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Improvements of Laying Performance of Ducks Integrated in Rice Production

Jon Verny D. Biaco, Diego M. Malones, Briddo V. Dorado, Fatima Nunez, Gwen Lungsod, Maryneth B. Barrios

Capiz State University - Pontevedra Campus and Mambusao Satellite College

Abstract

The study was conducted at PhilRice area of Capiz State University, Pontevedra, Capiz from June 8, 2019-october 3, 2019 to find out the effects of Ducks integrated to rice production in terms of height, tillers, percent of filled grains, and weight of grains per hill and to evaluate the Laying Performance of Ducks Integrated in Rice Production. The experiment was conducted in a Randomized Complete Block Design with four treatments replicated three times. Treatment - A Control (without ducks), Treatment - B 2 hours exposure of ducks in rice field, Treatment - C 4 hours exposure of ducks in the rice field, Treatment - D 6 hours exposure of ducks in the rice field. The analysis of variance for RCBD was used to test the significant difference on the data gathered and LSMD was used to test the significant mean difference among treatments at 5% level of Probability. Results showed highly significant differences among treatments at 7, 14, 21, 28, 35, 42, 49 and 56 days after transplanting were highly significant. Highly significant results were observed among treatment means on the number of tillers at 21, 42 and 49 days after transplanting and significant at 7, 14, 28 and 56 days after transplanting. Result showed no significant across weeks of measurement for the parameters laying efficiency and average egg production.

Keywords: Rice, duck, laying efficiency, integrated

Corresponding author: Jon Verny D. Biaco
Address: Capiz State University - Pontevedra Campus, Capiz State University
E-mail: jonverny@gmail.com

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Introduction

Rice (Oryza sativa L.) is mostly grown in the lowlands under irrigated and rainfed conditions. It provides 35 – 60 percent of the dietary calories of every consumer with a consumption rate of 126 kg milled rice per person per year (BAS, 2019). With this present consumption rate, the current production of rice cannot suffice the need of the burgeoning population, which may result to insufficiency problem.

Rice-duck farming is a low-cost, organic farming method for small entrepreneurs, introduced in Bangladesh in 2001. Initially, convincing people that ducks were not harmful to rice was a major struggle. By raising ducks on rice paddy, no chemical fertilizers or pesticides are required, while 20% higher crop yields are obtained and net income on a cash cost basis increased by 80%. Labour requirements are continuous at a low level and supplementary feed requirements can be high for certain ecosystems.

Integrated rice-duck production is a low-cost, organic farming method for small entrepreneurs. Ducks are allowed to forage in the paddy 15 days after rice transplanting until the flowering stage about 2 months later. While the ducks forage, they remove weeds, eat unwanted pests, soften the soil with their bill and feet movements thereby releasing trapped nutrients, and their droppings provide natural fertilizer. By raising ducks in rice fields, no herbicides, insecticides and chemical fertilizers are required, findings based on three years of research (Ahmed et al, 2004). In the experiments, rice yields increased on average by 20%, which increased household rice availability by two to eight weeks. Duck eggs and meat also significantly increased household protein intake; surplus eggs and ducks were sold at the market for cash.

Materials and Methods

Land Preparation

A lowland area of 374 square meters was utilized in the conduct of the study. This was plowed and harrowed twice at weekly interval to puddle the soil. This was also done to hasten the decomposition of weeds and rice stubbles and provide desirable tilth for better growth and development of planted crops.

Experimental Design ant treatments

The experiment was laid out in a Randomize Complete Block Design (RCBD). Three blocks were constructed and each block was divided into four (4) plots that represent the different treatments. The plots within each block were randomly assigned to different treatments. Each plot has a dimension of 5/5 meters having a pathway of 0.5 meter in between plot and block respectively.

Fifteen days after transplanting, ready to lay -ducks were released in the plots at the rate of 7 ducks per plot. The ducks was removed from the rice fields at

the flowering stage. The following treatment were as follows: T1 - Without ducks (control), T2-2 hours exposure of ducks in the rice field, T3- 4 hours exposure of ducks in the rice field, T4- 6 hours exposure of ducks in the rice field.

Preparation of Experimental Animals

Seventy two (72) heads of Philippine Mallard Ducks, pullets, were used in the study. They were purchased from a reliable source in the province of Capiz. Upon its arrival, animals were given electrolytes to combat stress acquired from transportation. They were acclimatized for two weeks prior to the conduct of the study.

Feeding

Ducks were fed twice daily. Feeds were given at seven o'clock in the morning and four o'clock in the afternoon. Treatment were administered twice a day
Egg Collection

The eggs were gathered once a day at six o'clock in the morning. The collected eggs wereseparated according to its treatment and were placed in the storage.

Seedbed and Seedling Preparation

Seeds of black rice were soaked in water for 24 hours and were incubated for 36 hours before sowing in the seedbed. The pre-germinated seeds were uniformly distributed in the seedbed measuring 1 m x 1 m. Complete fertilizer at the rate of 15 grams per square meter was applied to the seedbed before sowing. To protect the seedbed from birds and other pest, seedbeds were surrounded and covered with nets. Care and management were provided to the seedlings until they were ready for transplanting.

Fertilizer Application

The Rice straw compost was incorporated into the soil two days before transplanting of seedlings. This was done by applying the fertilizer evenly into the soil and incorporating them by bare hands.

Transplanting

Twenty (15) day old seedlings were transplanted at the rate of one (1) seedling per hill at a spacing of 25 cm x 25 cm. Each treatment plot contained ten (20) rows and 20 hills or a total of 400 hills. Replanting of missing hills was done five (5) days after transplanting.

Fourteen day-old seedlings will be transplanted in the designated plots at the rate of 2 to 3 seedlings per hill at a planting distance specified in the treatments. Seedlings will be carefully removed from the seedbed and immediately transplanted

in the field.

Water Management

Five (5) days after transplanting, the area was irrigated at a depth of (three) 3 cm and then raised gradually to five (5) cm depending on the growth of the transplanted seedlings. Water was reduced to a depth of 2.0 cm during the weeding operations and fertilizer application. During panicle initiation until flowering, water was maintained at a depth of five (5) to seven (7) cm and was drained two weeks before harvesting.

Harvesting

Rice plants within the harvestable area were harvested when approximately 85% of the grains in each plot had ripened as indicated by yellow color, firm and hard grains. The panicles were cut at the base of the plant using a sharp sickle. All the panicles in the six middle rows excluding one end hill in each row were threshed, cleaned and sundried to approximately 14 % moisture content.

A. Agronomic Characteristics

1. Plant height (cm) at heading - this was determined by measuring ten (10) sample plants in each plot from the ground level up to the tip of the tallest part of the plant at heading stage.
2. Number of tillers per hill. - this was determined by counting the number of tillers that develop panicles from ten (10) sample plants in each treatment plot at maturity.

B. Yield and Yield Component

1. Percentage of filled grains - this was done by dividing the number of filled grains by the total number of grains in each panicle.

2. Weight of grains per hill. A day before harvest the ten sample hills in each plot were harvested separately and placed in the proper labeled bags. The harvested sample was handly threshed, dried and weighed later using a digital weighing scale.

3. Weight of grains per plot. A harveste area of 10 square meters in each plot served as the source of data in grain yield. The harvested rice was threshed and winnowed immediately. Individual treatments of in each block were placed in sack which was properly labeled and weighed.

4. Weight of Grains in tons per hectare. The yields in ton per hectare were determined using the formula:

$$\text{Weight of grains in tons/ha} = \frac{\text{Weight of grains per plot (10m2) x 100}}{1000}$$

Duck laying performance

1.Laying Efficiency - It was determined by dividing the number of eggs to the number of hen and the result were multiplied to 100 percent.
Laying efficiency = No. of Eggs/No. of Hen x 100

2. Average Egg Production - Egg production was determined by dividing the total number of laid egg per day to the number of weeks.
Average egg production = Total No. of Laid Eggs/No. of Weeks

Statistical Analysis

The data were statistically analyzed using the computer software statistical tool for Agricultural Research (STAR). Comparison of treatment means were analysed using Least Significant Difference (LSD) Test.

Results and Discussion

Average Height of Black Rice

Table 1 shows the average height of black rice at different ages. Plants in treatment 4 6 hours exposure of ducks in rice field obtained the tallest height at 7,14,21,29,35,42,49 and 56 days after transplanting with an average mean of 28.23 cm, 42.75 cm, 48.93 cm, 70.34 cm, 86.68 cm, 89.38 and 98.20 cm respectively. This was followed by plants in treatment 3 (6 hours exposure of ducks in rice field) with the mean of 27.78 cm, 42.08 cm, 47.89 cm, 67.76 cm, 77.81 cm, 85.04 cm, 87.38 cm and 95.13 cm. Plants in treatment 2 hours exposure of ducks in rice field had a mean height of 26.75 cm, 41.15 cm, 46.59 cm, 62.22 cm, 72.48 cm, 77.84 cm, 81. 28 cm and 86.70 cm. and the shortest height was noted in treatment 1 plant that without ducks with the average height of 24.15 cm, 37.98 cm, 44.93 cm, 57.76 cm, 64.86 cm, 68.31 cm, 72.84 cm and 83.49 cm respectively. The analysis of variance on the height of black rice 7 days after transplanting revealed that the height of Black rice was highly significant affected by the duck integrated to rice production. The least significant difference further shows that treatment $ is significantly taller than those in treatment 2 and 1, but not significant over treatment 3. However, treatment 3 was significant over treatment 1 but not in treatment 2. Analysis of variance 28, 35, 42 and 56 DAT revealed a highly significant difference in height of different treatments further analysis using LSD indicated that the height of all treatments significantly differs from other 28, 35 and 42 DAT.

Table 1 Summary on the average plant hight Integrated with ducks

Treatment	7 DAT **	14 DAT**	21 DAT*	28 DAT**	35 DAT**	42 DAT**	49 DAT**	56 DAT**
T1	24.15^{c}	37.98^{C}	44.93^{c}	57.76^{d}	64.86^{d}	68.31d	72.84^{c}	83.49^{d}
T2	26.75^{b}	41.15^{b}	46.59^{b}	62.22^{c}	72.48^{c}	77.84^{c}	81.28^{b}	86.70^{c}
T3	27.78^{ab}	42.08^{a}	47.89^{ab}	67.76^{b}	77.81^{b}	85.04^{b}	87.11^{a}	95.13^{b}
T4	28.23^{a}	42.75^{a}	48.93^{a}	70.34^{a}	79.91^{a}	86.68^{a}	89.38 ^{a}	98.20 ^{a}

*- Significant
**- highly significant
^{abcd}- Treatment means in a column having the same letter superscript is not significant with each other at 5% level of probability.

Table 2 Summary of the average number of tillers Integrated with ducks

Treatment	14DAT *	21 DAT**	28 DAT*	35 DAT**	42 DAT**	49 DAT**	56 DAT**
T1	2.15^{c}	5.75^{c}	8.05c	8.59^{c}	7.15^{c}	6.35^{b}	5.22^{d}
T2	2.65^{bc}	6.79^{c}	10.29^{bc}	10.45^{bc}	9.32^{bc}	7.29^{b}	6.92^{c}
T3	3.12^{ab}	9.59^{b}	12.39^{ab}	12.99^{ab}	10.69^{b}	8.45^{b}	8.43^{b}
T4	3.95^{a}	11.75^{a}	14.02^{a}	14.15^{a}	14.32^{a}	11.99^{a}	11.75^{a}

*- Significant

**- highly significant

^{abcd}- Treatment means that a column having the same letter superscript is not significant with each other at 5% level of probability.

Average Number of Tillers

Table 2 shows the average number of tillers integrated with ducks from 14, 21, 28, 35, 42, 49 and 56 DAT. At 14 days after transplanting treatment 4 obtained the highest number of tiller with mean of 3.95, followed by treatment 3 with a mean of 3.12, treatment 2 with 2.65 and treatment 1 got the lowest number of tiller with an average mean of 2.15. Analysis of variance on the average number of tillers at 14 DAT revealed that rice integrated with ducks was highly significant. LSD test revealed that treatment 4 was significant over treatment 1 and treatment2 but not significant over treatment 3. However, treatment c was significant over treatment 1 but not significant with treatment 2. At 21 Days after transplanting. The highest number of tiller was observed in treatment 4 with mean of 11.75, followed by treatment 3 with a mean of 9.59, treatment 2 with 6.79 and treatment 1 got the lowest number of tiller with an average mean of 5.75. The ANOVA revealed that there was a highly significant result on the number of tiller 21 DAT. LSD indicated that treatment 4 was significantly over all treatments. Furthermore, treatment 3 was significantly over treatment 1 and 2. However, treatment 2 and treatment 1 re not significantly differ with each other. At 28 DAT data shows that treatment 4 got the highest number of tiller with a mean of 14.02, followed by treatment 3 with 12.39 average number of tiller, treatment2 with a tiller mean of 10.29, and treatment 1 with 8.05 got the lowest number of tiller at 28 DAT. Analysis of Variance showed a highly significant result. LSD revealed that treatment 4 was significantly over treatment 2

and A, significant difference was also observe between treatment 3 and treatment 1. However, treatment 4 was not significantly over treatment 3 and treatment 2. At 35 DAT as shown in table 2 treatment 4 obtained the highest number of tiller with an average mean of 14.15, followed by treatment 3 with a tiller mean of 12.99, treatment 2n with a mean of 10.45 tillers, and treatment 1 got a lowest number of tiller with a mean of 8.57. analysis of Variace showed a highly significant result. LSD revealed that treatment 4 was significant over treatment 2 and 1 significant difference was also observed between treatment 3 and treatment 1. However, treatment 4 was not significantly over treatment 3 and treatment 2. At 42 DAT treatment D maintained the highest number of tiller with a mean of 14.32, still followed by treatment 3 with a tiller of 10.69, treatment 2 with 9.32 average tiller and treatment 1 still the had the lowest number of tiller with an average mean of 7.15. Analysis of variance on the average number of tiller revealed that there was a higly significant difference among treatments. LSD test revealed that treatment 4 was significantly higher than treatment 1, 2 and 3. Significant effect was also observed between treatment 3 and 1, but treatment 2 and 3 were not significant with each other. At 49 DAT kit was observed that the average number of tiller had decrease from each treatment as showed in table 2. Treatment 4 maintained the highest number of tillers with an average mean of 11.99, followed by treatment 3 with a tiller mean of 8.45, treatment 2 with 7.29 average tiller, and treatment 1 obtained the lowest number of tiller with 6. 35 average tiller. Statistical analysis on the average tiller of rice 49DAT showed that the rice integrated with ducks resulted to a highly significant results, further analysis using LSD showed that treatment 4 was significantly over the rest of the treatment. At 56 DAT still treatment 4 obtained the highest number of tiller with a tiller mean of 11.75, followed by treatment 3 with 8.45 average tiller, treatment 2 with a mean of 6.92 tiller, and still treatment 1 got the lowest mean of 5.22 tillers. Analysis of variance revealed a highly significant LSD test further revealed that treatment 4 was significant over the rest of the treatments.

It can be implied from this experiment that rice production integrated with ducks the possibility of increasing the average number of tillers.

Yield Performance

Percent Filled Grains per panicle

Table 3 shows that the highest percentage of filled grains per panicle was obtained by plants in treatment 4 (6 hours ducks exposure in the rice field) with mean of 81.00 %, followed by treatment 3 (4 hours ducks exposure to rice field) with the mean of 79. 42 %. Treatments 2 (2 hours ducks exposure in the rice field) got the average mean of 77.92 and the lowest percentage of filled grains per panicle was noted in treatment 1 with the mean of 76.81 %. Analysis of variance revealed that rice integrated with ducks was highly significant. LSD indicated that treatment 4,3,2 and 1 was significant each other. It can be implied based on this experiment that rice integrated with ducks higher its percentage of filled grains per panicle.

Table 3. summary on the percent of filled grains per panicle rice integrated with ducks

TREATMENT	PERCENT OF FILLED GRAINS/PANICLE
T1- Without ducks (control)	76.81
T2-2 hours exposure of ducks in the rice field	77.92
T3- 4 hours exposure of ducks in the rice field	79.42
T4- 6 hours exposure of ducks in the rice field	81.00

*- Significant
**- highly significant
abcd- Treatment means in a column having the same letter superscript is not significant with each other at 5% level of probability.

Weight of Grains per Hill

Table 4 showed that treatment 4 got the highest weight of grains per hill with the mean of 33.24 grams, treatment 3 with 21.54 grams, treatment 2 with 16.45 grams and treatment 1 obtained the lowest weight of grains per hill with the mean of 13.24 grams analysis of variance revealed that the rice integrated with ducks was highly significant affected the weight of grains per hill. LSD test indicated that treatment 4, treatment 3, treatment 2 and treatment 1 was highly significant with each other. The result implied that the rice integrated with ducks will gave heavy weight of grains per hill.

Table 5. summary on the weight of grains per hill integrated with ducks

TREATMENT	PERCENT OF FILLED GRAINS/PANICI
T1- Without ducks (control)	13.24^{d}
T2-2 hours exposure of ducks in the rice field	16.45^{c}
T3- 4 hours exposure of ducks in the rice field	21.54^{b}
T4- 6 hours exposure of ducks in the rice field	32.24^{a}

*- Significant
**- highly significant
abcd- Treatment means in a column having the same letter superscript is not significant with each other at 5% level of probability.

Weight of grains in kilogram per plot

As shown in table 5 the highest weight of grains in kilogram per plot was obtained by those plants in treatment 4 (6 hours exposure of ducks in the rice field) with the mean of 5.82 kg, followed by treatment 3 with the mean of 4.67 kg, treatment 2 with 4.52 kg and treatment 1 got the lowest weight with the mean of 3.83 kg. analysis of variance revealed a highly significant result in the weight of rice

in terms of weight of grains in kilogram per plot. LSD further analysis showed that treatment 4 was highly significant over the rest of the treatment. However, treatment 3 and treatment 2 were not significant with each.

Table 5. summary on the weight of grains per hill integrated with ducks

TREATMENT	PERCENT OF FILLED GRAINS/PANICI
T1- Without ducks (control)	3.83[d]
T2-2 hours exposure of ducks in the rice field	4.52[c]
T3- 4 hours exposure of ducks in the rice field	4.67[b]
T4- 6 hours exposure of ducks in the rice field	5.82[a]

*- Significant
**- highly significant
[abcd]- Treatment means in a column having the same letter superscript is not significant with each other at 5% level of probability.

Weight of grains in tons per hectare

As shown in table 6 the highest weight of grains in tons per hectare was obtained by those plants in treatment 4(6 hours exposure of ducks in the rice field) with the mean of 5.82 tons, followed by treatment 3 with the mean of 4.67 tons, treatment 2 with 4.52 tons and treatment 1 got the lowest weight with the mean of 3.83 tons. Analysis of variance revealed a highly significant result in the weight of rice in terms tons per hectare. LSD analysis showed that treatment 4 was highly significant over the rest of the treatment. However, treatment 2 was not significant over treatment 3 but significant over treatmrnt 1 furthermore, treatment 2 is significant over treatment 1.

Table 6. summary on the weight of grains in tons per hectare integrated with ducks

TREATMENT	PERCENT OF FILLED GRAINS/PANICI
T1- Without ducks (control)	3.83[c]
T2-2 hours exposure of ducks in the rice field	4.52[c]
T3- 4 hours exposure of ducks in the rice field	4.67[b]
T4- 6 hours exposure of ducks in the rice field	4.82[a]

*- Significant
**- highly significant
[abcd]- Treatment means in a column having the same letter superscript is not significant with each other at 5% level of probability.

Conclusions and Recommendations

Based on the result of the study the following conclusions were made:

1. Rice under 6 hours exposure of ducks in the rice field gave the tallest height and highest number of tiller
2. Six hours exposure of ducks in the rice field gave the greatest number of filled grains per panicle, weight of grains per hill and weight of grains per plot and weight of grains in tons per hectare.
3. Laying performance of ducks integrated in rice production showed no significant differences among treatments across weeks of measurements as to laying efficiency and average egg production.

Based on the result of the study the following recommendations were made:

1. Rice production should be integrated with ducks in order to get high yield.
2. Similar study should be conducted using different varieties of low land rice.

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