

EFFECTS OF CUTTING STAGE AND DRYING TEMPERATURE ON THE RUMEN DEGRADABILITY OF CRUDE PROTEIN IN DEHYDRATED HAYS OF ITALIAN RYEGRASS AND ALFALFA

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Introduction

Forage quality has been evaluated by the apparent digestibility. Digestible crude protein (DCP) figures of feeds are still currently used to meet the protein requirements of ruminant animals in Japan although there is considerable dissatisfaction with the use of DCP for evaluating feed protein. This inadequacy has its roots in the extensive activities of rumen microorganisms. Available information on degradation properties of forage in the rumen is becoming important for attaining higher production, milk yields of more than 7,000 kg with a minimum of 3.5 % milk fat in dairy cows and daily gains of more than 1.0 kg in native finishing steers. The present paper gives results on the rumen degradation of crude protein in two species of dehydrated hays prepared at different drying temperatures in different stages of growth.

Materials and Methods

The representative samples of grass and legume were cut from the field at our Station on 19 April (booting), 30 April (heading) and 14 May (blooming). Italian ryegrass was seeded in mid-October 1987, and on 10 May (early blooming), 20 May (mid-blooming) and 30 May (late blooming). Alfalfa was seeded in mid-September 1987. Immediately after cutting at each stage of growth, the samples were freeze-dried (0 °C) and oven dried at 60 °C for 2 days and 105 °C overnight, and were milled through a 2-mm screen.

The rumen degradabilities of dry matter (DM) and crude protein (CP) in the hay samples were determined by the *in situ* nylon bag technique with two rumen fistulated Japanese Brown steers (approx. 500 kg) fed 4 kg of Italian ryegrass hay, 3.6 kg barley and 0.4 kg soybean meal daily. Three grams of hay samples eliminating minute particles

through a 100 mesh screen were placed in the bags with a mesh size of 50 µm and suspended for 6, 12, 24, 48 and 72 hours in the rumen. After the incubation, the bags were washed thoroughly and the residue remaining was oven-dried for determining the contents of DM and CP.

Results and Discussion

The rumen degradation properties of DM and CP in the dehydrated hays were determined by applying the degradability (P) at time t to the equation $P = a + b(1 - e^{-ct})$ (Ørskov and McDonald, 1979), where a is the intercept of the degradation curve at time zero and represents the fraction which disappears rapidly from the bags, b is the component of potentially degradable fraction which will in time be degraded and c is the rate of degradation of b . The values of a , b and c were estimated from the linear regression of natural logarithm of $\{(a+b) - P\}$ at the time of rumen fermentation by regarding the value of actual degradability at 72 hours as the value of $(a+b)$. The degradation curves were almost plateau after 48 hours of incubation.

The table shows the values of these parameters. It is clear that the stage of growth affected the parameters of rumen degradation for DM and CP in Italian ryegrass. As the grass matured, the values of $(a+b)$ and c for DM and CP decreased significantly. This means an increase of indigestible parts and a decrease of the degradation rate in the advanced stage of growth. The trend was, however, partly dissimilar for two components. A drastic decline in the value of $(a+b)$ for CP was found after the date of 30 April together with a rapid decrease of CP content. Italian ryegrass is the most popular grass cultivated throughout the country. The harvesting time of the grass is greatly affected by weather conditions, especially in making hay. The results indicate that the grass

TABLE 1. ESTIMATED VALUES OF PARAMETERS ON RUMEN DEGRADATION OF HAYS, SUMMARIZED ACCORDING TO CUTTING DATE AND DRYING TEMPERATURE

	Dry matter				CP %	Crude protein			
	a %	b %	a+b %	c %/h		a %	b %	a+b %	c %/h
Italian ryegrass									
19/3	38.6	49.9	88.5 ^a	6.52 ^a	12.6	59.4 ^a	35.5 ^a	94.8 ^a	6.44 ^a
30/4	32.4	46.9	79.3 ^b	5.23 ^b	11.9	67.5 ^a	25.1 ^b	92.6 ^b	5.37 ^b
14/5	27.1	43.4	70.6 ^b	4.70 ²	6.8	55.2 ^b	27.9 ^b	83.1 ^b	4.12
0°C	36.7	43.7	80.4	5.25	10.1	69.8 ^a	22.4 ^b	92.2	4.78
60°C	33.0	46.6	79.6	5.32	10.5	61.9 ^a	29.0 ^b	90.9	5.20
105°C	30.2	48.2	78.4	5.55	10.7	50.7 ^b	36.8 ^a	87.4	5.53
Alfalfa									
10/5	32.0	42.5	74.5 ^a	8.40	20.6	59.4	33.5	92.9	8.13
20/5	32.2	39.9	72.1 ^{ab}	8.98	19.5	67.4	24.6	92.0	7.08
30/5	28.0	41.5	69.5 ^b	8.63	18.8	66.0	25.4	91.4	6.75
0°C	37.4	33.9	71.3	8.02	18.6	77.7 ^a	14.9 ^b	92.6	5.44
60°C	40.0	33.3	73.3	8.19	20.7	70.9 ^a	22.1 ^b	93.0	7.39
105°C	12.8	58.7	71.5	9.65	19.5	42.0 ^a	48.7 ^a	90.7	8.59

a, b, c: Values with different superscripts differ significantly at $P < 0.05$ among cutting stages or drying temperatures.

should be cut up to the time of around heading for efficient utilization of the CP component in the rumen.

On the other hand, there were no significant differences in any parameters of rumen degradation for DM and CP except the value of (a+b) for DM among three stages of growth in alfalfa. This suggests less influence of the growing stage on rumen degradation characteristics in the legume compared with that in the grass. When the two species of hay were compared, the values of c for DM and CP in alfalfa were greater than those in Italian ryegrass, indicating a higher rate of degradation in the rumen.

Drying temperature in preparing the hay samples affected the values of a and b significantly for only the CP component in both species.

Heating at 105°C caused a much lower value of a and a much higher value of b for CP. Consequently, no significant differences were found in the total value of (a+b) among the three levels of drying temperature, indicating there was no decrease in potentially digestible parts of CP by heating.

(Key Words: Rumen Degradability, Italian Ryegrass, Alfalfa)

Literature Cited

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