EFFECT OF *SPOPHOCARPUS SCANDÉN* REPLACING *BRACHIARIA MUTICA* ON NUTRIENT UTILIZATION, DIGESTIBILITY, AND GROWTH PERFORMANCE OF CROSSBRED RABBITS IN THE MEKONG DELTA OF VIETNAM

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ABSTRACT

This study aimed to evaluate effects of levels of *Spophocarpus scandén* (SS) replacing Para grass (*Brachiaria mutica)* in the diets on feed and nutrient utilization, growth performance of crossbred rabbits. The experiment was a complete randomized design with five treatments and three replicates. Four female rabbits (balance in sex) at 60 days of age were allocated in one experimental unit and the treatments were levels of 0, 20, 40, 60 and 80% (DM basis) of *Spophocarpus scandén* replacing Para grass in the diets.

The results showed that DM intake was significantly different (P<0.01) among diets. Crude protein intake of rabbits significantly (P<0.01) increased with the higher levels of Para grass replaced by SS. The daily weight gain of the rabbits were higher in the diets with SS replacement, however only the daily weight gain of the SS40 treatment was significantly higher than the SS0 one. The nutrient digestibility of dry matter and crude protein and nitrogen retention of rabbits were also significantly (P<0.01) improved when increasing the levels of SS replacement. The conclusion was that using of *Spophocarpus scandén* to replace Para grass improved nutrient utilization, nitrogen retention and daily weight gain.

Keywords: *digestion, local feeds utilization, growth, natural grass and legume*.

INTRODUCTION

Due to the high feed costs of concentrates for monogastric animals and while the natural fodders available for grass-fed animals could be an alternative meat production in both economic and environmental benefits (Nguyen Van Thu, 2021). Rabbit meat production has been more developed recently in Vietnam in order to meet the meat demand of human food in Vietnam (Nguyen Van Dat, 2016). It is good for commercial farm income and also a tool of the poor producers for erasing starvation and alleviating poverty by rabbit production. While the pure improved breeds such as Californian and New Zealand are mainly raised in the intensive farms with the concentrate fellets (Truong Thanh Trung, 2016), the crossbred rabbits (Improved breeds x Local) are popularly raised in the Mekong delta because of their good adaptation to the local climate and feeds. Organic rabbit farming based on locally available feeds resources, particularly natural grasses, legume leaves and vegetables have a very important role for rabbit production in villages such as Para grass, Mom grass, water hyacinth, *Spophocarpus scandén* tropical kudzu, clovers, water spinach leaves … etc. However, studies on the appropriate usages of these feeds in rabbit diets are still limited due to a lack of feeding techniques produced. While a combination among the grasses and legumes for better nutrient balancing, particularly protein and energy could improve intakes, digestibility and growth performance (Nguyen Thi Kim Dong and Nguyen Van Thu, 2015). Therefore, the objectives of study was to evaluate effects of *Spophocarpus scandén* legume in the main diet of Para grass on nutrient utilization and growth rate of crossbred rabbits, then the results could be disseminated to producers for applications.

MATERIALS AND METHOD

Location and time

The experiment was carried out in the Nam Can Tho experimental farm of Can Tho City, while the chemical analysis of feeds, refusals, urine and feces was done at the E205

Laboratory, Department of Animal Science, College of Agriculture, Can Tho University, Vietnam. It was implemented from April to Dec 2020.

Experimental design

Sixty rabbits (New Zealand x local breed) at 60 days of age (790 ± 25g, Mean ± SE) were allocated in a complete randomized design with 5 treatments and 3 replications with 4 rabbits (balance in sex) in an experimental unit. The treatments were the replacement of Para grass (*Brachiaria mutica*) by *Spophocarpus scandén* (Photo 1) at levels of 0, 20, 40, 60 and 80% (DM basis), while the concentrate supplementation was the same in all treatments of 15g/day/rabbit at the beginning of the experiment. The replacement of the SS to Para grass in the all treatments was implemented by following the average DM intake recorded 5 days before entering the experiment. The experimental time was 10 weeks, and at 105 days of age the feeds offered, refusals and urine of all the rabbits in the treatments were collected for nutrient digestibility and nitrogen retention measurements.

Photo 1. *Spophocarpus scandén*

Feeds and feeding

The animals were fed three times a day at 7:00h, 14:00h and 18:00h. The feeds and refusals were recorded separately and daily**.** The diets were adjusted every week following their live weights**.** The refusals and spillage were collected and weighed daily in the morning to calculate the feed intake. Fresh water was available for all rabbits almost all day and night time. The animals were vaccinated to prevent some diseases, especially rabbit Hemorrhagic and parasite diseases.

Measurements taken

Chemical analysis

The feeds, refusals and feces were taken for analyses of DM, OM, CP, EE, NDF, ADF, and Ash following procedure of AOAC (1990) and Van Soest et al. (1991).

Daily feed and nutrient intakes. Feed and nutrients were daily measured and calculated for the intakes.

Daily weight gain and feed conversion ratio. All rabbits were individually weighed weekly, while daily DM intakes were calculated based on the daily weight gain.

Apparent feed and nutrient digestibility. Feed and nutrient intakes and feces were weighed for calculations following method suggested by Mc Donald et al. (2002)

Nitrogen retention. Urine of the rabbits were collected, weighed and analyzed nitrogen (AOAC, 1990) for a measurements.

Statistical analysis

The data of the experiment were analyzed by analysis of Variance using the ANOVA of General Linear Model of Minitab Reference Manual Release 16.1.0 and the comparison of significant difference between two treatments, Tukey's test was used (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 experiment

Feed	DM	OM	CP	NDF	Ash
Para grass	19.1	89.6	9.92	61.6	10.4
Spophocarpus scandén	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, CP: crude protein, OM: organic matter, NDF: neutral detergent fiber

In Table 1, the DM of Para grass was 19,1% and higher than *Spophocarpus scandén* of 14%. DM of Para grass reported by Nguyen Thi Xuan Linh (2005) was of 16.4% and 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 *Spophocarpus scandén* was of 23.1%, while it was 9.92% in Para grass. NDF content of *Spophocarpus scandén* was lower than Para grass (41.8% vs. 61.6%).

Feed and nutrient intakes

Table 2. Feed and nutrient intake of rabbits in experiment (g/rabbit/day)

Intake (g/rabbit/day)	Treatment					±SE/P
	SS0	***SS20***	***SS40***	***SS60***	***SS80***	
Para grass	77.7^{a}	64.9^{b}	51.5^{c}	39.0^{d}	28.7^{e}	1.52 / 0.01
Spophocarpus scandén (SS)	0.00^{a}	12.2^{b}	25.3^{c}	30.2^{d}	39.9^{e}	0.71 / 0.01
DM	93.5^{a}	93.0^{ac}	92.7^{ab}	85.0^{bc}	84.5^{b}	1.82 / 0.01
OM	84.0^{a}	83.6^{ab}	83.5^{ab}	76.7^{ab}	76.3^{b}	1.63 / 0.01
CP	10.9^{a}	12.4^{b}	14.0^{cd}	13.8^{c}	15.0^{d}	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: DM:dry matter, CP:crude protein, OM: organic matter, NDF: neutral detergent fiber

SS0: no Spophocarpus scandén (SS), SS20: SS replace 20% PG, SS40: SS replace 40% PG, SS60: SS replace 60% PG, SS80: SS replace80% PG

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

In Table 2 showed that DM intake of rabbit was lower in the treatments, which increased the SS replacement. The DM intake of SS80 was significantly lower than the SS0 and SS20 diets due to the lower DM of the SS compared to the PG. These results were consistent of that reported by Nguyen Thi Xuan Linh (2005). The CP intake proportionally increased in the diets to the increase of the SS replacement and they are significantly different among the treatments (P<0.01), while opposite pattern occurred for the NDF intake, due to the lower NDF content in the SS.

Daily weight gain and feed conversion ratio

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

Table 3. Final live weight, daily weight gain and feed conversion ratio of the rabbits fed different diets the experiment

Criteria	Treatments					±SE/P
	SS0	***SS20***	***SS40***	***SS60***	***SS80***	
LW at inititial (g)	807	784	798	803	805	6.44/0.16
LW at finishing (g)	1860^{a}	1955^{ab}	2075^{b}	1943^{ab}	2027^{ab}	42.1/0.041
Daily weight gain (g/rabbit)	15.1^{a}	17.3^{ab}	18.2^{b}	16.3^{ab}	17.5^{ab}	0.62/0.042
Feed conversion ratio	6.20^{a}	5.4^{ab}	5.10^{b}	5.27^{b}	4.83^{b}	0.62/0.040

Note: LW; live weigh, SS0: no Spophocarpus scandén (SS), SS20: SS replace 20% PG, SS40: SS replace 40% PG, SS60: SS replace 60% PG, SS80: SS replace 80% PG

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

Final live weight was significantly different among the treatments and the highest one was for the SS40 treatment. Similarly the daily weight gain of the rabbits were higher in the diets with SS replacement, however the daily weight gain of the SS40 treatment was significantly higher than the SS0 one. While the daily weight gains (15.1 – 18.2 g) were similar to those of crossbred rabbits reported by Nguyen Thi Vinh Chau (2015) being from 14.5-19.0g and Nguyen Van Thu and Nguyen Thi Kim Dong (2005) being from 12.9-19.0g. The feed conversion ratio of the SS40, SS60 and SS80 was significantly lower than that of SS0 and the results were consistent with those reported by Nguyen Thi Vinh Chau (2015) being from 4.26-4.60, but higher than those of crossbred rabbits stated by Do Thi Khanh Linh and Nguyen Van Thu (2017) being from 3.48 - 3.73. These differences could be caused by the higher concentrate in the diets.

Apparent nutrient digestibility and nitrogen retention

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

Table 5. Nutrient digestibility (%) and nitrogen retention (g/kg $W^{0.75}$) of rabbits in Exp.

Digestibility (%)	Treatment					±SE/P
	SS0	***SS20***	***SS40***	***SS60***	***SS80***	
DMD	42.1[a]	43.5[ab]	51.7[bc]	55.0 [c]	57.2[c]	1.94/0.001
OMD	43.2[a]	45.6[ab]	54.0[bc]	57.5[c]	58.5[c]	2.00/0.001
CPD	62.7[a]	67.3[a]	79.3[ab]	81.9[ab]	84.4[b]	3.56/0.005
NDFD	35.3	36.2	36.8	38.1	40.9	1.34/0.098
Nitrogen balance (g/kg $W^{0,75}$)						
Nitrogen intake	2.38[a]	2.52[a]	2.68[ab]	2.76[abc]	2.99[c]	0.1/0.002
Nitrogen retention	1.78[a]	1.84[a]	2.03[ab]	2.10[ab]	2.42[b]	0.1/0.007

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. SS0: no Spophocarpus scandén (SS), SS20: SS replace 20% PG, SS40: SS replace 40% PG, SS60: SS replace 60% PG, SS80: SS replace 80%

The digestibility of DM, OM and CP were improved with the increase of *Spophocarpus scandén* leaves in the diets. The DMD were significantly higher for the SS60 and SS80 diets, while the lowest DMD was for the SS0 diet (42.1%). These results were consistent with figures reported by Nguyen Thi Xuan Linh (2005) from 41.7-73.0% which included Para grass and sweet potato leaves in the diets. The increasing OMD pattern was similar to that of the DMD. There was an increase of CPD corresponding to the increased *Spophocarpus scandén* in the diets with a significantly higher CPD for the SS80 diet (84.4%) compared to that of the SS0 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 proportionally an improvement of NDFD numerically (from 35.3 to 40.9%) with the increase of *Spophocarpus scandén* 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 SS80 diet (2.99 and 2.42 g/kg $W^{0.75}$, respectively). This indicated that there was better utilization of plant foliated protein in rabbits when increasing legume leaves in the diets.

CONCLUSION

The conclusion of the study was that the use of *Spophocarpus scandén* to replace Para grass in the crossbred rabbit diets improved DM and CP intakes and digestibilities, daily weight gain and feed conversion ratio. At level of 40% replacement to Para grass by *Spophocarpus scandén* gave better results and should be recommended for applied practice.

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