ການທົດລອງນຳໃຊ້ຜັກຫົມ ແລະ ສະໄຕໂລ ເພີ້ມຕື່ມການນຳໃຊ້ສາລີ ໃນການລ້ຽງໝູລາດ

ອ້ອນ ພົມວິສິດ[1] ວຽງສະຫວັນ ພົມພະຈັນວິຈິດ[2]

ບົດຄັດຫຍໍ້

ການທົດລອງນຳໃຊ້ຜັກຫົມ ແລະ ສະໄຕໂລ ທົດແທນສາລີບົດໃນການລ້ຽງໝູພື້ນເມືອງ ເພື່ອສຶກສາອັດຕາການກິນໄດ້ ແລະ ການຈະເລີນເຕີບໂຕຂອງໝູ. ໃນປີທຳອິດ ໄດ້ຈັດຕັ້ງປະຕິບັດຢູ່ສູນບໍລິການເຕັກນິກກະສິກຳ ແລະ ປ່າໄມ້ ບ້ານອົ້ງ ເມືອງຊຳເໜືອ ຊຶ່ງໄດ້ນຳໃຊ້ໝູທົດລອງຈຳນວນ 16 ໂຕ ທີ່ຊື້ຈາກຕະຫຼາດໃນທ້ອງຖິ່ນ (ຈຳນວນໝູແມ່ ແລະ ໝູຕອນ ມີຈຳນວນເທົ່າກັນ) ແລະ ນ້ຳໜັກສະເລ່ຍ 10.3±0.07 ກກ, ໂດຍນຳໃຊ້ການທົດລອງແບບສຸ່ມສົມບູນ (CRD), ແບ່ງການທົດລອງອອກເປັນ 4 ຊ້ຳ ແລະ ນຳໃຊ້ອາຫານ 4 ສູດແຕກຕ່າງກັນ ຄື: RM (ປະກອບດ້ວຍ ຮຳເຂົ້າ 70% ແລະ ສາລີບົດ 30%), RMS1 (ປະກອບດ້ວຍຮຳເຂົ້າ 50%, ສາລີບົດ 20% ແລະ ຜັກຫົມ 30%), RMS2 (ປະກອບດ້ວຍຮຳເຂົ້າ 50%, ສາລີບົດ 20% ແລະ ສະໄຕໂລ 30%) ແລະ RMSS (ປະກອບດ້ວຍຮຳເຂົ້າ 50%, ສາລີບົດ 20%, ຜັກຫົມ 20% ແລະ ສະໄຕໂລ 20%); ກ່ອນຈະໃຫ້ອາຫານໝູແຕ່ລະຄັ້ງ ໄດ້ປະ ສົມສ່ວນປະກອບອາຫານແຕ່ລະຊະນິດເຂົ້າກັນ ຕາມອັດຕາທີ່ໄດ້ກຳນົດໄວ້ ແລະ ການທົດລອງຄັ້ງນີ້ ໄດ້ຈັດຕັ້ງປະຕິບັດໃນຊ່ວງເດືອນກັນຍາ ຫາ ເດືອນພະຈິກ ໂດຍໃຊ້ເວລາທົດລອງທັງໝົດ 70 ມື້.

ຄ່າສະເລ່ຍລວມການບໍລິໂພກອາຫານຂອງສັດທົດລອງແມ່ນ 725, 775, 925 ແລະ 837.5 ກຼາມ ຕໍ່ມື້ ສຳລັບສິ່ງທົດລອງ RM, RMS1, RMS2 ແລະ RMSS ຕາມລຳດັບ ຊຶ່ງມີຄວາມແຕກຕ່າງດ້ານສະຖິຕິ ($p<0.05$). ອັດຕາການຈະເລີນເຕີບໂຕມີຄ່າເທົ່າກັບ 102.5, 106.5, 128.1 ແລະ 130.4 ກຼາມ ສຳລັບສິ່ງທົດລອງ RM, RMS1, RMS2 ແລະ RMSS ຕາມລຳດັບ ຊຶ່ງມີຄວາມແຕກຕ່າງດ້ານສະຖິຕິ ($p< 0.05$). ອັດຕາການແລກປ່ຽນອາຫານເປັນຊີ້ນມີຄ່າສູງສຸດເທົ່າກັບ 7.28 ສຳລັບ RMS1 ແລະ ຕ່ຳສຸດເທົ່າກັບ 6.5 ສຳລັບ RMSS ແຕ່ບໍ່ມີຄວາມແຕກຕ່າງທາງດ້ານສະຖິຕິ ($p> 0.05$).

ໃນປີທີສອງ ການທົດລອງໄດ້ຈັດຕັ້ງປະຕິບັດຢູ່ 4 ຄອບຄົວ ປະຊາຊົນຜູ້ລ້ຽງໝູຢູ່ບ້ານກ້ານ ແລະ ບ້ານອົ້ງ ເມືອງຊຳເໜືອ ຊຶ່ງໄດ້ນຳໃຊ້ອາຫານທົດລອງ 2 ສູດທີ່ດີກວ່າ ປີທຳອິດ (RMS2 ແລະ RMSS) ເພື່ອປຽບທຽບກັບອາຫານທີ່ປະຊາຊົນນຳໃຊ້ລ້ຽງໝູຕາມປົກກະຕິຂອງເຂົາເຈົ້າ (ເປັນສູດຄວບຄຸມ-Ctrl), ໃຊ້ໝູທົດລອງ 24 ໂຕ ມີນ້ຳໜັກສະເລ່ຍ ລະຫວ່າງ 8-36.5 ກກ, ນຳໃຊ້ການທົດລອງແບບສຸ່ມບລັອກສົມບູນ (RCBD) ແລະ ຈັດແບ່ງເປັນ 4 ບລັອກ. ການທົດລອງ ໄດ້ຈັດຕັ້ງປະຕິບັດໃນຊ່ວງເດືອນກັນຍາ ຫາ ເດືອນຕຸລາ 2011 ໂດຍໃຊ້ເວລາທັງໝົດ 90 ມື້ ພົບວ່າ ອັດຕາການຈະເລີນເຕີບໂຕເທົ່າກັບ 109.03±25.19, 152.08±30.56 ແລະ 102.08±28.00 ກຼາມ ສຳລັບ Ctrl, RMS2 ແລະ RMSS ຕາມລຳດັບ ຊຶ່ງມີຄວາມແຕກຕ່າງດ້ານສະຖິຕິ ($p< 0.05$).

ຈາກການທົດລອງສະຫຼຸບໄດ້ວ່າ ການປະສົມສະໄຕໂລໃນອາຫານໝູ ປະລິມານ 30%, ຮຳເຂົ້າ 50% ແລະ ສາລີບົດ 20% ໂດຍປາສະຈາກສ່ວນປະກອບຂອງຜັກຫົມມີຄວາມເໝາະສົມໃນການລ້ຽງໝູ ຊຶ່ງສະແດງອອກໃນການບໍລິໂພກອາຫານໄດ້ດີ, ມີອັດຕາການຈະເລີນເຕີບໂຕ ແລະ ອັດຕາການແລກປ່ຽນອາຫານເປັນຊີ້ນດີກວ່າ ແລະ ຜ່ານການທົດລອງເຫັນວ່າ ການຈະເລີນເຕີບໂຕບໍ່ມີຄວາມແຕກຕ່າງລະຫວ່າງເພດຂອງໝູ.

ຄຳສັບສຳຄັນ: *ໝູລາດ, ຜັກຫົມ, ສະໄຕໂລ184, ສາລີບົດ, ການກິນອາຫານ ແລະ ການຈະເລີນເຕີບໂຕ.*

[1]ພະແນກກະສິກຳ ແລະ ປ່າໄມ້ ແຂວງຫົວພັນ

[2]ສູນຄົ້ນຄວ້າການລ້ຽງສັດ, ສະຖາບັນ ຄົ້ນຄວ້າ ກະສິກ ແລະ ປ່າໄມ້ ແຫ່ງຊາດ

Spinach and Stylo as potential protein supplements in ground maize diets for smallholder pig production

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Abstract

This study researched the effects of replacing ground maize by stylo (CIAT 184) and spinach vegetable as sources of protein in feeds for smallholder pig production. Sixteen Lao indigenous pigs (an equal number of castrated male and females) with an average live weight of 10.3±0.07 kg, were purchased from farmers in the local market of Sam Neua in Houaphanh province, for use in the study. The dietary treatments (DM basis) were: (i) RM = 70% rice bran + 30% maize as the control diet; (ii) RMS1= 50% rice bran + 20% maize + 30% spinach vegetable; (iii) RMS2 = 50% rice bran + 20% maize + 30% stylo ; and (iv) RMSS = 50% rice bran + 10% maize + 20% spinach vegetable + 20% stylo. All the feed components were mixed before feeding. The experimental design was a completely randomized design (CRD) with 4 replications. The feeding treatments were provided over a 70 day period. Data were collected on feed intake and growth performance. This component of the study was undertaken in the period September to November 2010.

Mean total DM intakes were 725, 775, 925 and 837.5 g/day for treatments RM, RMS1, RMS2 and RMSS, respectively ($p< 0.05$). The average daily live weight gains (ADG) were 102.5, 106.5, 128.1 and 130.4 g for treatments RM, RMS1, RMS2 and RMSS, respectively ($p< 0.05$). Feed conversion ratio (FCR) was highest at 7.28 kg feed/kg for treatment RMS1 and lowest at 6.5 kg feed/kg for treatment RMSS; FCR showed no significant difference among the treatments ($p> 0.05$).

In a second year of the study, the two best treatments (MRS2 and MRSS) were compared with feed prepared by local farmers (Ctrl) in four households in each of the villages of Ban Kan and Ban Ong, in Sam Neua district of Houaphanh province. The experiment was conducted using 24 pigs of various weights ranging from 8 to 36.5 kg. The feeding treatments were provided over a period of 90 days during September to December 2011. The experimental design was an RCBD with 4 replications. The ADGs were 109.03±25.19, 152.08±30.56 and 102.08±28.00 g for treatments Ctrl, RMS2 and RMSS, respectively ($p< 0.05$).

From the results of the study, it is concluded that a feed mixture comprising 30% (DM basis) stylo, 50% rice bran and 20% ground maize, without spinach, is an optimum diet for raising and fattening of pigs, through a combination of improved feed intake and a better feed conversion ratio. The response to the improved diet was not related to the sex of the pigs.

Key word: *Lao indigenous pig, Spinach, Stylo 184, ground maize, feed intake and growth performance.*

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Introduction

Livestock production is playing an increasingly important role in the smallholder farming systems of Laos, both in terms of helping increase the daily protein intake of the people and in helping improve and diversity household incomes. Most current animal production systems in Laos are based on low inputs, with there being chronic production constraints relating to the incidence of disease, and feed supply (sometimes inadequate and of poor quality). Most livestock feed is based on crop residues and household food waste. It is also known that, on average in Laos, 65 to 70% of total production costs of small monogastric animals relate to feed. Technical and practical (for smallholder producers) options to reduce this cost are being sought. Pig production is an important livelihood activity of smallholder upland farm households, with the sale of pigs often accounting for most of the cash income for poor households. The majority of pig production (>80%) is carried out by smallholder producers, with the remainder being produced by commercial enterprises near the major population centers. Per capita pig density is highest in the northern mountainous region of Lao PDR and in the mountainous areas in the southern region bordering Vietnam (MAF, 2000).

Pig raising by minority ethnic groups in mountainous areas is normally based on a free-range system with feed supplement comprising rice bran, household waste products and some wild tubers (Hansen, 1997).

Most pig raising in smallholder situations is based on native breeds. These include Moo-Chid, Moo-Laat, Moo-Dam and Moo Nonghaet (Vongthilath and Blacksell, 1999), which have a high fat content and a mature weight of between 60 and 120 kg. These breeds are well adapted to scavenging to meet part of their nutritional needs in free-range conditions. However, their growth rates tend to be very low in extensive management conditions, often taking up to 15 months to reach a weight of 40-50 kg (Kennard *et al*, 1996).

The present production system for monogastrics is commonly subsistence with low inputs. The main constraints for this kind of farming are disease and feed supply, both in terms of quality and quantity. Local breeds are still predominant in the rural production systems and the preference for local breeds is high throughout the country. Feed supply relies mostly on crop residues and wastes from the households, and chickens and pigs are let loose to scavenge in the villages (Bouahom, 1997). In general, pig diets are made up of rice bran, coarsely ground maize and weeds. These diets are low in crude protein resulting in poor pig performance. Furthermore, the availability of rice bran and maize fluctuates during the year and amounts depend also on rice production, which is often low in shifting cultivation farming systems, this results in slow growth and low performance and productivity of the pig. Phonepaseuth (1997) reported that Stylo 184 grows well and is well-adapted to a wide range of environmental conditions. Initially it was being grown mainly for improved ruminant

nutrition. However, more recently it is increasingly being fed to pigs as a protein supplement, with this and other legume leaves also providing essential minerals and vitamins for animal growth (Horne and Stür, 2000). The stylo supplementation increased the average daily gain of local growing pigs from 107 to 207 g per day (Stür *et al*, 2010).

Spinach grows well in temperate climates and is an excellent source of vitamin K, vitamin A, manganese, folate, magnesium, iron, vitamin C, vitamin B2, calcium, potassium, and vitamin B6. It is also a very good source of dietary fiber, copper, protein, phosphorus, zinc and vitamin E. In addition, it is a good source of omega-3 fatty acids, niacin and selenium (Nyska A, Lomnitski L, Spalding J, *et al*).

In Laos, especially in the northern province of Houaphanh, pigs are raised mainly to increase the daily protein intake of the people and generate cash incomes for families. The diets provided to pigs by farmers are generally of low digestibility and have a low protein and mineral content, resulting in overall poor growth performance. There is a need is to identity feeds which can compensate for these deficiencies.

The objective of this experiment was to investigate the effect of spinach and stylo 184 as potential protein supplements in a diet of ground maize for local pig production.

Materials and Methods

1. Location and climate of experiment area

The experiment was conducted at Agriculture and Forestry Technique Service Centre (AFTSC) near Ban Ong village for the first year and carried out in farmers' field in Ban Kan and Ban Ong village for the second year, in Sam Neua district, Houaphanh province, which is located about 640 km from Vientiane Capital, Lao PDR, at altitude of 967 m above sea level. The climate in the experiment area is divided into two seasons. The wet season from May to mid -November has an annual rainfall average of 90.6 mm with peak rainfall occurring from August to October. In contrast, the dry season from mid-November to April has an average temperature during range of 8-15 degree Celsius. The experiment was carried out during the period September to December, when the mean daily temperature was around 15 degree Celsius.

2. Experiment design, treatments and management

A growth performance trial was carried out with 16 local pigs who were individually housed. The pigs had an average live weight (LW) 10.3±0.07 kg (mean±SD), and were aged approximately three months. Equal numbers of castrated male and female, and each treatment had two castrated males and two females. The pigs were allocated at random to four dietary treatments with four replications, according to a completely randomized design (CRD).

The dietary treatments were as follow:

- RM: 70% rice bran + 30% maize (Controller).
- RMS1: 50% rice bran + 20% maize +30% spinach (DM).
- RMS2: 50% rice bran + 20% maize + 30% stylo CIAT 184 (DM).
- RMSS: 50% rice bran + 10% maize + 20% spinach (DM) + 20% stylo CIAT 184 (DM).

In the second year, the experiment was conducted in 4 farmers' field, 6 pigs were owned by each household. There were twenty four local pigs of minimum live weight 8±0.00 kg and 36.5±2.12 kg maximum. The pigs were allocated at random to three dietary treatments with four households as block, according to randomize completed block design (RCBD).

The fresh spinach and Stylo (Stylosanthes guianensis, CIAT184) were mixed with rice bran and ground maize. The pigs were vaccinated against swine fever and were treated with Ivomectin against external and internal parasites. All pigs were weighed at the beginning of the experiment and allocated at random to the four dietary treatments and randomly distributed and housed individually in 1.0 m x 1.5 m per pens following the experiment design for the first year and housed in pairs for the second year. Before commencement of the experiment all pigs were allowed to adapt to the conditions of the experiment for 2 weeks.

3. Experimental feed

The stylo 184 was cut and carried out from fields near the pig house, all spinach and stylo 184 were chopped into 1-2 cm lengths, and mixed to each feed formula as calculated. Feed were given three times daily; 07:00 h, 12:00 h and 17:00 h. Feed refusal was collected and weighed the following morning. The water was supplied adlibium in the trough. During the second year, the best performing treatments from the first year; RMS2 and RMSS, the feeds prepared by the householders as control feed.

4. Data collection

Feeds offered and refused were weighed daily. The pigs were weighed at the beginning and every 14 days over the experimental period until the experiment was completed. Feed samples brought to the laboratory of Faculty of Agriculture, National University of Laos to analyze for ADF, NDF, DM, CP, CF and Ash by standard methods (AOAC, 1990) for the first year. For the second year, all trial pigs were weighed at the beginning and at the end of experiment.

5. Statistical analysis

The data was analyzed by using the GLM option of the Statistic Analysis System (SAS) version 6.12 ANOVA software. The sources of variation in the model being treatments and error. Treatment means were compared using Duncan's New Multiple Range Test (Monchai 2004) was used to determine the differences between

treatments with confident level 95.0% for the first year. During the second year two factors experiment were used; treatment and household. Data was analysed using Excel software.

Results and Discussion

1. Ingredient and chemical composition of the diet

The chemical composition of the ingredients is shown in Table 1. Dry matter (DM) contents of rice bran, maize, spinach and stylo 184 are similar as those feed components. The crude protein (CP) and ash contents of spinach vegetable and stylo 184 were higher than maize and rice bran. CP content level of stylo-184 was 19.96% DM (Table 1), which is similar to the literature values of around 19.3% and 19.1%, 19% DM (Chanphone and Mikled, 2003; Bounlieng *et al*, 2004 and Phonepaseuth and Ledin, 2003) respectively, which higher than the 17.3% and 17.1% DM that reported by Du Thanh Hang et al (2009) and Kiyothong and Wanapat (2003), respectively. However, the CP component was lower than the 22.0% that reported by Bounhong *et al*. (2002). The CP content of spinach was 27.77% (Table 1), which higher than the 20.9% (Nguyen L.Q. *et al*, 2004).

The chemical composition of the experimental diets is shown in Table 2. Crude protein (CP) was 78.21, 137.93, 114.5 and 141.37 g/kg DM (Table 2), all CP composition of the experimental diets were lower than the CP level for growing pig that recommended by NRC (1998), although the pigs in our experiment were an indigenous breed, and would have had a lower requirement for protein compared to the NRC recommendation. The CP content in the basal diet was similar to typical diets for Lao indigenous pigs of 99 g/kg DM (Chanphone and Mikled, 2003). Acid detergent fiber (ADF) contents of RMS1, RMS2 and RMSS treatments were similar and higher than the RM treatment (Table 2). In contrast, its neutral detergent fiber (NDF) content was lower than RM treatment (Table 2).

2. Feed and nutrient intakes

The overall mean intakes of the basal diet were 725, 775, 925 and 838 g/day ($P<0.05$) for the RM, RMS1, RMS2 and RMSS treatments respectively (Table 3). This indicates that providing the foliages stimulated intake of the basal diet. The differences in DM intake in the RMS2 treatment compared with other treatments was significant ($P<0.05$). Also the low CP content of the basal diet in our study, which was below recommendations (NRC, 1998), could have encouraged the pigs to consume more spinach and stylo 184, as they are relatively high in CP, in order to meet their requirement for protein and amino acids. In an earlier study carried out in Laos supplying stylo 184 as a supplement to a poor quality basal diet was also shown to increase total feed intake (Horne and Stüre, 2000, and Bounhong *et al*, 2002), also found that the total DM intake was higher when the diets were supplemented with stylo 184. The overall CP intakes were 56.71,

106.90, 105.91 and 118.40 g/day (P<0.05) for the RM, RMS1, RMS2 and RMSS treatments respectively (Table 3). CP intake was highest for RMSS (P<0.05), mainly as a result of the higher total DM intake and fairly high CP content of the spinach and stylo. However, the CP of the experimental diets was 78.21, 137.93, 114.50 and 141.37 g/kg of DM (Table 2), well below the requirement for growing pigs of 150 g/kg DM (NIAH, 2001).

3. Growth performance

The results for initial and final weights, daily weight gain (ADG) and feed conversion ratio (FCR) are shown in Table 4. Pigs on the RM treatment had lower ADG (102.54 g/day) and weight gain compared with other treatments (7.08 kg), the difference being significant (P<0.05) due to the lower feed intake, and especially the CP content was lower than the requirement for growing pigs (NRC, 1998). Overall, ADG was highest in the RMSS diet (130.43 g/day), which was similar to the RMS2 treatment (128.08 g/day). The superior performance on the RMSS and RMS2 treatments was probably mainly due to their higher total DM intakes, CP level and also a better balance of amino acids this is in agreement with Bounlieng *et al* (2006) report. Because the higher ADG on the foliage diets was mainly due to higher DM intakes there was no difference in FCR among treatments (P>0.05), although they tended to be lower on the RM and RMS1 treatments. However, the ADG of this experiment was lower than 207 g/day (Stür *et al*, 2010). Results from field research show that Stylo is ideal for pigs weighing at least 15 kg. Stylo was most effective as a supplement to local feeds for growers, fatteners, sows and boars because these animals had a larger, more mature gut than younger pigs and so were able to cope better with fibrous diets. Both rice bran and forage legumes (and other greens) were relatively high in fiber (Stür *et al*, 2010). Despite spinach having the highest CP content (27.77% DM, table 1) the DM intakes and ADG was low in the RMS1 treatment compared with the RMS2 and RMSS treatments, but higher than the RM treatment (table 4).

In the second year, trial pigs were varying age and live weight from four families. The results of on farm research in term of ADG (shown in table 5) were highest at 191.67 and 155.56 for MRS2 treatment from 2nd and 3rd family respectively. In contrast, the result of ADG lowest at 86.11 and 75.00 for the 1st family for the Ctrl and RMSS treatment respectively. Overall mean of ADG in the second year were 152.08 and 102.08 for RMS2 and RMSS respectively, that nearly as overall mean of ADG in the first year (shown in table 4). The superior performance on the RMS2 treatments was due to their higher total DM intakes, CP level and also a better balance of amino acids this is in agreement with report by Bounlieng *et al* (2006).

Conclusion and recommendation

- Offering Stylo 184 in basal feed improved quality of diets, resulted in higher intakes and growth rates and high feed conversion efficiency compared to typical, poor-quality control diet;
- Inclusion of foliage in low protein diets has potential to improve CP and amino acid supply to pigs, when other protein rich feeds are not available;
- Stylo 184 can be used as protein source for growing pigs, and when supplemented with Stylo 184 to basal feed will result in significant increases in feed intake and weight gain;
- Mixture of Stylo 184 at 30% in a diet based on ground maize showed higher feed intake and highest growth rate;
- The spinach, despite it plenty of minerals, vitamins and omega-3 fatty acids that benefits for metabolic procedure but is inappropriate for using in pig's feed composition because spinach is fairly high price vegetable and commonly used for human's food. And feed formula that composed spinach was affected to pig growth not better than stylo 184.

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Annexes

Table 1: Percent chemical composition of the ingredients (DM basis).

Ingredient	Parameter					
	DM	CP	CF	Ash	ADF	NDF
Rice bran	86.00	7.44	31.39	10.46	79.06	68.60
Maize	87.00	8.71	1.15	1.15	12.64	10.34
Stylo 184	86.50	19.96	21.38	12.13	89.69	44.50
Spinach	82.50	27.77	6.67	30.90	73.36	24.84

Table 2: Chemical composition of the experimental diets (g/kg DM).

Ingredient	Diets			
	RM	RMS1	RMS2	RMSS
DM	863.00	851.50	863.50	855.00
C P	78.21	137.93	114.50	141.37
C F	223.18	179.26	223.39	214.20
ADF	591.34	640.66	689.65	734.04
NDF	511.22	438.20	497.18	492.02
Ash	76.67	147.30	90.99	139.50

Table 3: Mean values of feed intake of CP and CF (g/day DM basis).

Ingredient	RM	RMS1	RMS2	RMSS	SEM	P-value
Initial weight (kg)	10.20±0.26	10.33±0.17	10.30±0.73	10.18±0.41	0.201	0.9540
Final weight (kg)	17.28^{b}±0.34	17.68^{b}±0.28	19.14^{a}±0.65	19.18^{a}±0.51	0.2199	0.0001
DM intake (kg/h/d)	0.725^{b}±0.10	0.775^{b}±0.03	0.925^{a}±0.10	0.838^{ab}±0.11	0.0083	0.0464
CP (g/day)	56.71^{b}±8.14	106.90^{a}±3.98	105.91^{a}±10.96	118.40^{a}±15.67	111.961	0.0001
CF (g/day)	161.81^{bc}±23.23	138.93^{c}±5.17	206.64^{a}±21.39	179.39^{ab}±23.75	396.93	0.0030

abc Mean with different superscript differ significantly at P<0.05.

Table 4: Effect of Lao indigenous pigs fed spinach vegetable and stylo 184 as replacement for ground maize (mean±SD).

Parameter	Dietary treatments				SEM	P-value
	RM	RMS1	RMS2	RMSS		
Number of pig	4	4	4	4		
Initial weight (kg)	10.20±0.26	10.33±0.17	10.30±0.73	10.18±0.41	0.2013	0.9540
Final weight (kg)	17.28^{b}±0.34	17.68^{b}±0.28	19.14^{a}±0.65	19.18^{a}±0.51	0.2199	0.0001
Weight gain (kg)	7.08^{b}±0.53	7.35^{b}±0.19	8.84^{a}±0.97	9.00^{a}±0.54	0.3887	0.0013
ADG (g/day)	102.54^{b}±7.70	106.53^{b}±2.78	128.08^{a}±14.12	130.43^{a}±7.76	81.6587	0.0013
FCR	7.05±0.51	7.28±0.38	7.24±0.49	6.48±1.22	0.5332	0.4150

abc Mean with different superscript differ significantly at P<0.05.

Table 5: Pig growth performance from four families.

Family1	Treatments		
	Ctrl	RMS2	RMSS
Number of pig	2	2	2
Initial weight (kg)	31.00±1.41	8.00±0.00	9.00±1.41
Final weight (kg)	38.75±1.06	18.25±1.06	15.75±1.77
Weight gain (kg)	7.75±0.35	10.25±1.06	6.75±3.18
ADG (g/day)	86.11±3.93	113.89±11.78	75.00±35.36
Family2			
Number of pig	2	2	2
Initial weight (kg)	23.50±2.12	19.00±1.41	21.50±0.71
Final weight (kg)	36.25±0.35	36.25±1.77	31.00±1.41
Weight gain (kg)	12.75±1.77	17.25±0.35	9.50±0.71
ADG (g/day)	141.67±19.64	191.67±3.92	105.56±7.86
Family3			
Number of pig	2	2	2
Initial weight (kg)	19.50±2.12	36.50±2.12	27.00±7.07
Final weight (kg)	28.25±1.77	50.50±0.71	35.25±6.01
Weight gain (kg)	8.75±0.35	14.00±1.41	8.25±1.06
ADG (g/day)	97.22±3.93	155.56±15.72	91.67±11.79
Family4			
Number of pig	2	2	2
Initial weight (kg)	30.00±2.83	20.75±3.89	18.75±1.77
Final weight (kg)	40.00±0,71	34.00±3.54	31.00±1.41
Weight gain (kg)	10.00±2.12	13.25±0.35	12.25±0.35
ADG (g/day)	111.11±23.57	147.22±3.93	136.11±3.93
Overall weight gain	9.81±2.27	12.88±3.23	9.19±2.52
Overall ADG	109.03±25.19	152.08±30.56	102.08±28.00

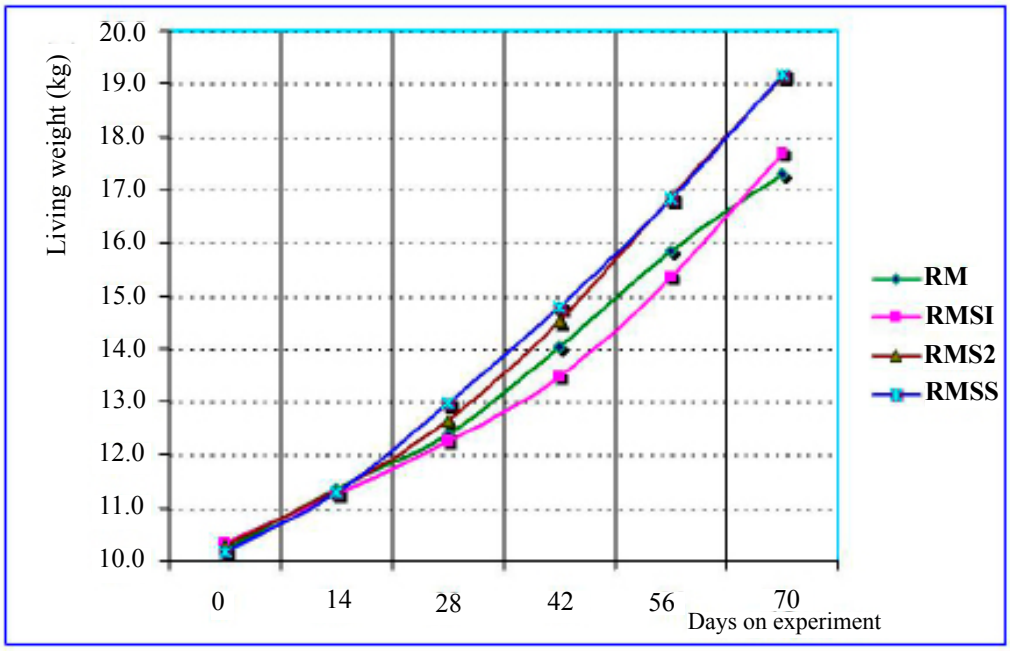

Figure 1. Growth curves of Lao indigenous pigs fed spinach and stylo 184 as replacement for ground maize.

Photo of experiment

Picture 1 and 2: penned individual for first year experiment.

Picture 3 and 4: penned in pair for second year experiment.