BIBLIOGRAPHY

LOPEZ, JUNALYN CEK-OPEN. APRIL 2013. Growth Performance of Growing-Finishing Pigs Given Commercial Feeds & Chopped Sweet Potato Leaves and Vines and Activated Charcoal Containing Wood Vinegar as Feed Additives. Benguet State University, La Trinidad, Benguet.

Adviser: Myrna B.Walsiyen, MSc.

ABSTRACT

The study was conducted at the BSU, Experimental Piggery, La Trinidad, Benguet from November 2012 to February 2013 to determine the growth performance of growing-finishing pigs given activated charcoal containing wood vinegar as feed additives.

A total of 8 pigs, belonging to one litter and were 60 days old, were grouped into two treatments following the Completely Randomized Design (CRD). The two treatments were as follows: 50 % commercial feeds and chopped sweet potato leaves and vines (T_o) and 50% commercial feeds and chopped sweet potato leaves and vines with activated charcoal containing wood vinegar.

The parameters measured were initial and final weights, gains in weight, feed consumption, feed conversion ratio, and returns on investment. Statistical analysis revealed that the performance of the pigs fed without activated charcoal containing wood vinegar was comparable to those pigs fed with activated charcoal containing wood vinegar.

This was proven by the non significant differences in terms of body weights, total and average daily gains in weight, total feed consumption, and feed conversion ratio.

Though the ROI was not subjected to statistical analysis, results of the study revealed that the pigs given diets without activated charcoal containing wood vinegar liquid had a higher ROI of 7.71% compared to the pigs given diets with activated charcoal containing wood vinegar liquid had an ROI of 2.23%, respectively.

Based on the results of the study, it is recommended that studies should be conducted to include more numbers of treatments, higher levels of activated charcoal containing wood vinegar higher than 2% level and its effect on the fecal odor.

INTRODUCTION

Swine raising is one of the agriculture's best sources of income and a very good source of protein. The Philippines swine industry is dominated by backyard raisers, which claims 76% of the total stocks while 24% come from commercial farms. The swine industry contributed 80% of the Philippine livestock output in 2004 (Abuel-Ang and Miller, 2005)

Science and technology have brought about various discoveries contributing to increase in productivity in livestock industries. Among these discoveries are feed additives which are now successfully manufactured commercially and consequently enhancing the populatory of the industries throughout the country.

Good performance of the animals depends on how we give them the proper nutrition, healthcare, and good management practices. Feed additives are added to the basic feed mix of the animals by swine raisers to improved feed efficiency, improved animal health, promote faster gains, or in short improve the overall production efficiency of the animals.

Nowadays, consumers are conscious with their health and food to eat. They prefer food derived from organically produced animals of farms animals. These are at least free of antibiotics or chemical residues.

To meet the above demand, some swine raisers are now shifting to organic farming or use of feed additives that result to the production of meat free from chemical residues. Recently one of these feed additives developed for animals is activated charcoal containing wood vinegar and this is what the researcher wants to find out in the study.

Activated charcoal containing wood vinegar is one of the recommended feed additives approved by the Japanese Government. Activated charcoal containing wood

vinegar is a product by mixing activated charcoal and mokusaku (wood vinegar) that contains organic acids. The activated charcoal containing mokusaku (wood vinegar) are both obtained from the bark of the evergreen oak (*Castanopsis cuspidate* and *Quercus acuta*) by carbonization. It has been reported that activated charcoal is useful for the removal of bacteria and bacterial toxins in vitro and in vivo (Gardiner *et al.*, 1993) as cited by Watarai and Tana, 2005.

This was to find out if activated charcoal containing wood vinegar is effective to the growth performance of swine. The study also intended to give information to the swine raisers by using organic base such as activated charcoal containing wood vinegar.

The result of the study, if found satisfactory, will benefit not only the researcher herself but also other researchers and swine raisers themselves. This can help them in increasing the production of animal products. It can also serve as a guide or basis of the people for the successful piggery operation either backyard or commercial farms. And to other researchers, it can serve as a reference in making follow-up studies.

Generally, the study aimed to determine the effect on the growth performance of growing-finishing pigs given activated charcoal containing wood vinegar liquid as feed additives.

Specifically, it aimed to: (1) determine the gain weight of the pigs given activated charcoal containing wood vinegar as feed additives, (2) know the feed consumption of the animals, (3) determine the feed conversion ratio, (4) morbidity and mortality, and (5) determine the profitability of raising swine given activated charcoal and wood vinegar.

The study was conducted at Benguet State University experimental piggery, La Trinidad, Benguet from November to Febuary 2013.

REVIEW OF LITERATURE

Feed additives

Antimicrobial agents are commonly added to the swine diets to improve the weight gain, feed conversion efficiency, and reproduction. These additives reduce morbidity and mortality in pigs (PCARRD, 2005).

Activated Charcoal Containing Wood Vinegar Liquid

Activated charcoal containing wood vinegar is obtained by combining charcoal and mokusaku (wood vinegar) from the evergreen broadleaf tree bark using "biomass transformation technology". Tree bark is full of energy. Mokusaku from the bark contains a number of useful substances. The product of activated charcoal containing wood vinegar is for animal medication, feed mix, and soil-mix fertilizer (Watarai, 2011).

Activated charcoal and wood vinegar has effects on microorganisms in intestinal organs. This improves the intestinal environment. Soft charcoal adsorp Pathogenic Microorganism (PthMio) and control propagation of lactobacillus (probiotics) and control the pathogenic microorganism (Koiwa and Watarai, 2011).

Effects of Probiotics

Probiotics improve micro-organism balance in intestines of host as stated by Koiwa and Watarai (2011), have favourable effects on host: (a) prevent propagation of intestinal PthMio; (b) prevent PthMio infections to intestines, enhance immunity.

Probiotics are beneficial microorganism added to the rations to improve the intestinal microbial balance of animal (PCARRD, 2000). In addition, Watarai and Tana (2005), stated that probiotics, (microbes that beneficially effect the host by improving its

intestinal microbial balance) such as Bifidobacteria and Lastic acid bacteria are useful in treating and preventing various intestinal infections and diarrhea caused by pathogenic bacteria.

They also stated that the effects of probiotic on the body of animals are: (1) fortify animal health; (2) reduce intestinal odor (reduce odor, improve animal quality); (3) enhance digestion (improve feeding efficiency).

Mokusaku (Wood Vinegar)

Mokusaku is a liquid obtained from oil, juices, sap and other liquid content of organic material such as wood, coconut shell, bamboo, grass, and other plants after being heated in a chamber. It is composed of a lot of organic chemical substances. Studies in Japan had shown that there could be more than 300 chemical substances. However, content of these substances are dependent on the materials to be heated as well as burning carbonization process and the time collecting cooled steam from the tube. This is used for animals even human beings. However, it must be really purified by long sedimentation and distillation process (Yokomori, 2011).

On the other hand, Watarai and Tana (2005) stated that wood vinegar have two effects against intestinal bacteria; (1) an inhibitory effect on the growth of pathogenic bacteria such as *S. enteriditis*; (2) a stimulatory effect on the growth of normal bacterial flora which act as probiotics such as *E. faecium* and *B. thermophilum* in the intestinal.

Activated Charcoal

Activated charcoal is known as a universal adsorbent because it can bind with variety of molecules. In addition, it has a high absorptive capacity although it tends to be

non selective. However, the adsorptive capacity having large pores is needed, whereas small substances need small pores (Chandy and Sharma, 1998) as cited by Watarai and Tana (2008). According to them, activated charcoal has its capacity to bind normal bacterial flora in the intestines.

Watarai and Tana (2005) stated that activated charcoal from the bark given orally could be able to function as an agent for reducing intestinal *S. enteridis* carriage and to minimize the removal of normal bacterial flora in the intestinal tract.

Antibiotics

Antibiotics are products produced by microorganism, which are added in the mixed feed at sub therapeutic level. These materials increase growth rate and feed conversion in animals, but are potentially harmful when improperly used (PCARRD, 2000).

MATERIALS AND METHOD

Materials

The materials used in the study were eight crossbred pigs (Large white x Landrace) that were two months old, belonging to the same litter, sweet potato leaves and vines (Fig.1), rice bran (D_1), activated charcoal containing wood vinegar (Fig.2), weighing scale, pig pen, feeding troughs, drinking nipples, disinfectants, stick broom, and recording materials.

Methodology

Preparation of the pens. Two weeks before the start of the study, the pig pens were, cleaned thoroughly including the surrounding areas. These were sprayed with disinfectants to minimize or even kill the microorganisms.

Preparation of the sweet potato leaves and vines. The sweet potato was collected at Palina, Kibungan, Benguet and these were washed thoroughly. These were chopped into small pieces at about one inch long and were not cooked. These were fed together with the commercial feeds and rice bran from the last month of the study. These were weighed based on the specific amount per treatment before giving to the pigs. Experimental design and treatments. The eight pigs were distributed at random into two treatments following the Completely Randomized Design (CRD). Each treatment was replicated four times with one pig per replication. The individual weights of the experimental pigs were taken first and were recorded before placing them into their respective pens.

The two treatments were as follows:

T_0- Without activated charcoal containing wood vinegar

T_1- With activated charcoal containing wood vinegar

Care and management of the pigs. All the pigs were subjected to the same care and management. The only difference was in the diets offered to them. The control pigs were fed with chopped sweet potato leaves and vines and commercial feeds. The pigs under treatment 1 were fed with chopped sweet potato leaves and vines and commercial feeds plus activated charcoal containing wood vinegar. Rice bran was added in the last month of the study. From the first two months, 50% commercial feeds and 50% chopped sweet potato leaves and vines were given to the pigs. However, at the last of the study, the diets given were 50% of chopped sweet potato leaves and vines, two thirds rice bran, and one third commercial feeds (Fig.3). Feeding was done two times a day from 7:00-8:30 in the morning and 4:00-5:30 in the afternoon. Activated charcoal containing wood vinegar liquid was added at the level of 20 grams for every kilogram of chopped sweet potato leaves and vines and commercial feeds mixture.

Clean and fresh water was always available for the experimental animals. Cleaning of the pig pens was done every day.

Data Gathered

The data gathered were as follows:

1. Initial weight (kg). This was determined by weighing the pigs at the start of the study which was at 60 days old.

2. Final weight (kg). This was taken by weighing the pigs at the end of the experiment or after a feeding period of 12 weeks.

Figure 1. Chopped sweet potato leaves and vines

Figure 2. Activated charcoal containing wood vinegar

Figure 3. Mixture of chopped sweet potato leaves and vines, commercial feeds, rice bran with activated charcoal containing wood vinegar

3. Amount of feed offered (kg). This was determined by weighing the feed offered to the swine from the start until the end of the experimental period.

4. Amount of feed leftover (kg). This was determined by weighing the spilled or refused feed.

5. Cost of inputs (Php). This was determined by recording all the expenses used in the study.

6. Morbidity. This refers to the number of pigs that got sick during the experimental period.

7. Mortality. This refers to the numbers of pigs that died during the study.

From the data above, the following parameters were computed:

1. Total gain in weight (kg). This was determined by subtracting the initial weight from the final weight.

2. Average daily gain in weight (kg). This was determined by dividing the total gain in weight by the number of days of feeding the pigs.

3. Total feed consumption (kg). This was determined by adding the amount of feed consumed by the pigs from the start to the end of the study.

4. Feed conversion ratio (FCR). This was determined by dividing the total feed consumption by the total gain in weight.

5. Morbidity rate (%). This was obtained by dividing the number of pigs that got sick by the total number of pigs at the start of the study multiplied by 100%.

6. Mortality rate (%). This was obtained by dividing the number of pigs that died by the total number of pigs at the start of the study multiplied by 100%.

7. Return on Investment. This was determined by using the following formula:

$$\text{ROI} = \frac{\text{Gross sales- Total Expenses}}{\text{Total Expenses}} \times 100\%$$

Data Analysis

All data gathered were consolidated, tabulated and analyzed. Treatment means were computed using the T-test.

RESULTS AND DISCUSSION

Body Weights of the Pigs

The initial and final weights of the pigs used in the study are shown in Table 1. Statistical analysis showed no significant differences in the two treatments in the initial weights of the pigs at 60 days of age. The average initial weight of the pigs given diets without activated charcoal containing wood vinegar was 15.063 kg while the pigs given diets with activated charcoal containing wood vinegar was 15 kg. This means that the experimental animals were more or less of the same weights at the start of the study.

Likewise in the final weights, there was no significant difference observed between the two treatment means. The mean final weight obtained from pigs given diets without activated charcoal containing wood vinegar was 66.25 kg and 64.75 kg from the pigs given diets with activated charcoal containing wood vinegar.

The result of the study indicates that the final weights of the pigs in the treatments were more or less the same. The mean final weight of the pigs ranged from 64.75 kg- 66.25 kg.

Table 1. Initial and final weights of pigs

TREATMENT	INITIAL WEIGHT AT 60 DAYS OF AGE (kg)	FINAL WEIGHT AT 144 DAYS OF AGE (kg)
Without activated charcoal containing wood vinegar	15.063	66.250
With activated charcoal containing wood vinegar	15.000	64.750

Feed Consumptions of the Pigs

Presented in Table 2 are the total and daily feed consumptions of the pigs. Statistical analysis revealed that no significant difference was observed on the feed consumptions of the pigs. This implies that the addition of activated charcoal containing wood vinegar to the pig's diet did not improve nor reduce the appetite or feed consumption of the pigs. The total feed consumption of the pigs given diets without activated charcoal containing wood vinegar for a period of 84 days was 212.802 kg. The pigs given diets with activated charcoal containing wood vinegar had a mean of 211.862 kg.

On the dry matter basis, statistical analysis revealed that no significant difference was observed. The pigs given diets without activated charcoal containing wood vinegar had a mean of 108.935 kg. The pigs given diets with activated charcoal containing wood vinegar had a mean of 108.471 kg.

Table 2. Total feed consumptions of pigs for 84 days

TREATMENT	AS FED (kg)	AS DRY MATTER (kg)
Without activated charcoal containing wood vinegar	212.802	108.935
With activated charcoal containing wood vinegar	211.862	108.471

Gains in Weight of the Pigs

The total and daily gains in weights of the pigs are shown in Table 3. Statistical analysis revealed that there was no significant difference between the two treatments. This means that the gains in weight of the pigs were more or less the same. It is also reflected that the ability of the animals to gain weight has not improved nor adversely affected by the addition of activated charcoal containing wood vinegar in their rations. The overall mean total gain and average daily gains in weight of the pigs was 50.469 kg and 0.601 kg, respectively.

This study agrees to the findings of Kritas and Morrison (2010) as cited by Tindaan (2012) who observed no difference in the average daily feed consumption of the weanlings given probiotics.

Feed Conversion Ratio

Table 4 presents the feed conversion ratios (FCR) of the pigs. No significant difference was observed between the two treatment means as revealed by the statistical analysis. This is expected because both of the pigs given diets without and with activated

Table 3.Total and daily gains in weight of the pigs

TREATMENT	TOTAL GAINS IN WEIGHT (kg)	AVERAGE DAILY GAINS IN WEIGHT (kg)
Without activated charcoal containing wood vinegar	51.188	0.609
With activated charcoal containing wood vinegar	49.750	0.592

charcoal containing wood vinegar consumed almost the same amount of feeds and had more or less the same gains in weight.

The pigs given diets without activated charcoal containing wood vinegar had an FCR of 4.147 while the pigs given diets with activated charcoal containing wood vinegar had an FCR of 4.287. This result indicates that activated charcoal containing wood vinegar liquid added to swine diets did not improve nor decrease the efficiency of the swine to convert nutrients in the feeds into a unit gain in weight. These was similar to the study of Wang *et al.* (2011) that bamboo vinegar as an antibiotic will give no significant difference in the feed intake and feed conversion ratio of weaned pigs.

On the dry matter basis, statistical analysis revealed also no significant difference was observed between the two treatment mean. The pigs given diets with activated charcoal containing wood vinegar had a FCR of 2.135 and 2.194 for the pigs given with activated charcoal containing wood vinegar.

Table 4. Feed conversion ratio (FCR) of the pigs grown from 60 to 144 days

TREATMENT	FCR	
	As Fed	As Dry Matter
Without activated charcoal containing wood vinegar	4.147	2.135
With activated charcoal containing wood vinegar	4.287	2.194

Returns on investment (ROI)

Table 5 shows the return on investment (ROI) per treatment though this was not subjected to statistical analysis. The result revealed that the pigs given diets without activated charcoal containing wood vinegar had a higher return on investment of 7.71 %. The pigs given diets with activated charcoal containing wood vinegar had an ROI of 2.23%.

Giving pigs with activated charcoal containing wood vinegar resulted in lower return on investment because no improvement was observed in the growth rates or gains in weight of the pigs and even their feed efficiency. The addition of activated charcoal containing wood vinegar was just an additional expense.

Other Observations

During the experiment, it was observed that the pigs given activated charcoal containing wood vinegar reduce the fecal odor compared to the pigs given diet without activated charcoal containing wood vinegar. In terms of their body conformation the pigs given activated charcoal containing wood vinegar is thin or slim compared to pigs not given activated charcoal containing wood vinegar.

Table 5. Returns on investment (ROI)

TREATMENT	GROSS SALES (Php)	TOTAL EXPENSES (Php	NET INCOME (Php)	ROI (%)
Without activated Charcoal containing Wood Vinegar	31,900.00	29,617.60	2,282.40	7.71
With activated Charcoal containing Wood Vinegar	31,180.00	30,514.49	665.51	2.23

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The study was conducted to determine the growth performance of growing-finishing pigs given activated charcoal containing wood vinegar as feed additives.

A total of 8 crossbred (Large white x Landrace) belonging to the same litter which were 60 days old pigs were used in the study. These were grouped into two treatments following the Completely Randomized Design (CRD). Each of the treatments was replicated four times with one pig per replication. The two treatments were: without activated charcoal containing wood vinegar (T_0), and with activated charcoal containing wood vinegar given at the level of 20g/kg of feed mixture (T_1). The diets given to the pigs were commercial feeds and sweet potato leaves and vines. The sweet potato leaves and vines were washed thoroughly and chopped into small pieces before giving to the pigs. Feeding was done twice a day.

Statistical analysis revealed that there were no significant differences among treatments in all the parameters namely; initial weight, final weight, gain in weight, total feed consumption, and feed con version ratio.

The pigs in the two treatments had an overall mean initial weight of 15.032kg and an overall mean final weight of 65.50 kg after 84 days of feeding.

As regards to the total gain in weight, the pigs given diets without activated charcoal containing wood vinegar had a mean of 51.188 kg and an ADG of 0.609 kg. On the other hand, pigs given diets with activated charcoal containing wood vinegar had a mean total gain in weight of 49.75 kg and an ADG of 0.592 kg.

From 60-144 days old, the pigs given diets without activated charcoal containing wood vinegar had a mean feed consumption of 212.802 kg (as fed basis) or 108.935 kg (DM basis). On the other hand, the pigs given diets with activated charcoal containing wood vinegar had a mean feed consumption of 211.862 kg (as fed basis) or 108.471 kg (DM basis)

For the feed conversion ratio (FCR), the pigs given diets without activated charcoal containing wood vinegar had a mean of 4.147 (as fed basis) or 2.135 (DM basis), while the pigs given diets with activated charcoal containing wood vinegar had a mean of 4.287 (as fed basis) or 2.194 (DM basis).

Finally, for the returns on return on investment (ROI), higher ROI was observed from the pigs given diets without activated charcoal containing wood vinegar which was 7.71%. The ROI realized from the pigs given activated charcoal containing wood vinegar was only 2.23%.

Conclusion

Based on the results of the study, it can be concluded that adding activated charcoal containing wood vinegar into the diets of the pigs at the level of 20/kg feed mixture gives no effect on the body weights, gain in weights, feed conversion ratio and the return on investment.

Recommendations

Based on the results of the study, it is recommended that studies should be conducted to include more numbers of treatments, higher levels of activated charcoal containing wood vinegar higher than 2% level and its effect on the fecal odor. It is also recommended that studies should be conducted to include the digestibility trials and the

effect of activated charcoal containing wood vinegar on the waste management in animal production.

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