serum (LABS), and examined possible interactions between these additives. The goal was to explore more sustainable and cost-effective options for quail farming. An experimental design using a Factorial Completely Randomized Design (F-CRD) was employed, with four levels of vermicast (Factor A) and three levels of LABS (Factor B), each replicated five times. A total of 300 laying quails were randomly assigned to 60 treatment combinations. Results showed no significant effects of vermicast or LABS on the number of eggs laid or water intake. However, egg weight was significantly improved with 8% vermicast, indicating its potential to enhance egg quality. A significant interaction between vermicast and LABS was observed in feed consumption, though no other parameters showed interaction effects. The study concludes that while vermicast and LABS did not improve egg production quantity, the addition of 8% vermicast had a positive effect on egg weight. These findings suggest that vermicast could be a functional feed additive to improve egg quality sustainably, with potential value for small-scale quail producers and vermiculture users.

Keywords: Quail production; Vermicast; Lactic Acid Bacteria Serum; Egg quality; Feed additives; Sustainable farming; Poultry nutrition.

1.0 Introduction

Quail farming is gaining popularity due to the increasing demand for quail meat and eggs (Mohanty et al., 2020). Quails, particularly the *Coturnix coturnix* (common quail) and *Coturnix japonica* (Japanese quail), are known for their fast growth, early maturity, and high egg production, making them a suitable option for commercial farming (Gladewood, 2024). In the Philippines, Japanese quails are commonly raised for meat and egg production, while common quails are often found in forested areas (Peter Knight, 2024). Quails are small game birds that belong to the pheasant family and are recognized for their rapid growth and short generation interval, which makes them efficient for large-scale production (Mishra et al., 2014). As farmers seek sustainable and cost-effective methods to enhance production (Chisoro et al., 2023), interest is growing in utilizing natural feed additives, such as vermicast (Chashmidari et al., 2021) and lactic acid bacteria (LAB) (Liu et al., 2025).

Vermicast, or worm humus, is an organic material produced by earthworms through the breakdown of waste. It contains higher nutrients and lower pollutants than raw organic materials (Voung, 2022). Vermicast in poultry diets enhances growth, gut health, and nutrient digestibility due to its rich organic matter and microbial content (Raza et al., 2024). Hwangbo et al. (2014) demonstrated that fermented worm cast improved egg quality and production in hens, suggesting its potential for other poultry species, such as quails. Similarly, lactic acid bacteria have positively affected poultry health and growth performance (Lokapirnasari et al., 2024). LAB is a practical probiotic that supports gut health and overall bird productivity (Sirisopapong et al., 2023).

While several studies have examined the effects of vermicast and LABs in poultry, limited research has explored their combined impact on quail laying efficiency. This study aims to evaluate the laying performance of quails fed commercial feeds supplemented with varying levels of vermicast and LAB, and to investigate any potential interactions between these two additives. The findings can help quail farmers and vermiculture practitioners adopt more sustainable and affordable methods in quail production.

2.0 Methodology

2.1 Research Design

This study employed an experimental design, a Factorial-Completely Randomized Design (F-CRD), with four treatment levels for factor A and three for factor B, replicated five times. There were 60-unit combinations of experimental animals, totaling 300 heads of Layer Quails. Each animal was assigned randomly to each treatment through a random draw.

2.2 Research Instruments

The materials, tools, and equipment for this experiment were 300 heads of ready-to-layer Quails, vermicast, a digital weighing scale, a rearing cage, Commercial feeds, water, a watering and feeding trough, an incandescent bulb, extension wires, sacks, a pail, spade, trash bin, strainer, plastic container, water dipper, feed scope, egg trays, calculator, pen, record book, water bottle, freshmilk, molasses, and 10ml syringe.

2.4 Data Gathering Procedure

As part of the experimental procedure, 300 ready-to-lay quails were procured from Quail Eggs Valladolid Farm in Negros Occidental. The birds were housed in battery-type cages made from wood and polyethylene plastic screen flooring, ensuring a 4-inch space per bird, as per standard requirements. Upon arrival, the quails were pre-conditioned for seven days by administering electrolytes to minimize stress and gradually introducing the designated vermicast feed levels (20 grams/head/day). The cages, waterers, and feeding troughs were cleaned, disinfected, and dried before use. Regular manure removal was scheduled twice a week to maintain sanitation. The quails were randomly assigned to treatments under a Factorial-Completely Randomized Design (F-CRD), with four levels of vermicast (factor A) and three levels of LABS (factor B), replicated five times, resulting in 60 treatment combinations.

LABS (Lactic Acid Bacteria Serum) was prepared by fermenting rice wash for 5–7 days at 20–25°C. Afterward, the pure lactic acid was stored and later diluted at a 1:20 ratio for use. Feed mixtures were prepared every five days according to the specific treatment requirements and fed to quails twice daily at a rate of 20 grams/head/day. Water with LABS levels was given using glass bottles and troughs. Eggs were collected every morning before feeding and weighed daily using a digital scale. The data gathered throughout the study included egg weight, egg count per treatment, feed consumption (measured as the difference between the feed provided and the leftovers), and water consumption (based on the difference between the water given and the amount consumed).

2.5 Data Analysis

The two-way Analysis of Variance (ANOVA) - Factorial Completely Randomized Design (F-CRD) at 5% and 1% levels of significance was employed to determine if there is a significant difference in the utilization of CF added with varying levels of VC and LABS. This study used Statistical Tools for Agricultural Research (STAR).

2.6 Ethical Considerations

This research was conducted in accordance with the ethical standards and approved by the research ethics committee. This research meets ethical standards and was approved by the research ethics committee.

3.0 Results and Discussion

3.1 Average Quail Egg Weight

Table 1 summarizes the average egg weight, added with different levels of vermicast and lactic acid bacteria serum.

Table 1. *The Average Egg Weight of Quail*

Factor A Different Levels of VC	Factor B: Different Levels of LABS			Total	Mean
	X Pure Water	Y *10ml LABS*	Z *20ml Labs*		
A - Pure CF	10.67	10.80	10.28	31.75	10.58
B - 8% VC	10.94	10.64	10.73	32.31	10.77
C - 10% VC	10.09	10.50	10.53	31.12	10.37
D - 6% VC	10.44	10.71	10.42	31.57	10.52
Grand Total	**42.14**	**42.65**	**41.96**	**126.75**	
Grand Mean	**10.53**	**10.66**	**10.49**		**10.56**

Statistical analysis revealed highly significant results based on the data collected on the average egg weight and laying efficiency of quails fed commercial feeds supplemented with varying levels of vermicast and lactic acid bacteria serum. Further analysis using the Least Significant Difference (LSD) test revealed that layers given 8% vermicast produced heavier eggs than those fed with 10%, 6% vermicast, or pure commercial feeds. Egg size may vary within and between clutches, and there is a correlation between early and late egg weight at sexual maturity and overall egg size (Kumar et al., 2022).

For Factor B, which refers to the different levels of lactic acid bacteria serum, the egg weight of layers given 10 ml of serum was 10.66 g, followed by 10.53 g for those given pure water, and 10.49 g for layers supplemented with 20 ml of lactic acid bacteria serum. The ANOVA showed no significant effect of lactic acid bacteria serum on the average egg weight. As the age of layers plays an important role in determining egg weight, egg weight increases with age (Kumar et al., 2022). No significant interaction was observed between the levels of vermicast and lactic acid bacteria serum, indicating that only the 8% vermicast treatment had a significant effect on egg weight, independent of lactic acid bacteria serum levels.

3.2 Average Eggs Laid by Layer Quail

Table 2 summarizes the average number of eggs laid by layer quail, added with different levels of vermicast and lactic acid bacteria serum.

Table 2. *The Average Egg Laid by Layer Quail*

Factor A Different Levels of VC	Factor B: Different Levels of LABS			Total	Mean
	X Pure Water	Y *10ml LABS*	Z *20ml Labs*		
A - Pure CF	3.48	3.88	4.04	11.40	3.80
B - 8% VC	3.64	3.92	4.08	11.64	3.88
C - 10% VC	3.36	3.92	4.12	11.40	3.80
D - 6% VC	3.84	3.40	3.92	11.16	3.72
Grand Total	**14.32**	**15.12**	**16.16**	**45.60**	
Grand Mean					**3.80**

Statistical analysis showed no significant results based on the data gathered on the average number of eggs laid and the laying efficiency of quails fed with commercial feeds supplemented with different levels of vermicast and lactic acid bacteria serum. Further analysis using the Least Significant Difference (LSD) test revealed that layers given 6% vermicast produced more eggs compared to those fed 10%, 8%, or pure commercial feeds. The number of eggs a particular bird lays may vary within and between clutches. At a crude protein level of 21%, potassium carbonate (K_2CO_3) has been shown to increase egg mass. Additionally, studies by Mopera et al. (2021) found that potassium levels influenced egg composition, with yolk and shell weights decreasing and albumen percentage increasing linearly as dietary potassium levels increased.

For Factor B, which involved different levels of lactic acid bacteria serum, layers given pure water laid an average of 3.84 eggs, followed by 3.67 eggs for those given 20 ml of serum, and 3.60 eggs for those given 10 ml. The ANOVA showed no significant effect of lactic acid bacteria serum on the average number of eggs laid. There was also no significant interaction between the levels of vermicast and the levels of lactic acid bacteria serum. This implies that, for this parameter, the number of eggs laid was not significantly influenced by an interaction between vermicast and lactic acid bacteria serum.

3.3 Average Feed Consumption of Layer Quail

Table 3 summarizes the average feed consumption of layer quail, added with different levels of vermicast and lactic acid bacteria serum.

Table 3. *The Average Feed Consumption of Layer Quail*

Factor A Different Levels of VC	Factor B: Different Levels of LABS			Total	Mean
	X Pure Water	*Y 10ml LABS*	*Z 20ml Labs*		
A - Pure CF	90.00	92.55	91.10	273.65	91.21
B - 8% VC	100.60	102.90	102.80	306.30	102.10
C - 10% VC	105.96	104.90	105.25	316.11	105.37
D - 6% VC	100.57	100.45	100.55	301.57	100.52
Grand Total				**1197.63**	
Grand Mean	**99.28**	**100.20**	**99.92**		**99.80**

Based on the gathered data on feed consumption, individual layers given 10% vermicast consumed the most feed, at 105.37 grams, followed by those fed 8% vermicast (102.10 grams), 6% vermicast (100.52 grams), and pure commercial feed (91.21 grams). Analysis of Variance (ANOVA) showed highly significant differences among the treatment means. Further analysis using the Least Significant Difference (LSD) test revealed that layers fed with 10% vermicast added to commercial feeds had significantly higher voluntary feed intake compared to those fed with 8%, 6%, and pure commercial feeds (treatments B, C, and A, respectively). This suggests that layers with lower feed consumption are more efficient in converting feed into kilograms of eggs produced. (Clark et al., 2019) highlighted useful information and technologies for improving productivity and product quality through research and development.

The different levels of lactic acid bacteria serum (LABS) given to the layers also showed differences in feed consumption. Treatment Y had the highest feed intake at 100.20 grams, followed by treatment Z with 99.92 grams and treatment X with 99.28 grams. ANOVA showed significant differences among the treatment means. In the 100 mg probiotic group, egg production improved by 5%, and shell thickness increased slightly, with fewer thin-shelled eggs than in the control group (Liu et al., 2023). The interaction between the levels of vermicast and lactic acid bacteria serum significantly affected the feed consumption of layers. ANOVA results indicated a statistically significant interaction between the two supplements regarding feed intake.

3.4 Average Quail Egg Weight

Table 4 summarizes the average water consumption of layer quail, added with different levels of vermicast and lactic acid bacteria serum.

Table 4. T*he Average Water Consumption of Layer Quail*

Factor A Different Levels of VC	Factor B: Different Levels of LABS			Total	Mean
	X Pure Water	*Y 10ml LABS*	*Z 20ml Labs*		
A - Pure CF	401.92	489.56	426.64	1318.12	439.37
B - 8% VC	494.12	437.92	434.68	1366.04	455.34
C - 10% VC	404.60	482.00	492.04	1378.64	459.64
D - 6% VC	487.88	446.44	478.28	1412.60	470.86
Grand Total				**5475.40**	
Grand Mean	**447.13**	**463.98**	**457.91**		**456.28**

Based on the data gathered on water consumption and laying efficiency of quails fed with commercial feeds supplemented with different levels of vermicast and lactic acid bacteria serum, layers given 6% vermicast had the highest water consumption at 470.86 ml, followed by 10% vermicast at 459.54 ml, 8% vermicast at 455.34 ml, and pure commercial feeds at 439.37 ml. The analysis of variance (ANOVA) showed no significant differences among the treatment means. This indicates that the addition of 10% vermicast did not significantly affect the water consumption of the layers. Although 6% vermicast showed the highest water consumption, it did not yield statistically significant results. The coefficient of variability was 14.90%.

Regarding the different levels of lactic acid bacteria serum (LABS), layers given 10 ml of LABS had a water consumption of 463.98 ml, followed by 20 ml of LABS at 457.91 ml, and pure water at 447.13 ml. ANOVA results showed no significant differences among these treatments. According to Merisa Sirisopapong et al. (2023), LABS supplementation affects daily egg production and mass and may reduce feed conversion ratio, shell thickness, and egg cholesterol. Based on the data gathered, the interaction between the different levels of vermicast and lactic acid bacteria serum showed no significant results in the variance analysis.

4.0 Conclusion

The results showed that though the application of vermicast and lactic acid bacteria serum (LABS) in quail feeding regimens had no marked effect on egg production or water intake, there were some notable changes to egg weight, especially with the 8% vermicast treatment. This may suggest that the use of vermicast could improve egg quality, which could be beneficial for quail farmers seeking to enhance their product quality. The noteworthy interaction effects on feed intake also suggest a blend of LABS and vermicast that may work together in a more complex manner, which deserves additional exploration.

Studies employing such combinations and ratios remain to be studied. Additionally, investigating the longer-term impacts, the mechanisms involved, and conducting a cost analysis in other production environments would also be valuable. If combined with probiotics like LABS, the addition of vermicast into quail diets has the potential to make poultry farming more environmentally friendly and economical.

5.0 Contributions of Authors

Author 1: proposal writing conceptualization, data gathering, data analysis,
Author 2: advising, data analysis

6.0 Funding

This study received no specific grant from any funding agency.

7.0 Conflict of Interests

This study has no conflict of interest of any sort.

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