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EFFECTS OF FEED ON MEAT YIELD OF HYBRID RABBITS AT A FAMILY SCALE IN TU NGHIA DISTRICT, QUANG NGAI PROVINCE

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Abstract
Feeding experiments were conducted to evaluate the effect of replacing mixed feed with other green foods to assess the growth performance of hybrid rabbits. Study rabbits were randomly divided into 4 treatments, each treatment repeated 3 times. Diets with 50% replacement of water spinach (RM50); 50% wild daisies (CD50); 50% silage cassava leaves (LSUC50). Rabbits studied in the experiment were vaccinated, cared for, and kept in the same captivity. The treatment of replacing 25% of the mixed feed with RM had higher steam weight, hook weight, and carcass weight than the rest of the groups, but the percentage of hooked meat, carcass percentage, and percentage of the carcass were higher, there was no statistically significant difference ($p>0.05$). Preliminary accounting from the time of experiment to the time of sale, if 25% of mixed feed is used to replace 50% of CD, the efficiency is higher than RM50 and LSUC50, so it is possible to replace 25% of mixed feed with other types Green food is an agricultural by-product in the process of raising hybrid rabbits in households in Tu Nghia District.
Keywords:Hybrid rabbit, mixed feed, morning glory, wild chrysanthemum, silage cassava leaves.

INTRODUCTION

In recent years, rabbit farming has been developing widely throughout the country, contributing to providing a source of nutritious, delicious, but low-fat and low-cholesterol meat for consumers, supplying rabbits for laboratories, Institutes, schools, used in research, and teaching. The domesticated rabbit is a domesticated animal known as a herbivorous species that efficiently converts vegetables to human food without competing for food resources with humans, other poultry and livestock. Research on carcass quality on rabbits shows that rabbit meat is high in protein, low in fat and calories. Rabbit meat has nutritional value that is very suitable for human consumption because of its delicious taste, high protein, low fat, and low cholesterol (Bielanski *et al*., 2000; Hermida *et al*., 2006). On the other hand, rabbits have small body weight, short generation distance, high fertility, and fast growth rate, so they are one of the selected livestock for raising in some rural areas of our country. In order to achieve this orientation, addition to seed work and key seed area planning, food is the top concern. Faced with the situation of continuously increasing feed prices in recent years, the search and selection of ingredients that are processing by-products or post-harvest by-products, and at the same time determine the proportion of raw materials This is a necessary direction in the diet to reduce feed costs and increase livestock efficiency. According to Gidenne (1998)that fiber has a clear effect on digestion, Quang Ngai is a province with a very diverse and rich source of natural green foods such as morning glory, wild chrysanthemum, elephant grass, legumes ... are very suitable for rabbit breeding. In order to evaluate the meat yield from different feed sources, from which there is a scientific basis for building diets to increase productivity and economic accounting, the study on the effects of different types of feeds and

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nutrients on The productivity and growth of rabbits raised on a household scale is really necessary.

RESEARCH METHODS

Research period: January 1, 2020 - December 31, 2020.

Research subjects: Hybrid rabbit (Newzealandrabbit x local rabbit) at a farmer's household in Tu Nghia District.

In the non-weaning stage, the young rabbits lived with the mother, weighed and marked, after weaning, each barn raised 1 female and 1 male rabbit, which was relatively equal in weight (repeat 3 times for each treatment).

Design of the cage: stainless steel frame, length: 70 cm, width 30 cm, height 40 cm, surrounded by iron mesh (mesh area: 1 x 1 cm); The barn is 70 cm above the ground. The bottom of the barn is lined with a net to collect manure and under the manure,the collection net is a thick layer of plastic to collect urine. Green feed trough and drinking water are separated.

Experimental rabbits were fully dewormed. Alternative foods: morning glory (RM), wild chrysanthemum (CD), and cassava leaf silage (LSUC) were fed to rabbits 3 times a day at 7:00, 13:00, and 19:00 daily. Mixed feed for rabbits 2 times a day at 8 is and 3 pm.

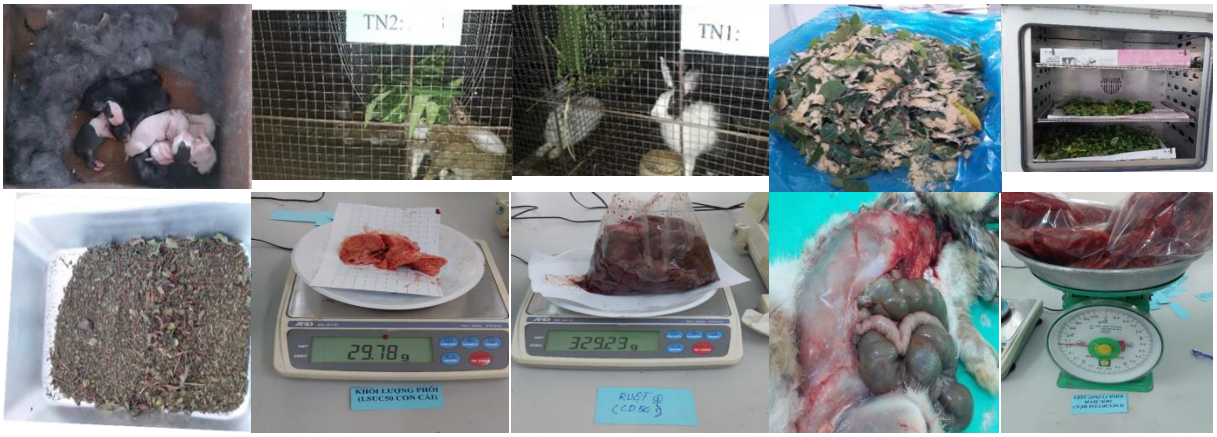

Figure 1. Some images in experiment

Analysis of some indicators on the nutrition of feed, growth, and carcass quality of rabbits: The materials after collection were sampled and dried at 65 ^{0}C to analyze the DM criteria: dry matter; CP: crude protein; Ash: total mineral, NDF: neutral fiber, and OM: organic matter.

Analysis of growth and carcass quality indicators according to the research method of Cheeke (1987).

Cumulative growth (g): cumulative growth is the bodyweight of rabbits through the rearing periods (determined by weeks of age). Rabbit weight in this study was determined by weighing once a week.

Relative growth (%): relative growth is the percentage (%) of the increased weight or size of the rabbit's body at the time of the survey compared to the time of the previous survey. $\mathbf{R}(\%) = \frac{(\mathbf{P2-P1})\mathbf{x100}}{(\mathbf{P2+P1})/\mathbf{2}}$.

Where R is the relative growth (%); P1: Bodyweight at previous weighing (g); P2: Bodyweight at the next weighing (g).

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Absolute growth (g/head/day): is the increase in body weight in a unit time.

Formula for absolute growth: $\mathbf{A} = \frac{\mathbf{P2-P1}}{\mathbf{T2-T1}}$(unit: grams/head/day).

In which: A is the absolute growth (gram/head/day); P1 is the bodyweight at time T1(g); P2 is body weight at time T2(g); T1 is the time of the previous survey (date of age); T2 is the time of the following survey (date of age).

Table 1. Setting up diets for experimental rabbits (from 5 weeks to 15 weeks)

	Material	**Experiments**			
		NT1	**NT2**	**NT3**	**NT4**
The rations of hybrid rabbits under 1000g	Elephant grass (g)	100	100	100	100
	Mixed food (g)	30	22.50	22.50	22.50
	Water spinach (g)	0	15	0	0
	Wild chrysanthemum (g)	0	0	15	0
	Silage cassava leaves (g)	0	0	0	15
The rations of hybrid rabbits is from 1000 - 2000g	Elephant grass (g)	200	200	200	200
	Mixed food (g)	100	75	75	75
	Water spinach (g)	0	50	0	0
	Wild chrysanthemum (g)	0	0	50	0
	Silage cassava leaves (g)	0	0	0	50
The rations of hybrid rabbits from 2000g to slaughter	Elephant grass (g)	300	300	300	300
	Mixed food (g)	150	112.50	112.50	112.50
	Water spinach (g)	0	75	0	0
	Wild chrysanthemum (g)	0	0	75	0
	Silage cassava leaves (g)	0	0	0	75

RESEARCH RESULTS

Nutritional composition of foods

T group they belong omnivore, so feed the rabbits in the wild and in the production of abundant variety and yield. Rabbit food is usually divided into 2 main groups; rough and refined food groups. The results of the nutritional analysis of raw and refined foods for experimental hybrid rabbits are presented in Table 2.

Table 2. Nutritional composition of experimental foods

%VCK

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Foods	DM%)	(OM%)	(CP%)	(NDF%)	(Ash%)
Mixed food	82.00^{a}	92.00^{a}	21.00^{ab}	19.50^{d}	8.00^{c}
Elephant grass	13.75^{c}	82.11^{b}	13.15^{b}	58.70^{a}	17.89^{b}
Water spinach	11.30^{c}	90.5^{a}	29.8^{a}	31.20^{c}	9.50^{c}
Wild chrysanthemum	10.80^{c}	83.60^{b}	14.30^{b}	40.00^{b}	16.40^{a}
Silage cassava leaves	29.00^{b}	93.80^{a}	24.85^{ab}	37.10^{c}	6.20^{d}

Note: The values a,b,c,d in the same column are statistically different (p<0.05).DM: Dry matter, CP: crude protein; OM: organic matter; NDF: neutral fiber; Ash: total mineral

The results of nutrient composition analysis of wild chrysanthemum (CD) show that the content of DM, CP, OM, NDF, and Ash is 10.80, respectively; 14.30; 83.60; 40.00, and 16.40%. Compared with other feeds used by farmers, the DM content of CD plants was equivalent to that of morning glory (RM) and elephant grass was lower than the DM of LSUC (p<0.05). The amount of organic matter (OM) in CD plants was similar to that of elephant grass but the crude protein (CP) content was higher than that of elephant grass. Compared with the study of some other authors, the CP content of CD plants in our study was higher (Danh Mo *et al*., 2003 CP content in CD was 11.00%; Ly Thu Lan *et al.,* 2016 CP at CD is 14.10%).

The results of the nutritional analysis of RM show that the content of DM, CP, OM, NDF, and Ash is 11.30%, respectively; 29.80%; 90.50%; 31.20%, and 9.50%, the analysis results showed that the amount of DM in RM, CD, and elephant grass was not statistically different (p>0.05), but the DM of RM was significantly different. millet with compound feed and LSUC (P<0.05). In addition, the crude CP content was relatively high, reaching 29.8%, which was higher than that of the feeds used at the farm (p<0.05). However, the CP content of RM in our study was lower than that of Nguyen Van Thu *et al*., (2011) (the crude CP content in RM reached 36.3%). For mixed feed C225 of Viet Phap Proconco joint venture company, the nutritional composition of dry matter (VCK) is 82.00%, organic matter (OM) is 92%, neutral fiber content (NDF)) is 19.5%, and total mineral (Ash) is 8%. This is the type of feed that the farmer uses as a concentrate in the hybrid rabbit's diet.

Elephant grass is a green food commonly used by households in the daily diet of rabbits. The analysis results of the nutritional composition of elephant grass at the study site showed that the VCK content in elephant grass was 13.75%. Compared with the research of Dinh Van Cai *et al*., (2004)finals are 14.00%. Thus, the concentration of VCK in our study was higher than that of Nguyen Nhut Xuan Dung and lower than in the study of Dinh Van Cai *et al*. Ash content (Ash%) of elephant grass in our study was 13.89% higher than the study of Nguyen Nhut Xuan Dung *et al* (Ash: 9.87%). The organic matter (OM) content was 86.11% lower than the study of Nguyen Nhut Xuan Dung *et al* (OM: 90.13%). The crude protein (CP) content of elephant grass in our study was 13.15%; In the study of Nguyen Nhut Xuan Dung *et al*., the CP of elephant grass was 8.52%, so the CP content in our study was higher than that of Nguyen Nhut Xuan Dung's study. According to the author, the CP content of plants is greatly influenced by the fertility of the soil and the time of grass harvest.Thus, compared with the study of some other authors, the results of our study on the content of nutrients in

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LSUC are within normal limits. Therefore, it is appropriate to use LSUC as a feed supplement for hybrid rabbits. According to Khieu *et al*., (2005)*and* Phuc (2001), cassava leaves have high protein content, making them suitable for monogastric animals.

Cumulative growth of hybrid rabbits from 5 weeks to 15 weeks of age

Cumulative growth is one of the important indicators to evaluate the growth ability of rabbits. Rabbits breastfeed from 1 to 30 days old, the next 5 days is the time when rabbits adapt to new foods. Research results on the cumulative growth of hybrid rabbits in 4 experimental treatments from 5 weeks to 15 weeks of age are shown in Fig 2.From the period of 5 weeks to the end of the experiment, when replacing 25% of mixed feed by adding RM50, CD50, and LSUC50 among the animals, there was a difference ($p<0.05$). Specifically, at the end of the experiment at 15 weeks of age in NT1, NT2, NT3, and NT4, the cumulative growth of hybrid rabbits was 2505 respectively; 2725; 2620, and 2530 g, the difference between the NTs is statistically significant. This shows that, when replacing 25% of mixed feed in the diet of hybrid rabbits daily with RM50 feed; CD50; LSUC50 showed similar and higher results compared to the 100% compound feed in NT1.

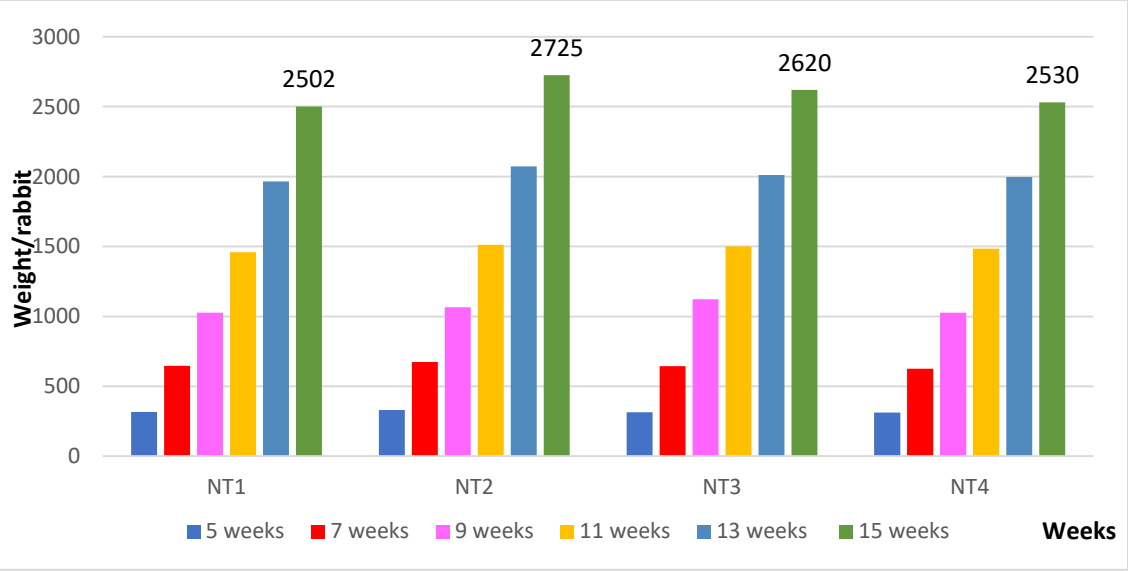

Figure 2. Cumulative growth of hybrid rabbits

According to Sheikh (2011) growth of some rabbit breeds including the New Zealand white rabbit (NZW), the V-line rabbit; Black Baladi rabbits (BB), and Gabali rabbits reared in conditions in Egypt showed the highest baseline and body weight at 60 days of New Zealand rabbits.Montessuy *et al.,* (2012) studied the effect of forageon the growth of rabbits from 32 to 70 days old.

Absolute growth of hybrid rabbits from 5 weeks to 15 weeks of age

Research results on absolute growth of hybrid rabbits between NTs are presented in Fig. 3. In the period from 7 to 15 weeks of age, there was a statistically significant difference between NT2, with NT1, NT3, and NT4.

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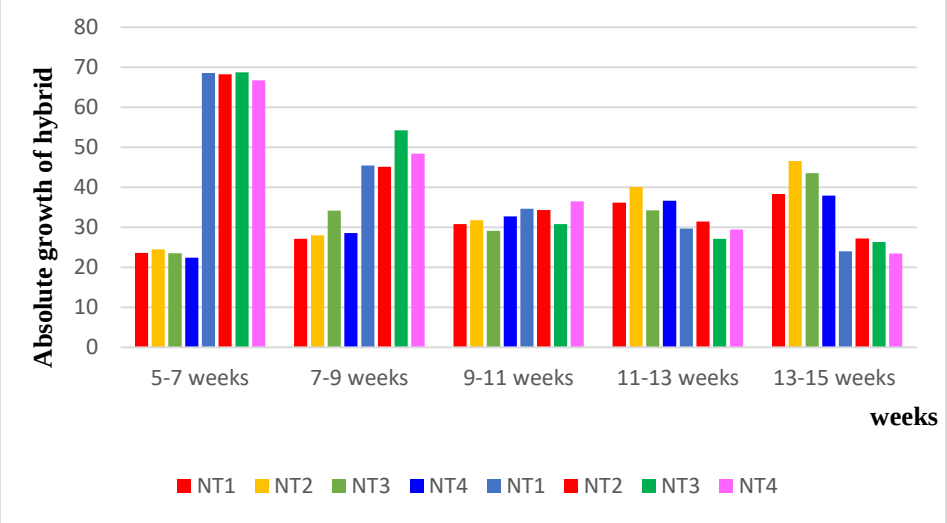

Figure 3. Absolute growth of hybrid rabbits

Specifically, in the period 11-13 weeks of age, the gestational age of NT2 was 40.12 (g/head/day) higher than that of NT1, NT3, and NT4, this difference was statistically significant. Thus, when replacing part of the mixed feed for rabbits with feeds RM50, CD50, and LSUC50, the results were equivalent to or higher than that of NT1, which is using completely KPTN with 100% compound feed. According to Ly Thi Thu Lan *et al*., (2016) when replacing CD35 for sweet potato in hybrid rabbits, the growth was higher than that of replacing CD65 and CD95. Therefore, the CD content is just enough to supplement with compound feed to improve the growth performance of rabbits at the end of the term.

Relative growth of hybrid rabbits from 5 weeks to 15 weeks of age

According to the law of growth, relative growth decreases over time. Research results on the relative growth of hybrid rabbits from 5 weeks to 15 weeks of age are presented in Fig. 4.

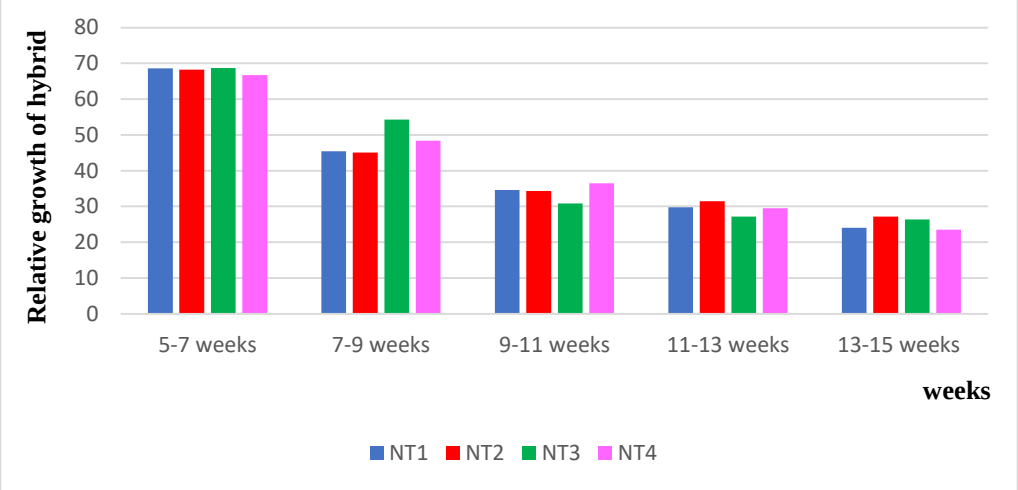

Figure 4. Relative growth of hybrid rabbits

The results showed that there was no statistically significant difference between the NTs ($p>0.05$). This shows that when replacing 25% of the compound feed with other forages, the growth is relatively little changed, proving that CD or LSUC plants can be

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utilized as an alternative or complementary agricultural by-product. added to the daily diet of hybrid rabbits.

Productivity of hybrid rabbits at the farm

The results of the survey of 2 rabbits/NT at the period of 105 days are presented in Table 3.

Table 3. Productivity of hybrid rabbits at the farm

Criteria	Experiments			
	NT1	NT2	NT3	NT4
Number of caesarean section samples (head/NT)	2	2	2	2
Survey operative age (days)	105	105	105	105
Steam weight (g/head)	2340^{b}±70.71	2435^{a}±21.21	2325^{b}±35.36	2300^{b}±14.14
Weight of hook meat (g/head)	1340^{ab}±56.57	1408^{a}±15.20	1295^{b}±35.36	1292^{b}±17.68
Hook rate (%)	57.26	57.84	55.69	56.20
Carcass weight (g/head)	1211.5^{a} ±31.82	1207.5^{a}±5.30	1139.5^{b}±7.78	1132.5^{b}±17.68
Carcass percentage (%)	51.77^{a}	49.58^{b}	49.01^{b}	49.23^{b}
Weight of front thigh (g/head)	153.23^{b}±10.68	155.59^{ab}±3.48	155.45^{ab}±9.83	159.74^{a}±12.96
Anterior thigh ratio (%)	6.55	6.39	6.69	6.95
Weight of hind thigh (g/head)	353.30^{a}± 4.95	340.65^{b}±7.18	314.44^{c}±19.47	334.34^{b}±10.60
Proportion of posterior thighs (%)	15.10^{a}	13.99^{ab}	13.52^{ab}	14.53^{b}

Note: Values a, b, c on the same row have different characters with statistical significance p<0.05).

The results show that rabbits in the batch supplemented with RM to replace 25% of mixed feed had higher steam weight and jaw weight compared to the rest of the groups, but the proportion of hamstring meat, There was no statistically significant difference between sawing and organ proportions (p>0.05). The weight of hook meat was highest in NT2 when replacing 25% of mixed feed with RM50(p<0.05). The proportion of hook meat in NT1, NT2, NT3, and NT4 respectively accounted for 57.26%; 57.83%; 55.69%, and 56.20%. The proportion of carcass between NT1 was higher than that of NT2, NT3, and NT4 (p<0.05), however, between NT2, NT3, and NT4 (p>0,05).

Ratio of fur and weight of internal organs of hybrid rabbits at the farm

The results of the study on the proportion of skin hair and internal organs of rabbits are presented in Table 4.The results show that the hair weight of hybrid rabbits in NT2 and NT3 is higher than in NT1 and NT4, this difference is statistically significant. Compared with other studies, the percentage of skin hair in our study is low, showing that the percentage of hook meat is relatively high.

Table 4. The ratio of fur and weight of internal organs of hybrid rabbits at the farm

Criteria	Experiments			
	NT1	NT2	NT3	NT4

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Number of caesarean section samples (head/NT)	2	2	2	2
Survey operative age (days)	105	105	105	105
Steam weight (g/head)	2340^{b}±70.71	2435^{a}±21.21	2325^{b}±35.36	2300^{b}±14.14
Feather weight (g/head)	336.21^{b}±22.92	358.62^{a}±13.00	340.92^{a}±21.67	338.20^{b}±43.42
Proportion of skin hair (%)	14.37	14.73	14.66	14.70
Spleen weight (g/head)				
Absolute (g)	15.12±0.64	15.48±0.17	15.39±0.25	15.85±0.23
Relative (%)	0.65	0.64	0.66	0.69
Kidney weight (g/head)				
Absolute (g)	17.15^{b}±0.20	22.12^{a}±1.18	17.89^{b}±0.94	18.74^{b}±0.08
Relative (%)	0.73	0.90	0.77	0.81
Liver weight (g/head)				
Absolute (g)	92.36^{b}±1.68	97.95^{a}±1.80	92.04^{b}±1.02	97.01^{a}±0.35
Relative (%)	3.95	4.02	3.96	4.21
Lung volume				
Absolute (g)	29.44±0.87	30.03±0.01	29.80±0.02	29.27±1.31
Relative (%)	1.25	1.23	1.28	1.27
Heart volume				
Absolute (g)	11.1±0.45	11.75±0.27	11.78±1.03	11.22±0.08
Relative (%)	0.47	0.48	0.51	0.49
Stomach volume				
Absolute (g)	71.62^{c}±1.77	75.39^{b}±0.05	81.78^{a}±0.88	76.49^{b}±5.57
Relative (%)	3.06	3.10	3.52	3.33
Intestinal volume				
Absolute (g)	200.55^{c}±4.60	226^{b}±2.12	230.5^{b}±7.78	258.50^{a}±12.02
Relative (%)	8.57	9.28	9.91	11.23
Organ mass				
Absolute (g)	437.33^{c}±1.02	478.71^{b}±1.26	479.17^{b}±5.70	507.06^{a}±7.72
Relative (%)	18.69	19.66	20.61	22.05

Note:Values a, b, c on the same row have different characters with statistical significance p<0.05).

According to the study of Sheikh *et al*., (2011) the percentage of foreign rabbit breeds is high. For the white New Zealand rabbit breed, the proportion of skin hair accounted for 58.84%, the V. Line rabbit breed had 62.71% hair and skin, the Babadi Black rabbit breed accounted for 57.72%, leading to the ratio of hook meat and the ratio According to Pla (2008) the weight of rabbits at 63 and 90 days, respectively, 2209 compared to 2488 g, was higher than our study results at 105 days in 4 treatments, respectively 2300-2435g

The results of a caesarean section of rabbits at the end of the term also showed that there was no statistically significant difference in spleen volume between 4 NTs ($p>0.05$). The kidney volume in NT2 was larger than in NT1, NT3, and NT4 ($p<0.05$). In general, the organ weight of the experimental animals was higher than that of the control animals using 100% mixed feed and elephant grass, so increasing the amount of forage increased the percentage of reduced viscera accumulated. nutrients are

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ingested, due to the higher costs of heat release activities for the acquisition, storage, and digestion of food.

Economic efficiency of crossbred rabbits raised in household ears

In livestock production in general and rabbit farming in particular, the economic efficiency of food replacement in the diet is often not fixed because it does not depend only on the effect of that type of feed replacement on productivity and quality. quality of livestock products but also depends much on the price of feed, care, and veterinary costs. The cost of feed for rabbit weight gain is calculated based on the daily weight gain of the rabbit and the cost of feed. Elephant grass, LS, CD, RM are grown by farmers themselves and are locally available raw materials. However, on the basis of market prices at the time of the study, feed costs can be calculated.

When replacing 25% of the mixed diet with RM50, CD50, and LSUC50, it showed that: the cost only decreased in the CD50 and LSUC 50 treatment and the RM50 treatment increased, however, the economic efficiency was still higher. compared with the batch using 100% compound feed. Therefore, the use of CD50 or LSUC50 can partially replace mixed feed, which is very practical because of the locally available green food sources in which CD plants grow all year round, the amount of cassava leaves is harvested before the rainy season. should be able to make use of agricultural by-products. When replacing RM50, the growth of rabbits increased compared to those raised with a 100% diet (Table 5). However, RM has to take care of and the cost is relatively higher than LSUC and CD.

Table 5. Effective use of different types of feed in breeding rabbit hybrids

Category	**NT1 (KPTN)**	**NT2 (RM50)**	**NT3 (CD50)**	**NT4 (LSUC50)**
Total expenditure (VND/child)				
Cost of buying mixed feed	56.000	42.000	42.000	42.000
Cost of purchasing elephant grass	5000	5.000	5.000	5.000
Cost of purchasing water spinach	0	25.000	0	0
Cost of purchasing wild chrysanthemums	0	0	5000	0
Cost of making silage cassava leaves	0	0	0	8.000
Cost of baby rabbits, care	100.000	100.000	100.000	100.000
Revenue (VND/child)	250.000	270.000	260.000	250.000
Expenses (VND/child)	161.000	172.000	152.000	155.000
Paying off interest = Income-expenditure (VND/child)	89.000	98.000	108.000	95.000
(%) vs NT1	100%	110.11	121.34	106.74
Economic efficiency compared to NT1		10.11%	12.34%	6.74%

Research results also show that when preliminarily accounting from the time of experiment to the time of sale, replacing 25% of mixed feed with 50% CD gives higher economic efficiency than RM50 and LSUC50. Wild chrysanthemum is an easy-to-grow plant, the stem grows wherever the roots go, with little care, the nutritional composition is equivalent to some grass species, but the fiber content is low, so it can be selected

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as a food. give priority to rabbits in the rearing process.Water spinach is also one of the green foods when supplementing to replace 25% of the mixed feed for rabbits, bringing high economic efficiency, increasing 10.11% compared to NT1. In the Mekong Delta, people have used a part of morning glory stalks to make pickles and the rest of the leaves as an additional source of food to raise rabbits to improve the economic efficiency of livestock production (Nguyen Van Thu *et al*., 2006).Besides, before the rainy season is the cassava harvest season, people can take advantage of LSUC to store and replace a part of mixed food in the rabbit's daily diet.

CONCLUSION

At 15 weeks of age, cumulative growth in NT1, NT2, NT3, and NT4 of hybrid rabbits is 2505 respectively; 2725; 2620, and 2530 g. When replacing part of the mixed feed for rabbits with RM50, CD50, and LSUC50, the absolute growth was equivalent to or higher than that of NT1 when using 100% mixed feed.When replacing 25% of the compound feed with other forages, growth was relatively little changed.

The treatment of replacing 25% of mixed feed with RM had higher steam weight, hook weight, and carcass weight than the other batches, but the percentage of hooked meat, carcass percentage, and percentage of the carcass were higher. There was no statistically significant difference in the percentage of organs (p>0.05).Preliminary accounting from the time of experiment to the time of sale, if using 25% of mixed feed with 50% CD, the efficiency is higher than RM50 and LSUC50.

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