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EFFECTS OF ENSILING RICE STRAW WITH UREA AND SUPPLEMENTING WITH DRIED CASSAVA LEAVES ON DIGESTION BY WATER BUFFALOES

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The effect of feeding urea-ensiled rice straw (UES) with minimal amount of dried cassave leaves (DCL) on digestibility of straw and weight change in yearling buffalo steers were studied in a 3 x 3 latin square design experiment using 6 animals. Dietary treatments were; a) untreated rice straw (UT) fed ad libitum, b) UES fed in a restricted amount based on UT consumption, and c) UES fed in a restricted amount based on UT consumption + DCL at 200 g/d. Three 7 week experimental periods were employed with 7-d preliminary, 14-d adjusting and 30-d feeding periods. Ensiling rice straw with urea for 3 weeks significantly increased digestibility of DM, OM, CP, ADF and GE. Supplementing UES with a minimal amount of DCL tended to enhance digestibility of nutrients but the differences were not significant ($P< 0.05$). Digestion coefficients determined by acid insoluble ash (AIA) and lignin (72% H_2SO_4) as internal indicators were comparable, however, the values obtained by lignin tended to be lower. Weight change of the buffaloes fed on UES (136 g/d) and UES + DCL (182 g/d) were significantly different from the weight loss of 383 g/d with buffaloes fed on UT.

Key Words: Water buffaloes, rice straw, ensiling with urea (ammonia), cassava leaves, digestibility, internal indicator, AIA, lignin, weight change.

As reviewed earlier by Wanapat (1981) there is a need for improving the quality of rice straw as a feed for ruminants during the dry season in Thailand. The low protein content of rice straw could be a factor contributing to weight losses observed in feeding experiments with ruminants (Suriyajuntratong et al 1972; Wanapat et al 1982). Doyle (1982) demonstrated that many treatments could possibly be applied to increase the nutritive values of rice straw, however, the most plausible one at present, suitable to the small farm scale, was urea-ensiling (Jayasuriya 1981; Saadullah et al 1981; Wanapat et al 1982).

Ensiling rice straw with urea for three weeks increased voluntary feed intake, digestibility and weight change of crossbred yarling dairy steers (Wanapat et al 1982). However, feeding urea-ensiled rice straw at a restricted level has resulted in similar weight gain in growing native cattle, to those which consumed treated straw ad libitum (Khan and Davis 1982). Marked increases in voluntary dry matter intake of urea-ensiled rice straw by cattle and water buffaloes were reported by Saadullah et al (1981). Jayasuriya (1981), Verma (1981), Wanapat (1982) and Wanapat et al (1982). Recently, Khan and Davis (1982) have shown that similar results in weight gain of growing cattle were obtained when the animals consumed urea-ensiled rice straw either ad libitum or at restricted level. Therefore, this experiment was designed to study the effect of supplementing urea-ensiled rice straw with minimal amounts of cassava leaves on digestibility and live-weight change in yearling buffalo steers.

Materials and Methods

Six buffalo steers weighing approximately 250 kg were allotted to three dietary treatments according to a 3 x 3 latin square design. Three seven-week periods consisting of 7-d preliminary, 14-d adjusting and 30-d feeding periods, were employed. During the feeding periods, samples of feeds and faeces (grab sampling twice a day) were collected every other week on two consecutive days. These samples were then kept in a freezer, dried in a forced-air oven at 50°C, ground and analyzed for chemical composition.

Rice straw was ensiled in long form with a solution containing ura (5%) and salt (0.3%). The ratio of straw : solution was 1:1 (w/w) and the application used was according to the method described earlier by Wanapat et al (1982). The straw was ensiled for 3 weeks at ambient temperature (30°C) before being fed to the animals in fresh form. Buffalo steers were treated for external and internal parasites before entering the experiments. Morning baths were given to the animals at regular pen clean-up. Small mud-swamps were also made available for the buffaloes to cool themselves off when necessary.

The three dietary treatments used in this experiment were: I. untreated rice straw (UT), II. urea-ensiled rice straw (UES) and III. urea-ensiled straw (UES) + dried cassava leaves (DCL). Animals in all treatments were fed untreated rice straw ad libitum for the first 7 days and then switched to the following feeding regimes: treatment I received straw ad libitum, treatment II received urea-ensiled straw at restricted level of untreated straw that was fed ad libitum during preliminary period, treatment III received the same diet as provided twice daily at 0900 and 1500 h. Water and mineralized salt were available at all times during the experimental periods. The animals were weighed at two-week intervals after 12-h fasting.

All samples of feed and feces were analyzed for dry matter (DM), crude protein (CP) and ash bu the methods of AOAC 1979, acid-detergent fiber (ADF) and acid-detergent lignin (ADL) by the methods of Goering and Van Soest (1970), acid-insoluble ash (AIA) by the method of Van Keulen and Young (1977). Gross energy (GE) was determined in a Ballastic Bomb Calorimeter. Digestion coefficients were determined by using AIA and lignin (72% H_2SO_4) as internal indicators. All data were subjected to analyses of variance and treatment means were tested for differences by Duncan's Multiple Range Test using a SAS Computer, Statistical Analysis System (SAS 1979).

Results and Discussion

Chemical composition of the feeds used in the experiment are presented in Table 1. Crude protein content of the straw was increased more than 2-fold by ensiling with urea. Acid-detergent fiber (ADF) and acid-detergent lignin (ADL) levels were higher in UES than untreated rice straw. These data were similar to the results observed by Jayasuriya (1981) and Wanapat et al (1982), but did not agree with those reported by Horton et al (1982). Dried cassava leaves (DCL) used as a protein supplement contained 26.1% CP on DM basis.

The use of lignin as a marker resulted in digestion coefficients slightly lower than did AIA. However, the values obtained by the two indicators did not differ statistically ($P< .05$). The standard error of the means was

lower when lignin rather than AIA was used as an indicator. However, digestion coefficients were comparable with both indicators which is contrary to the work reported by Herrera-Saldaña et al (1982). The slightly lower results obtained with lignin could be due to solubilization of lignin in the intestinal tract as indicated by Fahey et al (1980) and Horton et al (1982). It could concluded that using AIA as an internal indicator to determine digestibilily in straw-processed rations could be more reliable, despite somewhat higher variations.

Digestion coefficients of all nutrients were significantly enhanced for urea-ensiled straw fed to buffaloes at the restricted level. These increases were greater than the results reported by Wanapat et al (1982) for cattle and Wanapat (1982) for water buffalo steers fed UES ad libitum. Simlar increases were also obtained when using lignin (Table 5). Factors that may have influenced the increases in animals fed UES + DCL, were slower rate of passage, more available protein and carbohydrate as substrates for microorganisms in the rumen than when untreated straw was fed ad libitum.

Table 1:

Chemical composition of feeds (% of dry matter) used in the experiment.

Item	Untreated rice straw (UT)	Urea ensiled rice straw (UES)	Dried cassava leaves (DCL)
Dry matter, %	96.7	47.3	94.1
Ash, %	16.7	17.6	7.6
Crude protein, %	3.3	8.0	26.1
Acid-detergent fiber, %	54.7	62.5	38.4
Acid-detergent lignin, %	4.2	7.0	18.2
Gross energy, MJ/kg	13.9	14.1	19.2

Supplementation with a small amout of DCL to UES for buffaloes slightly improved digestion coefficients of DM. OM, CP, GE, ADF ($P<.05$) (Table 2 and 3). The increase in protein digestibility was possibly due to the nature of the DCL and/or the higher nitrogen intake. It was found that the protein solubility (in NaCl) of DCP was 24% (Wanapat and Chanthal, unpublished data), which means that more of DCL protein may escape rumen degradation.

Table 4 shows the dry matter intake and weight change of the buffaloes during the 3, 4-week experimental periods. As stated earlier, an equal roughage intake in the three groups was attempted, but the values were shown to be significantly higher than the amount fed to the animals in treatment I. The consumption of the untreated straw by the buffaloes seemed to be rather high. The animals fed on UES and UES + DCL gained at 136 and 182 g/d, respectively which was significantly ($P< 0.05$) different from a daily loss of 383 g on untreated rice straw. Similar gains were obtained previously in animals fed

Table 2:

Effect of urea ensiling and supplemental dried cassava leaves (DCL) on apparent digestibility (%) of rations using acid insoluble ash as an indicator.

Item	Untreated rice straw	Urea ensiled rice straw (UES)	UES + dried cassava leaves ±	SEM
Dry matter	49.5[a]	58.4[b]	58.5[b]	1.8
Organic matter	57.6[a]	64.6[ab]	66.3[b]	1.6
Gross energy	54.1[a]	63.1[b]	65.5[b]	1.6
Acid-detergent fiber	49.7[a]	58.9[b]	58.6[b]	1.7
Crude protein	-9.9[a]	24.6[b]	27.1[b]	3.7

[abc]Means within the same row with different superscripts are significantly different (P<0.05)

Table 3:

Effect of urea ensiling and supplemental dried cassava leaves (DCL) on apparent digestibility (%0 of rations using lignin as indicator.

Item	Untreated rice straw	Urea ensiled rice straw (UES)	UES + dried cassava leaves ± (DCL)	SEM
Dry matter	48.8[a]	56.0[b]	58.2[b]	1.2
Organic matter	56.4[a]	64.4[b]	66.6[b]	1.3
Gross energy	57.3[a]	61.9[b]	63.2[b]	1.4
Acid-detergent fiber	43.4[a]	58.5[b]	59.9[b]	1.6
Crude protein	2.9[a]	22.2[b]	26.6[b]	5.3

[abc]Means within the same row with different superscripts are significantly different (P<0.05)

only UES (Wanapat 1982 and Wanapat et al 1982). The higher digestion coefficients of nutrients as discussed earlier might have contributed to better utilization of the ensiled straw by the buffaloes. During the experimental periods, it was observed that the buffaloes fed on UES had watery eyes. Ammonia in the UES may have contributed to this condition, however, further observations need to be make.

Table 4:

Dry matter intake of straw and weight change by water buffalo steers.

Item	Untreated rice straw	Urea ensiled rice straw (UES)	UES + dried cassave leaves ±	SEM
Average body weight, kg	259[a]	248[a]	252.7[a]	3.3
Dry matter intake, kg/d	4.77[a]	6.14[b]	5.52[ab]	0.2
Dry matter intake, % of BW/d	1.84[a]	2.47[b]	2.19[ab]	0.1
Dry matter intake, g/kgW$^{.75}$.d	75.1[a]	98.1[b]	88.7[ab]	3.5
Weight change g/d	-383[a]	136[b]	182[b]	138

[abc]Means within the same row with different superscripts are significantly different (P<0.05)

In conclusion ensiling rice straw with urea increased digestibility and weight gain in water buffaloes but supplementation with dried cassava leaves at a low level had no significant effects.

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