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Research on Efficiency of Using Cassava Chip as Based Energy and Local Legume as Protein Supplement in Concentrate for Feeding Dairy Heifer Replacement

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Abstract The result revealed that initial weight of heifers were not significant but weight increase T1 was the highest weight increase among all four groups at the growth rate of 94.50 kg. or 0.45 kg./day later were T2 89.75 kg. or 0.43 kg./day T3 84.25 kg. or 0.40 kg/day and the lowest weight increase was T4 82.75 kg. or 0.40 kg./day respectively. Statically there were no significant different between T1 and T2 as same with T3 and T4 but significantly different from T1and T2 with T3 and T4 at the highly significant level of $p<0.01$ because in T2, T3 and T4 increasing local legume as protein feed supplement but in T1 was not increasing local legume so T1 have growth rate more than the others because in T1 can consume more protein (not mixed local legume) than the other groups (mixed local legume) the result showed as same research of Virapol (2011). Total feed consumption T1 was the highest consumer at 4,116.50 kg. or 19.60 kg./day later were T2 3,981.25 kg. or 18.96 kg./day. T3 3,976.25 kg. or 18.94 kg./day and the lowest was T4 3,973.50 kg. or 18.92 kg./day. There were no significantly different among T2, T3 and T4 but significantly different with T1 at the highly significant level of $p < 0.01$. Total cost of feed consumption T1 was the highest cost of feed consumption at 13,065.75 Baht or 62.21 Baht./day later were T2 10,986.38 Baht or 52.32 Baht./day, T3 10,973.13 Baht or 52.26 Baht./day and the lowest was T4 10,961.00 Baht or 52.208 Baht./day. There were no significantly different among T2, T3 and T4 but highly significant different from T1 at $p < 0.01$. Counting the cost of feed conversion rate, it was found that T1 used the highest cost at 138.25 Baht. respectively, T2 was at 132.91 Baht. T4 132.53 Baht. And the lowest was T3 at 130.38 Baht. Statically, T2,T3 and T4 were not different. but significantly different from T1 at $p < 0.01$. The experiment revealed that local legume used as protein feed supplement significantly different to feed conversion rate and as same with the cost of feed conversion rate in feeding dairy heifer also. This result mean local legume can be used for feeding animals to replace protein food that more expensive than local legume for save the cost of feeding dairy heifer butprotein from concentrate food had more efficiency than local legume in this experiment.

Keywords: Cassava chip, Local legume, Leuceana leaf, Dry soilbean, Saman leaf, Dairy heifer replacement.

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Introduction

The main problem in feeding and raising dairy cow to produce high quality and quantity of milk production are the source of food included roughage and concentrate even premixed (Virapol, 2013). At present the increasing gaps between supply and demand of protein rich (milk and meat) undated population growth, unemployment and income efficiency among farmers in developing country particularly in Southeast Asian nations. Nutrition represents one of the most serious limitations to livestock production in the developing countries. Feed resources are inadequate in both quality and quantity particularly during dry season. (Maetha, 1997) The main barriers in the dairy cattle farms are feed for dairy cattle and forage crops which are the main food for cattle. In dairy farming, feed is more dedicated to cattle than other species because the animals must be used to produce milk, meat and others. The space of land for use as a forage crop has decreased steadily and the quality of the food was poor in quality deterioration as well. In addition, a highly competitive economy make a career in agriculture has been declining throughout the world. These are affecting the agricultural products especially cassava. Cassava farmers who suffered heavy losses requested for government intervention. (LDD, 2009) Therefore, many researchers tried to find a way to transform cassava to other products and also to improve the use of cassava as animal feed to reduce cassava over supply. Cassava contains protein, fat and starch which are the sources of energy that are easily digestible for animals as well as the microorganisms living in the rumen of cattle (Virapol, 2011) Also with local legume are the sources of natural protein food that are growing plenty in the natural area and that are easily to find with low cost for feeding ruminant animal especially in dairy heifer replacement that will become a good dairy milking cows in the future.

Therefore, this research was studied by using cassava chip and local legume which are easily find in the field of agricultural areas for feeding dairy heifer replacement.The experiment aimed to find energy sources and protein supplements which available as local feedstuffs and costly. Farmers could implements or applies for a successful career in the dairy assets.

Objectives:

1. To study on effect of using cassava chip as based energy and local legume as protein supplement for feeding dairy heifer replacement.
2. To study on growth rate performance of dairy heifer fed the experimental diets
3. To be a guide line for implementation of agricultural products as a source of food energy and protein supplements for livestock and ruminant animal
4. Estimate the economic returns when use cassava and local legume for fed dairy heifer replacement.

Materials and methods

The experiment was conducted at Faculty of Agriculture and Natural Resourses, Rajamangala University of Technology Tawan-ok, in Chonburi province during October 2016-September 2017. Sixteen dairy heifers were 62.50-75.00% Holstein Friesian. Each animal was weighted bi-weekly for 210 days. The animals were grouped according to age and weight, designated into 4 treatments with 4 replications per treatment and arranged in a Completely Random Design (CRD.). The dietary treatments were as follows:

Treatment 1 (T I)	para grass + cassava chip + concentrate (control)
Treatment 2 (T II)	para grass + cassava chip + concentrate mixed leucaena leaf
Treatment 3 (T III)	para grass + cassava chip + concentrate mixed dry soilbean
Treatment 4 (T IV)	para grass + cassava chip + concentrate mixed saman leaf

For each day of the experimental period, every heifers were fully fed with para grass as roughage. They also fed cassava chip about 1% of body weight and fresh local legume about 1% of body weight. All heifers lived in separated confinements which had water and mineral bricks. Heifers were fed a half of feed in the morning (7.00 am) and the other half in the evening (17:00 PM). Experimental data was collected during a period of 210 days of experiment. Heifer weight gains were recorded every two weeks by weighed in the morning before feeding time until the end of the experiment and also measured the increase in the economic importance performances of the heifers as: height of wither, heart girth, body length and barrel girth.

For calculate the feed intake of heifers throughout the experiment, weighing the amount of food fed to the heifers and all the rest of feed were collected every day. The methods for analysis of the nutritional value were conducted by proximate analysis (DM, CF, CP, NFE, EE and Ash). The efficiency of digestion of heifers, performance changes based on the weight gain, cost of weight gain per 1 kg., costs to economic benefits, income, and other important economic traits were calculated. The data were analyzed variability in CRD experimental design and calculated the mean difference by Duncan 's New Multiple Range Test (Gomez and Gomez, 1984).

Results

The proximate chemical composition of para grass, cassava chip, leucaena leaf, dry soilbean and saman leaf are presented in Table 1.

Table 1. Proximate chemical analysis

ITEM	DM	CP	CF	NFE	EE	Ash
para grass	69.48	4.28	25.55	29.01	3.26	7.38
concentrate	80.22	16.02	15.74	34.68	7.65	6.13
cassava chip	87.00	4.0	29.88	41.67	3.55	7.89
leucaena leaf	75.04	14.25	16.21	31.92	5.62	7.04
dry soilbean	77.65	12.82	18.79	30.31	6.89	8.84
saman leaf	76.84	12.75	18.52	31.60	6.25	7.99

Means with different letter superscripts are highly significant at $p < 0.01$

Table 2. Body weight, body measurement and feed efficiency.

ITEM	Treatment			
	I	II	III	IV
Duration (day))	210	210	210	210
Number of animal (head)	4	4	4	4
Initial body weight (kg.)	178.25	178.00	177.50	178.25
Final body weight (kg.)	272.75	267.75	261.75	261.00
Total body weight gain (kg.)	94.50^{a}	89.75^{ab}	84.25^{bc}	82.75^{c}
Average daily body weight gain (kg.)	0.45^{a}	0.43^{a}	0.40^{b}	0.40^{b}
Height of wither (cm.)	33.25^{a}	29.25^{ab}	27.25^{bc}	25.00^{c}
Heart girth (cm.)	23.00	22.25	81.40^{a}	82.60^{a}
Body length (cm.)	32.75^{a}	28.75^{ab}	26.25^{b}	25.25^{b}
Barrel girth (cm.)	37.75	33.25	32.25	31.50
Feed conversion rate per 1 kg.	43.59^{a}	44.54^{ab}	47.24^{bc}	48.04^{c}

Means with different letter superscripts are highly significant at $p < 0.01$.

The result revealed that initial weight of heifers were not significant but weight increase T1 was the highest weight increase among all four groups at the weight gain or growth rate of 94.50 kg. or 0.45 kg./day later were T2 89.75 kg. or 0.43 kg./day T3 84.25 kg. or 0.40 kg/day and the lowest weight increase was T4 82.75 kg. or 0.40 kg./day respectively. Statically there were no significant different between T1 and T2 as same with T3 and T4 but significantly different from T1and T2 with T3 and T4 at the highly significant level of $p<0.01$. Feed conversion rate per 1 kg. T4 was the highest rate at 48.04 kg. later were T3 47.24 kg. T2 44.54 kg. and the lowest was T1 43.59 kg.. There were no significantly different with T1 and T2 as sme with T3 and T4 but highly significant from T1 and T2 with T3 and T4 at $p < 0.01$. because in T2, T3 and T4 increasing local legume as protein feed supplement but in T1 was not increasing local legume, the result showed that T1 feed with concentrate not mixed local legume have growth rate more than the others that mixed local legume.

Table 3. Feed consumption.

ITEM	Treatment			
	I	II	III	IV
Total para grass intake (kg.)	3,189.25[a]	3,048.00[b]	3,046.25[b]	3,045.25[b]
Average daily para grass intake (kg.)	15.19[a]	14.51[b]	14.63[b]	14.50[b]
Total cassava chip intake (kg.)	470.00	470.75	466.25	466.00
Average daily cassava chip intake (kg.)	2.24	2.24	2.22	2.22
Total concentrate and concentrate mixed local legume intake (kg.)	457.25	462.00	463.75	462.25
Average daily concentrate and concentrate mixed local legume intak (kg.)	2.18	2.20	2.21	2.20
Total feed intake (kg.)	4,116.50[a]	3,981.25[b]	3,976.25[b]	3,973.5[b]
Average daily feed intake (kg.)	19.60[a]	18.96[b]	18.94[b]	18.92[b]

Means with different letter superscripts are highly significant at $p < 0.01$

Total feed consumption(intake) T1 was the highest consumer at 4,116.50 kg. or 19.60 kg./day later were T2 3,981.25 kg. or 18.96 kg./day. T3 3,976.25 kg. or 18.94 kg./day and the lowest was T4 3,973.50 kg. or 18.92 kg./day. There were no significantly different among T2, T3 and T4 but significantly different with T1 at the highly significant level of $p < 0.01$.

Table 4. Feed cost,cost of weight gain per 1 kg. and feed conversion rate

ITEM	Treatment			
	I	II	III	IV
Total cost of para grass	6,378.50[a]	6,096.00[b]	6,092.50[b]	9,090.50[b]
Cost of para grass per day	30.38[a]	29.03[b]	29.01[b]	28.95[b]
Total cost of cassava	2,115.00	2,118.38	2,098.13	2,097.00
Cost of cassava per day	10.07	10.09	9.99	9.99
Total cost of local legume	4,572.50[a]	2,772.00[b]	2,782.50[b]	2,773.50[b]
Cost of local legume per day	21.77[a]	13.20[b]	13.25[b]	13.21[b]
Total cost of feed	13,065.75[a]	10,986.38[b]	10,973.13[b]	10,961.00[b]
Average daily cost of feed	62.21[a]	52.32[b]	52.26[b]	52.20[b]
Cost of weight gain per 1 kg.	138.35[a]	132.91[b]	130.38[b]	132.53[b]

Means with different letter superscripts are highly significant at $p < 0.01$.

Total Feed cost consumption T1 was the highest cost of feed consumption at 13,065.75 Baht or 62.21 Baht./day later were T2 10,986.38 Baht or 52.32 Baht./day, T3 10,973.13 Baht or 52.26 Baht./day and the lowest was T4 10,961.00 Baht or 52.208 Baht./day. There were no significantly different among T2, T3 and T4 but highly significant different from T1 at $p < 0.01$. Counting the cost of feed conversion rate, it was found that T1 used the

highest cost at 138.25 Baht. respectively, T2 was at 132.91 Baht. T4 132.53 Baht. and the lowest was T3 at 130.38 Baht.. Statically, T2, T3 and T4 were not different but highly significant from T1 at $p < 0.01$. The experiment revealed that local legume used as protein feed supplement significantly different to feed conversion rate and as same with the cost of feed conversion rate in feeding dairy heifer also.

Discussion

The result revealed that initial weight of heifers were not significant but weight increase T1 was the highest weight increase among all four groups at the growth rate of 94.50 kg. or 0.45 kg./day later were T2 89.75 kg or 0.43 kg./day T3 84.25 kg. or 0.40 kg/day and the lowest weight increase was T4 82.75 kg. or 0.40 kg./day respectively. Statically there were no significant different between T1 and T2 as same with T3 and T4 but significantly different from T1and T2 with T3 and T4 at the highly significant level of $p<0.01$ because in T2, T3 and T4 increasing local legume as protein feed supplement but in T1 was not increasing local legume so T1 have growth rate more than the others because in T2, T3 and T4 were increasing local legume as protein feed supplement but in T1 was not increasing local legume so in T1 can consume more high protein(not mixed local legume) than the other groups the result wasc similar to Virapol (2011).

Total feed consumption T1 was the highest consumer at 4,116.50 kg. or 19.60 kg./day later were T2 3,981.25 kg. or 18.96 kg./day. T3 3,976.25 kg. or 18.94 kg./day and the lowest was T4 3,973.50 kg. or 18.92 kg./day. There were no significantly different among T2, T3 and T4 but significantly different with T1 at the highly significant level of $p < 0.01$. Feed conversion rate per 1 kg. T4 was the highest rate at 48.04 kg. later were T3 47.24 kg. T2 44.54 kg. and the lowest was T1 43.59 kg.. There were no significantly different with T1 and T2 as sme with T3 and T4 but highly significant from T1and T2 with T3 and T4 at $p < 0.01$. because in T2, T3 and T4 increasing local legume as protein feed supplement but in T1 was not increasing local legume, the result showed that T1 feed with concentrate not mixed local legume have growth rate more than the others that mixed with local legume as reported by Virapol (2013).

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