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Utilization of Ensiled Cassava Leaf and Taro Mixed with Waste of Soybean Meal as Protein Sources Fed Different Sources of Energy on Fattening Crossbred Pigs

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Abstract:- The experiment was carried out at the station of Agricultural Research of Svay Rieng University, and was carried out from 15th April to 17th June 2023 with the title "Utilization of ensiled cassava leaf and taro mixed with waste of soybean meal as protein sources fed different sources of energy on fattening crossbred pigs". This research has 3 objectives: 1. To compare DM feed intake of crossbred pigs, 2. To compare the growth rate of crossbred pigs, and 3. To compare the feed conversion of crossbred pigs. There were 12 pigs were arranged within 2*2 factorial design through Randomized Complete Block Design (RCBD) with 3 replications. The factor with the energy source: rice bran or broken rice and the factor with the protein source: Ensiled taro mixed with waste of soybean meal or Ensiled cassava leaf mixed with waste of soybean meal. The treatments of the study are: T1: Ensiled Taro 30% + Waste of Soybean Meal 20% + Rice Bran 49% + Premix 1%; T2: Ensiled Taro 30% + Waste of Soybean Meal 20% + Broken Rice 49% + Premix 1%; T3: Ensiled Cassava Leaf 25% + Waste of Soybean Meal 25% + Rice Bran 49% + Premix 1%; and T4: Ensiled Cassava Leaf 25% + Waste of Soybean Meal 25% + Broken Rice 49% + Premix 1%. The period of experiment were 60 days only. All data were collected daily such as feed offer and feed refusals. Those pigs were weighed at every 10 days from the starting of the experiment until the end of experiment. The experiments' results were found that total intake on the energy sources were higher significant differently in broken rice compared with the rice bran (P<0.01) as total intake on the protein sources were higher significant differently on the ensiled taro mixed with waste of soybean meal (P<0.01). Growth rate on the energy sources were higher significant differently in broken rice as compared to the rice bran (P<0.01) while growth rate for the ensiled taro plus waste of soybean meal was slightly high if compared with the ensile cassava plus waste of soybean meal (P>0.05). Feed conversion ratio on the energy sources was better significant in broken rice compared to the rice bran (P<0.01) while feed conversion for ensiled taro mixed with waste of soybean meal was slightly better as compared with the ensile cassava plus waste of soybean meal (P>0.05). In conclusion, the use of the protein source from the ensiled taro mixed with waste of soybean meal plus the energy source of broken rice or rice bran, the pigs were increased on total intake, live weight gain and good improvement of feed conversion rather than the use of ensiled cassava leaf mixed with waste of soybean meal plus broken rice or rice bran. The research outcome indicated that efficiency of protein offering is asked to use the ensiled taro with waste of soybean meal combination with basal diet of broken rice or rice bran on reproduction of sows in the next trial.

Keywords:- *Ensiled Taro, Cassava Leaf, Soybean, Rice Bran, Broken Rice.*

I. INTRODUCTION

In Cambodia, the leaves of shrubs included cassava, Gliricidia, mulberry, Leucaena leaves, and other vegetables likely Sweet Potato, Leucaena, Taro, Water spinach, and Water Hyacinth which be able to use successfully in feed composition for raising the pigs to replace some parts or all of the protein sources of which are usually applied as soybean or fish meal or mixture of soybean and fish meal.

Taro plant (Colocia Esculenta) is plays an important role and many attention in view that it has high protein content and these plants are easy grown in the wild state, mountain areas, in forests, cannel, and also grown in ponds and other water surfaces (Pheng Buntha et al., 2008). Based on the findings of survey by the farmer practices in using the taro leaves as it is found that they are traditionally foliage be

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able to fed to pigs but if offering without boiling, farmers observed that it was eliminated the itching to the mouth, body and skin once the fresh leaf or whole plant. The problem of this itching to be caused by the presence of crystals of calcium oxalate in the leaves and petiole therefore the right way to reduce the itching have to boil or ensile prior offering to the animal (Pham Sy Tiep et al., 2005). Based on some findings from the researchers is indicated that the foliage of Taro (Colocasia esculenta) and particularly the forage likely Taro plant was potentially to use as protein sources to replace the fish meal or soybean meal for the trail which related to the digestibility study and then those biological values in the taro plant is higher (Chhay Ty et al., 2010). Du Thanh Hang and Preston (2008) were found that a total of feed intake of taro plant and nitrogen retention were highly increased once the taro plant were boiled or ensiled prior feeding to the pigs, as well as when using sun-dried Colocacia leaf that was supported highly amount of feed intake and nitrogen retention in fattening pigs rather than the use of ensiled leaves (Chhay Ty et al., 2007).

Cassava is a tropical grown crop in the many countries of Africa, Latin American, and Asia countries (Calpe, 1992). The cassava leaves are rich in protein values and also available forage at the time of root harvesting. Mostly reports showed that cassava leaf which is good source in lysine but less sulphur amino acids (Gomez and Valdivieso 1984). The utilization of ensiled cassava leaf for pigs and other livestock species had studied in different ways, and to this linkage, it has been shown the potential in using cassava leaves or ensiled cassava leaves as a protein source to support to the pig nutrition (Du Thanh Hang 1998; Nguyen Thi Loc et al 2000). Anyway, considerable efforts have been engaged to do the research through the process of cassava leaf ensiling for its elimination of cyanide in the cassava leaf (Limon,1992; Chhay Ty et al., 2001).

Soybean meal is the most grain-based diets and rich in protein source of which has been utilized in many countries to be used as protein sources for livestock feeding. Soybean meal is rich amino acids including lysine and also it is the first limitation of amino acid in the growing pigs (Gonzalez et al., 2011). Soybean meal is produced from raw soybeans after processes for the energy need in term of oil removement from the beans, and soybean meal has crude protein of 30-40% and also it contains about 20% oil (Salunkhe et al., 1983).

Rice bran is a rice by-product to be used as energy feed and it was produced by milling machine from paddy rice. The fraction of rice bran is contained with oil from 14-18%. Rice bran has not been defatted but it is very useful to use for combination or mixture feeds. Rice bran has been used with higher amounts than other energy feeds. Rice bran is often mixed with rice hulls, and then it riched a crude fiber (CF) from 10-15% (Göhl, 1982). And, rice bran has chemical composition of dry matter (DM) 91.0%, crude protein (CP) of 12.6%, crude fiber (CF) of 11.9% and Ash of 10.2% (Chiv Phiny et al., 2008).

Broken rice is other by-product from the rice milling machine and it has high potential to be used as energy density because of it is almost free of fibre content, and it has dry matter of 87-88%, crude protein of 8-9% and low in crude fiber (J Ly et al., 2002). These by-products have been used as traditional ingredients in the pig diets. The feeding values of broken rice is well improved when it mixed with water spinach, and it was selected and appeared studies mostly by researchers in Vietnam country (Bui Hong Van 1994; Le Thi Men 1999).

The aim of this experiment was to evaluate the effect of using the ensiled cassava leaf and taro mixed with waste of soybean meal as protein sources on the growth performance and feed conversion of crossbred pigs.

II. MATERIALS AND METHODS

➢ *Location and Climate*

The experiment was conducted at the station of Agricultural Research of the Svay Rieng University where located in Chambak village, Sangkat Chek, Svay Rieng town, Svay Rieng province. The temperature status during the conduction of the experiment was indicated from 35 to 39 degrees in the time of afternoon.

➢ *Experimental Design and Treatments*

There were 12 pigs and an average of 15 kg body weight were used and kept by the individual pen. This research was arranged within 2*2 factorial design in Randomized Complete Block Design (RCBD) and included 3 replications. Total of 12 pens and the size of the experimental pen was 2m for length, 1m for width, and 1.2m for height. Each pen and experimental house were made from brick and steel structure. Each pen under the experimental house had drinking nipple and feeder. The pigs were de-wormed and also vaccinated for 10 days before carrying out the experiment. The experiment was taken for 60 days, from 15th April 2023 to 17th June 2023. The factors, feeds and layout of the experiment are indicated as following below:

- *Energy Source*

✓ Rice Bran
✓ Broken Rice

- *Protein Source*

✓ Ensiled taro mixed plus waste of soybean meal
✓ Ensiled cassava leaf mixed plus waste of soybean meal

- *Treatment (T)*

✓ T1: Ensiled Taro 30% + Waste of Soybean Meal 20% + Rice Bran 49% + Premix 1%
✓ T2: Ensiled Taro 30% + Waste of Soybean Meal 20% + Broken Rice 49% + Premix 1%
✓ T3: Ensiled Cassava Leaf 25% + Waste of Soybean Meal 25% + Rice Bran 49% + Premix 1%
✓ T4: Ensiled Cassava Leaf 25% + Waste of Soybean Meal 25% + Broken Rice 49% + Premix 1%

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Table 1 Experimental Layout

Block	I		II		III	
Pens	T3	T1	T1	T2	T3	T2
	T4	T2	T4	T3	T4	T1

Table 2 Feed Formulation and Chemical Composition of the Goat Diets

Treatment	T1	T2	T3	T4
Ensiled Cassava Leaf (EC)	-	-	25	25
Ensiled Taro (ET)	30	30	-	-
Waste of Soybean Meal (WSM)	20	20	25	25
Rice bran (RB)	49	-	49	-
Broken Rice (BR)	-	49	-	49
Premix plus salt (PS)	1	1	1	1
Chemical composition of the feed (%)				
Dry Matter (DM)	63.7	67.8	71.2	72.3
Crude Protein (CP)	17.9	18.4	18.1	17.5
Organic Matter (OM)	25.4	21.5	29.5	25.6
Crude Fiber (CF)	10.8	6.95	9.58	5.77

➢ *Experimental Feeds*

The feed materials of the experiment included taro plant, cassava leaf, waste of soybean meal, rice bran, broken rice and premix. However, the cassava leaf was bought from the households who growing at cassava farm where farm from the Station of Agricultural Research of Svay Rieng University about 30km. Taro plant was collected from the cannels and ponds where far from the research station around 5km. For rice bran, broken rice and premix were bought from the shops in Svay Ring Province.

➢ *Ensiling the Taro Plant and Cassava Leaf*

The whole plant of taro was chopped by hand into 5cm and then kept these materials for 2 hours to remove the moisture of taro plant and after that put into the plastic bag by making pressure to remove the air inside the plastic containers and tied properly and storing safety. The ensiled taro plant was used and offered to the pigs after 21 days. For cassava leaf were ensiled with sugar palm syrup in proportion of cassava leaf 100kg mixed with sugar palm syrup 5kg. All mixed materials were put in the plastic bag with pressing to remove the air inside of plastic containers, tied, and stored at the saft place. The ensiled cassava was used and offered to the pigs after 21 days.

➢ *Feeding System and Live Weight*

The total of feed offers was calculated and weight according to the daily expectation from amount of feed intake during adaptation time. For water offer was freely accessed via drinking nipple which connected to each pen. In addition, the offerings to the pigs were divided within three times a day (08:00 am, 11:00 am and 16:00 pm). The pigs were weighed at the beginning of the experiment and then at every 10 days until the end of 60 days period. The scale with 5kg was used for weighing the feed offer and feed refusals, and the scale with 100kg was used for weighing the pigs at every 10 days during the experimental implementation.

➢ *Sample Collection*

At every 10 days interval of the experiment, all pigs were weighed in the morning around 6:00 am prior offering the experimental feeds. All feed offers and feed refusals daily were taken, weighed and recorded every day, and then 10% of total amount of feed offers and refusals were sampled and kept frozen at -20°C in the refrigerator to be waited for analysis with different parameter in Laboratory. At the end of each 10 days period, those samples of feed refusals and feed offers were mixed thoroughly by hand and homogenized by a coffee grinder prior doing analysis of those samples with different parameter such as dry mater (DM), crude protein (CP), crude fiber (CF) and organic matter (OM).

➢ *Chemical Analysis*

Those feed offers and feed refusals were prepared and undertaken by following the methods of AOAC (1990) for analysis to determine organic matter, nitrogen and crude fiber. In regard to the parameter in dry matter of the feed offers and refusals were analyzed by following the microwave or oven methods of Undersander et al. (1993).

➢ *Statistical Analysis*

The relevant data of the experiment such as the total of feed intake, live weight gain and feed conversion ratio were recorded and entered onto Microsoft Excel and then used the software program of Minitab Version 16 to analyze ANOVA by General Linear Model method, and the mean values of the experiment were compared by using turkey method in Minitab version 16. The sources of variation were energy feed, protein feed, and error.

III. RESULT S AND DISCUSSIONS

A. Feed Intake of Pigs

➢ *Feed Intake in Dry Matter (DM)*

Total of DM intake on the energy sources were higher significant differently for the broken rice (BR) compared with the ensiled to rice bran (RB) ($P<0.01$). And also total of DM intake on the protein sources were higher significant when the ensiled taro mixed with waste of soybean meal compared with the ensiled cassava leaf mixed with waste of soybean meal ($P<0.01$) (see Table 3 and Fig 1).

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This result is higher than the finding of Du Thanh Hang (1998) who reported that the daily intake ranged from 1,191 to 1,264g/day when the pigs were fed different levels of ensiled cassava leaf with 50%, 75% and 100% mixed with energy source of the ensiled cassava root to replace fish meal. The result is also higher than the results of Tran Trung Tuan and Preston (2021) who reported that the total of feed intake was 809g/day once used the ensiled taro foliage mixed with cassava root meal as energy source. The reason of the difference probably caused by using the ensiled cassava root or cassava root meal as energy source in the feed composition and then made the pigs were not familiar to consume while the feed composition in the present study was used the ensiled taro plus soybean meal or ensiled cassava leaf plus soybean meal fed the broken rice or rice bran as energy source respectively. However, this result is similar to the finding of Chhay Ty et al. (2009) who resulted that the daily intake was 1649 g/day when the pigs fed the ensiled taro leaf or ensiled taro leaves plus petiole with the energy sources of fine rice bran or coarse rice bran.

Table 3 Mean Values of Feed Intake of Pigs

	RB	BR	P-value	ETS	ECS	P-value	SEM
DM intake, g/day							
Ensiled Cassava Leaf (EC)	285	293	<0.001	579	-	<0.001	7.03
Ensiled Taro (ET)	205	232	<0.001	-	437	<0.001	5.40
Waste of Soybean Meal (WSM)	396	427	<0.001	386	437	<0.001	7.23
Rice bran (RB)	868	-	<0.001	466	402	<0.001	10.5
Broken Rice (BR)	-	933	<0.001	479	454	<0.001	11.6
Premix plus salt (PS)	18.0	19.1	<0.001	19.3	17.5	<0.001	0.32
Total	1772^{b}	1905^{a}	0.003	1929^{a}	1748^{b}	<0.001	31.8
DM, g/kg LW	44.8^{a}	41.8^{b}	<0.001	44.6^{a}	42.1^{b}	<0.001	0.18
Total CP, g/day	311^{b}	345^{a}	<0.001	305^{b}	352^{a}	<0.001	5.70
Total CF, g/day	372^{a}	145^{b}	<0.001	358^{a}	260^{b}	<0.001	4.74
Total OM, g/day	1405	1454	0.16	1587^{b}	1609^{a}	<0.001	24.9

[ab] Mean Values within row without a Common Letter are Different at P<0.05

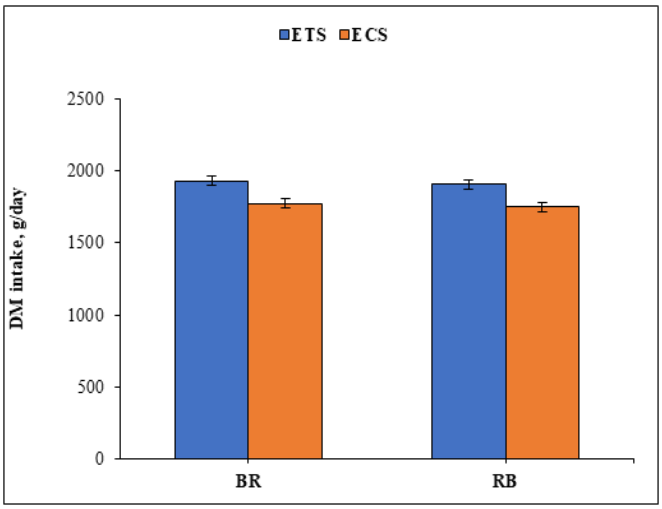

Fig 1 DM Feed Intake of Pigs from 0-60 Days

➢ *Intake of Crude Protein (CP)*

A total of CP intakes was higher significant differently on the broken rice (BR) as compared with the rice bran (RB) (P<0.01), and also were highly significant differently on the protein source of the ensiled cassava leaf plus waste of soybean meal compared with the ensiled taro plant plus waste of soybean meal (P<0.01) (Table 3 and Fig 2).

These results are higher than the results of Du Thanh Hang (1998) who reported that the daily intake of crude protein (CP) ranged from 127 to 156g/day when the pigs were fed different levels of ensiled cassava leaf in 50%, 75% and 100% mixed with energy source of the ensiled cassava root to replace fish meal as well as higher than the findings of Chhay Ty et al. (2009) who resulted that the daily intake was 1649 g/day when the pigs fed the ensiled taro leaf or ensiled taro leaves plus petiole with the energy sources of fine rice bran or coarse rice bran. The different of these results are caused by the protein source was from only one source such as the ensiled taro leaf or ensiled taro leaf plus stem or dry taro leaf mixed with energy source of rice bran as the current research was used the protein source from two different sources such as the ensiled taro leaf mixed with waste of soybean meal or the ensiled cassava leaf mixed with waste of soybean meal fed rice bran or broken rice as energy sources within the feed composition. However, this result was agreed to the reported by Ly Thi Thu Lan et al. (2021) who found that a total of crude protein (CP) was 351 g/day when the pigs were fed the taro silage of 20% mixed with concentrate feed of 80% plus salt of 0.5% into the feed formulation.

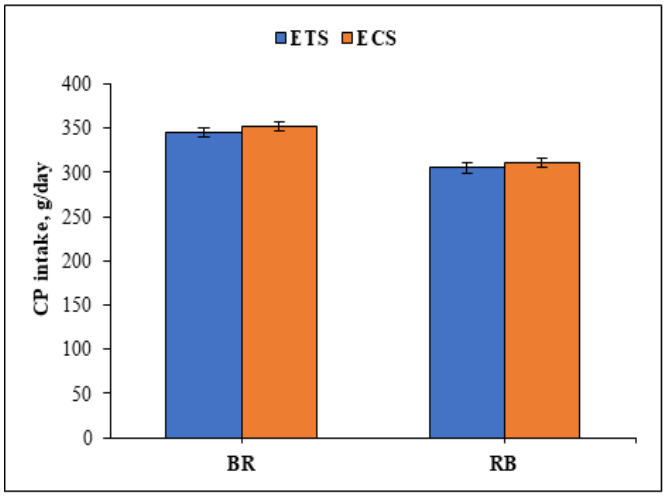

Fig 2 Crude Protein Intake of Pigs from 0-60 Days

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➢ *Intake of Crude Fiber (CF)*

Total of Crude Fiber (CF) intake on the energy sources were higher for the rice bran (RB) compared with the broken rice (BR) (P<0.01), and also CF intakes were higher when feeding the ensiled taro mixed with waste of soybean meal as compared with the ensiled cassava leaf mixed with waste of soybean (P<0.01) (Table 3 and Fig 3).

This result is higher than the finding of Chiv Phiny et al. (2021) when the pigs were fed the ensiled taro or rice wine by-product or combination both mixed with rice bran while the pigs in the current trial was used the ensiled taro plus waste of soybean meal or the ensiled cassava leaf plus waste of soybean meal mixed with rice bran or broken rice. The main effect was probably caused by the feed composition in present study had higher contain in fiber when a combination of the ensiled taro plant and the ensiled cassava leaf being selected and used to the pigs. And the result is also higher than the result of Chiv Phiny et al. (2008) once the pigs were fed water spinach or water spinach mixed with mulberry leaf plus basal diets of cassava root meal or sugar palm syrup. The reason of the different was this author had used the energy sources with low fiber mixed with the protein source within the feed composition.

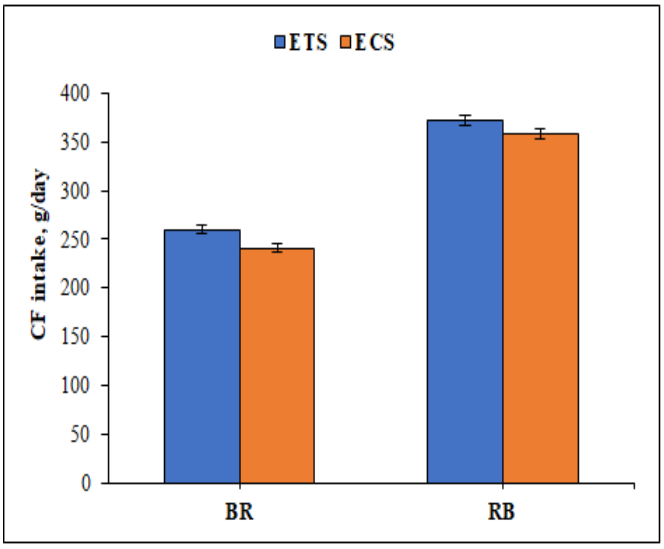

Fig 3 Crude Fiber Intake of Pigs from 0-60 Days

➢ *Intake of Organic Matter (OM)*

Total of OM intake on the energy sources were non-significant differently for the rice bran (RB) compared with the broken rice (BR) (P>0.05). However, the intake of Organic Matter on the protein sources were higher significant differently for the ensiled taro mixed with waste of soybean meal compared with the ensiled cassava leaf plus waste of soybean meal (P<0.01) (Table 3 and Fig 4).

This result is slightly higher than the result of Chiv Phiny et al. (2021) when the pigs were fed the ensiled taro or rice wine by-product or combination both mixed with rice bran while the pigs in the current trial was used the ensiled taro plus waste of soybean meal or the ensiled cassava leaf plus waste of soybean meal mixed with rice bran or broken rice. However, this finding was similar to the reported by Ly Thi Thu Lan et al. (2021) who found that a total of organic matter (OM) was 1,659 g/day when the pigs were fed the taro silage of 20% mixed with concentrate feed of 80% plus salt of 0.5% into the feed formulation.

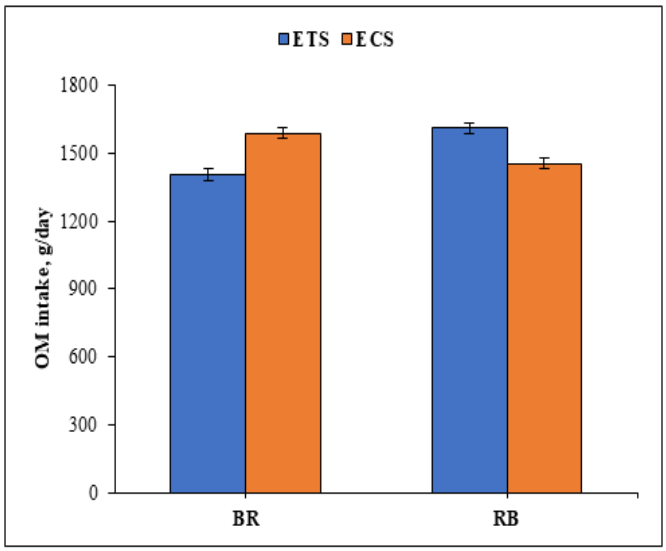

Fig 4 Intake of Organic Matter of Pigs from 0-60 Days

B. The Growth Rate of Pigs

The overall of live weight gain on the energy sources were higher significant differently for the broken rice (BR) compared with the rice bran (RB) (P<0.01), and also the live weight gain was slightly high on using the ensiled taro plus waste of soybean meal as compared to the ensiled cassava leaf plus waste of soybean meal (P>0.05). However, the both of the protein sources were non-significant effect (Table 4 and Fig 5).

The result is higher than the results of Tran Trung Tuan and Preston (2021) who reported that the overall daily weight gain was 245g/day as used the ensiled taro foliage mixed with cassava root meal as energy source. The reason of the difference probably caused by using the ensiled cassava root or cassava root meal as energy source in the feed composition and then made the pigs were not familiar to consume. Also is higher than the finding of Chiv Phiny et al. (2012) who reported that the overall daily weight gain was 365g/day when the pigs were fed the ensiled taro plus protein-enriched rice mixed with cassava root meal as energy source, and higher than the result of Nouphon Manivanh and Preston (2015) who reported that overall live weight gain was 152 g/day when the pigs were offered taro silage, ensiled banana stem and protein enriched cassava root in the dietary feeds. However, the result is agreed to the report of Du Thanh Hang (1998) who reported that the live weight gain was 435g/day when the pigs were fed the ensiled cassava leaf of 35% mixed with duckweed, sweet potato vines plus the energy sources from the ensiled cassava root mixed with rice bran.

The growth curves between the live weight gain and the days of experiment found that once increasing the period of the experiment and then it caused the live weight gain of pigs in treatments which offered the ensiled taro mixed with waste

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of soybean meal fed energy source of broken rice (BR) or rice bran (RB) were increased than the treatment which had used water the ensiled cassava leaf mixed with waste of soybean meal fed BR or RB (Fig 6). Anyway, the relationship between the amount of feed intake and live weight gain of pigs were expressed that the live weight gain was increased tendency by dealing with the feed intake of pigs (Fig 7). However, it was contrasted for the relationship between DM intake and feed conversion ratio (Fig 8).

Table 4 Mean Values for the Main Effects on the Growth Performance and Feed Conversion Ratio of Pigs

	RB	BR	P-value	ETS	ECS	P-value	SEM
Live weight, kg							
Initial	26.2	26.7	0.86	26.3	26.5	0.95	1.97
30 days	38.0	46.0	0.26	42.2	41.8	0.93	2.81
60 days	50.0[b]	61.8[a]	0.03	58.5	53.3	0.30	3.31
Final	55.0[b]	67.8[a]	0.02	63.0	59.8	0.48	3.05
Live weight gain, g/day							
0-30 days	394[b]	644[a]	<0.001	528	511	0.72	31.2
30-60 days	566[b]	727[a]	0.01	694	600	0.06	31.6
0-60 days	481[b]	686[a]	<0.001	611	556	0.11	22.0
Feed conversion ratio (FCR), kg/kg of body weight							
0-30 days	3.28[a]	2.14[b]	<0.001	2.61	2.61	0.17	0.09
30-60 days	4.04	3.35	0.06	2.83	2.81	0.34	0.23
0-60 days	3.69[a]	2.76[b]	0.001	3.19	3.27	0.65	0.13

[ab] Mean values within row without a common letter are different at P<0.05

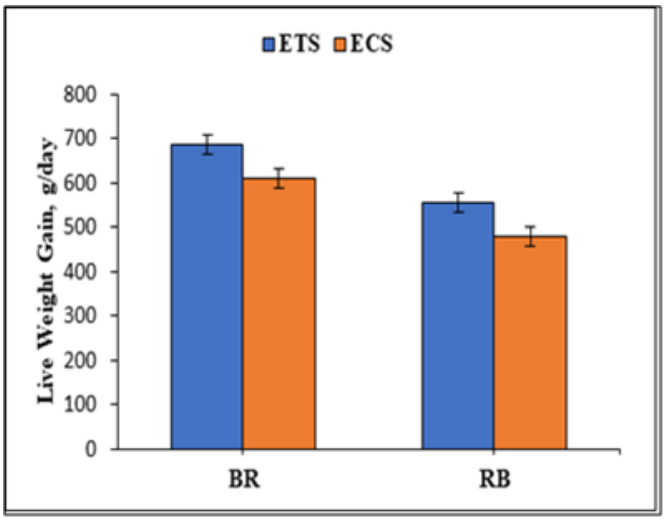

Fig 5 Growth Performance of Pigs from 0-60 Days

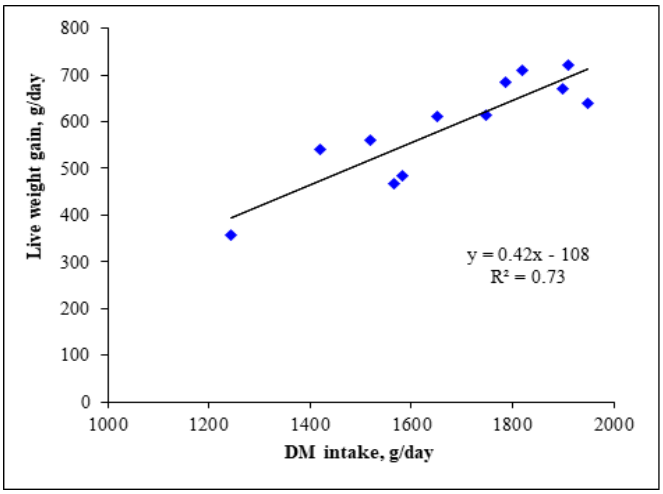

Fig 7 Relationship between live Weight Gain and DM Intake of Pigs from 0-60 Days

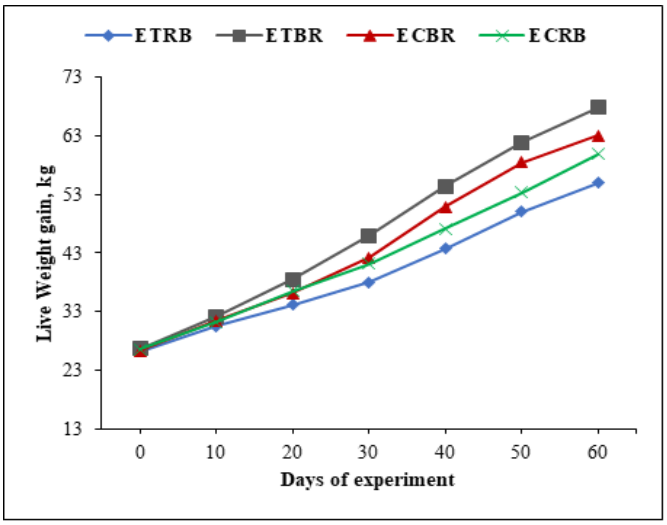

Fig 6 Growth Curves of Live Weight with Days of Experiment of Pigs from 0-60 Days

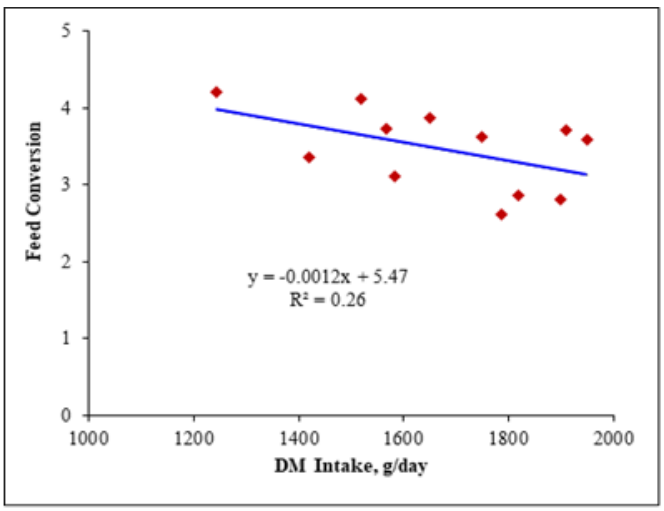

Fig 8 Relationship between Feed Conversion and DM Intake of Pigs from 0-60 Days

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C. Feed Conversion Ratio of Pigs

The overall of feed conversion on the energy source were highly improved significant for the broken rice (BR) compared with the rice bran (RB) ($P<0.01$), and were non-significant for using the ensiled taro mixed with waste of soybean meal compared with the ensiled cassava leaf mixed with waste of soybean meal ($P>0.05$). However, it was better performance on the treatment of which using the ensiled taro plus waste of soybean meal fed BR or RB compared with the ensiled cassava leaf plus waste of soybean meal fed BR or RB (Table 4 and Fig 9).

This result is better than the report of Chiv Phiny et al. (2012) who reported that the overall feed conversion ratio was 4.07 when the pigs were fed the ensiled taro plus protein-enriched rice mixed with cassava root meal as energy source. Also this result is better than to the report of Du Thanh Hang (1998) who reported that the overall feed conversion was 4.99 when the pigs were fed the ensiled cassava leaf of 35% mixed with duckweed, sweet potato vines plus the energy sources from the ensiled cassava root mixed with rice bran. Furthermore, it is better than to the finding of Nouphon Manivanh and Preston (2015) day when the pigs were fed the taro silage and the ensiled banana stem mixed with protein enriched cassava root in the dietary feeds. These differences maybe using with different type of the feed ingredients in the dietary composition. However, it agreed to Tran Trung Tuan and Preston (2021) who reported that the overall feed conversion was 3.30 once using the ensiled taro foliage mixed with cassava root meal as energy source. And also, it is similar to the reported by Ly Thi Thu Lan et al. (2021) who found that feed conversion was 3.03 as the pigs were fed the taro silage 20% mixed with concentrate feed 80% plus salt 0.5% within the feed composition.

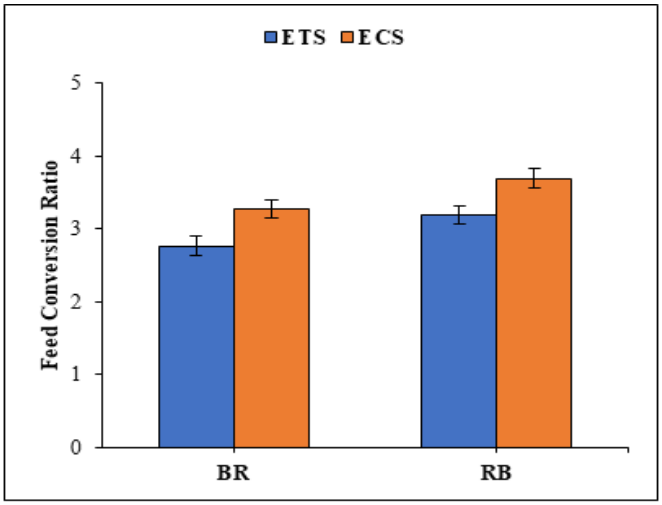

Fig 9 Feed Conversion Ratio of Pigs from 0-60 Days

IV. CONCLUSIONS AND RECOMMENDATIONS

Through the research findings for 60days was shown that total of DM intake on the energy sources were higher significant in broken rice compared with the rice bran while the DM intake on the protein sources were higher significant for ensiled taro mixed with waste of soybean meal.

Overall growth rate on the energy sources were higher significant in broken rice as compared to the rice bran while the growth rate for the ensiled taro plus waste of soybean meal was slightly high if compared with the ensile cassava plus waste of soybean meal. For overall feed conversion on the energy sources was better significant in broken rice compared to the rice bran while feed conversion for ensiled taro mixed with waste of soybean meal was slightly better as compared with the ensile cassava plus waste of soybean meal.

In conclusion, when using the protein source of ensiled taro mixed with waste of soybean meal plus the energy source of broken rice or rice bran, it was highly increased on DM intake, high growth rate and better improvement on the feed conversion rather than using ensiled cassava leaf mixed with waste of soybean meal plus broken rice or rice bran.

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