Effect of Supplementation Levels of Coconut Cake on Reproductive Performance of Californian Rabbit Fed Basal Diets of Para Grass (*Brachiaria mutica*) in the Mekong Delta of Vietnam

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ABSTRACT

A study was implemented on 30 Californian does by using a complete randomized design with 5 treatments and 6 replications to evaluate their reproductive performance over two litters. The supplementation levels were 10, 15, 20, 25 and 30 g coconut cake were corresponding to the CO10, CO15, CO20, CO25 and CO30 treatments. The does were fed Para grass *ad libitum*, while other supplements of soybean and tofu waste were fed at the same levels in different treatments. The results showed that the average dry matter intakes (DMI) of the does in different treatments in the first litter was similar (P>0.05) and were from 130 to 144 g/doe/day, however in the second litter these were significantly different (P<0.05) with highest value (156 g) for the CO25 treatment and the lowest one (137 g) was for the CO10 treatment. The average crude protein intakes (CPI) of the first litter were significantly different (P<0.05) with the highest value (30.4 g/doe/day) of CO25 treatment, while in the second litter these were not significantly different (P>0.05) and were from 29.6 to 32.5 g/doe/day. The average metabolizable energy intakes (MEI) were significantly different (P<0.05) in both two litters and had a tendency of the increase MEI for the treatments when supplementing coconut cake. The litter sizes at birth and at weaning were higher for the CO20 and CO25 treatments and the daily milk yield was increased (P<0.05) when supplementing the coconut cake in both two litters. These criteria in litter 2 was tendentiously higher than in the litter 1. It was concluded that under feeding conditions of present study supplementing 20 g coconut cake per doe per day gave better reproductive performance of the Californian rabbit.

Key Words: Rabbit, Supplements, Agro-Industrial Byproducts, Reproductivity, Green Forages

INTRODUCTION

In recent years rabbit production has been developed well in Vietnam to satisfy the demand of meat. This has also gave better income for the producers, particularly for the peasants who is living in the rural areas with the low financial benefits from their production. They have utilized the natural grasses and agro-industrial byproducts available in the villages for feeding the rabbits. In the Mekong delta of Vietnam where the rabbit production has rapidly developed due to the advantages of suitable climate, rich soil and fresh water. Californian rabbits were imported this region over ten years, then they have been adapted to the living environment with local feed resources (Phan Thuan Hoang & Nguyen Van Thu 2010). In Vietnam the coconut areas are about 200.000 ha and they were mainly in the Mekong delta provinces (Agriviet 2009), then as a result there is a huge amount of coconut byproducts produced such as coconut cake and oil. The coconut cake is widely used as feed resources supplying protein and energy for pigs, chicken and other ruminants, however, studies of effects of coconut cake supplementation on reproduction of the rabbit have been limited in Vietnam. Therefore, this study aimed to evaluate the response of reproductivity of the Californian rabbits supplemented different levels of coconut cake for a practice recommendation.

MATERIALS AND METHODS

Animals and experimental design

The study was implemented at the Experimental farm Long Hoa and the

Laboratory E205 of Department of animal sciences of Cantho University in 2010. Thirty Californian does were allocated in a complete randomized design with 5 treatments and 6 replications to evaluate their reproductive performance over two litters. The treatment were supplementation levels of 10, 15, 20, 25 and 30 g coconut cake corresponding to the CO10, CO15, CO20, CO25 and CO30. The treatments were described as in Table 1.

Feeds, feeding and management

The does were fed Para grass *ad libitum*, while other supplements of *Operculia turpethum* leaves, soybean and tofu waste were fed at the same levels in different treatments. Para grass was collected daily in the areas surrounding Cantho University. Coconut cakes were bought from the company. The animals were fed three times a day, at 8:00, 15:00 and 19:00h. The diets were adjusted weekly by increasing allowances by 5, 10 and 15% in the second, third and fourth week of pregnancy, respectively. During the lactation period allowances were increased by 10% in the first week, 30% in the second and third week, and 40% in the fourth week. All animals had access to fresh water at all times. The does were kept individually in separate cages, and only one buck was used for mating. The breeding service was done at two weeks after birth. The new-born animals were weaned at the 30th day. Refusals and spillage were collected and weighed daily in the morning to calculate feed intake. Weights of rabbits at birth and weaning, and daily milk yields were measured. The does were weighed weekly from mating to parturition and their weight gains calculated during pregnancy. Before entering experiment all does were vaccinated to prevent some diseases, especially rabbit Hemorrhagic diarrhea and also parasite diseases.

Measurements taken

Reproduction criteria were recorded in 2 litters. Feeds and refusals were taken for analyses of DM, OM, CP, NDF and ADF following the procedure of AOAC (1990) and van Soest et al. (1991). The measurement taken including: daily feed and nutrient intakes for each litter, litter size at birth and weaning and daily milk yield recorded by weighing the kids before and after suckling of kids.

Statistical analysis

The data of experiments were analyzed by analysis of variance using the ANOVA of General linear model of Minitab Reference Manual Release 13.20 (Minitab 2000) to compare the differences among the treatments. For the comparison of the reproduction criteria between the litters the paired T test of Minitab Reference Manual was also used.

RESULTS AND DISCUSSION

Chemical composition (% DM) and energy of feeds

In Table 2 showed that Para grass (PG) contained higher DM, but lower CP concentration as compared to *Operculia turpethum* leaves. Tofu waste, soybean and coconut cake had higher CP content and energy. Coconut cake had higher DM and NDF as compared to tofu waste and soybean.

Table 1. Feeds (in fresh) of treatments (g/doe/day) used in the experiment at the start of experiment

	Treatments				
	CO10	CO15	CO20	CO25	CO30
Coconut cake	10	15	20	25	30
O. turpethum	200	200	200	200	200
Tofu waste	200	200	200	200	200
Soybean	25	25	25	25	25

CO10, CO15, CO20, CO25 and CO30: the coconut cake supplemented at levels of 10, 15, 20, 25 and 30 g/doe/day

Table 2. Chemical composition and energy of feed used in the experiments

	DM	OM	CP	EE	NDF	Ash	ME, MJ/kg
Para grass	17.70	89.10	12.90	3.70	65.60	10.90	8.23
O. turpethum leaves	11.90	87.90	15.50	6.52	38.80	12.10	10.70
Tofu waste	12.20	96.00	23.50	9.23	22.90	4.00	11.20
Soybean	92.80	94.80	42.30	11.40	22.90	5.20	12.10
Coconut cake	95.70	96.00	21.30	7.18	56.70	3.97	11.00

DM: dry matter; OM: organic matter; CP: crude protein; EE: Ether extraction; NDF: neutral detergent fiber; ME: metabolizable energy

The CP and ME of tofu waste and soybean were similar to those presented by Nguyen Tan Nam (2011) and Phan Thi Huyen Thoai (2012). While the DM and CP of Para grass in the present study were somewhat higher those reported by Nguyen Tan Nam (2011).

Feed and nutrient utilization and reproduction

Litter 1

The average feed and nutrient intakes of rabbits of pregnancy and lactation periods in litter 1 was presented in Table 3.

The DM and OM intakes for both pregnancy and lactation periods were similar (P>0.05) among the treatments, while the ME intake was significantly different (P<0.05) among the treatments with the higher values for the CO20 and CO25 treatments (Table 3). The CP and EE intakes for the CO25 treatment were significantly (P<0.05) higher than those of the CO10 treatment. The NDF intakes were similar among the treatments and higher than those reported by Nguyen Tan Nam (2011) when studying on the crossbred rabbits (New Zealand × local) being from 44.0 to 46.7 g/doe/day. But they were lower than results of Californian rabbits stated by Phan Thi Huyen Thoai (2012) being from 57.6 to 69.1 g/doe/day.

In Table 4 showed that the litter size at birth, weight of litter at birth, number of alive rabbit at weaning and milk production of litter 1 were significantly different (P<0.05) among the treatments with the highest values for the CO20 treatment. Although the values of the C20 treatment were higher, they were not significantly different (P>0.05) among the treatments for the number of alive rabbit at birth, weight of litter and rabbit at weaning and milk consumed of kitten per day. The number of rabbit at birth of present study (5.67-7.0) was higher than that reported by Phan Thi Huyen Thoai (2012) being from 5.33 to 6.67 for the Californian rabbits. However, it was lower than that of crossbred rabbits stated by Truong Thanh Trung (2006). The weight of litter at birth was higher that presented by Nguyen Thi Xuan Linh (2008) and Truong Thanh Trung (2006). The milk production of litter was from 67.3 to 82.0 g/d and similar to that reported by Phan Thi Huyen Thoai (2012).

Litter 2

The DM and OM intakes in litter 2 was not significantly different (P>0.05), while the CP and EE intakes were significantly (P<0.05) higher for the CO25 and CO30 treatments as compared to the CO10 treatment. The ME and NDF intakes were not significantly different (P>0.05) among the treatments, even though the values of the CO20 and CO25 treatments were numerically higher than those of the others.

In Table 6 showed that the litter size at birth and number of live rabbit at birth, milk production of litter were significantly different (P<0.05) among the treatments with the highest values for the CO20 treatment. While the weight of litter at birth and weaning, number of alive rabbit at weaning were numerically higher for the CO20 treatment compared to the other treatments, but they were not statistically significant (P>0.05) among the treatments. The number of Californian rabbit at birth and milk production of litter in litter 2 in this experiment were consistent with those reported by Phan Thi Huyen Thoai (2012).

Table 3. Average feed, nutrient (gDM) and ME intakes of rabbits for both pregnancy and lactation periods in litter 1

Items	Treatments						
	CO10	CO15	CO20	CO25	CO30	±SE	P
DM	140.00	143.00	146.00	147.00	141.00	2.26	0.225
OM	129.00	131.00	135.00	136.00	131.00	2.00	0.163
CP	30.10^{a}	30.70^{ab}	31.80^{ab}	32.20^{b}	31.80^{ab}	0.32	0.004
EE	9.82^{a}	10.00^{ab}	10.40^{bc}	10.60^{b}	10.50^{ab}	0.09	0.001
NDF	61.30	62.60	64.10	64.40	60.70	1.53	0.376
Ash	11.00^{a}	10.90^{a}	10.70^{a}	10.20^{ab}	9.19^{b}	0.27	0.005
ME, MJ/doe/day	1.43^{a}	1.46^{ab}	1.51^{ab}	1.53^{b}	1.49^{ab}	0.02	0.030

The data with different superscript letters in the same row differ significantly (P<0.05)

Table 4. The reproductive criteria of does in different treatments in litter 1

Items	Treatments					
	CO10	CO15	CO20	CO25	CO30	±SE/P
Litter size at birth	5.67^{a}	6.67^{ab}	7.00^{b}	7.00^{b}	6.33^{ab}	0.300/0.020
Number of live rabbit at birth	5.67	6.67	6.67	6.33	6.33	0.330/0.270
Weight of litter at birth (g)	313.00^{a}	315.00^{a}	367.00^{b}	364.00^{b}	322.00^{ab}	16.900/0.050
Weight of rabbit at birth (g)	55.20	47.80	52.40	52.00	51.20	3.180/0.610
No. of live rabbit at weaning	5.00^{a}	5.67^{a}	6.67^{b}	6.00^{ab}	6.00^{ab}	0.210/0.002
Weight of litter at weaning	1327.00	1245.00	1283.00	1277.00	1043.00	198.000/0.800
Weight of rabbit at weaning (g)	265.00	296.00	323.00	274.00	276.00	28.000/0.620
Milk production of litter (g/d)	67.30^{a}	74.70^{ab}	82.00^{b}	77.70^{b}	77.90^{b}	2.020/0.005
Milk consumed of rabbit (g/d)	13.40	13.20	12.40	12.90	13.00	0.640/0.800
Weight gain of rabbit (g/d)	7.01	8.26	9.03	7.39	7.50	0.910/0.560
Alive rabbit at weaning (%)	88.90	85.70	100.00	95.20	95.20	5.380/0.400

CO10, CO15, CO20, CO25 and CO30: the coconut cake supplemented at levels of 10, 15, 20, 25 and 30 g/doe/day. The data with different superscript letters in the same row differ significantly (P<0.05)

Table 5. The average feed, nutrient intakes (gDM) and ME intakes of rabbits for both pregnancy and lactation periods in litter 2

Items	Treatments						
	CO10	CO15	CO20	CO25	CO30	±SE	P
DM	144.000	146.000	149.000	149.000	146.000	2,360	0,456
OM	132.000	134.000	137.000	137.000	135.000	2,120	0,344
CP	30.600^{a}	31.200^{ab}	32.100^{ab}	32.400^{b}	32.600^{b}	0.380	0.017
EE	10.000^{a}	10.200^{ab}	10.500^{bc}	10.700^{bc}	10.700^{c}	0.110	0.030
NDF	63.300	64.800	66.400	65.400	62.800	1.480	0.429
Ash	11.500^{a}	11.300^{a}	11.000^{a}	10.300^{ab}	9.620^{b}	0.270	0.002
ME (MJ/rabbit/day)	1.460	1.490	1.540	1.550	1.530	0.020	0.072

CO10, CO15, CO20, CO25 and CO30: the coconut cake supplemented at levels of 10, 15, 20, 25 and 30 g/doe/day. The data with different superscript letters in the same row differ significantly (P<0.05)

Table 6. The reproductive criteria of does in different treatments in litter 2

Items	Treatments						
	CO10	CO15	CO20	CO25	CO30	±SE	P
Litter size at birth	6.00[a]	6.67[ab]	7.00[b]	7.00[b]	6.67[ab]	0.21	0.04
Number of alive rabbit at birth	6.00[a]	6.00[a]	7.00[b]	6.67[ab]	6.67[ab]	0.21	0.02
Weight of litter at birth (g)	283.00	322.00	377.00	348.00	316.00	21.40	0.09
Weight of rabbit at birth (g)	47.20	53.70	53.90	52.20	48.00	3.97	0.65
Number of alive rabbit at weaning	5.67	6.00	6.67	6.33	6.33	0.30	0.24
Weight of litter at weaning	1568.00	1730.00	2306.00	1728.00	1774.00	186.00	0.13
Weight of rabbit at weaning (g)	273.00	288.00	346.00	276.00	278.00	24.30	0.26
Milk production of litter (g/d)	70.90[a]	76.50[ab]	84.40[b]	81.10[ab]	80.80[ab]	2.76	0.04
Weight gain of rabbit (g/d)	12.60	12.80	12.70	12.90	12.80	0.74	1.00
% alive rabbit at weaning	94.40	100.00	95.20	95.20	95.20	4.45	0.90

CO10, CO15, CO20, CO25 and CO30: the coconut cake supplemented at levels of 10, 15, 20, 25, and 30 g/doe/day. The data with different superscript letters in the same row differ significantly (P<0.05)

Table 7. The reproductivity of Californian rabbits supplemented coconut cake in different treatments of the litter 1 as compared to the litter 2

Item	Litter 1	Litter 2	± SE	P
Litter size at birth	6.530	6.670	0.130	0.330
Number of alive rabbit at birth	6.330	6.470	0.190	0.050
Weight of litter at birth (g)	336.000	349.000	12.60	0.060
No. of alive rabbit at weaning	5.870	6.200	0.130	0.019
Weight of litter at weaning (g)	1235.000	1821.000	126.000	0.005
Weight of kitten at weaning (g)	287.000	292.000	14.000	0.710
Milk production of litter (g/d)	75.900	78.800	2.120	0.036
Daily weight gain (g)	7.840	8.030	0.460	0.690
Alive kitten at weaning (%)	93.000	96.000	2.910	0.320

In comparison the reproductive criteria between litter 1 and litter 2 indicated that the number of alive rabbit at birth and at weaning, weight of litter at weaning and milk production of litter of the litter 2 was significantly higher (P,0.05) than these of the litter 1, while the other criteria were not statistically different (P>0.05). The above results were consistent with these reported by Vo Thanh Dung (2008) and Nguyen Thi Kim Dong et al. (2008).

The economic analysis was also done for both two litters and indicated that the CO20 treatment gave the better profits as compared to the others and they were 354023, 352256, 441776, 338478 and 352446 VND/doe for the CO10, CO15, CO20, CO25 and CO30 treatments, respectively.

CONCLUSION AND RECOMMENDATION

It was concluded that supplementing 20 g coconut cake per doe per day gave the better reproductivity and economic return under the feeding condition of the present study. Coconut cake should be supplemented in rabbit diets to improve rabbit reproductive performance and more studies on coconut cake could be done to utilize this local supplement for rabbits and to reduce the production cost.

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