

# EFFECT OF WATER SPINACH AND SWEET POTATO VINE ASSOCIATED WITH 2 OTHER NATURAL PLANTS, ON GROWTH PERFORMANCE, CARCASS VALUES AND ECONOMIC RETURN OF GROWING CROSSBRED RABBITS IN THE MEKONG DELTA OF VIETNAM

Nguyen Van T.\*, Nguyen Thi K.D.

Department of Animal Sciences, Faculty of Agriculture and Applied Biology, Can Tho University, Vietnam

\*Corresponding author: nvthu@ctu.edu.vn

## ABSTRACT

This study aimed to evaluate the effects of fresh Sweet Potato Vine (*Ipomoea batatas*) and Water Spinach (*Ipomoea aquatica*) associated with Mom grass (*Hymenachne acutigluma*) and Cuc (*Wedelia spp*) in the diets on feed and nutrient utilization, growth performance and economic return of crossbred rabbits. A complete randomized design experiment with six treatments and three replicates was used. Two male rabbits at 60 days of age were allocated in one experimental unit. The treatments were six diets including Water Spinach (WS), Sweet Potato Vine (SP), WS+Mom grass (WS+M), WS+Cuc (WS+C), SP+Mom grass (SP+M) and SP+Cuc (SP+C). The combination of two kinds of forages in the diets was at a ratio of 1:1 (DM basis). In addition 15 g/head of paddy rice were distributed daily to rabbits throughout the 70 days of experiment. Chemical composition of forages was given. The two types of *Ipomoea* were richer in protein (18.1-18.8 %DM) than the two other forages (12.4% DM for *H. acutigluma* and 10.0% for *Wedelia spp*). On the contrary their proportion of fiber was lower. Paddy rice used as concentrate had a protein content of 6.68% DM and NDF of 29.1%. There was no significant difference for intakes of DM ( $P=0.22$ ) and crude protein ( $P=0.07$ ) among the diets, but a significant difference ( $P<0.001$ ) of NDF intake was found. The daily weight gain was significantly higher in the WS diet: values for the 6 diets in the above order were 17.7, 15.8, 15.0, 15.2, 14.2 and 14.4 g/d. The feed conversion ratios (DM basis) were in the same order 3.35, 3.91, 4.34, 4.19, 4.50 and 4.39. Values of feed conversion ratio observed for the two single forage diets (WS and SP) were significantly ( $P<0.05$ ) lower than those observed for the four other diets involving two forages. However, the higher financial benefits were found for SP+M and SP+C diets, *i.e.* for water spinach associated with one other forage. The carcass values and meat composition were not significantly different ( $P>0.20$ ) among the treatments. The conclusion of the study was that Water Spinach, Sweet Potato Vine, Mom grass and Cuc could be used for feeding the growing rabbits for an utilization of local available feeds. Water spinach and sweet potato vine associated Mom grass or Cuc at ratio of 1:1 would be economically used and increase economic return.

**Key words:** Water spinach, Sweet potato vine, Growing rabbit, Feed utilization, Daily weight gain, Economic return, Carcass.

## INTRODUCTION

In recent year rabbit production and meat have been popular in the Mekong delta of Vietnam due to the human demands during the bird flu outbreak. Crossbred rabbits (Local x improved pure breeds) are raised in the Mekong delta because of a good adaptation to the local climate and feeds (Nguyen Van Thu and Nguyen Thi Kim Dong, 2005). Because of good natural conditions such as suitable ambient temperature, rich soil and available fresh water through out a year the locally green feed resources are abundant in this region for both planted and natural plants such as sweet potato (*Ipomea batatas*), water spinach (*Ipomoea aquatica*), Mom grass (*Hymenachne acutigluma*), Cuc (*Wedelia spp*), etc. However, there has been a limitation of studies of these feeds in the rabbit diets for further research and farmers' production. Therefore, the objectives of the study were to evaluate effects of sweet potato

vine, water spinach associated with Mom grass and Cuc in the diets on feed and nutrient utilization, growth performance, meat production and economic return of growing crossbred rabbits. The positive results of the study should be disseminated to producers for practice.

## MATERIALS AND METHODS

In this experiment, thirty six growing male rabbits of 60 days of age were allocated in a complete randomized design with 6 treatments and 3 replicates. Rabbits were placed by two (one replicate) in wire cages during the 70 days of the experiment. The treatments were water spinach (WS), sweet potato vine (SP), WS and Mom grass (WS+M), WS and Cuc (WS+C), SP and Mom grass (SP+M) and SP and Cuc (SP+C). The rate of the two green feeds in the diets was 1:1 based on DM basis. Paddy rice was added to all the diets at the same level of 30 g/day/experimental unit. The feeds and refusals were taken for analyses of DM, OM, CP, NDF, ADF, and ash following procedure of AOAC (1990) and Van Soest *et al.* (1991). Rabbits were weighed weekly. Daily feed intakes, growth rate, and feed conversion ratios were measured. The economic analysis was also done among the treatments. After finishing the experimental rabbits were slaughtered for evaluating carcass and meat quality. Economic analyses were done using current prices in Vietnamese Dong (VND) to compare differences of income and the feed cost in different treatments. The data were analyzed by analysis of variance using the ANOVA of General Linear Model, while Tukey test was used to compare the means of the criteria (Minitab, 2000).

## RESULTS AND DISCUSSION

The chemical composition of green feeds and paddy rice fed rabbits in the experiment was showed in Table 1.

**Table 1:** Chemical composition (% DM) of feeds used in the experiment

Raw feeds	DM	OM	CP	NDF	ADF	Ash
Water spinach	9.63	89.1	18.1	37.2	25.0	10.9
Sweet potato vine	8.56	87.6	18.8	41.4	29.6	12.4
Mom grass ( <i>H. acutigluma</i> )	15.7	90.7	12.4	66.3	36.9	9.32
Cuc ( <i>Wedelia spp</i> )	12.1	84.5	10.0	41.8	34.3	15.5
Paddy rice	87.4	93.6	6.68	29.1	15.8	6.37

DM:dry matter, CP:crude protein, OM: organic matter, NDF: neutral detergent fiber, ADF : acid detergent fiber

Mom grass had the highest DM content (15.7%) compared to those of Cuc, water spinach and sweet potato vine (12.1, 9.63 and 8.56%, respectively). These figures were similar those reported by Nguyen Hai Phu (2004), Danh Mo (2003) and Dao Hung (2006). Crude protein content was higher for sweet potato vine and water spinach. Those figures were slightly lower than that of Nguyen Thi Xuan Linh (2005) and Danh Mo (2004) due to the affects of rainy season for the experiment. The NDF content was high in Mom grass (66.3%), while that was similar in the others. The ADF content of Mom grass and Cuc was higher than those of sweet potato vine and water spinach. Paddy rice supplemented had DM and CP content of 87.4 and 6.68%, respectively.

Feed and nutrient intakes of rabbits was presented in Table 2. The DM intake (g/rabbit/day) was not significantly different among different diets; however, the lower figures were for the WS and SP diets, due to the low DM content of the SP and WS. These results were consistent with report of Nguyen Van Thu and Nguyen Thi Kim Dong (2005) being from 51.4-61.5 g DM/rabbit/day in a study with SP replacing para grass in growing rabbit diets. In general DM intake of rabbits in the present experiment was good with the values ranged from 60.7 to 65.0 g/day/rabbit. The OM and CP intakes were not significantly different among the treatments, however, the CP intake of the WS and SP diets was numerically higher than for the other 4 diets. The NDF intake of the WS+M and SP+M diets were significantly higher than other because of higher NDF content of the Mom grass.

**Table 2:** Average feed and nutrient intakes (g/rabbit/day) in the experiment, on dry matter basis

	Treatments						SE	Significance P value
	WS	SP	WS+M	WS+C	SP+M	SP+C		
Sweet potato vine	-	44.5 <sup>a</sup>	-	-	26.4 <sup>b</sup>	24.2 <sup>b</sup>	1.74	<0.001
Water spinach	43.9 <sup>a</sup>	-	29.5 <sup>b</sup>	26.7 <sup>b</sup>	-	-	2.22	<0.001
Mom grass	-	-	18.6	-	20.5	-	0.65	<0.001
Cuc	-	-	-	19.4	-	21.9	1.15	<0.001
<i>Overall intakes (g/d)</i>								
Dry matter	60.7	61.4	65.0	63.2	64.0	63.0	0.18	0.220
Organic matter	55.0	54.9	58.9	58.1	57.6	55.5	0.48	0.200
Crude protein	9.07	9.47	8.77	7.90	8.63	7.83	2.11	0.070
NDF	21.2 <sup>a</sup>	23.3 <sup>a</sup>	30.3 <sup>b</sup>	22.9 <sup>a</sup>	31.8 <sup>b</sup>	24.1 <sup>a</sup>	1.09	<0.001

NDF: neutral detergent fiber. WS: Water spinach, SP: Sweet potato vine, M: Mom grass and C: Cuc  
Means with different letters within the same rows are significantly different at the 5% level

Daily weight gain, feed conversion ratio and economic analysis were showed in Table 3. Daily weight gain was significantly different among the treatments ( $P < 0.05$ ) with the highest value of the WS diet, while the significantly lower values were for SP+M and SP+C diets. The results of daily weight gain of crossbred rabbits fed local green foliages in present experiment ranged from 14.2 to 17.7 g.

**Table 3:** Daily weight gain, feed conversion ration and economic return of rabbits in the experiment

	Treatments						SE	Significance P value
	WS	SP	WS+M	WS+C	SP+M	SP+C		
Initial weight (g)	790	780	730	760	730	758	39	0.836
Final weight (g)	1985 <sup>a</sup>	1818 <sup>ab</sup>	1780 <sup>ab</sup>	1825 <sup>ab</sup>	1725 <sup>b</sup>	1767 <sup>b</sup>	47	0.030
Daily weight gain (g/d)	17.7 <sup>a</sup>	15.8 <sup>ab</sup>	15.0 <sup>ab</sup>	15.2 <sup>ab</sup>	14.2 <sup>b</sup>	14.4 <sup>b</sup>	0.7	0.032
Feed conversion ratio	3.35 <sup>a</sup>	3.91 <sup>a</sup>	4.34 <sup>b</sup>	4.15 <sup>b</sup>	4.50 <sup>b</sup>	4.39 <sup>b</sup>	0.17	0.005
Feed cost (VND/rabbit)	26 385	22 269	20 721	19 897	16 707	16 491	-	-
Total cost for production (VND/rabbit)	46 385	42 269	40 721	39 897	36 707	36 491	-	-
Income (VND/rabbit)	59 550	54 550	53 400	54 750	51 750	53 000	-	-
Difference (VND/rabbit)	13 165	12 281	12 679	14 853	15 043	16 509	-	-

WS: Water spinach, SP: Sweet potato vine, M: Mom grass and C: Cuc  
Means with different letters within the same rows are significantly different at the 5% level

They are consistent with those (from 11.0 to 19.0 g) of other reports in Vietnam by Nguyen Thi Xuan Linh (2005), Dao Hung (2006), Nguyen Van Thu and Nguyen Thi Kim Dong (2005) and Nguyen Thi Kim Dong *et al.* (2007). Le Thi Ha *et al.* (1996) stated that the weight gain of the pure New Zealand rabbits fed grasses, concentrate and legume leaves were 15.5 g and 20.6 g per day. The values were also within the range reported by (Samkol *et al.*, 2006). They were slightly lower than those found by Phimmasan *et al.* (2004) or Khuc Thi Hue and Preston (2006). Feed conversion ratio of the rabbits was from 3.35 to 4.50, and values for the WS and SP diets were significantly lower than for the 4 other diets. The obtained values for feed conversion ratio were at acceptable levels and consistent with the results being from 4.9 to 6.0 indicated by Akinfala *et al.* (2003). The economic analysis showed that benefits got from the WS+M, SP+M and SP+C diets were higher than the rest of diets due to acceptable growth rate and lower cost of feed, despite growth rate and feed conversion ratio of the WS and SP diets were better. Thus local green feed sources available could be used as staple feeds in the rabbit diets to get better benefits by farmers.

The criteria of carcass, lean meat, offals and meat quality were no significantly affected by the different diets. Nguyen Van Thu and Nguyen Thi Kim Dong (2005) in a study of sweet potato vine replacing para grass in the diets reported that the carcass and lean meat percentage of growing crossbred rabbits were from 41.6 to 47.1% and from 67.8 to 79.2, respectively (Table 4). Crude protein content of rabbit meat in the present experiment was from 18.7 to 19.5%, while this was 22.5% reported by Nguyen Chu Chuong (2003). The difference could be caused by feed sources and supplements. In the current experiment paddy rice was supplemented with a average level of 15 g/day/rabbit, while other experiments on pure improved breeds concentrates were mostly used for supplementing.

**Table 4:** Carcass and meat quality of crossbred rabbits fed different diets

	Treatments						SE	Significance P value
	WS	SP	WS+M	WS+C	SP+M	SP+C		
Live weight LW (g)	2273	2060	1997	1970	2030	1933	83	0.130
Carcass weight (g) †	1093	973	937	967	923	847	69	0.300
Carcass percentage (% LW)	48.0	47.0	47.0	48.7	45.5	44.0	1.9	0.520
Lean meat weight (g)	863	772	754	764	724	669	52	0.260
Lean meat (% carcass)	79.3	79.3	80.3	79.2	78.3	79.0	2.3	0.990
Thigh meat weight (g)	325	280	273	282	279	246	21	0.260
Thigh meat percentage (%)	37.7	36.3	36.3	37.0	38.6	36.6	0.9	0.435
Full Caecum weight (g)	244	181	191	181	185	194	25	0.490
Full Stomach weight (g)	161	116	128	109	124	141	18	0.420
<i>Fresh meat composition</i>								
Dry matter (%)	24.3	24.9	24.0	24.3	24.0	23.5	0.6	0.675
Crude protein (%)	19.0	19.1	18.7	19.5	19.1	18.9	1.1	0.997
Ash (%)	5.01	5.23	4.71	4.87	5.12	4.43	0.35	0.699

WS: Water spinach, SP: Sweet potato vine, M: Mom grass and C: Cuc

† Carcass weighted without head, feet and offal

## CONCLUSIONS

The conclusion of the study was that local available green feeds such as water spinach, sweet potato vine, Mom grass (*Hymenachne acutigluma*) and Cuc (*Wedelia* spp) could be used for feeding the growing rabbit. Water spinach and sweet potato vine associated Mom grass or Cuc in the diet at the ratio of 1:1 would be economically fed and increase economic return.

## REFERENCES

- Akinfala E.O., Matanmi O., Aderibigbe A.O. 2003. Preliminary studies on the response of weaned rabbits to whole cassava plant meal basal diets in the humid tropics. *Livestock Research for Rural Development*, 15(4), <http://www.cipav.org.co/Irrd/Irrd4/akin.htm>.
- AOAC 1990. Official methods of analysis (15<sup>th</sup> edition). *Washington, DC, USA, Volume 1, 69-90*.
- Danh Mo. 2003. A study of improving *in vitro* forage digestibility measurement by using rumen fluid as nutrient source replacing chemicals for microbes in swamp buffaloes (Vietnamese). *MSc thesis, Faculty of Agriculture and Applied Biosciences, Cantho University, Vietnam*.
- Dao Hung 2005. Breed characteristics and productivity; and effect of crude protein levels on growth rate, feed intake, nutrient digestibility and nitrogen retention of crossbred rabbits (Vietnamese). *MSc thesis, Faculty of Agriculture and Applied Biosciences, Cantho University, Vietnam*
- Khuc Thi Hue, Preston T.R. 2006. Effect of different sources of supplementary fibre on growth of rabbits fed a basal diet of fresh water spinach (*Ipomoea aquatica*). *Livestock Research for Rural Development*, 18 (3).
- Le Thi Ha, Nguyen Quang Suc, Dinh Van Binh, Le Thi Bien, Preston T.R. 1996. Replacing concentrates with molasses blocks and protein rich tree leaves for production and growth of rabbits. *Livestock Research for Rural Development*, 8 (3), 39-43.
- Minitab 2000. Minitab reference manual. *Release 13.20. Minitab Inc.*
- Nguyen Chu Churong 2003. Questions and Answers on rabbit husbandry. *Agriculture Publishing House, pp. 43-45*.
- Nguyen Hai Phu 2004. Growth characteristics and nutritional values of Mom (*Hymenachne acutigluma*) and para grass (*Brachiaria mutica*) grown at SOHA farm. *BSc thesis, Faculty of Agriculture and Applied Biosciences, pp. 3*.
- Nguyen Thi Kim Dong, Nguyen Van Thu, Brian Ogle, Preston T.R. 2007. Effect of supplement level of water spinach leaves in diets based on para grass on intake, nutrient utilization, growth rate and economic returns of crossbred rabbits in Mekong delta, Vietnam. *In: MEKARN Proceedings of Workshop on Forages for Pigs and Rabbits, 2006 August, Phnom Penh, Cambodia, Agricultural Publishing house, Hanoi, P 176-182*.
- Nguyen Thi Xuan Linh 2005. Effect of sweet potato vines replacing para grass (*Brachiaria mutica*) on feed and nutrient digestibility and nitrogen retention of growing crossbred rabbits. *BSc thesis, Faculty of Agriculture and Applied Biosciences, pp. 4-12, 17*.
- Nguyen Van Thu, Nguyen Thi Kim Dong 2005. Effect of replacement of different levels of para grass by sweet potato vines on feed utilization, growth rate and carcass quality of crossbred rabbits in the Mekong delta of Vietnam. *In: Proc. of Integrating Livestock-crop systems to meet the challenges of globalisation. Ed. Rowlinson P., Wachirapakorn C., Pakdee P., Wanapat M., Vol 2, T51*.
- Phimmasan H., Kongvongxay S., Chahay T., Preston T.R. 2004. Water spinach (*Ipomoea aquatica*) and Stylo 184 (*Stylosanthes guianensis* CIAT 184) as basal diets for growing rabbits. *Livestock Research for Rural Development*, Vol. 16 (5).

- Samkol P., Preston T.R., Ly J. 2006. Digestibility indices and N balance in growing rabbits fed basal diet of water spinach (*Ipomoea aquatica*) supplemented with broken rice. *Livestock Research for Rural Development*, 18 (2).
- Van Soest P.J., Robertson J.B., Lewis B.A. 1991. Symposium: Carbohydrate methodology, metabolism and nutritional implications in dairy cattle: methods for dietary fiber, and non-starch polysaccharides in relation to animal nutrition. *J. Dairy Sci.*, 74, 3585-3597.

