THE USE OF CASSAVA ROOTS AND LEAVES FOR FEEDING PIGS IN VIETNAM

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ABSTRACT

In Vietnam, cassava (*Manihot esculenta Crantz*) is the second most important food crop after rice in terms of total production; annual root production is about 2 million tonnes, the majority of which is used for animal feeding. Cassava is also an important source of income for poor farmers.

Making silage is an appropriate method to preserve cassava roots to be used for pig feeding and is applicable under village conditions. After harvest, fresh roots are cleaned, grated finely and mixed with 0.5% salt. The mixture is put into plastic bags of 20-30 1, pressed tighty to expel all air and tied; it is then let to ferment naturally. The mixture could be used after 2-3 weeks of ensiling and can be kept for at least 3-4 months.

Research has shown that including about 40% ensiled cassava roots (ECR) in diets for growing pigs does not affect their growth performance. Under village conditions, the inclusion of 30% ECR of DM of diet improved the daily weight gain and decreased feed cost by 7%. However, a higher proportion of ECR in the diet may cause an imbalance in amino acid concentrations, particularly low methionine.

A higher level of digestibility of organic material and crude protein was obtained when including levels of 0.1, 0.2 and 0.3% (as DM) DL-methionine in ECR-based diets for pigs. Inclusion of DL-methionine in the diet significantly reduced the amount of N secreted in urine, increased the retention of N and improved the performance of growing pigs. Although inclusion of DL-lysine (0.1%) and DL-methionine (0.05%) in 30% ERC-based diets did not increase performance, it reduced the feed cost by 3%.

At root harvesting time, about 5-7 t/ha of fresh leaves can also be collected. However, leaves are seldom used for feeding animals. The high crude protein content of cassava leaves (20-30%) makes these a very useful feed resource.

Making silage of cassava leaves reduces the toxicity of HCN and this is a very practical and applicable method. Additives used in the ensiling process are readily available in the village, such as salt, rice bran, molasses and cassava root meal.

In diets for growing pigs, inclusion of 15% (as DM) ensiled cassava leaves (ECL) improved daily weight gains and the food conversion ratio, as well as reduced the feed cost by 25%. Additionally, for pregnant sows the feeding with 15% ECL improved their piglet live weight gain at weaning time.

In conclusion, cassava roots and leaves can be used effectively for feeding growing pigs and pregnant sows. However, a low protein content of the roots and an imbalance of essential amino acids in the leaves could limit their inclusion in pig diets.

INTRODUCTION

In Vietnam, cassava (*Manihot esculenta* Crantz) is the second most important food crop after rice in terms of total production; annual fresh root production is about 2 million tonnes (GSO, 2001), most of which is used for animal feeding. Cassava is also an important source of income for poor farmers.

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Ensiled Cassava Roots as Pig Feeds

Sun-drying of cassava roots is the method of processing commonly used by Vietnam farmers. After harvesting, the roots are cleaned, chopped by hand or by machine into small pieces, sun-dried and stored. However, it is difficult to sun-dry cassava roots in the rainy season.

Making silage is an appropriate alternative method to preserve cassava roots to be used for pig feeding, and this can be done under village conditions (Loc, 1996). After harvest, fresh roots are cleaned, grated finely, and mixed with 0.5% salt. The mixture is put into plastic bags of 20-30 liters, pressed tightly to expel all air and then tied; it is then let to ferment naturally. The mixture could be used after 2-3 weeks of ensiling, and can be kept for at least 3-4 months. The pH of the mixture decreases after the first week of ensiling and then remains constant, while the HCN content is reduced to about 35% after 150 days of ensiling **(Table 1)**.

Table 1. Effect of time of ensiling on pH and the HCN content of cassava roots.

Day of ensiling	DM (%)	pH	HCN (mg/kg fresh roots)
0	37.5	6.6	112
30	37.8	4.1	77
60	37.4	3.8	59
90	37.3	3.8	51
120	37.3	3.8	44
150	37.4	3.8	39

Source: *Nguyen Thi Loc et al., 2001.*

The present study has shown that including about 40% ensiled cassava roots (ECR) in diets for growing pigs did not affect their growth performance **(Table 2).**

Table 2. Effect of different levels of ensiled cassava roots in the diets of growing pigs on their performance.

	Treatments[1)]					
Item	Control	20 ECR	40 ECR	60 ECR	SEM[2)]	P[2)]
No. of pigs (head)	9	9	9	9		
Live weight (kg)						
- initial	18.6	18.7	18.5	18.6	0.36	0.9
- final	89.2a	89.6a	86.5a	70.2b	0.84	0.001
Daily weight gain (g/day)	588a	591a	567a	428b	11.1	0.001
Feed in take (kg/day)	2.07a	2.09a	2.02a	1.78b	0.01	0.001
Feed conversion ratio[3)]	3.52a	3.54a	3.56a	4.16b	0.09	0.001

[1)] 20 ECR, 40 ECR, 60 ECR, diets containing 20, 40 and 60 % ensiled cassava roots (as DM)
[2)] SEM= Standard error of the mean; P=Probability
[3)] Feed conversion ratio= Feed intake/weight gain;
Source: *Nguyen Thi Loc et al., 2000.*

Under village conditions, the inclusion of 30% ECR (as DM) increased the daily weight gain by 5.7% and reduced feed cost by 7.3 % (**Table 3**).

Table 3. Effect of using 30% ECR (as DM) in diets of growing pigs on their performance under village conditions.

Item	Control	ECR
Live weight (kg)		
- intitial	27.79	28.75
- final	61.90	64.68
Daily weight gain (g/day)	378.90	400.50
Feed conversion ratio (FCR)	4.34	4.10
Feed cost/kg gain (VND)	7,237	6,711

Source: *Nguyen Thi Hoa Ly et al., 2001.*

However, a higher proportion of ECR in the diet may cause an imbalance in amino acid concentrations, particularly methionine. Studies on supplementation of methionine show that inclusion of 0.1, 0.2 and 0.3% (as DM) could increase the daily weight gain and reduce the feed conversion ratio (FCR) and feed cost **(Table 4).**

Table 4. Effect of DL-methionine supplementation in ECR-based diets on performance of pigs and feed cost.

	DL-methionine inclusion (% as DM)					
Item	0	0.1	0.2	0.3	SEM	P[1)]
Daily weight gain (g/day)	568	661	649	628	12.05	0.01
Daily feed intake (kg)	2.09	2.12	2.09	2.10	0.02	0.42
Feed conversion ratio	3.67	3.47	3.21	3.34	0.03	0.001
Feed cost/kg gain ('000 VND)	8.4	7.9	7.7	8.8	0.06	0.001
Feed cost (% of control diet)	100	95	91	97		

[1)] SEM = Standard error of the mean; P = Probability
Source: Nguyen Thi Loc *et al.*, 2001.

A higher level of digestibility of organic material and crude protein was obtained with supplementation of 0.1, 0.2 and 0.3% (as DM) DL-methionine in ECR-based diets for pigs. Inclusion of DL-methionine in the diet significantly reduced the amount of N secreted in the urine, increased the retention of N and improved the performance of growing pigs (**Table 5**).

Table 5. Effect of DL-methionine in ECR-based diets on ileal and total tract digestibility, and N-retention in growing pigs.

	DL-methionine inclusion (% as DM)					
Item	0	0.1	0.2	0.3	SEM[1)]	P[1)]
Ileal digestibility of DM (%)	78	80	82	82	1.04	0.07
Total tract digestibility of DM (%)	86	87	90	90	0.21	0.26
Daily N-retention (g)	19.3	20.1	21.9	20.8	0.49	0.02
N-retained/N-digested (%)	58	59	63	62	0.77	0.002

[1)] SEM =Standard error of the mean; P = Probability
Source:*Nguyen Thi Loc et al., 2001.*

Ensiled Cassava Leaves for Feeding Growing Pigs and Sows

1. Making silage

At root harvesting time, about 5 t/ha of fresh leaves and about 7 t/ha of total foliage (Ngoan and Duong, 1993) can be harvested. However, cassava leaves are seldom used for feeding animals. Cassava leaves have high levels of crude protein (20-30%) and are a good source of protein for animals, but their high content of cyanide limits their use as an animal feed.

Making silage of cassava leaves reduces their HCN content and this was found to be a practical method (Loc, 1996). Trials on the use of various additives for ensiling the leaves indicate that inclusion at 5% of rice bran, molasses or cassava root meal, which are common feed sources in the market, enhanced the natural fermentation process (Loc, 1996; 2000). The authors reported that the pH of the silage decreased quickly within one week after ensiling and that the HCN content decreased about 50% after 56 days of ensiling (**Table 6**).

Table 6. Effect of various additives on the pH and HCN (ppm) content at different times (days) after ensiling.

	Days of ensiling											
Treatments[1)]	0	7	14	21	28	56	0	7	14	21	28	56
	pH						HCN (ppm on fresh basis)					
T_1	6.7	4.3	4.1	4.1	4.2	4.2	302	284	226	192	189	141
T_2	6.6	3.7	3.7	3.6	3.6	3.6	291	250	233	164	126	120
T_3	6.6	3.7	3.7	3.6	3.6	3.6	276	220	212	177	106	102
T_4	6.7	4.1	3.9	3.8	3.8	3.8	287	258	237	171	143	110
T_5	6.7	4.0	3.9	3.8	3.8	3.8	274	235	221	192	125	112
T_6	6.7	4.1	4.0	3.8	3.8	3.8	283	231	215	172	137	103
T_7	6.7	4.2	3.9	3.9	3.9	3.9	269	240	217	134	130	91

[1)] T_1 = Cassava leaves + 0.5% NaCl; $T_2 = T_1$ + 5% molasses; $T_3 = T_1$ + 10% molasses; $T_4 = T_1$ +5% cassava root meal (CRM); $T_5 = T_1$ + 10% CRM; $T_6 = T_1$ + 5% rice bran; $T_7 = T_1$ + 10% rice bran.

In diets for growing pigs, inclusion of 15% (as DM) of ensiled cassava leaves (ECL) increased the daily weight gains, and reduced FCR by 6.1% and feed cost by 25% (**Table 6**).

Table 7. Effect of using 15% ensiled cassava leaves in the diet of growing pigs on their performance.

Item	Control	15% ECL
Live weight (kg)		
- initial	24.2	24.3
- final	58.6	60.8
Daily weight gain (g/day)	382	405
Feed conversion ratio (FCR)	4.9	4.6
Feed cost/kg gain (VND)	7,904	5,879

Source: *Nguyen Thi Hoa Ly et al., 2001.*

Additionally, pregnant sows fed 15% ECL improved the live weight gain of piglets at weaning time (**Table 8**).

Table 8. Effect of using ensiled cassava leaves during pregnancy on reproductive traits of Mong Cai sows under farm conditions.

	Control	15 ECL	SEM[1)]	P[1)]
No. of live piglets born	11.3	10.3	1.06	0.535
Average piglet weight (kg)	0.68	0.70	0.015	0.209
No. of piglets weaned	9.75	9.14	0.925	0.632
Average weight of weaned pigs (kg)	6.9	7.5	0.11	0.010

[1)] SEM = Standard error of the mean; P = Probability

CONCLUSION

Cassava roots and leaves can be used effectively for feeding growing pigs and pregnant sows. However, the low protein content of roots and an imbalance of essential amino acids in leaves could limit their inclusion in pig diets.

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