

Effect of Supplementing the Worms and Earthworms on Growth of Local Duck (Pet Laat)

LotchanaTaysayavong, BamphenKeomoungkhoun and ViraphetPhetsamay

Faculty of Agriculture and forestry, Champasack University
Champasackprovince, Lao PDR
Lotchanasouks@yahoo.com

Abstract

The experiment was carried out at the Integrated Farming Demonstration center of Champasack University, situated about 13 km from Pakse city, Pakse District, Champasack Province; Laos PDR, Sixty four local ducks (Pet Laat), 32 females and 32 males, with initial weights of 500 – 600 g, were allocated to a arrangement with four replications of four treatments in a Randomized Completely Block Design (RCBD). The factors were: diets and supplementation with worm and earthworm. The basal diet was a mixture of rice bran and broken rice. The diets were offered in amounts based on an expected DM intake of 10 % of live weight. For the control diets (no worm and earthworm), for the diets supplement with worm, earthworm and worm plus earthworm the proportions (% DM) were 20, 20 and 10), worm, earthworm, worm plus earth worm respective.

Daily feed intakes were 244.5, 369.7, 376 and 401 g/dayDM and daily live weight gains were 26.2, 28.0, 30.1, and 29.1g for control (DRB), DRBW, DRBEW and DRBWEW respectively. Corresponding feed conversion ratios were 4.31, 4.24, 3.88 and 4.21 respectively. There were significant differences among the treatments ($P < 0.01$). The diet supplement with earthworm20% in the diet was the most profitable for growing local duck (Pet Laat).

It was concluded that worm and earthworm can meet the duck's requirement for protein; earthworm can add up to 20% of the rice bran and broken rice in diets for growing ducks without any reduction in growth performance. For smallholder farmers in the area there are likely to be significant economic benefits from the opportunity to fatten local ducks using resources (rice bran, worm and earthworm) that are widely available in the region and of lower cost than commercial feeds.

Keywords: duck, worm, earthworm, local breeds, intake; daily gain; feed conversion

Background

In Asia, duck production has remained a traditional poultry industry playing an important role in the rural economy. However, while in many developing countries ducks are traditionally raised in small-scale for meat and eggs, large-scale production has recently been prevalent among more advanced countries in the region, and chilled/frozen duck meat and processed eggs have become major export commodities, faced with strong competition worldwide. On the other hand, in many developing Asian countries ducks are still raised in traditional system of herding and scavenging, where ducks are mostly kept in small flocks by farmers as extra activities in between their crop farming routines, and are expected to produce eggs only as additional income to the farmers' households. Variability of production is still very high because of low performance and productivity under extensive and subsistence system (FFTC, 2007).

In addition, duck production is one component of integrated farming systems which are regarded as being part of a sustainable development in agriculture. They can be integrated with rice plantation, orchards, cash crops, livestock and fish (Bui Xuan Men *et al.*, 2003). Thus, the stakeholders not only can develop their livelihoods without accumulating debts, but also can get extra income through off-farm and non-farm activities (Le ThanhPhonget *al.*, 2007). Because duck production is mostly based on the rice crop the prices of duck meat and eggs fluctuate according to the economics of rice production and thus vary in different months of the year. The higher the price of rice the greater the incentive to use other feeds as substitutes in order to maintain duck production at a uniform level (Bui Xuan Men *et al.*, 1992).

Nowadays in the world have rapidly increasing human populations and consequently increasing demands for duck meat and eggs. Thus, to meet the increasing consumer demand, and increase profit margins, there is an increasing interest in confinement of improved breeds reared on cheap, locally available feed resources, potential source of "natural" feeds that could be cultivated as feed for ducks are fly larvae, earthworms, termites, duckweeds and snails. Earthworms are appropriate elements in systems of recycling livestock manure (Bay, 2002), as they are more suitable than biodigesters when the manure is applying goat manure as substrate supported higher production of earthworm biomass than manure from cattle which was better than pig manure (Nguyen Hieu Phuong, 2008). Earthworms are high in protein and would thus appear to be suitable components in the feeding system for duck. On the other hand, at smallholder level, many farmers have not enough money to buy the high quality protein sources such as fish meal and soybean meal that are the basis of intensive livestock feeding systems. However, they are able to grow many plants the leaves of which are relatively high in protein. Examples of these potential protein sources are the foliages from duckweed, water spinach, cassava, Taro and sweet potato. Besides that, SengsoulyPhongphanithet *al.*, (2012) also commented that Supplementing rice bran with fresh duckweed and water spinach supported growth rates of 26.5 - 27.5 g/day in Muscovy ducks. Supplementation with ensiled taro leaves led to lower feed intakes and growth rates. DM feed conversion was similar on all diets in the range of 5.28 - 5.66

Objectives

- To compare the effect of worms, earthworms, worms plus earthworms on growth of Local duck (Pet Laat)
- To evaluate the most suitable supplement from worms, earth worms, worms plus earthworms to be as a material mix with the other diets feed to duck.

Methodology

Research model

The model of this research will be:

$$Y_{hi} = \mu + \theta_h + \tau_i + \varepsilon_{hi}$$

$$\varepsilon_{hi} \sim N(0, \sigma^2)$$

ε_{hi} 's independent

Where:

- Y_{hi} is the random variable representing the response for treatment i observed in block h ,
- μ is a constant (which may be thought of as the overall mean – see below)
- θ_h is the (additive) effect of the h^{th} block ($h = 1, 2, \dots, b$)
- τ_i is the (additive) effect of the i^{th} treatment ($i = 1, 2, \dots, v$)
- ε_{hi} is the random error for the i^{th} treatment in the h^{th} block.
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Materials and methods

Location

The experiment was carried out at the Integrated Farming Demonstration center of Champasack University, situated about 13 km from Pakse city, Pakse District, Champasack Province; Laos PDR. The experiment was started on 15 October and finished on 3 February 2014.

Experimental design

Four treatments with four replications in Randomized Completely Block Design (RCBD).

Table 1: Experiment layout.

Cage No.	1	2	3	4
Treatment	DRB	DRBW	DRBEW	DRBWEW
Cage No.	5	6	7	8
Treatment	DRBW	DRBEW	DRBWEW	DRB
Cage No.	9	10	11	12
Treatment	DRBEW	DRBWEW	DRB	DRBW
Cage No.	13	14	15	16
Treatment	DRBWEW	DRB	DRBW	DRBEW

The individual treatments are:

- DRB: Duck fed rice bran and broken rice
- DRBW: Duck fed rice bran and broken rice + worms 20%
- DRBEW: Duck fed rice bran and broken rice + earthworms 20%
- DRBWEW: Duck fed rice bran and broken rice + worms 10% + Earthworms 10%

Animals and management

Sixty four local ducks (Pet Laat), 32 females (photo 1) and 32 males (photo 2). The Local ducks (Pet Laat) were bought from farmer's farm with initial weights about 500 – 600 g, the ducks (4 ducks) were housed in individual pens (2*2 m). In a simple house construct of wood, bamboo and nets, the floor was overlaid with 20 cm of rice husk for bedding; and provided with feeders, and automatic water tanks. The ducks were vaccinated against fowl cholera disease; duck plague and de-wormed with albendazole before start the experiment.



Figure. 1. Female

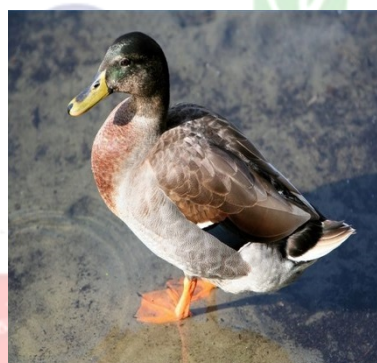


Figure. 2. Male

Feeds and feeding

The diets were offered in amounts based on an expected DM intake of 7 % of live weight. For the control diets (no worms and earthworms), the worms and earthworms were given at 20% of the diet DM.

The rice bran and broken rice were bought in the market. The worms and earthworms were raised on farm and chop in to 1 – 1.5 cm. For the worms were used

the residues from the vegetables and fruits and chop into small pieces and then were ensil

ed in tanks(capacity 15 kg) with levels of molasses of 4%(Dry matter basic) for 14 days. All the diet ingredients was mixed together before feeding to ducks, which was done in two meals per day at 07.00 and 16.00 hours.



Figure. 3. House fly worms from the ensiled vegetable and fruit



Figure. 4. Earthworms (Eudrilus engeniae)

Measurement

The ducks were weighed at the beginning of the trial, in the morning before offering the new feed, and every 2 weeks during the experiment with last 120 days. The daily gain in live weight was determined from the linear regression of live weight (Y) on days in the trial (X). Feed offered and residues were recorded daily. Samples of feeds and residues was taken weekly and stored at -16 °C until analysis

Chemical analysis

Samples of feeds and residues was analyzed for dry matter (DM) by micro-wave radiation (Undersander et al 1993), and nitrogen (N), crude fibre (CF) and ash following AOAC (1990) procedures

Statistical analysis

The data will be analyzed using the General Linear Model (GLM) in the Analysis of variance (ANOVA) program of the Minitab software (version 13.1. The sources of variation in the model were: diet and error.

Expected outcome

- ❖ Low input but get higher outcome.
- ❖ Growth performance of Local ducks (Pet Laat) will improved.

Results and discussion

Chemical composition of diets

The rice bran was high quality (11.5% CP in DM) and the CP content in the earthworm was higher than worm (45.8% and 35.6%, respectively)(Table 4). When the basal diet was supplemented with worm (DRBW), earthworm (DRBEW) and worm + earthworm (DRBWEW) were analyzed, the CP content in the diets were higher than the control diet (DRB)at 15.9, 17.9, 12.7 and 10.7%, respectively (Table 5). Especially, the diet supplemented with earthworm was highest. The minerals and vitamins content in the premix (Table 6) can meet the requirement of ducks in term of mineral and vitamin.

Table 2: Average chemical composition of ingredients (% dry basis, except for DM which is on fresh basis)

Item	DM	CP	CF	Ash
Rice bran	86.95	11.5	16.4	8.78
Broken rice	87.02	7.8	13.6	9.1
Worm	68.63	35.6	14.5	40.6
Earthworm	75.68	45.8	12.3	46.2
Salt	96.2	-	-	-
Premix	98.2	-	-	-

Table 3: Formulation of diets, % of DM

Ingredient	DRB	DRBW	DRBE	DRBWE
Rice bran	80	70	70	70
Broken rice	19	9	9	9
Worm	0	20	0	10
Earthworm	0	0	20	10
Premix	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total	100	100	100	100
% Crude protein	10.7	15.9	17.9	12.3

DRBM: rice bran and broken rice, W: worm, E: earthworm

Feed intake, growth rate and feed conversion

Table 4: Mean values for change in live weight, feed intake and conversion for local duck supplemented worm, earthworm and worm plus earthworm

Item	DRB	DRBW	DRBE	DRBWE	SE	Prob.
Number of duck	16	16	16	16	-	-
Live weight (g)						
Initial	591.6	600.3	579.1	579.2	3.28	0.96
Final	919.0 ^d	1103.5 ^c	1165.8 ^a	1116.5 ^b	6.21	0.01
Average daily gain (g/day)	26.2 ^d	28.0 ^c	30.1 ^a	29.1 ^b	1.43	0.04
DMI, g/day	244.5	369.7	376.0	401.6	6.84	0.01
Feed conversionratio (FCR)	4.31 ^d	4.24 ^c	3.88 ^a	4.21 ^b	4.18	0.01

a, b, c, d Mean values within rows with different superscript are different at $P < 0.05$

According to the data for feed intake was given in Table 7. When we supplement worm and earthworm in the diet, ducks were consumed readily on all treatments from. Intake of the control diet (Rice bran plus broken rice) was depressed slightly. However, the intake of worm and earthworm supplementing increased such as: an average of DM intake of all the treatments (DRB, DRBW, DRBEW and DRBWEW were 244.5, 369.7, 376 and 401 g/day, respectively) (Figure 1). Total DM intake was highest in the treatment that supplemented the earthworm (DRBWEW) and least in the control (DRBM). This was probably because of the improved palatability when the rice bran and broken rice was supplemented with worm and earthworm. So there were significant different among treatments ($P < 0.01$)

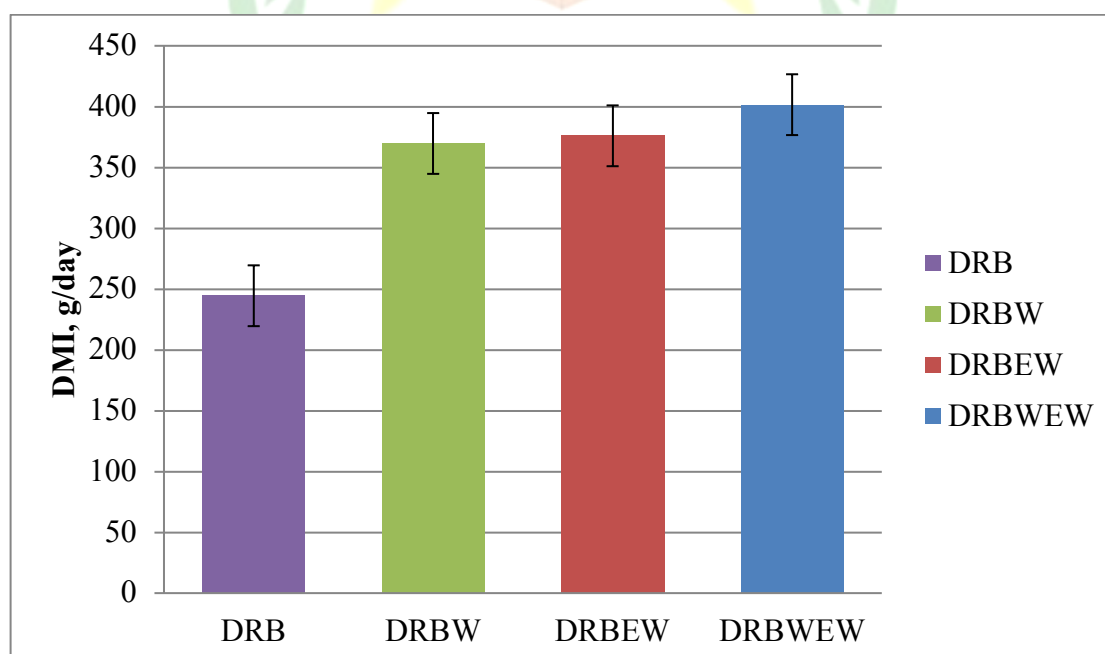


Figure 5. Contrasting effect of supplement worm and earthworm on feed intake in Local duck (pet laot)

The average daily gain (ADG) and feed conversion ratio (FCR) was improved when the three feed ingredients were mixed together compared with giving them only

rice bran and broken rice (Table 7). This may have been due to the higher CP content of the diets when supplemented with worm and earthworm and the expected higher protein content of the diets, which had higher proportions of earthworm compared with rice bran and broken rice.

Live weight gain was significantly higher on the DRBEW and DRBWEW diets than on the control diet (DRB). The diet with supplement earthworm (DRBEW) supported slightly better growth than on the control diet (DRB). In addition feed conversion was low in DRBEW and high in the control diet (DRB) (3.88 and 4.31 kg feed/kg gain) (Figure 2). The growth performance of the ducks in this study research was higher than when ducks were fed duckweed, the result carried out by Bui Xuan Men (1995) This maybe a reflection of the use in our experiment of earthworm was a source of protein which resulted in a higher protein content (45.8 % in dry matter compared with 35%). In spite of the fact that ducks can consume high amounts of bulky and fibre-rich feeds, the growth rate was poorer than when ducks received a lower fibre and a higher protein diet. The growth performance of the ducks in this study research was higher than when ducks were fed "A" molasses substituted for broken rice and rice polishings at 15 or 30% in the diet (Bui Xuan Men and Vuong Van Su 1990).

The most interesting finding from this study was that when the diet included rice bran, broken rice and supplement with worm and earthworm improved the live weight gain, the rate of growth of local duck (Pet Laat)(Figure. 3).

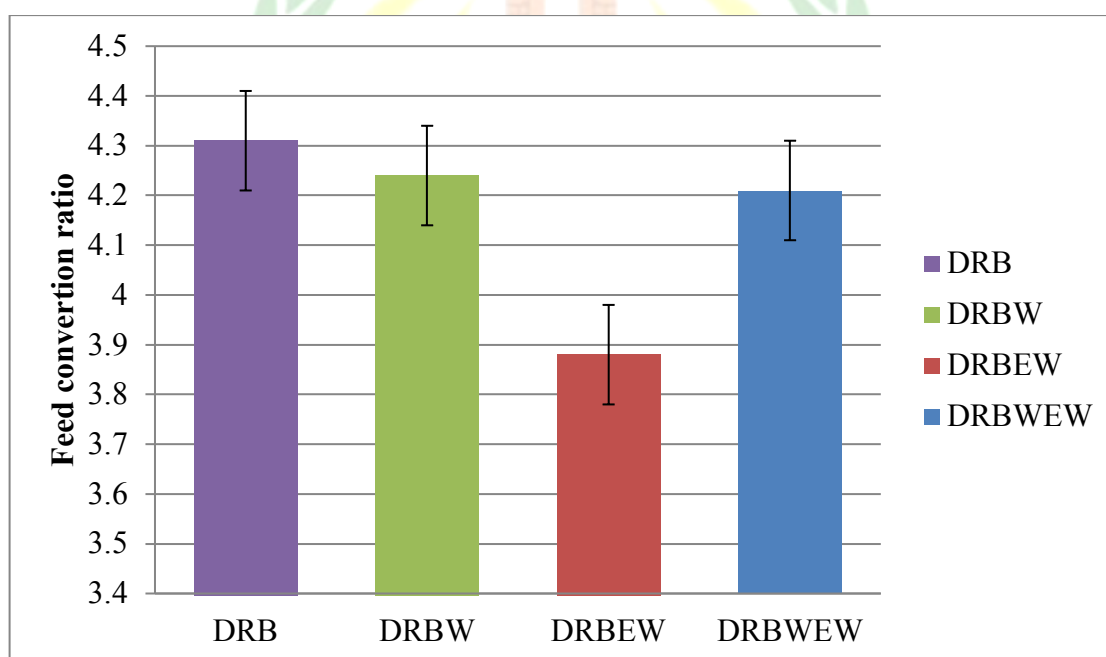


Figure. 6. Contrasting effect of supplement worm and earthworm on feed conversion in Local duck (pet laat)

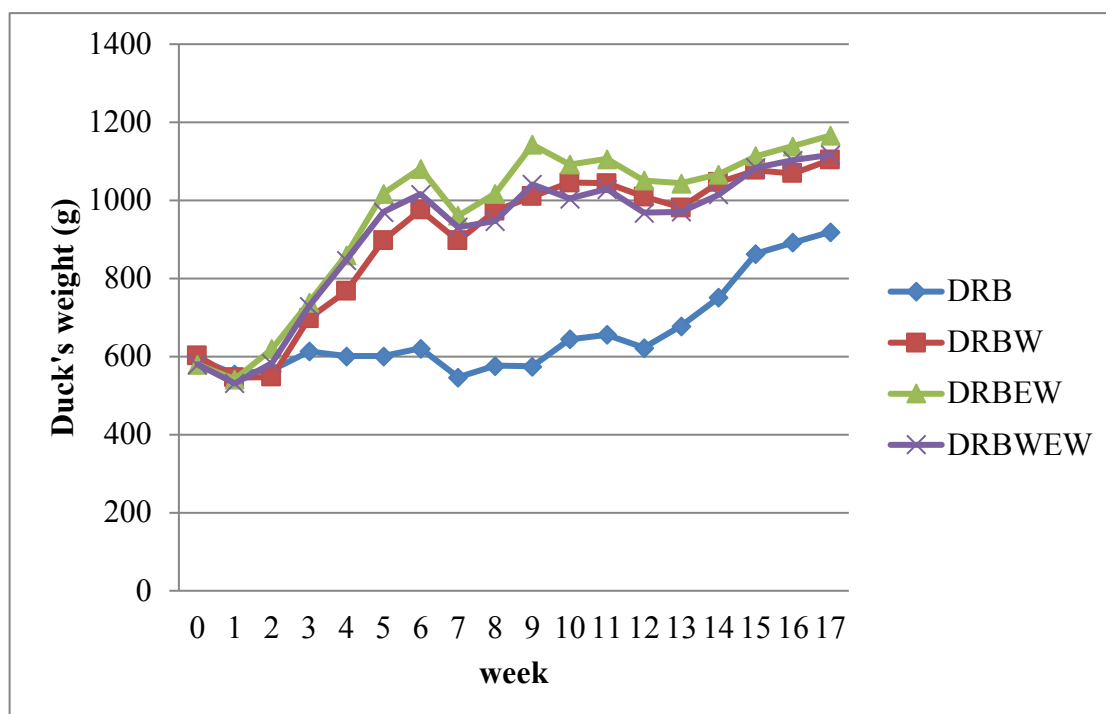


Figure. 7. Growth curves of local duck (pet laot) fed rice bran and broken rice supplemented with worm, earthworm and worm+ earthworm

The ducks supplemented with earthworm grew significantly faster than those supplemented worm and worm plus earthworm. The effect was almost certainly due to the higher protein intake as can be seen from the data in Table 5. The growth rate of duck that consumed the diet supplemented with earthworm (30.1 g/day) was higher than that with no supplementation (control diet 26.2 g/day) and other treatments.

Economic benefit

Table 5: Economic analysis of the effect of supplementing worm and earthworm on the growth of local ducks (Pet Laot) (in Kip; about 8000 Kip = 1 USD)

Experiment condition	DRB (kip/kg gain)	DRBW (kip/kg gain)	DRBEW (kip/kg gain)	DRBWE (kip/kg gain)
Experimental conditions (*)	11,637	14,840	11,640	15,156
Raised worm and earthworm (**)	11,637	8,755.6	8,012.2	8,693.65

(*) 1kg rice bran = 2500 Kip, (**) Farmers raised worm and earthworm by themselves: 1 kg worm or earthworm = 0 Kip

The market price of rice bran (2,500 kip/kg) and broken rice (3,000 kip/kg) are around the half price of commercial duck feed (5,000 kip/kg). Worm and earthworm were raised by local farmers was valued at 800 kip/kg and an extra 800 kip was added for the cost of supplement. The same price as the rice bran but half that of the commercial feed, on this basis the feed cost per kg live weight gain is the same irrespective of the proportion of worm and earthworm (Table 8). However, if Worm and earthworm were raised by household labour (considered as zero cost) because they could use the by-product in the household, then there would be an economic advantage from using worm and earthworm as a source of protein feed to duck. There were no health problems on any of the diets and mortality was zero. From the consumer standpoint, in the ducks fed the diet supplement with worm and earthworm, would be considered as an advantage.

Conclusions

According to the result of this experiment could conclude that the worm and earthworm can meet the duck's requirement for protein. Earthworm can add up to 20% of the rice bran and broken rice in diets for growing ducks without any reduction in growth performance. For smallholder farmers in the area there are likely to be significant economic benefits from the opportunity to fatten local ducks using resources (rice bran, worm and earthworm) that are widely available in the region and of lower cost than commercial feeds.

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