Increasing incomes of organic farmers through insect-based bioconversion of brewery wastes into animal feed and fertilizers in rural communities

Technical Report

Part 1
Technical Implementation

Objective, Location and Inputs

1. This report has 2 objectives: (1) to study chicken egg-laying with three different feeding techniques; (2) to understand economic returns of applying such techniques. The results of this project would help farmers make an informed decision if wanting to raise egg-laying chicken beeds.

2. The project site is located in Nathom Village, Saythany District, Vientiane Capital, which Green Community Development Association established its demo organic farm.

3. The inputs used comprised three main items (1) 60 egg-laying chickens; (2) feed that included CP chicken feed, black soldier fly larvae, broken rice (*kao pai*), ground maize, and vegetable residues; (3) chicken pens and some equipment.

Techniques

4. *Time* – The activity started on 24 April and ended on 30 October 2017 or 159 days.

5. *Design* – a chicken house was constructed and divided into 3 blocks of the same size (2m x 150cm) with the same physical conditions; the chicken was raised in the three assigned blocks and each block chicken were fed with different feeds. In other words, there were three groups of chicken called T1, T2, and T3. T1 was 100 percent fed with CP feeds. T2 was fed with feeds mixing up CP feed, vegetables, ground maize, and broken rice. T3 was fed with CP feed, larvae and ground maize.

6. *Chicken breeds* – the study chicken breed was CP breed aged 1 month old (about to lay eggs) and 60 egg-laying chickens were bought for this pilot.

7. *Feeds and feeding techniques* – two sources of feeds (1) feeds that were locally available or sourced locally such as rice hulls (*ham*), maize, broken rice and vegetables, and (2) processed feeds. The block chicken was fed 3 times a day (i.e. morning 7:00-7:30, afternoon 11:30-12:00, and evening 17:30-18:00). To observe how much each block chicken consumed the feeds or the chicken ate up, the feeds were given little by little. The same quantity of 3 three feeds was given to the block chicken.

Data collection

8. *Weighing* chicken raised in each block was to understand the growth rate by block at a given time and the weighing was done once a week. It was random weighing of 5 chicken each time.

9. *Counting the number of eggs* – eggs were collected every day and the eggs collected from each block were separated and put in trays. To understand the difference of each block chicken was done every 7 days by observing the egg shell and yolk.

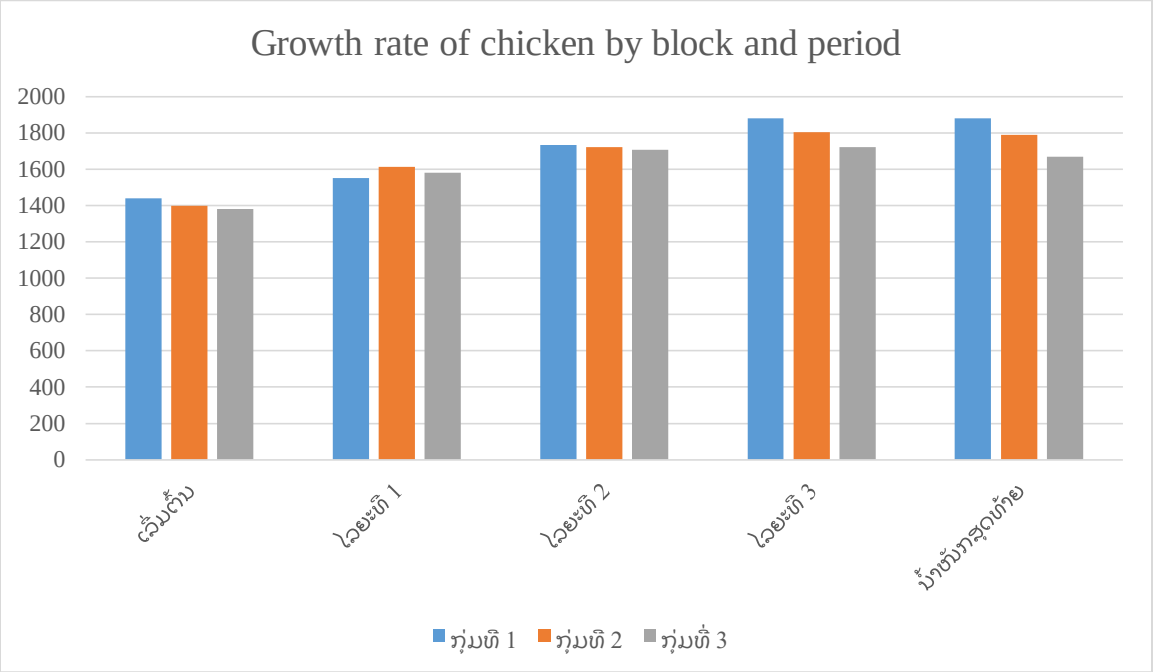
Results

Quantity and weight

10. The growth rate of chicken by block (through weighing) is shown in Table 1.

Table 1. Weight by block chicken

Time	Block 1 (g)	Block 2 (g)	Block 3 (g)
Initial weight	1,440	1,400	1,380
Period 1	1,553	1,613	1,580
Period 2	1,733	1,722	1,709
Period 3	1,882	1,805	1,723
Final weight	1,880	1,805	1,723

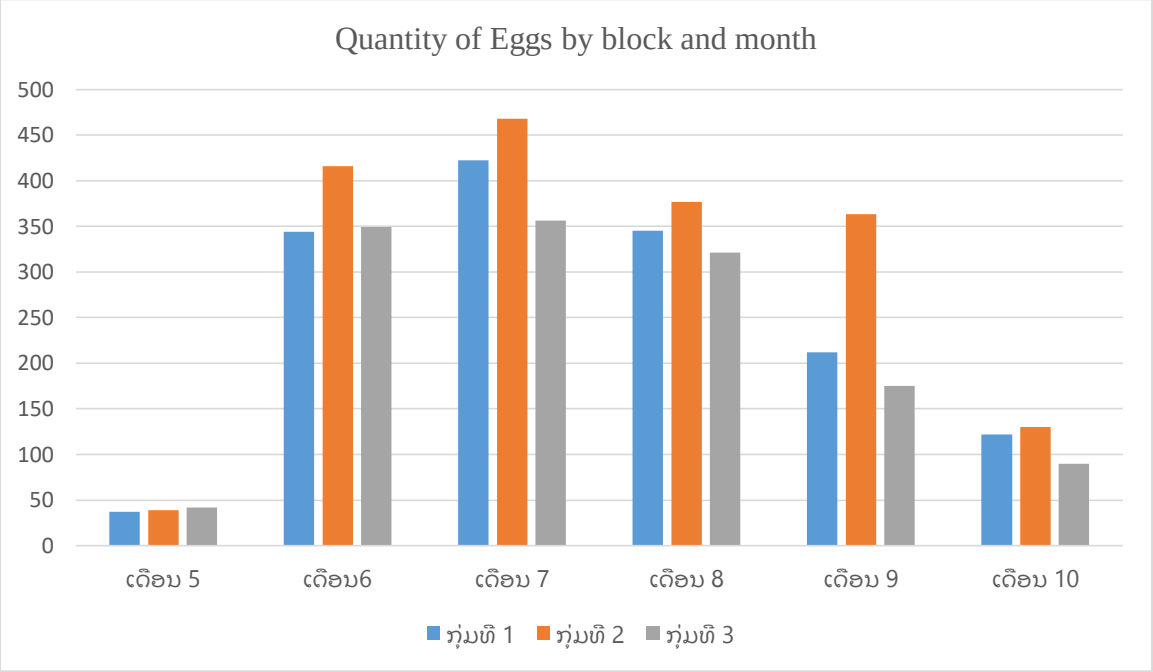


11. The data collection in 189 days of the activity shows the consistent growth of the chicken in each block from the initial period until period 3; and the growth rate started declining slowly until the final period. The chicken in Block 1 (fed with CP feed only) however showed better results than other blocks. The weight at the final period was 1880 grams, followed by the block-2 chicken (1805 grams) that was fed with feeds mixed with CP feeds, vegetables, ground maize and broken rice. The final block fed with CP feeds, larvae and maize had the least weight, 1723 grams.

12. The quantity of eggs collected in each block is shown in Table 2.

Table 2. Eggs and weight by block

Time	Block 1 (eggs)	Weight (g/egg)	Block 2 (eggs)	Weight (g/egg)	Block 3 (eggs)	Weight (g/egg)
May	37		39		42	
June	344		416		349	
July	422		468		356	
August	345		377		321	
September	212		363		175	
October	122		130		90	
Total	1,582		1,793		1,336	
Average/Month	264		299		222	



13. The findings showed that the chicken that produced the most eggs was those in Block 2 – fed with feeds mixed up with CP feeds, vegetables, maize, broken rice. There were 1793 eggs with an average of 299 eggs per month. The reason could be because of the feeds that were mixed with different ingredients; and the chicken could adapt themselves better in the surrounding environment. The second was the block-1 chicken (fed with CP feeds only) producing 1582 eggs or 264 per month. The block-3 chicken that was the highlight of the pilot produced the least eggs, 1336 or 222 eggs on average per month; this block chicken was fed with CP feeds, larvae and maize.

Considering economic returns

14. Tables below show investment costs by three blocks. Table 3 shows the startup costs – constructing a chicken house of 3 blocks, feeds, and some necessary equipment. Table 4, 5 and 6 show running costs used by each block.

Table 3. Chicken house and equipment

No	Description	Unit		Unit cost	Lifespan	Once a year	Depreciation, Kip
1	Chicken house	House	1	4,000,000	5	3	266,667
2	Chicken feeder	Piece	3	75,000	2	3	12,500

3	Water feeder	Piece	3	90,000	2	3	15,000
4	Scale	Unit	1	100,000	5	3	16,667
5	Egg container	Unit	1	6,000	1	3	6,000
6	Broom	Piece	2	50,000	1	2	16,667
			Total	**4,321,000**			**333,501**

Remark: the depreciation of the chicken house was 333,501 Kip or 111,167 Kip per block.

Table 4. Running costs – Block 1

No	Description	Unit		Unit cost	Total, Kip
1	Chicken	Head	20	42,000	840,000
2	CP feed	Kg	451	4,000	1,804,000
3	Lime	Bag	1	6,000	6,000
				Total	***2,650,000***

Table 5. Running costs – Block 2

No	Description	Unit		Unit cost	Total, Kip
1	Chicken	Head	20	42,000	840,000
2	CP feed	Kg	51	4,000	204,000
3	Vegetables	Kg	105	1,500	157,500
4	Ground maize	Kg	77	3,000	231,000
5	Broken rice	Kg	67.5	3,000	202,500
6	Larvae	Kg	166	14,000	2,324,000
7	Lime	Bag	1	6,000	6,000
				Total	***3,965,000***

Remark: The cost of larvae included transportation service fee and fuel allowance, fuel 1kg = 8,200 kip and transportation service 3800 kip per kg, totaling 14000 kip per kg.

Table 6. Running costs – Block 3

No	Description	Unit		Unit cost	Total, Kip
1	Chicken	Head	20	42,000	840,000
2	CP feed	Kg	127.5	4,000	510,000
3	Larvae	Kg	185	14,000	2,590,000
4	Ground maize	Kg	124	3,000	372000
5	Lime	Bag	1	6,000	6,000
				Total	***4,318,000***

Income from selling chicken (no longer producing eggs)

15. Table 6 shows incomes from selling chicken that no longer produced eggs.

Table 6. Estimated incomes by block

Block	No of chicken	Weight, Kg	Price, Kip	Total, Kip	Average price
1	20	38	18,000	677,000	34,000
2	20	36	18,000	650,000	33,000
3	20	34	18,000	620,000	31,000

Incomes from selling eggs

16. Table 7 shows incomes earned from selling eggs by block

Block	No of eggs	No of egg trays	Price per tray	Total, Kip

1	1,582	53	20,000	1,054,667
2	1,793	60	20,000	1,195,333
3	1,336	45	20,000	890,667

Income-expense comparison (table 8)

Block	Income from selling chicken, kip	Income from selling eggs, kip	Expenses, kip	Balance, kip
1	677,000	1,054,667	2,761,167	(1,029,500)
2	650,000	1,195,333	4,076,167	(2,230,834)
3	620,000	890,000	4,429,167	(2,919,167)
Total	***1,947,000***	***3,140,667***	***11,266,501***	***(6,179,501)***

Part 2
Conclusions

17. The findings show that raising chicken fed with larvae and other locally available feed items was not suitable for commercial purposes. However, Block 2 or Test 2 showed higher incomes (from selling eggs and chicken) compared with Blocks 1 and 3. The income from this block was 1,843,000 kip; however, it also cost higher, 4,076,167 kip and the balance was quite significant, 2,230,834 kip. Block 1 or Test 1 was the second in terms the incomes earned (1,731,667 kip). The investment cost was less than Blocks 1 and 3, at 2,761,167 kip and the balance stood at 1,029,500 kip which looked better from the economic viewpoint. Block 3 or Test 3 earned the least incomes (1,510,000 kip) and the costs were the highest, 4,429,167 kip due to the larvae purchase.

18. In a nutshell, the lessons learned from the demonstration of three blocks show good and bad points. The good points of the chicken feeding with larvae and locally available ingredients are (1) cost saving; (2) chicken looked healthy and adaptable to the surrounding environment; and (3) chicken could continue laying eggs if male chicken were there; the bad points however are (1) the issue of growth as expected by the CP standards; and (2) less eggs. This is not to mention the higher cost of buying larvae fed with brewery waste and limited accessibility to only where there are brewery factories.

19. It is recommended that, in consideration of limitations – accessibility to larvae fed with brewery waste and associated costs of transportation – producing larvae with vegetables and animal dungs could be an alternative even though it might take time but would be worth. This requires demonstration before jumping into any conclusions and should be a small-scale demo. The inputs require 5 kg of vegetable wastes, 3 kg of animal dungs and water. The next step is to mix vegetable wastes with dungs and water, then leave it for 3-4 days until the temperature of composing gets cooler, and put larvae eggs on it. During the process, regular check is required to ensure that the processing is not dry (water is needed if it is the case). It would take 2-3 days to see micro larvae come out.