Volume 3 | Issue 1 | Jan - Jun 2024
ISSN: 2984-9896

EFFECT OF AZOLLA AS PARTIAL FEED SUBSTITUTE ON THE GROWTH PERFORMANCE OF ITIK PINAS (Anas platyrhynchos)

Christina A. Martinez
Vernice Joy S. Nagtalon
Rochel Anne A. Singgi
Jazrael A. Siriban
Philip Carlo A. Martinez Jr.
Cagayan State University – Sanchez Mira Campus
Sanchez Mira, Cagayan, Philippines

ABTRACT

The escalating prices of commercial feed ingredients, attributed to production challenges, market constraints, and raw material availability, have led to significant price hikes, with reports indicating a 30% increase from 2022 to 2023. These factors critically impact the sustainability of duck farming in the Philippines, discouraging farmer engagement in the industry. In response to these challenges, Azolla (Azolla pinnata), an aquatic fern rich in essential amino acids and crude protein, emerges as a potentially economical, abundant, and readily available alternative feed source for poultry. This study investigates the effect of Azolla pinnata as a partial feed substitute on the growth performance of Itik Pinas. Eighty ducklings were randomly assigned to four experimental groups (each with two replicates of ten ducks) and fed four different diets: T1 (100% Commercial Feeds (CF)), T2 (20% Fresh Azolla + 80% CF), T3 (30% Fresh Azolla + 70% CF), and T4 (40% Fresh Azolla + 60% CF). Body weight increased significantly in the T2 and T3 groups, while feed consumption showed no significant difference among all treatment groups, indicating that adding fresh azolla did not affect feed intake. The feed conversion ratio and feed conversion efficiency also showed no significant differences among all groups. Using Cost Minimization Analysis, it was determined that all treatments achieved the target weight and Treatment 4 was the most cost-effective being 31.9% less expensive than the control treatment. Thus, substituting up to 40% of commercial feed with fresh azolla does not negatively impact the efficiency of feed conversion into body weight in the Itik Pinas breed of ducks.

Keywords: *Anas platyrhyncos, Azolla, Feed Substitute, Growth Performance, Itik Pinas*

INTRODUCTION

Itik Pinas (IP) is a genetically superior breed of duck developed in 2016 by the National Swine and Poultry Research and Development Center (NSPRDC) of the Bureau of Animal Industry (BAI). Itik Pinas was bred to specialize in egg production through continuous selection and breeding of the traditional Pateros duck. Duck eggs are highly sought after in local markets across the Philippines, Malaysia, Indonesia, and other parts of Southeast Asia (Alejandria, 2019).

Recent studies highlight the escalating prices of commercial feed ingredients, attributed to production challenges, market constraints, and raw material availability, resulting in significant price hikes, with reports indicating a 30% increase from 2022 to 2023 (Osborn, 2023). These factors are crucial in understanding the challenges faced by duck feed production, which directly impact the sustainability of duck farming in the Philippines. Recent research by Manalo et al. (2022) discusses the technical and socioeconomic constraints that hinder feed production, discouraging farmer engagement in the duck industry (Baris, 2023).

In light of the escalating feed costs and challenges in duck farming, exploring alternative feed sources becomes imperative. One such promising option is azolla, scientifically known as Azolla pinnata. Azolla's symbiotic relationship with the nitrogen-fixing algae Anabaena azollae enhances its nitrogen fixation and assimilation capabilities, thereby enriching its nutrient, mineral, and crude protein content. Moreover, Azolla's low fiber content makes it highly digestible, offering a competitive advantage over other feed alternatives that require extensive processing before being suitable as feed for farm animals (El Naggar, 2022).

The goal of this study was to evaluate how azolla, as a partial substitute for conventional feeds, affects the growth performance of Itik Pinas. Understanding the potential of azolla in mitigating the challenges posed by expensive and sometimes scarce commercial feeds could provide sustainable solutions for duck farmers in the Philippines, promoting economic viability and enhancing the overall productivity of Itik Pinas.

MATERIALS AND METHODS

The following materials and supplies used in the study were 80 heads of Itik Pinas, feeds, digital weighing scale, record book, azolla, feeding troughs, eight plastic basins, waterer, silpaulin sheet, cement, steel bars, hollow blocks, galvanized steel, measuring tape, electrolytes, major d, net and cleaning materials.

The study was laid out following Completely Randomized Design (CRD) with four treatments replicated two times. The study of Punyatong et al served as the basis for the treatment levels, increasing the level of substitution to evaluate its effects on the growth performance of Itik Pinas.T1- 100% Commercial feeds, T2- 20% azolla + 80% commercial feeds, T3- 30% azolla + 70% commercial feeds, T4 - 40% azolla + 60% commercial feeds.

Materials used for the construction of semi-permanent experimental cages are cement, steel bars, hollow blocks, and galvanized steel. The 40 square feet experimental cages were equipped with feeding and drinking troughs. The experimental area was cleaned thoroughly and leveled. The azolla pond was constructed with the dimensions of 6 by 4 feet using cement and hollow blocks. The pond was lined with durable silpaulin sheets on a raised embankment to prevent water leakage. A net was used as a physical barrier to prevent the entry of leaves, small insects and animals, and other foreign materials. The net also served as a partial shade which is essential for azolla cultivation. One kilogram of chicken dung and 100g of complete fertilizer was mixed to the water as additional sources of nutrients for the azolla. Complete fertilizer was added to the ponds every other week. The azolla was gathered from Sto. Tomas, Claveria Cagayan using a hand net and was then equally distributed to six (6) ponds.

A total of eighty (80) ducklings as experimental units of Itik Pinas were procured at Mallig, Isabela. The experimental birds chosen for the study are of similar age and size, all of which are healthy and energetic without visible signs of deformities. The brooding area was lit

three (3) hours before the arrival of the experimental ducks to prevent temperature shock.

Upon arrival, the ducks were given water with Spectrum (electrolytes) to prevent mortalities caused by transportation stress. They were kept in the brooder house lined with rice hull as litter materials and fluorescent light bulbs were installed. The rice hull served as heat insulators and the light bulbs provided artificial heat that helped in maintaining the optimum temperature during the brooding period. Light was available twenty-four (24) hours a day and seven (7) days a week and the ducklings were provided with water and feeds ad libitum.

The eighty (80) ducks were assigned randomly after their 21- day brooding period. They were segregated by size and their initial weights were recorded. In addition, they were cared for in the cages until they reached the age of fifteen (15) weeks.

Throughout the study, clean drinking water was provided ad libitum to help them in consuming more feeds and help against heat stress. Restricted feeding was practiced throughout the duration of the study. The feed was weighed before being given to the ducks following the proper amount of azolla and commercial feeds according to the treatments. The azolla was harvested from the pond and washed with running water before being thoroughly mixed with feeds. The leftover feed was weighed before giving another ration to get the total feed consumed for the day.

Maintaining cleanliness and sanitation within the experimental area was given emphasis throughout the entire duration of the research study. Strict protocols were implemented to ensure that the experimental area remained hygienic and free from potential sources of contamination or disease. This included daily cleaning of feeding and watering troughs to prevent the accumulation of dirt, debris, and microbial pathogens. Disinfection was performed every month. Daily cleaning and sanitation included removal of manure by sweeping it into the drainage using a broom along with flushing with water. This practice was implemented to mitigate foul odor and minimize health risks associated with accumulated waste.

RESULTS AND DISCUSSION

Generally, during the brooding period, the ducklings were notably active and consumed substantial amounts of water and feeds. During feeding, although mixed homogeneously, the ducks tend to eat the azolla first than the commercial feeds.

Initial Weight

Table 1 presents the initial weight of the experimental ducks in grams (g) prior to treatment application. Analysis of Variance (ANOVA) indicated no significant difference in the initial weights among the replicates. This homogeneity in starting weights across all treatment levels ensures a reliable assessment of the ducks' growth performance.

Table 1. Initial weight (kg) of the ducks measured before the administration of treatments.

TREATMENT	WEIGHT (kg)
1	0.5783
2	0.5626
3	0.5567
4	0.5254
CV (%)	6.87

Weekly Body Weight

The data on weekly body weight of ducks are summarized in Table 2. The study confirms that the target weight range of 1.3 kg to 1.5 kg for layer ducks was consistently achieved across all experimental treatments, aligning with established practices for Itik Pinas (IP) ducks (Poultry Extension, 2024). The partial substitution of commercial feeds with fresh azolla up to 40% did not reduce body weight gain. Treatment 3 with 30% TREATMENT WEIGHT (kg) 1 0.5783 2 0.5626 3 0.5567 4 0.5254 CV (%) 6.87 substitution consistently achieved the highest body weights throughout the study while Treatment 1 with 100% commercial feeds had the lowest body weights. Analysis of Variance (ANOVA) showed significant differences in treatment means during the 4th, 6th, 11th, 12th, 13 th, 14th and 15th weeks. Posthoc pairwise comparison using Least Significant Difference indicated that Treatments 2

(20% fresh azolla substitution) and Treatment 3 (30% fresh azolla substitution) were significantly heavier compared to other treatments. This demonstrates that substituting commercial feeds with fresh azolla at 20% and 30% levels enhances body weight gain.

Table 2. Weekly body weight (kg) of ducks given different levels of azolla as feed substitute.

Week	Treatment				CV (%)
	1	2	3	4	
1	0.738	0.693	0.643	0.670	5.35
2	0.787	0.767	0.753	0.731	3.24
3	0.904	0.887	0.871	0.832	4.42
4	0.972	0.907	0.943	0.929	2.25
5*	1.037^{a}	1.039^{a}	1.038^{a}	0.933^{b}	1.49
6*	1.198^{b}	1.254^{ab}	1.318^{a}	1.195^{b}	2.76
7	1.287	1.343	1.336	1.275	2.71
8	1.223	1.328	1.305	1.292	3.85
9	1.242	1.333	1.319	1.281	4.31
10	1.277	1.285	1.295	1.257	1.31
11	1.265	1.320	1.308	1.308	1.67
12*	1.277^{b}	1.370^{a}	1.371^{a}	1.328^{a}	1.46
13*	1.274^{c}	1.420^{a}	1.436^{a}	1.343^{b}	1.09
14*	1.282^{b}	1.344^{a}	1.390^{a}	1.351^{a}	1.6
15*	1.305^{b}	1.446^{a}	1.446^{a}	1.357^{b}	1.67

* Significant at 0.05

Weekly Feed Consumption

During the last four (4) weeks of the study, ANOVA revealed no significant difference in the mean feed consumption among the treatment groups. However, significant differences in weekly feed consumption were observed during the 4th, 5th, and 7th weeks. During these weeks, the experimental birds in Treatment 1 consumed significantly less feed compared to the other treatments. Additionally, researchers observed that the ducks tended to eat the azolla first before the commercial feeds, even though the feeds were mixed homogeneously.

Table 3. Weekly feed consumption (kg) of ducks given different levels of azolla as feed substitute.

Week	Treatment				CV (%)
	1	2	3	4	
1	19.762	19.664	20.073	20.195	0.775
2	18.028	19.225	19.549	19.421	2.063
3	19.774	19.467	19.774	19.467	0.529
4	17.771^{c}	19.135^{b}	19.274^{ab}	19.421^{a}	0.334
5	18.696^{b}	20.196^{a}	19.989^{a}	20.320^{a}	1.355
6	18.283	19.238	19.956	19.711	2.547
7	19.757^{b}	20.03^{b}	20.543^{a}	20.184^{ab}	0.791
8	19.543	19.956	19.485	19.638	3.7519
9	19.763	20.257	19.832	20.01	0.932
10	20.108	19.962	19.765	20.085	0.502
11	20.336	20.609	20.087	20.030	0.557
12	20.270^{ab}	20.270^{a}	19.983^{b}	20.021^{b}	1.137
13	20.078	19.81	19.961	20.175	0.956
14	20.071	20.331	20.235	20.049	0.628
15	20.034	19.927	20.38	20.046	1.091

* Significant at 0.05

Cost Minimization Analysis (₱)

In the study, Cost Minimization Analysis (CMA) was conducted to compare the incurred costs of the four treatments which attained standard weight of 1.3kg to 1.5kg for duck egg layers (Poultry Extension, 2024) to evaluate which treatment is the most cost-effective. Table 4 summarizes the results, revealing that Treatment 4 is the most economical having the lowest expenditure. Compared to the control treatment, Treatment 2 with a total expenditure of ₱8,418.00 is 15.2% less expensive, Treatment 3 with a total expenditure of ₱7,606.00 is 23.4% less expensive, and Treatment 4 with a total expenditure of ₱6,752.00 is 31.9% less expensive. Thus, Treatment 4 is identified as the most cost-effective among all the treatments while adhering to the standard weight of duck egg layers.

Table 4. Summary of costs incurred per treatment.

ITEMS	T1			T2			T3			T4		
	Quantity	Unit Cost	Price	Quantity	Unit Cost	Price	Quantity	Unit Cost	Price	Quantity	Unit Cost	Price
Stocks	10	50	500	10	50	500	10	50	500	10	50	500
Electrolytes	5 sachets	20	100	5 sachets	20	100	5 sachets	20	100	5 sachets	20	100
Starter	38 kg	30	1,140	38 kg	30	1,140	38 kg	30	1,140	38 kg	30	1,140
Grower	292.5 kg	28	8,190	238.5 kg	28	6,678	209.5kg	28	5,866.00	179 kg	28	5,012
Azolla	0	0	0	60 kg	7.67	460.2	90 kg	7.67	690.3	119.5 kg	7.67	916.565
Total Cost (₱)			9,930.00			8,418.00			7,606.00			6,752.00

Break-Even Analysis

The costs incurred during the study were summarized in Table 4 and the break-even analysis was performed with a number of assumptions to project the number of days it would take to reach the break-even point and start gaining profit. According to Julian et al (2022), laying percentage of Itik Pinas depends on several factors like type of housing, climate, and age. In the study of Berdos et al (2019), laying percentage ranges at 77 – 85% when raised in a semi-intensive farming system while the Poultry Manual (2018) states that a duck has a peak egg production percentage of 98% to 100% while consuming 140g of feeds per day. For the break-even analysis, it was assumed that the laying percentage of ducks is 80% throughout. Duck layer feeds are available commercially at ₱39.00/kg and duck eggs are sold for ₱12.00 at farm gate price.

Table 5. Break-Even Analysis on Itik Pinas egg production given different levels of fresh azolla as partial feed substitute

Treatments	Cost of Chicks (Php)	Cost of Feeds			Total Feed Cost (₱)	Projected Feed Costs (3-month Operation)		Projected Revenue per Day	Break-Even Point (days)	Projected Roi (3-month Operation)
		Starter Feeds	Grower Feeds	Fresh Azolla		Layer Feeds	Fresh Azolla			
1	₱500.00	₱1,140.00	₱8,190.00	₱0.00	₱9,830.00	₱9,828.00	₱0.00	₱192.00	104	-12.10%
2	₱500.00	₱1,140.00	₱6,678.00	₱460.2	₱8,778.20	₱7,862.40	₱386.57	₱192.00	90	1.48%
3	₱500.00	₱1,140.00	₱5,866.00	₱690.3	₱8,196.00	₱6,879.60	₱579.85	₱192.00	83	10.38%
4	₱500.00	₱1,140.00	₱5,012.00	₱916.57	₱7,568.57	₱5,896.80	₱773.136	₱192.00	76	21.36%

CONCLUSION

The findings of the study led the researchers to conclude that partially substituting commercial feeds with fresh azolla up to 40% does not affect the ducks' weekly feed consumption and it was also found that 20% and 30% fresh azolla partial substitution enhances body weight gain. The researchers conclude that fresh azolla is a viable partial feed substitute to commercial feeds, reaching the standard weight of 1.3kg to 1.5kg for layer ducks before laying. Treatment 4 with 40% fresh azolla and 60% commercial feeds is the most cost effective and Treatment 3 with 30% fresh azolla and 70% commercial feeds is cost-effective along with enhancing the body weight gain.

RECOMMENDATIONS

Based on the findings of the study, the following are recommended:

The study's findings indicate that conducting a verification trial is prudent to thoroughly validate the feasibility of azolla as a suitable partial substitute feed for Itik Pinas. This proposed trial would serve to provide additional evidence regarding the effectiveness of azolla in meeting the nutritional needs of Itik Pinas. By subjecting azolla to further testing under controlled conditions, researchers can gain deeper insights into its potential as a sustainable and cost-effective feed option for Itik Pinas.

To conduct future researches, focusing on studying the laying performance of Itik pinas holds promise for enhancing profitability.

Further recommendation was made to utilize ready-to-lay Itik Pinas hens for the study to streamline both cost and time efficiency.

Ready-to-lay hens, referring to birds that are at the point of laying eggs, offer several advantages for research purposes. Ready-to-lay hens can be more costeffective compared to raising birds from a younger age. By starting with hens that are already close to laying age, researchers can save on the costs associated with raising ducklings, such as feed, housing, and labor.

REFERENCES

Berdos, J., et al. (2019). Comparative Expression Analysis of Small Intestine Nutrient Transporters Sodium-Glucose Cotransporter 1 (SGLT1) and Peptide Transporter 1 (PEPT1) between Itik Pinas (Anas plathyrhinchos L.) and Commercial Layer Chicken (Gallus gallus domesticus). Philippine Journal of Veterinary and Animal Sciences, 46(2), 114-122.

Berdos JI, Martin EA, Celestino OF and Paragas EJS. 2019. Egg Production Performance of Improved Philippine Mallard Ducks (Anas platyrhynchos) Fed Diets Supplemented with Fresh Trichanthera (Trichanthera gigantea) Leaves. Philipp J Vet Anim Sci 45(1):48- 57.

Fasuyi, A.O., & Aletor V. A. (2021). Green plants as a Potential Source of Proteins: Synthesis of Amino Acids from Primary Materials. Journal of Sustainable Agriculture, 25(3), 78-89.

Feeding Ducks for Egg Production in Small

Flocks. (n.d.). Poultry Extension. Retrieved June 7, 2024, from https://poultry.extension.org/articles/feeds-and-feeding-ofpoultry/feeding-ducks-for-egg-production-kept-in-small-flocks/

Julian, J. K. D., Velasco, V. V., Manlapig, J. J. D., & Orden, E. A. (2022). Laying performance and egg quality traits of Itik PINAS (IP)-Kayumanggi (Anas platyrhynchos) under intensive and semiintensive farming system. Philippine Journal of Veterinary and Animal Sciences, 48(2), 35-42.

Kumar, M., Gupta, K., & Kumar, S. (2018). Effect of inclusion of Azolla (Azolla pinnata) on the performance of broiler chickens. Journal of Animal Research, 8(4), 629-632.

Le, T. T., Pham, M. N., Nguyen, V. K., & Nguyen, T. T. (2021). Effect of Azolla meal substitution on nutrient utilization, growth performance and economic benefits in duck farming. Vietnam Journal of Agricultural Sciences, 19(3), 245-254.

Manalo, G.B.P., et al. (2022). Socio-economic impacts of Philippine Mallard duck production: A case study in the province. Journal of Poultry Science, 9(3), 72-85.

Martinez, A., et al. (2021). Ducks: Hardy, adaptable, and Profitable. Journal of Poultry Science, 15(2), 45-56.

PCAARRD. (2017, July 3). Itik Pinas; Development, promotion, and utilization in building rural enterprises.

Pereira, A. L. (2017). The Unique Symbiotic System between a Fern and a Cyanobacterium, Azolla-Anabaena azollae: Their Potential as Biofertilizer, Feed, and Remediation. International Journal of Applied Research and Studies, 10(2), 45-58.

Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD). (2017). Itik Pinas: Development, promotion, and utilization in building rural enterprises. Philippine Statistics Authority. (2023). Duck Situation Report, January to March 2023.

Philippine Statistics Authority. (2023). Duck Situation Report, July to September 2023.

Poultry Manual. (2018, January 3). Duck farming in the Philippines. Poultry Manual. https://poultrymanual.com/2018/01/03/duck-farmingphilippines/

Punyatong, M., Kanjak, P., Tapingkae, W., Lumsangkul, C., Moonmanee, T., Van Doan, H., & Khamtavee, P. (2024). Effect of fresh azolla (Azolla pinnata) feed replacement on growth performance, carcass quality, and oxidative stress in Thai native crossbred chicken. Veterinary Integrative Sciences, 22(3), 1019–1028. https://doi.org/10.12982/VIS.2024.069. Retrieved from https://he02.tci-thaijo.org/index.php/vis/article/view/266664

Ramos, J., Mendoza, M., Aglibot, C., & Pati, M. (2019). Genetic Improvement and Utilization of Itik Pinas. Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD).

Reang, L., Kaimun, S., & Debbarma, D. (2020). Effect of Azolla substitution on growth performance and egg quality traits in poultry. Journal of Animal Research, 10(2), 375-380.

Sarian, Z. (2018). Itik Pinas: A native duck breed in the Philippines known for its adaptability and resilience. Agriculture Monthly.

Swain, B., et al. (2018). Effect of Feeding of Azolla (Azolla pinnatra) on the Performance of White Pekin Laying Duck. International Journal of Livestock Research, 11(3), 45-52.

Zhai, et al. (2018). Dietary Protein and Carbohydrate Utilization Efficiency, and Growth Performance of Ducklings.