ອິດທິພົນຂອງຂີ້ມັນຕົ້ນໝັກຕໍ່ການຍ່ອຍໄດ້ຂອງໝູລາດໂດຍການນຳໃຊ້ຮຳ ແລະ ການຖົ່ວເຫຼືອງເປັນອາຫານພື້ນຖານ

Effect of cassava root residue fermented on digestibility of growing Moo lath pigs fed a basal diet of rice bran and soya meal residue

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Abstract

The aim of this study was to determine nutrient digestibility, nitrogen retention and nitrogen utilization of diets with different cassava root residue fermented levels by Moo Lath pigs. A total of 3 Moo lath gilt pigs with average initial body weight of 19 ± 1 kg were used in this study They were housed in individual metabolism cages. The experiment was arranged as a 3*3 Latin square design. The treatment were three diets as RSC0, RSC10 and RSC20 which content different levels 0, 10 and 20% of fermented cassava residue, respectively. During three experimental periods, faces and urin were quantitatively collected and analyze for chemical composition.

The apparent digestibility of dry, organic matter, crude protein and crude fiber were increased when mixing the diet with fermented cassava residue and there were significant difference among the treatment ($p<0.05$). The increased in crude protein (CP) digestibility from 65.7 80.5% in DM. Nitrogen retention also increased from 6.28 to 12.23 g/day when fermented cassava residue (FCR) was used at level of 10%. Dietary fermented cassava residue had no detrimental effect on the pig digestibility. It may be concluded that using fermented cassava residue in the pig diet improved the nutrients digestibility and nitrogen retention of Moo Lath pigs and it is also recommended that fermented cassava residue can be use in diet of growing pig up to 10 %.

Keywords: *Cassava residue, fermented, digestibility, protein and cyanide*

ບົດຄັດຫຍໍ້

ຈຸດປະສົງຂອງການສຶກສາໃນຄັ້ງນີ້ເພື່ອຊອກຫາອັດຕາການຍ່ອຍໄດ້ຂອງທາດບຳລຸງລ້ຽງ, ການດູດຊຶມໄນໂຕຼເຈນ , ການ ນຳໃຊ້ໄນໂຕຼເຈນຂອງໝູລາດທີ່ກິນອາຫານປະສົມກັບຂີ້ມັນຕົ້ນໝັກໃນອັດຕາທີ່ແຕກຕ່າງກັນ, ເຊິ່ງການທົດລອງໃນຄັ້ງນີ້ ແມ່ນນຳໃຊ້ໝູແມ່ທັງໝົດ 3 ໂຕ ມີນ້ຳໜັກໂຕສະເລ່ຍ 19 ± 1 ກິໂລ, ໝູແມ່ນຂັງໃນຄອກເມຕາໂບລິດສຶກ

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ຄອກ ລະໂຕ, ການທົດລອງໃນຄັ້ງນີ້ແມ່ນນາໃຊ້ຮູບແບບການທົດລອງແບບ 3*3 Latin square design, ສິ່ງທົດລອງ ແມ່ນອາຫານເຊັ່ນ: RSC0, RSC10 ແລະ RSC20 ອາຫານປະສົມກັບຂີ້ມັນຕົ້ນໝັກໃນອັດຕາທີ່ແຕກຕ່າງກັນ 0, 10 ແລະ 20% ຕາມລໍາດັບ, ໃນໄລຍະການທົດລອງ ອາຈົມ ແລະ ປັດສະອະຂອງໝູແມ່ນໄດ້ຖືບັນທຶກ ແລະ ເກັບຕົວຢ່າງ ເພື່ອວິໄຈຫາສ່ວນປະກອບທາງດ້ານເຄມີ.

ອັດຕາການຍ່ອຍໄດ້ຂອງ ວັດຖຸແຫ້ງ, ອິງຄະທາດ, ໂປຕີນ ແລະ ເຍື່ອໃຍອາຫານແມ່ນມີລັກສະນະເພີ້ມຂຶ້ນເມື່ອ ອາຫານ ປະສົມກັບຂີ້ມັນຕົ້ນໝັກ ແລະ ມີຄວາມໝາຍແຕກຕ່າງກັນທາງດ້ານສະຖິຕິລະຫວ່າງຈຸທົດລອງໃນລະດັບ ($p<0.05$) ອັດຕາການຍ່ອຍໄດ້ຂອງໂປຕີນແມ່ນເພີ້ມຂຶ້ນຈາກ 65.7 - 80.5% ໃນວັດຖຸແຫ້ງ, ການດູດຊຶມໄນໂຕເຈນ ກໍ່ມີລັກສະນະເພີ້ມຂຶ້ນເຊັ່ນດຽວກັນຈາກ 6,28 – 12,23 g/ວັນ, ເມື່ອນໍາໃຊ້ອາຫານປະສົມກັບຂີ້ມັນຕົ້ນໝັກໃນ ອັດຕາ 10%, ການນໍາໃຊ້ຂີ້ມັນຕົ້ນໝັກປະສົມກັບອາຫານພື້ນຖານແມ່ນບໍ່ມີຜົນທາງລົບຕໍ່ການຍ່ອຍໄດ້ຂອງໝູລາດ, ເຊິ່ງສາມາດສະຫຼຸບໄດ້ວ່າ ຂີ້ມັນຕົ້ນໝັກປະສົມກັບອາຫານສາມາດປັບປຸງການຍ່ອຍທາດບໍາລຸງລ້ຽງຂອງໝູລາດ ແລະ ການນໍາໃຊ້ຂີ້ ມັນຕົ້ນໝັກປະສົມກັບອາຫານທີ່ເໝາະສົມແມ່ນນໍາໃຊ້ໃນອັດຕາ 10%.

Keywords: ຂີ້ມັນຕົ້ນໝັກ, ການຍ່ອຍ, ໂປຕີນ ແລະ ໄຊຍານາຍ (cyanide)

Background

Farmers in Laos traditionally keep pigs of predominantly indigenous breeds in foraging systems. The number of pigs kept by a household varies between 1.4 and 3.7 animals, depending on the region (Knips, 2004). Livestock is playing significant role as a protein source, for sacrifice in traditional ceremonies and as a family's source of income (Phengsavanh, 1997). There are several breeds of local pigs called: Moo Chid, Moo Laat, Moo Daeng and Moo Nonghaet. They are slow growing with high fat content in the carcass. Mature body weight in sows ranges from 60 to 90 kg except for the Moo Chid that is smaller. The litter size is usually small (7 to 8) and the farrowing interval about 1.5 litters per year. The native breeds are hardy, well adapted to a free-ranging system and can survive in a hot climate on low quality feed, and with a high resistance to diseases (Vongthilath and Blacksell, 1999). A small number of farmers use exotic breeds or crossbreeds, but compared to local breeds they are considered to be less resistant in smallholder farming conditions and do not perform as well. The type of feed given depends on the farming system, the availability of labor and suitable natural vegetation. Feeds include rice bran, broken rice, banana pseudo-stem, taro, yams, maize, cassava, by-products (especially rice distillers' waste) and vegetation collected in fallow fields and forests (Stur Werner *et al*., 2002).

In Lao villages, where most farmers are growing paddy rice for sale, the feed for pigs is based on rice bran, which is fed together with a small amount of green feed. Thus rice bran is available in most farm households. The main problem is the supply of protein as soybean and fish meals are not available in rural areas. Phengsavanh and Stür (2006) showed that growth rates were increased from 100 to 200 g/day by providing some protein-rich forage in the form of stylosanthes. However, other forages appear to have more potential in pig diets based on rice bran. Thus, BounhongNorachack *et al.* (2004) reported that N retention was two times higher when cassava leaves replaced stylosanthes. Besides that, Cassava *(Manihotesculentacrantz)* is widely grown in the tropical regions. It is estimated that about 65% of the cassava crop is used for human consumption while the remainder is used for animal feed, starch, and industrial

applications. Basically, the cassava root is an excellent source of dietary energy but low in protein and can be used as fresh, dried, or ensiled products in swine diets (Gomez, 1995). Moreover, Tewe (1984) has reported that removal of cyanide through boiling, drying, grating, soaking, fermentation, or a combination of these processes may produce final products containing not more than 100 ppm HCN, and prevent microbial activity during sun-drying, particularly in a humid environment. High cyanide levels and the presence of microorganisms have been demonstrated to reduce performance and prevent hematological changes of growing pigs fed on sun-dried cassava-based rations. Besides that, ensiling is the preservation of forage (or crop residue or by-product) of high moisture content based on a lactic acid (ideally) fermentation under anaerobic conditions (Moran, 2005; McDonald *et al*., 2002). Recent research in Laos has shown that Golden Apple Snail flesh can be successfully preserved for at least 24 weeks by ensiling with an additive mixture of molasses and rice bran and then's successfully used as feed for growing pigs (Kaensombath, 2005). Moreover, Boonnop *et al.* (2009) have reported that yeast fermentation, especially in cassava root pulp and cassava chip, could potentially be used to enhance their nutritive value as animal diets, especially the protein and mineral contents of these products (fresh pulp and chips), were increased ($p<0.01$) in protein (with these levels 30.4% in cassava chips and 13.5% in fermented cassava root and fat contents (5.8% in cassava chips and 3.0% in fermented cassava root). Moreover, the fermented cassava product had very low hydrocyanic acid (HCN) contents (0.5 mg kg^{-1} in cassava chips and 47.3 mg kg^{-1} in fermented cassava root) and increased lysine content (lysine content 5.5 g/100 g protein to be compared with 3.9 g/100 g protein in unfermented cassava).

Objectives

- To determine nutrient digestibility, nitrogen retention and nitrogen utilisation of diets with different cassava root residue fermented levels by Moo Lath pigs.

Materials and methods

Location

The experiment was carried out at the Integrated Farming Demonstration Centre of Champasack University, situated about 13 km from Pakse city, Champasack Province, Lao PDR. The temperature in the area ranges from 22 to 32°C. The experiment was started in November2015 and finished in January 2016.

Treatments and experimental design

The treatments in a 3*3 Latin square design with three Moo Lath pigs were levels of Cassava residue fermented at 0, 10 and 20% of diet DM (Table 1). Each period was 10 days, of which 5 days for adaptation and 5 days for the collection of data.

Table 1 Experiment layout

Periods/pig	1	2	3
1	RSC0	RSC10	RSC20
2	RSC10	RSC20	RSC0
3	RSC20	RSC0	RSC10

The individual treatments are:

- RSC0: Pig fed rice bran, maize meal and soy bean residue
- RSC10: Pig fed rice bran, maize meal and soy bean residue + Cassava root residue fermented 10%
- RSC20: Pig fed rice bran, maize meal and soy bean residue + Cassava root residue fermented 20%

Animals and management

The three Moo Lath gilts were used in this study. Moo Lath pigs were bought from the farmer's farm in Pakse district with initial weight of 19 ± 1 kg. The pigs were housed in individual metabolism cages (0.66 m x 0.63 m x 0.60 m)(Photo 1),elevated 0.6 m from the ground, allowing for separate collection of faeces and urine. The cages were made of bamboo and wood, and designed to collect feces and urine separately, and provided with feeders, and automatic water drinkers. The pigs were de-wormed with Ivermectin prior to beginning the study.

Photo 1: Metabolism cage

Feeds and feeding

Rice bran, soy bean meal residue was purchased from the market around the experimental area of Integrated Farming Demonstration Centre of Champasack University. For cassava residue (by-product) was purchased from KPN TAPIOCA factory, was steamed for 25 minutes and cooled to room temperature. After that it was ensiled in a container (capacity 2 kg in DM) and mixed with yeast (8 g/2 kg in DM of cassava residue) and then the N source was tted (Urea 10 g/l). The container was an open vessel to let the air come in and then was put into plastic buckets to exclude mice and prevent external mechanical damage (Photo 2). It was stored at room temperature (20-30^{o}C). The mean total sugar content (°Brix) of the molasses is 77. Each

combination of molasses level and nitrogen source was repeated three times, and fermented for 7 days (Photo 3).

Photo 2: The process on fermented cassava residue

Photo 3: Fermented cassava residue for 7 days

The total offer level was about 3 kg DM per 100 live weights. The rice bran, soy bean residue and cassava residue fermented was mixed together and given in two meals per day at 07.30 and 16.30 hours.

Table 2. Formulation of diets, % of DM

Ingredient	RSC0	RSC10	RSC20
Rice bran	89	84	77
Soy bean meal	10	5	2
Fermented cassava	0	10	20
Premix	0.5	0.5	0.5
Salt	0.5	0.5	0.5
Total	100	100	100
% Crude protein	14.9	15.0	15.1

Data collection

Feeds offer and residues was recorded daily and representative samples taken for analysis. Each morning, prior to feeding, the faeces and urine from the experimental animals were collected separately (nylon net for the faeces and plastic bucket for urine). In the plastic urine buckets, 20 ml of a solution of 10% concentrated sulphuric acid (H_2SO_4) was added daily to preserve the nitrogen in the urine.

Chemical analysis

Feed and fecal samples were dried by microwave radiation to measure the DM content (Undersander et al 1993). Total nitrogen (N), organic matter (OM), ash and crude fibre of samples (feed, faeces and urine) were analysed according to the AOAC (1990) recommendations.

Statisticanalysis

During and after the experiment, data was collected and analysed by using analysis of variance (ANOVA) according to the general linear model (GLM) of the Minitab software (version 13). The sources of variation in the model were; levels of cassava residue fermented, periods, animals and error.

Results

Chemical composition of diets

The rice bran was high quality (11.2% CP in DM) and The fermented cassava residue in this study was low dry matter of 35.6%. this was lower than in the report of Manivanh et al (2015)and Boonnop *et al.* (2009) that cassava had (36.4% and 85.3% DM, respectively) (Table 3). The fermented cassava residue contains 31.2% crude protein which was higher than the levels of 13.4% and 17.6% reported by Hieu Le Huu *et al.* (2014) and Boonnop *et al.* (2009), respectively. However, crude fiber of fermented cassava residue was 13.4% which was lower than level of 20.1% in cassva pulp reported by Ali *et al.* (2011).

Table 3 Average chemical composition of ingredients (% dry basis, except for DM which is on fresh basis)

Item	DM	CP	CF	Ash
Rice bran	88.7	11.2	16.4	8.7
Soy bean meal	45.5	41.8	19.5	3.8
Fermented cassava	35.6	31.2	13.4	5.8
Salt	96.2	-	-	-
Premix	98.2	-	-	-

Nutrient digestibility

The digestibility for different levels of fermented cassava residue (FCR) (0, 10 and 20%) inclusion in the diets of growing pigs is shown in Tabke 4. The data indicate that The feed intake and DM intake appeared to be slightly increased for pigs given fermented cassava residue (FCR) compare with no fermented cassava residue in the diet. There were statistically significant differences of DM, OM, CP and CF ($P<0.01$).

Table 4. Apparent digestibility coefficients of diets with different levels of fermented cassava residue

Items	Treatments	SEM	P-value

	RSC0	RSC10	RSC20		
Feed intake (g/day)	834[c]	919[a]	740[b]	0.04	0.01
DM intake (g/day)	777 [c]	814 [a]	658 [b]	25.19	0.02
Fecal output (g/day)	379 [c]	469 [a]	588 [b]	47.61	0.01
Fecal DM (g/day)	347 [c]	388 [a]	538 [b]	1.09	0.01
Digestibility (%)					
DM	60.3 [c]	88.5 [a]	72.6 [b]	4.56	0.03
OM	70.1 [c]	86.4 [a]	73.2 [b]	5.48	0.01
CP	65.7 [c]	80.5 [a]	73.4 [b]	1.05	0.05
CF	53.4 [c]	61.1 [a]	56.8 [b]	0.78	0.02

[a, b, c,] *Mean values within rows with different superscript are different at P<0.05*

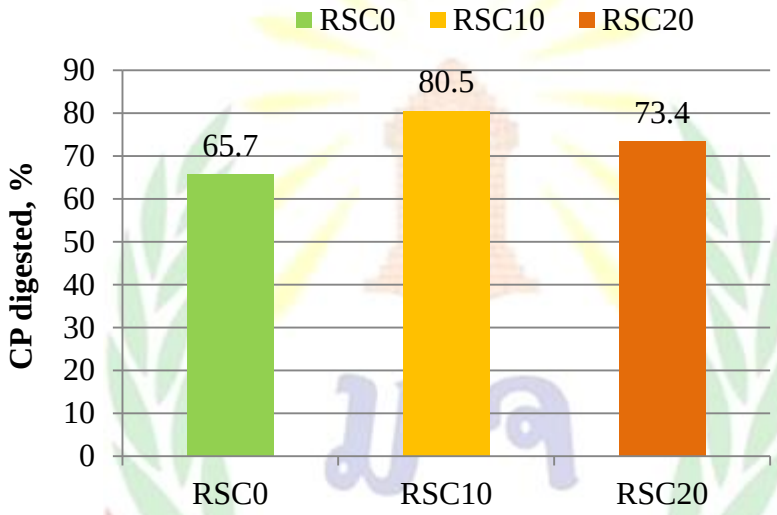

Figure 1. CP digestibility of pig

Nitrogen balance

The data shown effect of the level of FCR on the digestibility of nitrogen or on nitrogen retention. Chyay Ty *at al.* (2003) reported that diets based on ensiled cassava leave had no effect on both nitrogen digestibility and nitrogen retention ot the growing pigs. In this study, the range of value for retained nitrogen (6.28 to 12.23 g/day) were higher than the data reported by Chhay Ty *et al.* (2003) (range of 4.4 to 5.4 g/day) although intake on the ensiled leaf diet (13 to 14.7 g/day) were higher than present diets (12.4 to 13.9 g/day). The data are in agreement with Lizardo and Aumaitre (2001) who reported that total tract digestibility of N was not affect when 6 to 12% of beet pulp in piglet diet was used. In addition, a

Table 5. Nitrogen balnace of Moo Lath pigs fed fermented cassava residue

Items	Treatments			SEM	P-value
	RSC0	RSC10	RSC20		
N balance, g/day					
Intake	8.96[c]	13.87[a]	10.74[b]	1.10	0.01
Fecal N	1.06 [c]	0.63 [a]	0.74 [b]	0.08	0.01
Urinary N	1.95	1.01	1.21	0.23	0.33
Digested N	8.21 [c]	13.24 [a]	10.00 [b]	0.60	0.01
N retention					
N retention, g/day	6.26 [c]	12.23 [a]	8.79 [b]	0.38	0.05
% of N intake	76.25 [c]	92.37 [a]	87.90 [b]	2.35	0.01
% of digested N	69.87 [c]	88.17 [a]	81.84 [b]	5.59	0.01

[a, b, c] *Mean values within rows with different superscript are different at P<0.05*

In addition, there were no sifc effects of health problems and the pigs gained weight during the study

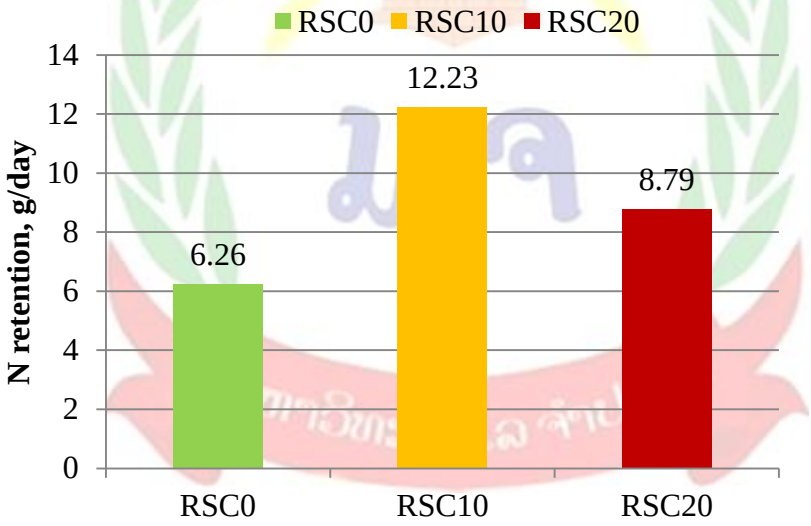

Figure 2. Nitrogen retention of pig

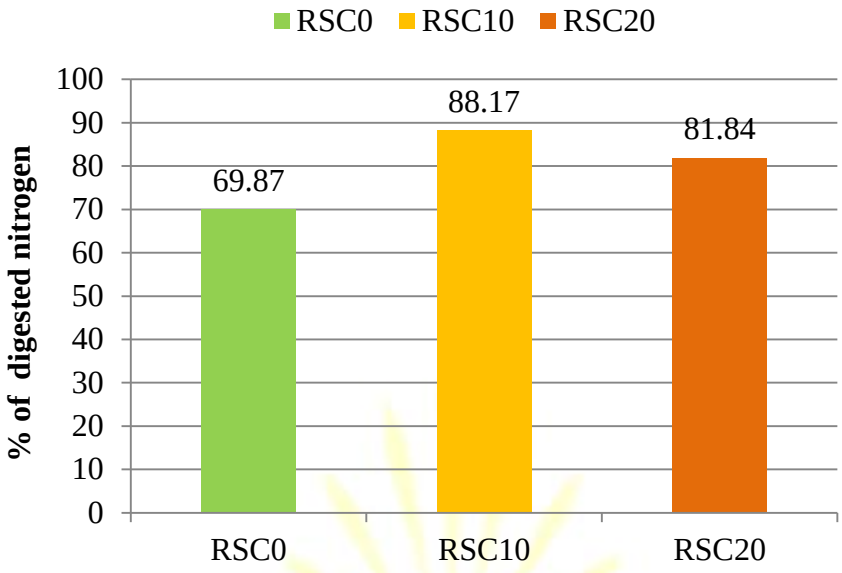

Figure 3. Percentage of N digestibility of pig

Conclusions

- Using fermented cassava residue in the pig diet was improved the nutrient digestibility and nitrogen retention of Moo Lath pigs
- It is recommended that fermented cassava residue can be used in diet of growing pig up to 10 %.

Acknowledgements

We would like to sincerely thank SHEP project and the ADB bank for financial support. I also would like to express my gratitude to all the personal who helped me carry out this study. The authors thank the Faculty of Agriculture and forestry, Champasack University, for helping in assistance with the experiment. Thanks also to Mr Somsavat for analytical assistance in the laboratories.

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