

Production responses of Lactating cows fed urea - treated rice straw compared to untreated rice straw supplemented with Leuceana Leaves. 278

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SUMMARY

Six cross-bred Holstein - friesian Lactating cows were used to investigate milk production and milk composition response after being fed 4% or 6% urea treated rice straw or untreated rice straw plus Leuceana Leaves for 84 days. All rice straw was treated by exposing unchooped straw to urea solution (6% or 4% + 100% water, W/W). The straw stacks were stored for at least 3 weeks. The treated rice straw was aerated until no odour of ammonia could be noticed.

The supplemented sundried Leuceana Leaves were supplied in a fixed amount (1.5 kg/d) on an ad lib diet of untreated rice straw.

There were no significant differences ($p > .25$) in dry matter intake between groups fed 6% urea - treated straw (11.23 kg/d), 4% Urea - treated straw (10.7 kg/d) or untreated straw plus Leuceana Leaves (11.12 kg/d).

Further, no significant differences between treatment mean ($p > .25$) were found for milk production and milk composition : 8.8 kg/FCM/d, 8.4 kg FCM/d and 8.5 kg FCM/d respectively, 3.7%, 3.7% and 3.4% milk fat respectively and 3.5%, 3.5% 3.4% milk protein respectively.

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Introduction

Crops residues from agricultural operations are extremely large in relation to primary products in South - East Asia. Many attempts have been intensified in this region to make better use of main crop residues. Rice straw, represents the main by-product in Thailand and always form the main roughage supply for cattle and buffalos during the dry season.

Parameters of production are reported to decrease, if rice straw forms the main component of the ration (LBS, Chiang Mai, 1979) and remains unchanged by supplementing straw rations by concentrates (Promma et al. 1982). Treatment of rice straw with urea has been shown to increase voluntary dry matter intake (Promma et al. 1982; Wanapat et al. 1982). Feeding urea treated rice straw could heifers (Perdock et al. 1982) and growing steers (Wanapat et al. 1982). Positive production responses in buffaloes were recorded with diets containing urea treated rice straw (Perdock et al. 1982) and in cross-bred Lactating cows (Promma et al. 1984; Rengsirikul and Chairatanayuth, 1984)

Treatment of rice straw with urea has been done by using 4% urea (Perdock et al. 1982) or 5% urea (Saadullah et al. 1982; Verma et al. 1982; Wanapat et al. 1982) or 6% urea (Promma Et al 1982; Rengsirikul and Chairatanayuth, 1984). Similar results have been reported and confirmed that treatment of rice straw with urea seem to be the most practical method in South - East Asia.

Supplementation of rice straw with Leucaena Leaves in dairy bull calves was investigated by: Cheva-Isarakul and Potikanond, 1984. Dry matter intake, weight gains and feed conversion were similar to group being offered urea treated rice straw, when fed with concentrates. Consequently, this method may be useful in the Dairy area where Leuceana Leaves are available.

This experiment was carried out: 1. to investigate the production responses of Thai-crossbred: Holstein-friesian Lactating cows on urea treated rice straw compared to untreated rice straw supplemented with Leuceana Leaves, 2. to compare economic results of Lactating cows being offered 4% urea treated straw, 6% urea treated straw and untreated straw supplemented with Leuceana Leaves in completion with concentrates.

Materials and Methods

Urea treatment of rice straw

All rice straw is treated with 4% or 6% urea and 100% water W/W. Sheets of plastic are spread and have to overlap to provide an adequate seal against the floor surface. Rice straw is spreaded uniformly over the plastic bottom. Part quantity of water is sprinkled over the straw using a sprinkling can. The rest is used to dissolve Urea (4% or 6% of urea) and the solution is sprinkled over the straw again. Next layer is treated in the same way, until the stack contains the required quantity (500-1000 kg). The stack is sealed off by using plastic sheets overlapping each other. Covering sheets are folded at its bottom and pushed under the ground sheet. Shading is done by using used gunny bags, palm Leaves or bundles of straw. The straw heap is stored for a Least 3 weeks. All treated rice straw needs to be aerated until no adour of ammonia can be noticed.

This experiment was conducted at Chiang Mai Livestock Breeding Station, Thailand, throughout the dry season of 1984. 6 cross-bred Holstein friesian lactating cows were selected 1 week after second daving, with similar blood, body weight, milk production/day and similar milk production in first lactation period. All Lactating cows were dewormed and randomly allocated in a balanced design for 3 periods of 28 days, the cow got 3 different treatments which are given below.

1. 6% urea treated rice straw (ad libitum) + concentrated (rationing)
2. 4% urea treated rice straw (ad libitum) + concentrates (rationing)
3. Untreated rice straw (ad libitum) + dry Leuceana Leaves (1.5 kg/h/d) + concentrates (rationing)

Concentrates were prepared based on 12% digestible protein and 70% TDN respectively. All Lactating cows were given concentrates twice a day before milking. Milking was done by milking machine at 0500 hours and 1500 hours. Conditions of roughages were detected and measured each day. Milk samples were checked in a milk laboratory weekly throughout the experimental period. Body weight of cows were measured at the end of each period. All Lactating cows were adequately supplied with minerals and water.

The examination of feeding effects and the comparison of treatment means were done by using analysis of variance and orthogonal comparisons as described by Chantalakhana, 1980.

Results and Discussion

Straw treatment method

Treatment of rice straw with 6% urea has been done in Thailand by Promma et al. since 1979. 6% of Urea was used to ensure an adequate amount of ammonia as some of ammonia will escape between plastic layer. The small scale experiment with different levels of urea by Promma and Panichayakarn, 1983 has shown that total fixed nitrogen and dry matter digestibility of 4% urea treated aerated rice straw was similar to those 6% urea treated rice straw (p > .25) (See table 1). Total unreacted ammonia in fresh 10% urea treated straw was higher than those of 8%, 6% and 4% urea treated rice straw respectively. Consequently, 4% urea (W/W of straw) may sufficient for rice straw treatment in warm climate. Similar results regarding 4% urea treatment have been reported by Jayasuriya (1980); Jayasuriya and Perera (1982).

The chemical composition of feeds used were shown in Table 2. The results of urea treatment increased organic matter digestibility from 49.0 to 54.2 (6% ureatreated straw) and from 49.0 to 53.9 (4% urea treated straw). The average increase in crude protein was 5.1 percent units (6% urea treated straw) and 1.5 percent unit (4% urea treated straw) Crude protein content of 4% urea treated aerated rice straw was slightly lower than 6% urea treated aerated rice straw. This may be due to lower concentration of ammonia in

4% urea treated straw heap as somme of ammonia could escape between plastic layers. Consequently 4% urea treatment requires carefully sealing off or in the other hand, 4% urea treated rice straw should be fed without aeration. Feeding 4% urea treated unaerated rice straw has been done and reported by Jayasuriya, 1980; Jayasuriya and Perera, 1982; Perdock et al. 1982; Ibrahima, 1984. Feeding un-aerated treated rice straw could protect nitrogen loss by some 25% (Jayasuriya and Perera, 1982).

Lactating Cows Performance

Total voluntary intake of each diet; roughage dry matter intake weight change, milk production and milk composition are summarized in Table 3.

There were no significant differences ($p > .25$) in dry roughage intake between groups being fed 6% urea treated straw (7.20 kg/d), 4% urea treated straw (6.8 kg/d) and untreated straw plus Leuceana Leaves (7.0 kg/d), or 1.98, 1.86 and 1.95% BW/d or 86.6, 81.4 and 84.8 g/kg $W^{0.75}$ /d respectively. Total dry roughage intake in group fed untreated rice straw plus Leuceana leaves was similar to those given urea treated rice straw. This may be due to the feeding regime which all supplemented Leuceana leaves was given 1 hour prior to the untreated rice straw feeding (08:00 hours), or the supplementation of Legume leaves could increase feed intake (Lane, 1982; Sriwattana sombat and Wanapat, 1984). Nevertheless, dried Leuceana leaves were used only in one fixed ration (1.5 kg/h/d or 1.35 kg DM/h/d). More trials are needed to determine the most appropriate ratio of Leuceana leaves and rice straw.

Live weight change was similar in all treatment. Most cows were able to gain weight particularly after having passed peak production. Lactating cows being offered untreated rice straw plus Leuceana leaves tended to have slightly lower weight gain (71.8 g m/d) while cows being fed 6% urea treated straw or 4% urea treated straw showed similar weight gain (96.4 gm/d and 96.3 gm/d respectively. The lower weight gain may be due to: unproper ratio of untreated rice straw and Leuceana Leaves or insufficient digestible energy. However, there were no significant differences between treatment means ($p > .25$)

Differences in average milk production expressed as 4% FCM/hd/d or 4% FCM/hd/period were not significant ($P > .25$) for cows being fed 6% urea treated straw (8.8 kg/hd/d or 245 kg/hd/period), 4% urea treated straw (8.4 kg/hd/d or 235 kg/hd/period) and untreated straw plus Leuceana leaves (8.5 kg/hd/d or 237 kg/hd/period).

The cows being offered 4% urea treated straw tended to be slightly lower in milk production. This may be due to a lower crude protein content of 4% urea treated aerated straw compared to 6% urea treated straw (see table 2) or lower roughage dry matter intake and lower total feed intake. However, Lactating cows being offered 4% urea treated straw showed a minimum feed efficiency (see table 3)

Differences in milk composition expressed as average percentage of fat and protein in milk or fat and protein production per period were not significant ($P > .25$) for cows being fed 6% urea treated straw 4% urea treated straw and untreated straw plus Leuceana Leaves.

The animal being offered untreated straw plus Leuceana Leaves tended to show slightly lower milk fat production. This may be due to the feeding regime or the ratio of untreated straw and Leuceana Leaves supplementing by concentrates, could not meet the proper requirement.

Economic Evaluation

There were no significant differences ($p > .25$) in average net profit obtained from milk sale for cows being fed 6% urea treated straw (19.2 h/d or 575.4 h/month), 4% urea treated straw (19.15 h/d or 574.5 h/month) and untreated straw plus Leuceana Leaves (17.3 h/d or 517.8 h/month). Average net profit obtained for Lactating cows being fed urea treated rice straw was similar to those reported by Promma et al. 1984. However, it can be considered from Table 4 that while cost of diet containing Leuceana Leaves tended to be the lowest, average net profit obtained showed some particular trend. This was due to the increase of variable cost, of which 57% was used for concentrates, in cows being offered Untreated rice straw, while cows being offered 6% urea treated straw or 4% urea treated straw required 53.4% and 55.5% respectively.

Conclusion

Feeding 6% urea treated rice straw can increase Liveweight gain and animal milk production, the cows condition and production can be well maintained during the dry as well as during the rainy season (Froemert, 1983).

Feeding 4% urea treated rice straw could maintain cow's conditions and production as well as 6% urea treated rice straw. Further alternative method for Lactating cows feeding, may requires non-aerated urea treated rice straw.

The supplementation of untreated rice straw with Leuceana Leaves could provide nutrients as well as 6% or 4% urea treated rice straw. However, the combination of untreated rice straw and Leuceana Leaves should be considered for further experiments.

The relevance to the use of each diet depends on many factors: quantity of crop residue and supplementary diets and their availability, cost of operation and profitability, practicability of the method and the acceptance among the farmers.

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Table 1. Effect of urea level on fixed nitrogen, unreacted ammonia and dry matter digestibility of treated rice straw at 21 days ensiling period.

Parameter	4% Urea	6% Urea	8% Urea	10% Urea
Fixed nitrogen (%)	1.056 ^a	1.320 ^a	0.830 ^b	0.770 ^b
Untreated ammonia (%)	1.57 ^a	1.51 ^a	1.80 ^b	2.63 ^b
IVDMD (%)	45.2 ^a	43.5 ^a	46.5 ^b	43.5 ^b

(Promma and Panichayakarn, 1983)

with row, means with different superscripts are significantly different ($P > .05$)

Table 2. Chemical composition of feeds used in feeding trial for Lactating cows

Feed	Percent of dry matter						
	DM	ASH	FAT	FIBER	CP	NFE	IVDM
Concentrates mix	88.5	8.3	7.9	17.1	14.2	41.0	-
Untreated rice straw	91.1	14.6	2.8	38.4	2.6	32.6	49.0
6% urea treated rice straw	95.3	15.4	3.5	40.9	7.7	27.8	54.2
4% urea treated rice straw	96.9	15.3	3.2	41.2	4.1	33.1	53.9
Leuceana Leaves	90.0	8.0	4.4	15.1	23.0	39.5	57.3

Table 3. The performance of Lactating cow given 6% urea treated rice straw, 4% urea treated rice straw and untreated rice straw plus leuceana leaves.

Parameter	6% urea treated straw	4% urea treated straw	untreated straw + L
Roughage dry matter, intake (kg/hd/day)	7.2 ^a	6.8 ^a	7.0 ^a
(g/kg W ^{0.75} /day),	86.6	81.4	84.8
(% body weight)	1.98	1.86	1.95
Concentrates dry matter intake (kg/hd/day)	4.03 ^b	3.9 ^b	4.12 ^b
intake (kg/hd/day)	11.23	10.7	11.12
Feed efficiency (kg feed/kg FCM milk)	1.28	1.27	1.31
Milk production (4% FCM) (kg/hd/28 days)	245.0 ^c	234.9 ^c	236.0 ^c
(kg/hd/day)	8.8	8.4	8.5
Milk fat (kg/hd/28 days)	9.4 ^d	9.2 ^d	8.9 ^d
average Fat (%)	3.7	3.7	3.4
Milk protein (kg/hd/28 days)	9.03 ^e	8.62 ^e	8.9 ^e
average Protein (%)	3.5	3.5	3.4
weight changes (gm/day)	+96.4 ^f	+96.3 ^f	+71.8 ^f

* Non significant differences ($p > .25$) between treatment means are indicated by similar superscripts.

Table 4. Economic evaluation of Lactating cows fed 6% urea treated rice straw, 4% urea treated rice straw and untreated rice straw plus leuceana leaves.

Parameter	6% urea treated straw	4% urea treated straw	untreated straw + L
variable cost (₹ 100 kg milk)	336.3	326.3	331.7
Labour, feeds, antibiotic instrument, A.I., 15% interest etc.			
Stable cost (₹ 100 kg milk)	86.0	86.0	86.0
land, barn, cows, tools 15% interest, etc.			
<u>Total operation cost</u>			
(₹ 100 kg milk)	422.3	412.3	417.7
(₹/kg milk)	4.22	4.12	4.18
Average milk yield (kg/hd/day)	8.8	8.4	8.5
Milk price (₹/kg)	6.4	6.4	6.4
Net income (₹/hd/d)	19.20 ^a	19.15 ^a	17.26 ^a
(₹/hd/month)	575.4	574.5	517.8

* Non significant differences ($p > .25$) between treatment means are indicated by similar superscripts.

Table 4. Economic evaluation of Lactating cows fed 6% urea treated rice straw, 4% urea treated rice straw and untreated rice straw plus leuceana leaves.

Parameter	6% urea treated straw	4% urea treated straw	untreated straw + L
variable cost (Rs 100 kg milk)	336.3	326.3	331.7
Labour, feeds, antibiotic instrument, A.I., 13% interest etc.			
Stable cost (Rs 100 kg milk)	86.0	86.0	86.0
land, barn, cows, tools 13% interest, etc.			
<u>Total operation cost</u> (Rs 100 kg milk)	422.3	412.3	417.7
(Rs/kg milk)	4.22	4.12	4.18
Average milk yield (kg/hd/day)	8.8	8.4	8.5
Milk price (Rs/kg)	6.4	6.4	6.4
Net income ($\text{Rs}/\text{hd/d}$)	19.20 ^a	19.15 ^a	17.26 ^a
($\text{Rs}/\text{hd/month}$)	575.4	574.5	517.8

* Non significant differences ($p > .25$) between treatment means are indicated by similar superscripts.

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