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Evaluation on productive performance of pekin duck and rice (*Anas platyrhinchos domesticus*) under rice-duck-azolla farming method

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Abstract

The rice-duck- Azolla integrated farming has mutual benefits, the duck is a natural grazer and scavenger they can eat a wide variety of growing weeds, insects, and snails while the rice provides a natural feed and habitat that can lower the reliance of farmers on expensive commercial feeds that contribute to 60%-70% in livestock raising . The study was conducted in the rice production area of the Cagayan State University-Gonzaga campus to evaluate the growth performance and feed consumption of Pekin duck under rice-duck-Azolla farming. A total of seventy-two (72) heads of 3 (three) week-old Pekin ducks have been distributed into Three (3) treatments and replicated three (3) times per treatment with a total of 8 Pekin ducks per replication. The statistical design used in the study is a complete randomized design (CRD). The result of the study based on the data gathered shows that T1, Pekin duck fed with pure commercial duck feeds and confined in space where no grazing area is provided have obtained the highest Average Daily Gain (ADG) of 56.00g gain in weight/day and FCR of (2.77). Treatment 1 grows the fastest due to the lesser space for movement of ducks and fully dependent on the commercial feeds given to them leading to less energy used and higher concentrate feed intake that causes them to have the highest volume of commercial feed consumed. Treatments 2 and 3 have consumed a lot of energy to graze in the rice field and are not dependent on pure commercial feeds. T2 and T3 have lower FCR because of the additional sources of feeds such as weeds, insects, worms, and snails that they have found in their range area which were not quantified as feed consumed but have provided additional/supplement to the commercial feeds given to them. Based on the result of a study conducted it was concluded that treatments 2 and 3 are the highly recommended methods in Pekin duck production because they decrease the dependence on duck in pure commercial feeds which lessens the volume of consumption and lowers the cost of production with competitive growth performance of duck which leads to the increase of income of raisers.

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Introduction

In the Philippines, Balut is a popularly known Filipino delicacy made from incubated duck eggs. It is the main product of the duck industry in the Philippines followed by salted duck eggs locally known as "itlog na maalat". Cooked balut is sold as snacks in the evenings by street vendors, either peddling on the street or stationing on the sidewalk. Most Filipinos speak of balut fondly and proudly. Although in the Philippines some meat-type ducks are being raised, the majority of duck meat is derived from excess males and culled layers. Consequently, the meat is relatively low in quality, with fishy meat taint and tough and coarse texture (Perez, 2003). Duck meat is often used for making another traditional Filipino duck dish known as "kinulob na itik", whereby fishy smell and toughness are overcome or disguised by heavy seasonings and deep frying after being boiled for hours (Lambio, 2001). As a result, consumers prefer pork and chicken meat and the demand for "kinulob na itik" is limited to a small segment of the Filipino population (de Castro *et al.*, 2002).

Raising native ducks is usually divided into two systems known as free-range and a confined system that uses a duck house called kamalig. Free-range duck farming is the traditional way of raising native ducks since the birds are allowed to graze and scavenge on newly harvested rice fields. A temporary fence and shelter made from fishnets are established to allow ducks a place to rest during the afternoon. The shelter protects the ducks from wild animals and also serves as a nesting place.

This method allows duck farmers to save money from feeds and housing. It is also used to raise ducks that are one to five months old. Meanwhile, the other scheme that requires the kamalig doesn't give ducks as much freedom. Here, they are provided with a balanced diet that includes formulated feeds, clean drinking water, proper floor space, and other requirements to foster proper maintenance, growth, and development needed for egg production.

Most of the smallholder farms use the free-range method of farming ducks to minimize their expenses in feeds, but problems have been encountered in ranging the duck in the newly harvested rice fields this is the short period for the rice field to be available as ranging area, the interval of harvesting to planting again will take only take 1 (one) month, especially in irrigated areas. raisers have to look for another ranging area where rice is newly harvested. When all the rice fields start planting, duck raisers will be forced to use commercial feed, which is way more expensive and could lessen their income causing a burden to raisers. Sometimes raisers who don't have the financial capability to purchase commercial feed have no choice but to give the ducks with inferior quality of local feeds like the rice hull which cannot meet the nutrient requirements of ducks for egg production that cause them to stop producing eggs. This problem is always observed during the time of rice planting to harvesting when there are no available duck eggs in the market. his makes itik not practical to range in the rice field due to the limited period of the availability of ranging area in the rice field.

The use of integrated rice duck farming in duck egg production also has limitations because the duck is not allowed to graze in the newly transplanted rice and it takes one month for the rice to grow and develop its root system to not disturb the growth of the rice, secondly, the rice will start to ripen its fruits after three (3) months of transplanting at this period the duck has to be removed in the rice field because it could eat all the rice grains.

In this study, the use of integrated rice duck farming using a fast-growing meat type of duck is highly recommended like the Pekin duck. This breed of duck is considered the broiler of ducks because of its fast-growing characteristics. They are good layers, and ducklings are ready for market at 2 or 3 months old which can produce a total weight of 3.5 kg.

For integrated rice duck farming the two-week-old ducklings can be allowed to graze in the rice field, for

two weeks after transplanting and the duck can stay at the rice field until 2 weeks before harvesting giving the duck 3 months staying in the rice fields at this period the duck is ready for slaughter. The proper use of breed in integrated rice duck farming is highly advisable because the raiser will not encounter a feeding problem for the animals it will also help the rice by controlling insects, snails, and weeds and giving natural fertilizer. The use of Azolla in rice fields also adds benefits to the production of duck and rice. The azolla can fix nitrogen from the air that can be used by the rice and it also be a good source of protein when eaten by the ducks. The duck will be an additional source of income for farmers by growing the rice and ducks at the same time with minimal inputs given to them with a possible higher income thus this study will be conducted.

Materials and methods

Locale of the study

The study was conducted in Cagayan State University-Gonzaga rice production area.

Treatment sample

Fresh water and feeds are given daily to different replications of the study. The feeds were weighed before and after feeding to calculate the total volume of feeds consumed daily. The different treatments given in the study are the following:

T1-Ducks fed with pure commercial concentrated feeds without ranging in rice fields
T2- Ducks fed with pure commercial concentrated feeds and allowed to range in the rice fields
T3- Ducks fed with pure commercial concentrated feeds and allowed to range in the rice fields with Azolla

Experimental design

A total of seventy-two (72) heads of 3 (three) week-old Pekin ducks have been distributed into Three (3) treatments and replicated three (3) times per treatment with a total of 8 Pekin ducks per replication. The statistical design used in the study is a complete randomized design (CRD).

Data collection

Average daily gain (ADG)

The formula for calculating average daily gain (ADG) is:

ADG= (Final weight−Initial weight)/Number of days

Where:

Final weight = The animal's weight at the end of the period.

Initial weight = The animal's weight at the beginning of the period.

Number of days = The total number of days over which the gain is measured.

Feed conversion ratio (FCR)

The formula for calculating the feed conversion ratio (FCR) is:

FCR=Total Feed Intake/Total Weight Gain

Cost and return analysis were done by the standard formulae.

Results

Average daily gain (ADG)

Based on the result of the study T1 has the highest Average Daily Gain (ADG) in weight with a 56g daily gain in weight. This is followed by T3 with an average daily gain in weight of 46.9g and T2 with a 45.3 g daily gain in weight (Table 1).

Feed conversion ratio (FCR)

The data gathered shows that T1 has the highest Feed Conversion Ratio with 2.77kg of feeds consumed to gain a 1kg body weight. This is followed by the T2 with 2.02kg of feeds to gain 1kg weight and the T3 is 1.97 kg (Table 2).

Cost and return analysis

For the total cost of production of pekin duck T1 has the highest with a total amount of 12,738.7 pesos because this group have the highest consumption of feeds. This is followed by T3 with 9,966.99 pesos and T2 with 9,958.2 pesos (Table 3).

For the net income, data shows that T3 has the highest income with 1,838.46 pesos followed by T2 at 1,409.94 pesos and T1 at 944.48 pesos (Table 4 & 5).

Table 1. Average daily gain

Treatment	Initial wt. (g)	Final wt.(g)	Final-initial wt.(g)	ADG (g)
1	513.9	3,257.90	2,744	56
2	489.5	2,706.70	2,217.20	45.3
3	513.1	2,810.80	2,297.70	46.9

Table 2. Feed conversion ratio

Treatment	Daily feed intake(g)	Average daily Gain(g)	FCR (g)
1	155.1	56	2.77
2	91.2	45.3	2.02
3	91.4	46.9	1.97

Table 3. Total cost of production

Particulars	Unit	Qty			Unit cost (P)	Total expense		
A. Labor Inputs		T1	T2	T3		T1	T2	T3
1. Installation of bamboo pole	MD	1.5	1.5	1.5	350	525	525	525
2. Installation of net	MD	1.5	1.5	1.5	350	525	525	525
Sub-total								
B. Materials								
1. Chicken net	Roll	1	1	1	3500	3500	3500	3500
2. Feeds	kg	182.3	107.2	107.4	37	6748.7	3968.2	3976.9
3. Chicks	head	24	24	24	60	1440	1440	1440
Total						12,738.7	9,958.2	9,966.9

Table 4. Total gross income per treatment

Treatments	Final weight (kg)	Number of Duck	Total weight	Price/kg of duck live weight	Gross income (P)
T1	3.2579	24	78.1896	175	13,683.18
T2	2.7067	24	64.9608	175	11,368.14
T3	2.8108	24	67.4592	175	11,805.36

Table 5. Total net income per treatment

Treatments	Cost of production	Gross income	Total net income (P)
1	12,738.70	13,683.18	944.48
2	9,958.20	11,368.14	1,409.94
3	9,966.90	11,805.36	1,838.46

Discussion

The result of the study based on the data gathered shows that T1 was found to have the highest ADG over T3 and T2 while ducks raised under the rice duck Azolla and rice duck farming system were found similar to each other. Birds raised under T1 intensive duck farming were found to have the highest ADG when compared to those that were raised under the integrated farming system due to lesser space for their movement where less energy was used and they are fully dependent on commercial concentrated feeds which could help for faster growth and weight gain.

The other group of ducks that were raised in an integrated rice duck farming system (T2 & T3) have wider space for their movements, in which their body consumes a lot of energy for ranging this energy converted from the nutrients they feed that affect their body weight gain. The (T2 & T3) have a different variety source of feeds like insects, mollusks, weeds, worms, and fish which minimizes their feed intake in commercial feeds that could affect their weight gain. Ducklings were found catching insects efficiently in the rice-duck plots, thereby reducing the insect population. Similar results were reported by Choi Song Yoel *et al.* (1996), Hossain *et al.*, 2002, and Foruno, 2001.

As shown in the result of the study, birds fed with pure duck feeds had the highest FCR of 2.77. This was followed by T2 birds raised in integrated duck rice farming with a mean of 2. T3 duck rice Azolla farming system had the lowest FCR of 1.97. Statistically T2 and T3 were found similar to each other and were found to have lower FCR than T1.

T1 shows the highest Feed Conversion Ratio which means that those ducks in this group have to consume the highest volume of feeds to gain the same weight as T2 and T3. The T1 is fully dependent on the commercial feeds and all the sources of the converted weight of ducks in this group were only based on the volume of the commercial feeds they consume that make them have the highest FCR in the study.

While T2 and T3 have lower Feed Conversion Ratio means that they gain weight with a lower volume of commercial feeds consumed than the T1. This could be due to the additional feeds eaten by the ducks such as weeds insects and snails that they have found in their range area which were not quantified but have provided additional supplements to the commercial feeds given to them. Some additional feeds in the ranging area are excellent sources of nutrients especially protein that help in the growth and development of the Pekin duck which increases the weight of the animals the golden apple snail meal in the ducks' diet had a significant positive impact on body weight gain and overall growth performance (Niepes *et al., 2023*), because it is a good source of protein and based from (Sajid *et al.*, 2023) insect meal, emerges as a highly encouraging protein alternative, offering sustainable prospects for its utilization within the poultry sector. Aside from snails and insects the ducks also can eat small fishes and weeds that can also aid in the nutrient requirement of the ducks in the ranging area.

Cost and return analysis

Based on the data shown in Table 3 all of the treatments have the same expenses in the establishment of the study but in terms of the total feed used the T1 has the highest volume consumed because the ducks in this treatment are fully dependent on the commercial feeds which make the T1 to be the highest cost of production in the study.

In terms of the total gross income of the study shown in Table 4, T1 has the highest income because the animals in this treatment have a higher gain in weight than the T2 and T3 due to the effect of the pure commercial feeds eaten by ducks in T1. But in net income shown in Table 5, where the total gross income is subtracted from the total cost of production, T1 shows the lowest, and T2 and T3 have shown a higher positive income which makes the T2 and T3 more profitable than the T1 in this study.

Conclusion

Based on the result of a study conducted it was concluded that treatment 1 has the highest Average Daily Gain (ADG) in weight and Feed conversion Ratio (FCR). The ducks from treatment 1 grew faster than the other treatments but it took the highest volume of feed to consume to gain 1 kg body weight which increases the cost per kg of body weight gain which increases the cost of feed consumption and leads to lower income in the study.

Treatments 2 and 3 are the best methods in the study because they decrease the dependence on duck in pure commercial feeds due to another feed source available in the rice fields which lessens the volume of commercial feed dependence and lowers the cost of production with competitive growth performance of duck that leads to the higher profitability of the study.

The T1 and T2 are the recommended methods of rice-duck-Azolla integration because based from the results of the study show that they gain more income in production. This technology developed from the study is important to be disseminated to farmers to make additional income during the time of rice production. The study only focuses on the growth performance of Pekin duck by the Average Daily Gain (ADG) and Feed Conversion Ratio (FCR) it is highly recommended to conduct another study on the carcass quality and egg performance of Pekin duck.

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