A RESPONSE OF GROWTH PERFORMANCE, NUTRIENT DIGESTIBILITY AND NITROGEN RETENTION OF GROWING FEMALE RABBITS TO LEVELS OF *Psophocarpus scandens* VINES IN DIETS

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ABSTRACT

A study was implemented to determine the optimum levels of *Psophocarpus scandens* (PS) vine in diets of female rabbits (New Zealand x local breed) based on growth performance, nutrient intake and digestibility. It was a complete randomized design with five treatments and three replicates. Sixty female rabbits at 60 days of age (799 g on average) were allocated in the experiment for 70 days. The treatments were levels of 0, 15, 30, 45 and 60% (DM basis) of *Psophocarpus scandens* replacing Para grass (PG) in the diets. They were corresponding to the treatments named PS0, PS15, PS30, PS45 and PS60, respectively. PS protein content was higher than that of PG (23.1 vs. 9.9% of DM) and NDF content was lower (41.8 vs. 61.6% of DM). The results showed that dry matter intake was significantly reduced for the highest PS proportions ($P<0.01$) with 93.5 - 93.0 - 92.7 - 85.0 and 84.5 g/d for the PS0 to PS60 diets respectively. Crude protein intake of rabbits significantly ($P<0.01$) increased with the increase of the PS proportion. The daily weight gain of the rabbits was higher in the diets with PS replacement (15.1, 17.3, 18.2, 16.3 and 17.5 g/d for diets PS0 to PS60 respectively). However, only the daily weight gain of the PS30 treatment was significantly higher than that of the PS0 one. The nutrient digestibility (dry matter and crude protein) and nitrogen retention of rabbits were also significantly ($P<0.01$) improved with increasing the level of PS in the diets. It was concluded that the use of *Psophocarpus scandens* vine to replace Para grass improved nutrient utilization, daily weight gain and profits, and replacing Para grass by *Psophocarpus scandens* at a level of 30% (DM) could be recommended for producers' application.

Keywords: *Para grass, Psophocarpus scandens, growing rabbit, feed utilization, daily weight gain, digestion.*

INTRODUCTION

The rabbit known as small herbivore animal placed after chicken for meat, which can be a great source of food production with advantages of very fast growing, better food converting rate, high productivity, small keeping space, less cost production and risks of disease outbreaks, and tasty and nutritious meat. Rabbit production is easy to apply modernized and automatic systems with low water consumption, environmental pollution and greenhouse gas emissions compared to other animal species (Nguyen Van Thu, 2021). Crossbred rabbits (local and improved pure breeds) are popularly raised in the Mekong delta because of a good adaptation to the local climate and feeds. Organic rabbit farming based on locally available feeds resources, particularly natural grasses, legume leaves and wild vegetables have a very important role for production. There are also several kinds of naturally available protein-rich forages in the Mekong Delta, which have been very good plant protein sources for rabbits (Nguyen Van Thu and Nguyen Thi Kim Dong, 2005). They provides adequate protein and other essential nutrients for rabbits, particularly *Psophocarpus scandens* with 17.6% DM and 18.8% CP, which is developed well and available in nature through out a year in Mekong delta of Vietnam (Nguyen Thuy Linh and Nguyen Van Thu, 2022), while Para grass (*Brachiaria mutica*) from natural pastures is a good fiber feed source as a basal diet for rabbits (Nguyen Thi Kim Dong et al., 2008). However, using solely Para grass in the diets could reduce the growth rate of rabbits due to the high dietary fiber. Therefore, the objectives of study are to evaluate effects of *Psophocarpus scandens* replacing Para grass at different levels in the diets on growth performance and feed nutrient utilization of female crossbred rabbits. The results of the study will be disseminated to producers for practice.

MATERIALS AND METHOD

Location and time

The trial was conducted from March to July in 2022, at an Experimental farm in Phong Dien District, Can Tho city. The chemical analysis of feeds, refusals and feces, urine was done at the laboratory of the Department of Animal sciences, College of Agriculture of Can Tho University.

Experimental design and methods

The experiment aimed to measure the effects of the replacement of Para grass (PG) by *Psophocarpus scandens* (PS) on dietary nutrient digestibility, growth rate and economic analysis of crossbred rabbits. Sixty female rabbits (New Zealand x local breed) at 60 days of age (mean live weight of 799 g) were allocated in a complete randomized design with 5 treatments and 3 replications (4 rabbits in an experimental unit). The treatments were the replacement of Para grass (*Brachiaria multica*) by *Psophocarpus scandens vine* (Photo 1) at levels of 0, 15, 30, 45 and 60% (DM basis), while the concentrate supplementation was the same in all treatments of 15 g/day/rabbit. At 105 days of age, the feeds offered, refusals, feces and urine were collected for nutrient digestibility and nitrogen retention measurement. Total experiment length was 70 days.

Before entering the experiment all the rabbits in one experimental unit were offered Para grass and concentrate for 7 days to calculate daily dry mater of PG intake and then *Psophocarpus scandens* replacement to PG was applied for the experiment. During the experiment PG was fed *ad libitum*, while every two weeks the DM intakes of Para grass and PG were checked so that the percentage of PS in the diet was followed the experimental design.

Photo 1. *Psophocarpus scandens* vines

Measurements and chemical analysis

The feeds and refusals were taken for analyses of DM, OM, CP, NDF, and ash following procedure of AOAC (1990) and Van Soest et al. (1991). At the beginning of the experiment four rabbits per experimental unit were weighed individually and then they were weighed weekly during experimental period. Daily feed intakes, growth rate, and feed conversion ratios were measured and calculated. For the measurements of nutrient digestibility and nitrogen retention feeds, refusals and urine were daily measured during six days. DM, CP and NDF digestibility were employed according to Mc Donald (2011).

Data and statistical analysis

The data from the experiment were analyzed by analysis of variance using the ANOVA of General Linear Model, while Tukey test was used to compare the means of treatments of Minitab Reference Manual Release 16.2 (Minitab, 2010).

RESULTS AND DISCUSSION

Chemical composition of feeds

Chemical composition of feeds was stated in Table 1.

Table 1. Chemical composition of feeds used in the experiment

Feeds	DM	OM	CP	NDF	Ash
Para grass	19.1	89.6	9.92	61.6	10.4
Psophocarpus scandens	14.0	90.4	23.1	41.8	9.60
Concentrate	87.0	91.1	20.0	23.6	8.90

Note: DM: dry matter % fresh feed, and CP (crude protein), OM (organic matter), NDF (neutral detergent fiber) in % of DM

In Table 1, the DM of Para grass was 19.1% and higher than *Psophocarpus scandens* of 14%. DM of Para grass reported by Nguyen Thi Xuan Linh (2005) was of 16.4% Danh Mo (2003) of 18.4%. The higher figures of DM of Para grass in the experiment could be caused by cutting during the dry season. The CP content of *Psophocarpus scandens* was of 23.1%, while it was only 9.92% in Para grass. NDF content of *Psophocarpus scandens* was lower than that of Para grass (41.8% *vs*. 61.6%).

Feed and nutrient intakes

Table 2. Feed and nutrient intakes of rabbits in the Experiment (g/rabbit/day)

Intake (g/rabbit/day)	Treatments					SEM	P.
	PS0	***PS15***	***PS30***	***PS45***	***PS60***		
Para grass (PG)	77.7^{a}	64.9^{b}	51.5^{c}	39.0^{d}	28.7^{e}	1.52	0.01
Psophocarpus scandens (PS)	0.0^{e}	12.2^{d}	25.3^{c}	30.2^{b}	39.9^{a}	0.71	0.01
Concentrate	15.8	15.9	15.9	15.8	15.9	-	-
Dry matter	93.5^{a}	93.0^{ac}	92.7^{ab}	85.0^{bc}	84.5^{b}	1.82	0.01
Organic matter	84.0^{a}	83.6^{ab}	83.5^{ab}	76.7^{ab}	76.3^{b}	1.63	0.01
Crude protein	10.9^{d}	12.4^{c}	14.0^{ac}	13.8^{b}	15.0^{a}	0.32	0.01
NDF	51.6^{a}	48.8^{ab}	46.1^{b}	40.4^{c}	38.1^{c}	1.04	0.01

Note: NDF: neutral detergent fiber; PS0: no Psophocarpus scandens (PS), PS15: PS replace 15% PG, PS30: PS replace 30% PG, PS45: PS replaces 45% PG, PS60: PS replaces 60% PG

Means with different letters within the same rows are significantly different at the 5% level

The dry matter intake of rabbits was reduced with the increasing proportion of PS (Table 2). The DM intake of PS60 rabbits was significantly lower than that observed for PS0 and PS15 diets due to the lower DM of the PS compared to the PG. These results were consistent of that

reported by Dao Hung (2006). The CP intake proportionally increased in the diets with the increase of the PS proportion and they are significantly different among the treatments ($P<0.05$), while opposite pattern occurred for the NDF intake, due to the lower NDF content in the PS.

Growth rate and feed conversion ratio

Daily weight gain and feed conversion ratio of the rabbits were stated in Table 3.

Table 3. Daily weight gain and feed conversion ratio of the female rabbits fed different diets in the experiment

Criteria	Treatments					SEM	P.
	PS0	***PS15***	***PS30***	***PS45***	***PS60***		
LW at initial (g)	807	784	798	803	805	6.44	0.160
LW at finishing (g)	1,860^{b}	1,955^{ab}	2,075^{b}	1,943^{ab}	2,027^{ab}	42.1	0.042
Daily weight gain (g/rabbit)	15.1^{b}	17.3^{ab}	18.2^{a}	16.3^{ab}	17.5^{ab}	0.621	0.041
Feed conversion ratio	6.20^{a}	5.4^{ab}	5.10^{b}	5.27^{b}	4.83^{b}	0.423	0.043

Note: LW; live weigh, PS0: no Psophocarpus scandens (PS), PS15: PS replace 15% PG, PS30: PS replace 30% PG, PS45: PS replaces 45% PG, PS60: PS replaces 60% PG

Means with different letters within the same rows are significantly different at the 5% level

Daily weight gain of the rabbits were higher in the diets with PS, however only the daily weight gain of the PS30 treatment was significantly higher than that of the PS0 one. The daily weight gain of rabbits in this experiment was similar to results in the crossbred rabbits (both male and female supplemented concentrate 30 g/d) reported by Dao Hung (2006) from 14.5 - 19.0 g/d and Nguyen Thi Vinh Chau (2015) from 17.1 - 19.4 g/d. The feed conversion ratio of the PS30, PS45 and PS60 was significantly lower than that of PS0 and the results were slightly lower with those reported by Nguyen Thi Vinh Chau (2015) from 4.20 - 4.83.

Nutrient digestion and nitrogen balance

Nutrient digestibility and nitrogen retention of rabbits were showed in Table 4.

Table 4. Nutrient digestibility (%) and nitrogen retention (g/kg $W^{0.75}$) of rabbits in Exp 1

	Treatments					SEM	P
	PS0	***PS15***	***PS30***	***PS45***	***PS60***		
Digestibility							
Dry matter	42.1^{c}	43.5^{bc}	51.7^{ab}	55.0^{a}	57.2^{a}	1.91	0.001
Organic matter	43.2^{c}	45.6^{bc}	54.0^{ab}	57.5^{a}	58.5^{a}	2.0	0.001
Crude protein	62.7^{b}	67.3^{b}	79.3^{ab}	81.9^{ab}	84.4^{b}	3.62	0.005
NDF	35.3	36.2	36.8	38.1	40.9	1.30	0.098
Nitrogen balance (g/kg $W^{0,75}$)							
Nitrogen intake	2.38^{b}	2.52^{b}	2.68^{ab}	2.76^{ab}	2.99^{a}	0.104	0.002
Nitrogen retention	1.78^{b}	1.84^{b}	2.13^{ab}	2.10^{ab}	2.42^{a}	0.093	0.007

Note: Means with different letters within the same rows are significantly different at the 5% level.

DMD: dry matter digestibility , CPD: crude protein digestibility, OMD: organic matter digestibility, NDFD: neutral detergent fiber digestibility. PS0: no Psophocarpus scandens (PS), PS15: PS replace 15% PG, PS30: PS replace 30% PG, PS45: PS replaces 45% PG, PS60: PS replaces 60% PG

The digestibility of DM, OM and CP were improved with the increase of *Psophocarpus scandens* leaves in the diets. The DM digestibility were significantly higher for the PS45 and PS60 diets, while the lowest DM digestibility was for the control PS0 diet (42.1%). These results were consistent with figures reported by Dao Hung (2006) from 46.1 - 66.7%. which included Para grass and sweet potato leaves in the diets. The increasing OM digestibility pattern was similar to that of the DM. There was an increase of CP digestibility corresponding to the increased *Psophocarpus scandens* in the diets with a significantly higher CP digestibility for the PS60 diet (84.4%) compared to that of the PS0 one. The result was also consistent with that (82.0 - 83.0%) reported by Nguyen Van Thu and Nguyen Thi Kim Dong (2005). The digestibility of NDF in different diets was not significantly different; however, there was numerically an improvement of NDF digestibility (from 35.3 to 40.9%) with the increase of *Psophocarpus scandens* leaves in the diets. Similar patterns of nitrogen intake and retention were obtained in diets, however, they were significantly different ($P<0.01$) among the treatments with the highest values of the PS60 diet (2.99 and 2.42 g/kg $W^{0.75}$, for N intake and retention, respectively). This indicated that there was better utilization of plant foliated protein in rabbits when increasing PS leaves in the diets.

CONCLUSION AND RECOMMENDATION

It was concluded that the use of *Psophocarpus scandens* to replace Para grass in diet of growing female rabbit diets was beneficial. It improved crude protein intake, dietary digestibility and daily weight gain. A replacement of dietary Para grass of the rabbits by *Psophocarpus scandens* at a level of 30% should be applied by producers in practice.

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