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Effects of cassava leaves silage as protein source in dietary on growth and reproductive performance Lao native pig gilts

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Abstract The control diet (CLS0) was formulated with soybean meal as main protein source, and the other 3 protein sources were derived from cassava leaves silage at 10 % (CLS10), 20 % (CLS20) and 30% (CLS30) respectively. All diet treatments included rice bran, and maize meal compound. The results showed that the average daily gain (ADG) during pregnancy was linearly decreased ($P<0.05$). The feed convert ratio (FCR) was linearly increased. While the litter weight (kg) and mean weight of piglet linearly decreased ($P<0.05$) when increasing CLS up to 30%. In conclusion the cassava leaves silage could potentially be used as protein source up to 20% in diet for an advantage of nutrient utilization and production during pregnant and reproductive performance of Lao native pigs.

Keywords: Cassava leaves silage, Growth performance and piglet productive, Lao native pig

Introduction

To meet the challenges of food and nutritional security of fast-growing population there is a need for an integrated approach for livestock farming. The pig has played a vital role in the production of food for human consumption (Jayashree and Sivakumar, 2013). As evidenced by the fact that pork consumption exceeds all other meat products throughout the world in year 2014 at 115.5 million tons higher than both bovine and poultry meat (FAO, 2015). Pigs are one of the most important livestock species raised by smallholder farmers in Lao PRD with more than 80 % of pig herds being native breeds (Keonouchanh *et al.,* 2011), as the local people prefer pork from native breeds to pork from imported (exotic) breeds, traditional input. However, under village conditions the use of protein supplements is limited because of the inflated cost. Farmers fed their pigs rice bran, distiller's waste, maize, cassava, and green plant materials unmorally depend on season effected to low performance and reproductive performance (Phengsavanh *et al.,* 2011).

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Cassava (*Manihot esculenta* crantz) known as "Man Ton" in Lao, is an important crop for smallholder upland farmer, and it can be used for food, feed, and other uses (Aye and Howeler, 2008). In Lao PDR production of cassava root was about 3.32 million tons in year 2019 (MAF, 2020). There was crude protein content in cassava fresh leave range from 27.1-34.6 % (Norachack *et al., 2004*) and the concentrations of essential amino acids were adequate, except for methionine and true digestibility (TD) was from 70 to 80% (Eggum, 1970). The greatest limitation to the use of cassava leaves as animal feed is the high hydrogen cyanide (HCN) content. Therefore, the most common procedures for reducing the HCN content are sun-drying and ensiling, although ensiling after sun wilting was more effective (Phuc *et al.,* 1996; Borin, 2005) and cassava leaves silage has CP about 28.8 %.

It can be used in livestock feed approximately 10-30% and the pigs utilized the nutrients in cassava leaf silage more efficiently than in cassava leaves meal (Xaypha *et al*., 2007; Aye and Howeler, 2008; Borin, 2005). The objective was evaluated the effect cassava leaves silage replacement to soybean meal as a protein source in a diet on the growth performance and reproductive of Lao native pig gilts during first pregnancy.

Materials and methods

The experiment was conducted at the Faculty of Agriculture and Forest Resource in Souphanouvong University. The site is located 7 km from Luang Prabang City, Lao PDR. The experiment was conducted during pregnancy of Lao native pig gilt in March 2017. The experimental pigs were used with 16 Lao native pig gilts whose average of live weight about 40±5 kg and average age of 8 months followed by 4 diets with distinct levels of cassava leaves silage as protein source containing for 0, 10, 20 and 30 % in diet. All pig before starting were given vaccinations for swine fever, parasite treated, matting about 3 weeks, and adapted to experimental dietary feed. The pigs were raised individually pen in 1 x 3 x 1 m, open condition house. The experiment was arranged to complete randomize design (CRD), there were 4 treatments and 4 replications as follows: Completed feed within 0 % of cassava leaves silage (control or CLS0); Completed feed within 10 % of cassava leaves silage (CLS10); Completed feed within 20 % of cassava leave silage (CLS20) and Completed feed within 30 % of cassava leave silage (CLS30).

Cassava leaves silage was silage method by chopping the leaves into 2-3 cm and left in the sun to reduce moisture about 2-4 hours. Next mixing with 0.5% of normal salt and stocking into plastic bag under anaerobic condition until 21 days before feeding and completed feed was done with all ingredients (Table 1). It was measured to 3 % of body weight by mixing between completed feed and cassava leaves silage following each diet. Finally, it was mixed with water before feeding to pigs and giving water in

the trough after each feeding. Feeding was done twice daily at 7:00 and 16:00 hours. All pigs were weighed before starting and every month during experiment to measure weight change by using weight scale at 100 kg before feeding. For piglets born weight was measured at birth and every feed and residual feed were weighed before feeding every day by using weight scale, to evaluate feed intake (DMI) of gilt during experimental period. Feed sample (completed feed and cassava leaves silage) were randomized twice weekly. The chemical analysis of feed (dry matter, organic matter, ether extract, HCN and N according to methods of AOAC (1990) and crude fiber were done according to the method of Goering and Van Soest (1970). All the collected data were analyzed of variance (ANOVA) and the differences among the treatments were identified by use of Duncan's Multiple-Range Test (DMRT) using a computer program (SAS, 1998).

Table 1. The experimental dietary formula and chemical composition (% in DM basal)

	CLS_0	CLS_{10}	CLS_{20}	CLS_{30}
Ingredient				
Rice bran	59	54	49	39
Maize meal	24	24.4	24.5	30
Soybean meal	16	10.6	5.5	0
Cassava leaves silage	0	10	20	30
Salt	0.5	0.5	0.5	0.5
Mineral	0.5	0.5	0.5	0.5
Total	100	100	100	100
Chemical composition (% in DM)				
DM	91.97	79.59	68.88	59.83
CP	14.15	13.77	13.67	13.42
CF	15.27	15.79	16.32	16.21
OM	8.61	9.98	11.36	12.08
EE	10.45	10.29	10.14	9.51
HCN, mg/kg DM	0.00	18.24	36.48	54.72
Energy (Kcal)*	3,048	3,027	3,004	2,985

**Calculated value*

Results

Growth performance during pregnancy

The growth performance of Lao native pig gilts is shown in Table 2. The initial weight and final weight were not significant (P>0.05) among treatments. The value of average daily gain (ADG) of gilts was found that it decreased linearly (P<0.05) when CLS in diet was increased. However, when compared among control diet (CLS_0) with CLS_{10} and CLS_{20} was not different significantly but different with CLS_{30}. In contrast feed convert ratio (FCR) increased linearly (P<0.05) when increased CLS in diet, the value of FCR that shown higher in CLS_{30}, CLS_{20} and CLS_{10} than control diet (CLS_0), therefore, when compare CLS_0 with CLS_{10} and CLS_{20} was not significantly.

Table 2. Effect of cassava leaves silage replacement to soybean meal as protein source in diet on growth performance of Lao native pig gilts during pregnancy

					SEM	Contrast		
	CLS_0	**CLS_{10}**	**CLS_{20}**	**CLS_{30}**		**L**	**Q**	**C**
Initial weight (kg)	40.5	40.5	40.75	41.75	0.001	ns	ns	ns
Final weight (kg)	74.5	71.75	70.5	68.75	0.229	ns	ns	ns
ADG (g)	299^{a}	275^{ab}	261^{ab}	238^{b}	0.125	*	ns	ns
FCR	6.35^{b}	6.62^{b}	6.97^{ab}	7.63^{a}	0.082	*	ns	ns

^{abc} Mean in the row with different significantly (p<0.05). CLS = cassava leaves silage; * Significant at 95% (p<0.05); ** significant at 99% (p<0.01); ns = non-significant (p>0.05); L = Linear; Q = Quadratic; C =Cubic

Reproductive performance

The potential of cassava leaves silage (CLS) as protein source replacing soybean meal in diet of Lao native pig gilts on reproductive performance (Table 3). The day of pregnancy was shown normal range at 113.5 days. Litter size live born was not significant (p>0.05) from diet including CLS different level there was average of value at 6.75 to 7.75 piglets per gilts. The value of little weight and mean live weight (kg) were decreased linearly (P<0.05) when increasing of CLS in dietary up to 30%.

Table 3. Effect of cassava leaves silage replacement to soybean meal as protein source in diet on reproductive of Lao native pig gilts

Parameters	CLS_0	CLS_{10}	CLS_{20}	CLS_{30}	SEM	Contrast		
						L	Q	C
Pregnancy, day	113.50	113.75	113.75	113.25	-	-	-	-
Litter size	7.50	7.75	7.25	6.75	0.010	ns	ns	ns
Litter weight, kg	4.33^{a}	4.02^{a}	3.87^{ab}	3.33^{b}	0.176	**	ns	ns
Mean piglet LW, kg	0.58^{a}	0.54^{ab}	0.50^{ab}	0.492^{b}	0.163	**	ns	ns

^{abc} Mean in the row with different significantly ($p<0.05$). CLS = cassava leaves silage; * Significant at 95% ($p<0.05$); ** significant at 99% ($p<0.01$); ns = non-significant ($p>0.05$); L = Linear; Q = Quadratic; C =Cubic

Discussion

The ADG of Lao native pig gilts during pregnancy was influenced from CLS content in diet. The ADG of CLS_0 was similar with CLS_{10} and CLS_{20} but different with CLS_{30}. Agreement with Xaypha *et al.* (2007) was used 20% cassava leaves silage within complete feed as 80% for Lao Native pig (Moo Lath) had a result that was advantageous in terms of pig growth rate range of 302.4 g/day. According to results, it was found that 20% of ensiled cassava KM49 leaves in a diet as replacement protein source from fish meal of growing Mong Cai and Large white, the results showed no difference significant of ADG when compared with the diet that included protein source from fish meal (Ly *et al.,* 2010). However, the reporting for the diet with 50% of ensiled cassava leaves with combined feed with 50% in diet for a growing pig (Mong Cai x Large White) the results show ADG was not different with basal diet as without cassava leaves silage (Kaensombath *et al.,* 2006).

The potential of cassava leaves silage (CLS) as protein source replacing to soybean meal in diet of Lao native pig gilts is shown in Table 3. The result of litter size live born agreement with Chittavong, (2012) was study on field of Borikhamxay province the results of litter size live born at 6.7 piglets. However, the different significantly among diet that included different of CLS. The value of little weight and mean live weight (kg) decreased linearly ($P<0.05$) when increasing of CLS in dietary up to 30%. The mean live weight of piglet was nearly with Vasupen *et al*. (2005) was reported in Thai native pig (Moo Kadoon) the value at 0.58 kg and Chittavong *et al.* (2008) that shown mean live weight of piglet at born of Mong Cai pigs at 0.55 kg. There are many reports that discuss various levels of cassava leaves silage in dietary that have no effective to sow and their reproductive performance. According to Phuc and Ogle (2005) it found that in the diet for

pregnancy and lactation of sow that up to 30 % of cassava leaf meal can be included in the diet of pregnant sows without any detrimental effects on reproduction. There was found that used only 10-15% of ensiled cassava leaves in diet of pregnancy sow, the result was showing no significant differences for reproductive parameters of sow, except for the mean pig weight at weaning when compared with the group as without or higher than 15% of cassava leaves silage in their diet (Ngoan and Ly, 2002; Ly *et al,* 2011). Also, Duyet *et al.* (2006) reported that the optimum level of replacement of soybean meal by a mixture of foliage (sweet potato leaves, water spinach and fresh cassava leaves) in pregnancy and lactation diet is 50% (for both Mong Cai and Yorkshire sows) the reproductive performance and Mong Cai sow appear to be better adapted to high level of foliage in the diet than Yorkshire sows not had effect.

It concluded that cassava leaves silage resulted to 20 % ineffective of average daily gain of during pregnancy gilts, litter size, litter weight and mean piglets' live weight when compared with no cassava leaves silage. In contrast when compared to the control diet with CLS_{30} which was significantly differed ($P<0.05$).

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