The Use of Sugarcane Stalk for Feeding Lactating Cows

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ABSTRACT : The use of chopped sugarcane stalk (CSS) as a roughage for lactating cows was examined using four Holstein crossbred cows in a private dairy farm in Khon Kaen, Thailand, in comparison with rice straw (RS), which is the conventional roughage in the dry season in the region. Cows were subjected to the following two dietary treatments: Diet 1) RS with commercial concentrate feed, and Diet 2) CSS and RS with commercial concentrate feed. The diet was switched over every 3 weeks. The amount of concentrate was determined by the experience of the owner of the cows. RS and CSS were given *ad libitum*. There was no difference in milk production between two groups, although the total DMI was less in cows fed CSS. Solid-not-fat (SNF) content in milk was significantly higher in the cows given CSS. The NEFA content was significantly lower in the animals given CSS, which suggested that cows given only RS as roughage would be suffering from energy malnutrition. Therefore, it was considered that CSS feeding improved energy supply, which resulted in higher SNF in milk. In the nutritional point of view, the present study clearly showed CSS can be used as a roughage for dairy cows in the dry season. ***(Asian-Aust. J. Anim. Sci. 2002. Vol 15, No. 2 : 205-208)***

Key Words : Lactating Cows, Sugarcane Stalk, Milk Production, Milk Composition

INTRODUCTION

The number of dairy cows is dramatically increasing in Northeast Thailand in the last decade. However, the milk yield is still low (average 9.4 kg per day, Udchachon et al., 1996). Although there are complex reasons for the low milk yield, one of the main reasons would be a problem of feed. The situation is worsened in the dry season, as the production system highly relies on rice straw as roughage. Although urea treatment of rice straw has been promoted for dairy farmers, the adoption of by farmers is still very low (Udchachon et al., 1996).

The previous study (Kawashima et al., 2001) shows that chopped sugarcane (*Saccharum officinarum*) stalk (CSS) can be used as a roughage source for cattle in the dry season. The present study is aimed of examining the validity of sugarcane stalk as a roughage for lactating cows in comparison with the conventional feeding system.

MATERIALS ANS METHODS

One private dairy farm in Khon Kaen province, Thailand was selected to conducted this study. Four milking cows were used for the trial. The details of each cow at the beginning of trial are shown in table 1. The cows were crossbreeds of Holstein-Friesian. The blood from Holstein-Friesian would be more than 75% and the remaining would be from either native, Brahman or Sahiwal, although it could not be certified.

Cows were divided into 2 groups, and subjected to the following dietary treatments:

Diet 1) CSS and rice straw (RS) with commercial concentrate (CC) feed.

Diet 2) RS with CC.

First group was assigned to diet 2, followed by diet 1 and then diet 2. Second group was assigned to diet 1, followed by diet 2 and then diet 1. The treatment for the first group was commenced in advance, which defined as period 1. Then two groups were given the same feed in periods 2 and 3. And then in period 4, trial was continued only with second group, which was given diet 1. The feeding management became simple by this design, although the effect of environment could not be separated.

The duration of each period was 3 weeks. The CSS and CC were given two times a day. The amount of CSS was more than that the cows could consume within several hours. RS was always filled up in the trough in both treatments. The consumption of CSS by individual cows was measured at every meal. The consumption of RS was measured as a total of two cows in each group. The amount of CC given was determined by the owner of the farm from his experience based on milk yield and body condition of the cow.

The CSS given to the animals was U-Tong 1 variety. The variety was developed by Suphanburi Field Crops Research Center, using polycross method with F 172, which was a female parent. This variety was registered and recommended by the Department of Agriculture, Ministry of Agriculture and Co-operatives, Thai government in 1986. The sugarcane yield is 94-125 t/ha in irrigated area and 75-94 t/ha in rain-fed area. Commercial Cane Sugar is 11-12. It has good ratooning ability. And it is resistant to smut

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Table 1. The details of cows at the beginning of the trial

Cow No.	Age (years)	BW (kg)	Pregnancy	No. of calves born	The latest calving
1	6	445	Not pregnant	3	3 month ago
2	3	387	Not clear	1	2 month ago
3	6	449	Pregnant (5 month)	3	6 month ago
4	4	355	Pregnant (6 month)	1	7 month ago

disease and tolerant to stem borer (Boontum and Thumtong, 1997).

The harvest period of sugarcane is generally from the beginning of December to the beginning of May in the region, which is the dry season. The present study was carried out from February 19 to May 15. The CSS given to the animals had been grown for more than one year and less than one and a half years, and was already matured and ready to be harvested for sending to the sugar mill. The sugarcane stalk was cut by hand at ground level, removed top and trash every three or four days, and kept under shade until chopped with conventional forage chopper just before given to the cows. Each cow was milked at 07:00 and 17:00 h, and the yield was measured every time. The milk sample was collected at the end of each period, added sodium azide and kept in the refrigerator until analysis. The body weight was measured at the beginning and the end of each period by a portable electric balance. The blood samples were taken in heparinized tubes from vein of tail at the end of each period about 3 h after feeding, chilled on ice and centrifuged to separate the plasma.

Glucose and urea nitrogen in blood plasma were measured using diagnostic kits (Biotech Reagent, Thailand) based on enzyme-calorimetric method. Total protein content in blood plasma was measured using diagnostic kits (Biotech Reagent, Thailand) based on Biuret method. Plasma non-esterified fatty acid (NEFA) was measured using diagnostic kits (NEFA C-Test Wako, Wako Pure Chemical Industries, Ltd., Japan). The DM, CP, ether extract (EE), crude fiber (CF) and ash in feed were determined by the method of AOAC (1975). Fat, protein, lactose, total solid (TS) and solid not fat (SNF) contents in milk were measured by Milko Scan (Foss Electric, Denmark).

A general linear model (SAS, 1990) was used to analyze all data as randomized block design. The model included dietary treatment as main factor and individual animal as block. The effect of environment was neglected.

RESULTS

The chemical composition of feed is shown in table 2. The CP and CF were lower in CSS than in RS, while NFE was higher in CSS. The NFE content of CSS was lower in period 4 than in period 2.

Feed consumption, milk production, milk composition and the change of body weight are shown in table 3. There was no significant difference in milk production. However, it tended to be higher in the cows fed with CSS than in those fed only RS as roughage, although the total DMI was less in the cows fed CSS. There was no difference in milk fat content between two groups. Protein content tended to be higher in the milk of cows given CSS. The SNF was significantly higher in the cows given CSS. There was no difference in body weight change between two groups.

Hematocrit, total protein, urea nitrogen (PUN), glucose and NEFA contents in blood plasma are shown in table 4. Glucose and NEFA contents were significantly lower in the animals given CSS. The PUN contents tended to be lower in the animals given CSS ($p=0.057$).

DISCUSSION

NFE content of CSS was lower in period 4 than in period 2. Period 4 was the end of the dry season. In the year that the present study was conducted, rain started relatively earlier. Some of the nutrient would have been either mobilized for ratooning or lost by fermentation due the change of weather. Thus, NFE was decreased in period 4 and consequently CF was increased.

There was no significant difference in milk production and body weight change between two treatments. The milk production, however, tended to be higher in the cows given CSS than those given only RS in spite of the lower DMI. According to Standard tables of feed composition in Japan (Agriculture, Forestry and Fisheries Research Council Secretariat, 1995), metabolizable energy (ME) content of

Table 2. Chemical composition of feed (%DM)

	DM[a] (%)	CP	EE	CF	Ash	NFE
Commercial concentrate	92.7	18.8	0.7	27.2	7.2	46.1
Rice straw	91.4	4.7	1.2	44.7	11.5	37.9
Sugarcane stalk (period 2)	26.7	2.0	0.0	23.0	1.8	73.2
Sugarcane stalk (period 4)	23.1	1.4	0.4	36.9	1.3	60.0

[a] DM, dry matter; CP, crude protein; EE, ether extracts; CF, crude fiber; NFE, nitrogen free extracts.

Table 3. Feed consumption, milk production, milk compostion and body weight change of cows given sugarcane stalk or rice straw

Treatment	Rice straw[a]	Sugarcane[b]	S.E.[c]
Consumption of concentrate feed (kgDM/day)	6.56	5.94	0.35
Consumption of rice straw (kgDM/day)	6.83	1.14	0.31
Consumption of sugarcane stalk (kgDM/day)	-	5.22	0.34
Milk production (kg/day)	8.6	9.0	0.3
Milk composition (%)			
Fat	3.49	3.50	0.25
Protein	3.42	3.70	0.08
Lactose	4.16	4.17	0.05
Total solid	11.77	12.07	0.29
Solid not fat	8.28	8.57*	0.08
Body weight Change (kg/3weeks)	5.0	7.0	9.4

[a] Chopped sugarcane stalk and rice straw with commercial concentrate.
[b] Rice straw with commercial concentrate.
[c] Standard error. * Significant difference $p<0.05$.

Table 4. Hematocrit, total protein, glucose and NEFA in plasma of cows given rice straw or sugarcane stalk

		Rice straw	Sugarcane	S.E.
Hematocrit	%	29.3	29.0	1.0
Total protein	g/dl	7.90	7.40	0.18
PUN[1)]	mg/dl	16.8	11.7	1.57
Glucose	mg/dl	85.7	74.4*	2.4
NEFA	mEq/l	0.205	0.127**	0.013

[1)] PUN, Plasma urea nitrogen; NEFA, Non-esterified fatty acid.
*,** significant difference $p<0.05$ and $p<0.01$, respectively.

RS is 6.19 MJ/kg. While ME content of sugarcane stalk is 9.04 MJ/kg (Kawashima et al., 2001). On the basis of these figure, the ME intake from roughage was about 30% higher in the cows given CSS (totally 54.2 MJ/day) than that given only RS (42.3 MJ/day). With an assumption that the ME content of CC was 12 MJ/kg, the cows given CSS consumed 4.5 MJ higher ME. Blood NEFA content is considered to reflect the mobilization of fat as an energy source. The difference in NEFA suggested that body fat was mobilized more in the cows given only RS in order to compensate the shortage of energy intake.

One typical effect of CSS feeding was found in SNF, which was higher in the cows given CSS. Sutton (1989) suggested that increasing energy intake is the most reliable means of increasing milk protein concentration. In the present study, the cows given only RS might be suffering from energy malnutrition as mentioned in the previous paragraph although there was no significant difference in body weight. The CSS might have eased energy malnutrition and consequently milk protein was improved.

There were some reports (Obara et al., 1994 and Sutoh et al., 1996) suggesting that sucrose supplementation resulted in an improvement in the efficiency of nitrogen retention in trials with sheep given lucerne hay as a basal diet. The sugarcane stalk utilized in the present study was already matured and considered to include 40-50% of sucrose on the basis of DM although sucrose content might be lower in period 4 due to the reason mentioned previously. Obara et al. (1994) reported that sucrose supplementation resulted in a decrease in the urinary nitrogen excretion rate and therefore an increase in nitrogen retention, which was accompanied with decreases in the ammonia concentration in the rumen and the plasma urea concentration. In the present study, a similar trend was found in the plasma urea concentration. Therefore, the effect of sucrose on protein metabolism would be another reason for higher SNF. While, in the studies of Obara et al. (1994) and Sutoh et al. (1996), the plasma glucose concentration tended to increase with sucrose supplementation, it was significantly decreased in the cows given CSS in comparison with the cows given only RS. There may be some difference between lactating cows and wethers in the physiological response to sucrose.

The present study was carried out at a private farm with lactating cows belonging to the farmer in order to see a possibility to practically utilize CSS as a roughage for lactating cow in the dry season. In the nutritional point of view, the present study clearly showed CSS can be used as a roughage for lactating cows. However, the utilization of CSS as a roughage for dairy cows highly depends on the cost of the sugarcane. Quantity and quality of supplement should be also examined in order to cut down the cost of feed and to make the production effective.

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