

BIBLIOGRAPHY

CARACHO, YVONNE A. APRIL 2013. Comparative Performance of Growing Pigs Given Commercial Feeds Supplemented with Sweet Potato Leaves (*Ipomea batatas*) and Vines and Galiang (*Colocasia esculenta*). Benguet State University, La Trinidad, Benguet.

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ABSTRACT

This study was conducted at Panad, West, Poblacion, Mankayan, Benguet from August to October 2012 to determine the response of growing pigs to some indigenous feedstuffs, namely, camote and galiang in combination with commercial feeds.

The study was conducted to determine the response of growing pigs of camote and galiang in combination with commercial feeds. Specifically, the study aimed to determine the response of growing pigs in terms of gain in weight, feed consumption, feed conversion ratio of growing pigs an, feed cost and morbidity and to determine the Return on Investment (ROI) when fed with commercial feeds plus camote and galiang. A total of 9 pigs were allocated into 3 treatments with 3 replications following the Completely Randomized Design (CRD). The different treatment were T₀- pure commercial feeds, T₁- 75% commercial feeds plus 25% camote leaves and vines and T₂- 75% commercial feeds plus 25% cooked galiang.



Statistical analysis revealed no significant differences among treatments in the initial weight, final weight, total gain in weight and average gain in weight of pigs. However in terms of feed conversion ratio DM basis, feed cost per kilogram gain in weight, total feed consumption, dry matter intake and daily dry matter intake highly significant differences between treatments were observed.

Pigs used in this study had an average initial weight of 11.900 kg at 10 weeks of age, an average final weight mean of 51.644 kg, total gain in weight of 39.744 kg and average daily gain in weight of 0.510 kg after 78 days of feeding.

For the feed conversion ratio (FCR) DM basis, the pigs given commercial feeds had FCR of 5.267 kg while pigs given commercial feeds plus camote leaves and vines had a mean FCR of 3.982 kg. The lowest FCR was obtained from pigs given commercial feeds plus cooked galiang with a mean of 3.477 kg.

Finally, in terms of Return on Investment (ROI), the highest was observed in pigs given commercial feeds plus camote leaves and vines which was 10.86%. This was followed by the pigs fed with pure commercial feeds which was 7.82% and lastly, by pigs given commercial feeds plus cooked galiang which was 5.07%.



INTRODUCTION

Pig farming is a source of protein for the family, a valuable source of organic fertilizer for rice paddies and vegetable plots. It also plays an important role in farming system and a means of augmenting of family. At present, one of the challenges in swine production is shortage and high costs of commercial feeds that supply the proper amount of nutrients needed by the animals. Hence alternative feed resources are resorted.

Camote is a versatile vine ideal for home gardens because it has the ability to grow in any kind of soil condition and can survive in adverse/ diverse environment. Camote is a good source of calorie and carbohydrates. The yellow-orange flesh contains the higher amount of pro-vitamin-A (carotene). The leaves are excellent source of pro-vitamin A and thereby contribute in the prevention of Vitamin A deficiency. Aside from its nutritional value, sweet potato is important as an excellent supplement staple food, for its medicinal value, and as a source of feeds for animals like rabbit and swine.

Galiang is traditionally grown in marginal areas, backyard gardens, or portions of a field as a source of vegetable, snack food and animal feeds. As a vegetable, practically all parts from leaves, petioles, corms, cormels and rhizomes are used. The corms and cormels are a good substitute staple to rice as they contain high amount of carbohydrates like camote. The leaves and petioles are very good source of pro-vitamin A.

Today, Camote and galiang is also a good source of cash income since it does not require much cash input. Labor and planting materials constitute the bulk of the production cost which are often provided by the farmer as non-cash input.



Most backyard swine raisers in the cordillera, feed their pigs with the camote and galiang as a means of reducing feed cost. The common practice is to feed their pigs with these otherwise farm wastes, either raw or cooked, in combination with rice bran or commercial feed.

There were studies conducted previously on the utilization of the above feedstuffs as feeds to pigs. However until now, there are no established levels of each of these feedstuffs in the swine ration. There is a great need to explore different feeding regiments of using camote leaves and vines and galiang as feeds to growing- fattening pigs.

This study was conducted to study the utilization of the above feedstuffs as feeds to pigs. The result of this study could serve as a guide to the swine raisers and also to researchers. This may also benefit farmers most especially those who grow sweet potato and galiang.

Generally, the study was conducted to determine the response of growing pigs to some indigenous feedstuffs, namely, camote and galiang in combination with commercial feeds.

Specifically, the study aimed to:

- a. determine the response of growing pigs in terms of gain in weight, feed consumption, feed conversion ratio of growing pigs an, feed cost and morbidity; and
- b. to determine the Return on Investment (ROI) when fed with commercial feeds plus camote and galiang.

This study was conducted in Poblacion, Mankayan, Benguet from August 2012 to October 2012.



REVIEW OF LITERATURE

In 1986, Quinio reported that sweet potato meal (*Ipomoea batatas*) is one of the most common and major crop grown in Cordillera since time immemorial. This serves as a good substitute for rice and a good source of feed for animals, during the civil war and in time of economic depression, sweet potato has been reported as an everyday food. Grown the whole year round, it is used for food consumption as feed for domestic animals. In her study involving hogs, she observed that hogs given higher levels of sweet potato meal of 40% with commercial hog mash had higher gains in weight compared to those fed with pure commercial feeds.

The camote tubers have high carbohydrate content while the leaves are rich in protein, hence both can be used as animal feed. The vines include the leaf and stem, with crude protein content in the leaves of 260-330g/kg DM compared with 100-140g/kg DM in the stems (An, 2003).

Camote is one of the average calorie starch food (provide 90 cal/100g versus 70 calories/100g of white potato). It also provides a good amount of vital minerals such as iron, calcium, magnesium, manganese, and potassium that are very essential for enzyme, protein, and carbohydrate metabolism (Cullison and Lowrey, 1987).

According to SIM, M. J. et al, white sweetpotato fresh contents 73.5g moisture content, 100kcal energy, 0.7g protein, 23.4g carbohydrates, 0.5g fat, 152mg calcium, 50mg phosphorus, 1.1mg iron, 25ug B-carotene, 0.13mg thiamin, 0.04mg riboflavin, 0.7mg niacin, and 48mg vitamin C.



Boiled leaves of galiang contents 88g moisture content, 34kcal energy, 3.6g protein, 4.5g carbohydrates, 1.1g fat, 181mg calcium, 70mg phosphorus, 1.0mg iron, 10,055ug B-carotene, 0.06mg thiamin, 0.21mg riboflavin, 1.1mg niacin, and 54mg vitamin C. Boiled stalks and petioles of galiang also contents , 96.2g moisture content, 9kcal energy, 0.3g protein, 2.2g carbohydrates, 0.1g fat, 63mg calcium, 22mg phosphorus, 0.8mg iron, 235ug B-carotene, 0.01mg thiamin, 0.02mg riboflavin, 0.02mg niacin, and 3mg vitamin C. This can sustain the human and animal requirements in terms of nutrient.

Bautista (1997) reported that green leafy vegetables such as young leaves of gabi, sitao, sweet potato, chayote and Chinese cabbage, mustard, saluyot, malunggay, kangkong, pechay would be an excellent source of vitamin A, vitamin C, Calcium, and potassium.

Generally, root crops like gabi, cassava, sweet potato, and ube contain a lot of food energy. They are rich in proteins, vitamins, and carbohydrates. They can be good supplement to rice and other staple food (Ynaya, 1993).

As for it galiang (*Colocasia esculenta*) has high starch content and on this account is very nutritious. The leaves and petioles are also used as vegetables, being very good source of calcium, phosphorus, and iron (Maranon, 1985). The corms, petioles, and leaf blades are not only excellent as to taste but also rich in minerals. It is also a fair source of vitamin B (Hermano and Sepulveda, 1984).



MATERIALS AND METHODS

Materials

The materials used in the study includes 9 head of pigs, camote leaves and vines, galiang, commercial feeds, pig pen, feeding and drinking troughs, pails, stick broom, weighing scale, record book, and pen.

Methods

Experimental design and treatments. Following the Completely Randomized Design (CRD), the nine growers were distributed to three treatments. Each treatment was replicated three times with one grower per replicate. Before the growers are placed into their respective pens, their initial weights were taken individually.

The different treatments were as follows:

T₀ -100% Commercial Feeds (CF) Control

T₁ - 75% CF + 25% chopped camote leaves and vines

T₂ - 75% CF + 25% cooked galiang stems and leaves

All the experimental pigs were equally treated except on the diet offered to each treatment. The control pigs were fed with pure commercial feeds. The pigs under treatment 1 were given 750g commercial feeds and 250g chopped camote leaves and vines were added. The pigs in treatment 2 were given 750g commercial feeds and 250g chopped and cooked galiang were added.

To give time for the pigs to get adjusted to the new feeds that were offered to them, the addition of the new feeds were gradual until the pigs reached 3 months of age. From 3 months and on, the above proportions were then followed.



Feeding was done twice a day, one in the morning during 6:00 to 6:30 and another in the afternoon during 4:30 to 5:00. Adequate drinking water was always available.

Preparation of galiang and camote leaves. The camote leaves and galiang were collected at Panad West, Poblacion, Mankayan, Benguet, the place where the study was conducted. After collection, these were washed and allowed to drain. The camote leaves and vines were chopped into small pieces approximately 0.50 inch to 0.75 inch long and weighted based on the specified amounts before giving to the pigs. The galiang were also chopped into small pieces approximately 0.50 inch to 1 inch long. Every five kilogram of galiang were mixed with two liters of water and cooked within two hours, allowed it to boil within one hour to remove toxic components and served to the pigs. This were fed together with the commercial feeds.

Preparation of the pens. A week before the start of the study, the pigpens, including the feeding troughs as well as the whole area of the growing house were cleaned and disinfected.

Management of the pigs. All the experimental animals were subjected to the same management except on the diet offered depending on the treatment assigned to individual animals. To avoid and protect the pigs from diseases, cleaning of pigpens were done every day.



The amount of commercial feed given to experimental animals in treatment 1 and 2 were as follows (Entrepinoy, 2009):

AGE IN WEEKS	Kg feed/ day
10	1.0
11	1.1
12	1.2
13	1.4
14	1.5
15	1.6
16	1.7
17	1.8
18	1.9
19	2.0
20	2.1

Data Gathered

1. Initial body weight (kg). This is the weight of pigs at the start of the study (65 days old).
2. Final body weight (kg). This is the weight of the pigs at the end of the study (143 days old).
3. Feed offered (kg). This refers to the amount of the feeds given to the pigs each day.
4. Feed left-over (kg). This is the amount of feeds not consumed by the pigs which was taken every morning before feeding the pigs.
5. Cost of production (Php). This refers to the cost of all of the materials used during the duration of the study period were recorded like for example the commercial feeds, individual feedstuffs, etc.



6. Dry matter content of feed (%). This was obtained by oven drying the feed sample to constant weight.

Data computed:

1. Total gain in weight (kg). This was computed by taking the difference between the initial weight and final weight.
2. Average daily gain in weight (ADG, kg). This was obtained by dividing the total gain in weight by the number of feeding days.
3. Total feed consumption (kg). This refers to the total amount of feed consumed by the pigs during the entire duration of the study.
4. % Dry Matter. This was determined using the formula:

$$\% \text{ Dry Matter} = \frac{\text{Dry weight of sample}}{\text{Fresh weight of sample}} \times 100$$

5. Dry Matter intake (Kg). This refers to the total and daily dry matter intake of pigs. This was computed using the formula:

$$\text{Dry Matter intake} = \text{Feed consumption} \times \% \text{ Dry matter}$$

$$\text{Daily DM intake} = \text{Total DM intake} / \text{Experimental days}$$

6. Feed conversion ratio (FCR, kg). This was obtained by dividing the total feed consumption by the total gain in weight.
7. Feed cost per kilogram gain in weight (Php). This was computed by multiplying the FCR by the cost of 1 kilogram feed.



8. Morbidity Rate. This was obtained by dividing the number of animals that got sick by the initial number of pigs multiplied by 100.

9. Net profit (Php). This was obtained by subtracting the total cost of production from the total sales.

10. Return on investment (ROI, %). This was obtained using the following formula:

$$\text{ROI} = \frac{\text{Net profit}}{\text{Total Cost of Production}} \times 100\%$$



RESULTS AND DISCUSSION

Body Weight

Table 1 shows the result of the initial and final weight of the experimental animals which covered the whole duration of the study. Statistical analysis revealed no significant differences among treatments. This means that the initial weights of the pigs at the start of the study (August 3, 2012) and final weights (October 13, 2012) of pigs at the end of the study from the treatments do not differ significantly. The initial weight of the pigs coming from pure commercial feeds, commercial feeds plus camote leaves and vines and commercial feeds plus cooked galiang are 12.367 kg, 11.133 kg and 12.200 kg respectively while the final weights of pigs coming from pure commercial feeds, commercial feeds plus camote leaves and vines and commercial feeds plus cooked galiang 55.200 kg, 51.133 kg and 48.600 kg respectively.

Total Gain in Weight

Presented in Table 2 indicates the average total and daily gain in weight of pigs from the treatments. Statistical analysis revealed no significant differences among treatments. The total gain in weight of the pigs given pure commercial feeds, commercial feeds plus camote leaves and vines and commercial feeds plus cooked galiang were 42.833 kg, 40.000 kg and 36.400 kg respectively with an average of 39.744 for 78 days. The average daily gain in weight of pigs given pure commercial feeds, commercial feeds plus camote leaves and vines and commercial feeds plus cooked galiang were 0.549 kg, 0.513kg and 0.467 kg respectively with an average daily gain of 0.509.



Table 1. Initial weight of the pigs at 70 days and final weight at 148 days of age

TREATMENT	BODY WEIGHT (kg)	
	INITIAL	FINAL
100% commercial feeds	12.367 ^a	55.200 ^a
75% Commercial feeds + 25% camote leaves and vines	11.133 ^a	51.133 ^a
75% Commercial feeds + 25% Cooked galiang	12.200 ^a	48.600 ^a

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT

Table 2. Total and average daily gain in weight

TREATMENT	Total Gain in weight (kg)	Average Daily gain in weight (kg)
100% Commercial feeds	42.833 ^a	0.549 ^a
75% Commercial feeds + 25% Camote leaves and vines	40.000 ^{ab}	0.513 ^{ab}
75% Commercial feeds + 25% Cooked galiang	36.400 ^b	0.467 ^b

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT

Total Feed Consumption

Table 3 shows the total feed consumption of pigs from treatments. Statistical analysis revealed that the differences among treatments in total feed consumption are highly significant. Pigs fed with pure commercial feeds had a mean total feed consumption DM basis of 225.776 kg and 242.2 kg as fed basis, followed by pigs fed with commercial feeds plus camote leaves and vines with a mean total feed intake DM basis of 159.065 kg and 302.75 kg as fed basis and those fed with commercial feeds plus cooked galiang with



a mean total feed intake DM basis of 126.338 kg and 302.75 as fed basis. The higher feed consumption DM basis were observed from the pigs given pure

Table 3. Total feed consumption

TREATMENT	TOTAL FEED CONSUMPTION (kg)	
	As Fed	DM intake
100% Commercial feeds	242.2 ^a	225.776 ^a
75% Commercial feeds + 25% Camote leaves and vine	302.75 ^b	159.065 ^b
75% Commercial feeds + 25% Cooked galiang	302.75 ^b	126.338 ^c

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT

commercial feeds and the lowest was observed in pigs given commercial feeds plus cooked galiang. The experimental animals given commercial feeds plus cooked galiang had the lowest feed consumption (as DM basis) due increase in bulkiness of the resulting ration after cooking hence the animal tend to eat less of it.

According to the result of the feed analysis by the Department of Science and Technology, the ration composed of 75% commercial feeds and 25% camote had a crude protein content of 20.74%, while the ration composed of 75% of mixed commercial feeds plus 25% cooked galiang had a crude protein content of 20.23%.

Feed Conversion Ratio

Statistical analysis showed that the differences in the feed conversion ratio (FCR) of pigs (Table 4) in the different treatments are highly significant. Pigs given pure commercial feeds had a FCR of 5.267 followed by pigs given commercial feeds plus



camote leaves and vines with a mean FCR of 3.982 and lastly by pigs given pure commercial feeds with an FCR of 3.477. Pigs given pure commercial feeds were the least efficient in converting feed into body weight. The FCR of pigs given commercial feeds + camote leaves and vines did not vary significantly with the FCR of pigs given commercial feeds plus galiang.

Feed Cost per Kilogram Gain in Weight

Based on statistical analysis (Table 5) differences in the feed cost per kilogram gain in weight obtained from pigs in the different treatments is highly significant. Pigs fed with pure commercial feeds had the highest feed cost per kilogram gain in weight of PhP 105.340. Pigs fed with commercial feeds plus camote leaves and vines has a mean of PhP 79.640 while the pigs fed with commercial feeds plus cooked galiang has the lowest

Table 4. Feed conversion ratio

TREATMENT	FCR
100% Commercial feeds	5.267 ^a
75% Commercial feeds + 25% Camote leaves and vines	3.982 ^b
75% Commercial feeds + 25% Cooked galiang	3.477 ^b

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT



Table 5. Feed cost per kilogram gain in weight

TREATMENT	FEED COST/KG GAIN (Php)
100% Commercial feeds	105.340 ^a
75% Commercial feeds + 25% Camote leaves and vines	79.640 ^b
75% Commercial feeds + 25% Cooked galiang	69.533 ^b

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT

feed cost per kilogram gain in weight with a mean of PhP 69.533. This is because the commercial feeds were more expensive than camote and galiang.

Morbidity and Mortality Rate

Of nine heads of pigs used in the study, two pigs, had colds but recovered after 2-3 days without medication. One of the pigs that got sick belong to the group given commercial feeds plus camote and the other from those given commercial feeds plus galiang. The cold was maybe due to the fluctuation of temperature because it was very cold in the morning and very warm at daytime. In terms of mortality, there were no recorded mortality in all treatments.

Cost and Return Analysis

The cost and return analysis is presented in Table 7. A net income of Php 2,333.00 was realized from the pigs given commercial feeds plus camote leaves and vines with a return on investment (ROI) of 10.86%. On the other hand, the net income from pigs given pure commercial feeds was Php 1,812.00 with an ROI of 7.82%, while pigs given commercial feeds plus cooked galiang had a net income of Php 1,035.00 with an ROI of



5.07%. Pigs given pure commercial feeds had a higher return on investment compared to those given commercial feeds plus galiang.

The above findings corroborates with the observation of Mang-usan (2004) who stated that forages like sweet potato leaves and vines should be a part of swine rations since it lessens the cost of production.

Table 6. Morbidity rate

TREATMENT	TOTAL NO. OF PIGS	NO. OF PIGS THAT GOT SICK	TOTAL MORBIDITY (%)
100% Commercial feeds	3	0	0
75% Commercial feeds + 25% Camote leaves and vines	3	1	33.33
75% Commercial feeds + 25% Cooked galiang	3	1	33.33

Table 7. Cost and return analysis

TREATMENT	GROSS INCOME (PhP)	TOTAL EXPENSES (PhP)	NET INCOME (PhP)	ROI (%)
100% Commercial feeds	23,184.00	21,372.00	1,812.00	7.82
75% Commercial feeds + 25% Camote leaves & vines	21,476.00	19,143.00	2,333.00	10.86
75% Commercial feeds + 25% Cooked galiang	20,412.00	19,377.00	1,035.00	5.07



SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

A total of 9 experimental animals were used in the experiment. The experimental animals were allocated into 3 treatments with 3 replications following the Completely Randomized Design (CRD). Each of the 3 treatments were as follows: pure commercial feeds (T₀), 75% Commercial feeds plus 25% camote leaves and vines (T₁) and 75% commercial feeds plus 15% cooked galiang (T₂). The camote leaves and vines and galiang were collected and washed, allowed to drain and finally were chopped into 0.5 to 1 inch size or length. The galiang were cooked while the camote was given fresh. These were then mixed with commercial feeds and fed to pigs. Feeding was done twice a day.

The study was conducted to determine the response of growing pigs to camote and galiang in combination with commercial feeds. In particular, it aimed to determine the response of growing pigs in terms of gain in weight, feed consumption, feed conversion ratio of growing pigs and, feed cost; morbidity rate, and to determine the Return on Investment (ROI) when fed with commercial feeds plus camote and galiang.

Statistical analysis revealed no significant differences among treatments in the initial weight, final weight, total gain in weight and average gain in weight of pigs. However in terms of feed conversion ratio DM basis, feed cost per kilogram gain in weight, total feed consumption, dry matter intake and daily dry matter intake highly significant differences between treatments were observed.



Pigs used in this study had an average initial weight of 11.900 kg at 10 weeks of age, an average final weight mean of 51.644 kg, total gain in weight of 39.744 kg and average daily gain in weight of 0.510 kg after 78 days of feeding.

In terms of dry matter intake, pigs fed with pure commercial feeds had the highest mean of 210.466% and a daily dry matter intake of 2.698%, followed by the pigs given commercial feeds plus camote registered mean total of dry matter intake of 83.573% and a daily dry matter intake mean of 1.071%, pigs fed with commercial feeds plus cooked galiang had the lowest a mean of 52.721% and daily dry matter intake mean of 0.676% respectively.

For the feed conversion ratio (FCR) DM basis, the pigs given commercial feeds had FCR of 5.267 kg while pigs given commercial feeds plus camote leaves and vines had a mean FCR of 3.982 kg. The lowest FCR was obtained from pigs given commercial feeds plus cooked galiang with a mean of 3.477 kg. Results revealed that pigs given pure commercial feeds is the most efficient in converting feed into the body gain in weight compared to the other treatments. This is due to the fact that these indigenous feeds have a higher moisture content compared with commercial feeds, hence the feed efficiency is poorer and the FCR is higher.

As regards to feed cost per kilogram gain in weight, pigs fed with pure commercial feeds had the highest feed cost of PhP 105.340, while pigs given commercial feeds plus camote leaves and vines had a lower feed cost of PhP 79.640. Pigs given commercial feeds plus cooked galiang had the lowest feed cost of PhP 69.533.



Finally, in terms of Return on Investment (ROI), the highest was observed in pigs given commercial feeds plus camote leaves and vines which was 10.86%. This was followed by the pigs fed with pure commercial feeds which was 7.82% and lastly, by pigs given commercial feeds plus cooked galiang which was 5.07%.

Conclusion

Based on the results of the study, the researcher concludes that camote leaves and vines and galiang have no adverse effect on the growth performance of swine.

Recommendation

It is therefore recommended that camote leaves and vines and cooked galiang in combination with commercial feeds be used a feed for swine.



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