PROCESSING FOR WINTERING

LOW QUALITY ROUGHAGES which have limited alternate uses are important sources of feed for wintering young cattle. These feeds are characteristically low in digestible energy and protein, are high in fiber, and their intake by cattle is low. Previous experiments at Davis have shown that cubed rice straw, with appropriate supplementation, may be fed as a wintering ration for cattle with resultant body-weight gains of 0.5 to 0.8 lb per head per day. However, to obtain these gains from a low quality roughage, high feed intakes are necessary. The low intake of digestible energy is the main limitation in the use of poor quality roughages. Any method of feed processing which will increase feed intake will enhance the potential value of low quality roughages.

Pelleting

Previous work at Davis and other Experiment Stations had shown that pelleting some roughages increased food intake. It is now known that the main effect of pelleting on feed intake is due to the grinding of the feed prior to pelleting, with the consequent reduction in particle size. This experiment was to study the effect of processing to provide a different physical form of three roughages constituting major components in wintering rations for cattle.

Three forms

The three physical forms in which the roughage was fed were: pelleted (P), cubed (C), or milled (M). Three roughages were used: rice straw, wheat straw and oat hay; they were fed *ad lib* to steers at Davis, along with a protein-mineral-vitamin A supplement. Urea was added to the roughages to improve their nitrogen or protein contents (table 1) along with a binder (2.5% Al-Bond) to enhance their cubing or pelleting properties. Because chemical analyses indicated that the protein content was lowest for the wheat straw, 2% urea was added, whereas only 1.33% urea was added to the rice straw and oat hay. These additions were made to roughage regardless of the method of processing. In addition, a supplement (shown in table 1 and 2) was fed to all steers at the rate of 3 lb per head per day. The supplement was placed daily on top of the roughage in the feed bunks.

Physical characteristics

The physical characteristics of the milled, cubed and pelleted rations are shown in table 3. Sieve tests to determine particle size distribution of the feed showed the modulus of fineness for the pelleted feed was lower than for cubes or milled rations, since no coarse material was present in the pellets. Milled roughages contained 5 to 11% of coarse material averaging 2 to 3 inches long. Cubes contained 1 to 2% of 1¼-inch long roughage. Rice straw was consistently lower in coarse fractions than either wheat straw or oat hay, regardless of the method of processing.

Wintering performance

Fifty-four head of good-to-choice weaned steer calves were used in this trial. After an initial period of six weeks during which the calves were vaccinated for infectious bovine rhinotrachieitis, leptospirosis and bovine virus diarrhea and adjusted to feedlot conditions, six calves were alloted to each of the nine experimental rations. All calves were weighed every 28 days after an overnight shrink without feed or water. After the last week of the wintering experiment, all calves received alfalfa hay to equalize rumen fill.

No significant differences in body-weight between treatments were found due to this equalizing period so the results of the complete 98-day wintering phase are presented in table 4. They show that cattle given the pelleted diet had a significantly ($P<0.01$) greater feed intake and daily gain than those given either milled or cubed rations.

Post-wintering gains

Following the wintering period, the steers were transferred to the University's Sierra Foothill Range Field Station, Browns Valley, California where they grazed native grass which contained an established stand of subterranean and rose clover for 64 days. During this period, which was in the flush of spring growth, forage availability was not a limiting factor.

Table 5 gives the performance of the steers during the grazing period, showing that the body-weight response of the cattle during grazing was in the reverse order to that during the wintering period. The steers that were wintered on the pelleted roughage had significantly ($P>0.01$) lower gains than those wintered on a milled roughage, or the cubed roughage ($P<0.05$). The large steers coming off the wintering treatment made almost no body-weight gain and all previous roughage treatments were significantly ($P>0.01$) different from each other.

ROUGHAGES STEER CALVES

Table 6 gives a summary of the complete 162-day trial. Overall significant differences ($P>0.01$) were still apparent in favor of the pelleting treatment of the wintering roughage but there were no differences between the other processes (milling or cubing) or between the poor quality roughages—rice or wheat straw. Steers wintered on oat hay had significantly greater average daily gains than those wintered on the other two roughages.

This experiment provides a good example of compensatory gain in cattle. Those groups of steers which gained the most on the wintering ration gained least on range. Unless the higher bodyweight at the end of wintering can be capitalized upon (e.g., transferring the cattle to a feedlot or breeding them) it is largely lost when cattle are transferred to range.

In general, costs of processing, handling and feeding did not differ greatly between the three roughages, and the three forms of roughage. Pelleting required the most energy for grinding and compacting, but pellets cost less to feed. Milled rations involved lower processing costs but were very bulky and required more labor for feeding. Processing costs for cubes were lower than for pellets but were considerably higher than for milled straw, and were also intermediate in handling and feeding costs.

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TABLE 1. CHEMICAL ANALYSIS OF INGREDIENTS FED WINTERING STEER CALVES IN DAVIS TESTS, 1972

Ingredient	Nitrogen	Ether extract	Ash	Acid detergent fiber
	%	%	%	%
Wheat straw	1.1	1.0	9.7	51.4
Rice straw	1.1	1.6	18.9	53.7
Oat hay	2.3	1.5	10.9	36.8
Supplements for:				
Wheat straw	4.9	1.1	13.0	21.1
Rice straw	4.2	1.2	11.0	19.0
Oat hay	1.9	1.3	9.8	13.0

TABLE 2. PERCENT INGREDIENTS IN SUPPLEMENT FED WINTERING STEER CALVES

Roughage	Wheat straw	Rice straw	Oat hay
	%	%	%
Cottonseed meal	57	49.0	—
Ground barley	35.5	45.0	95.0
Gypsum	1.5	1.0	1.0
Dicalcium phosphate	2.5	2.5	2.0
Oystershell	1.0	—	—
Trace mineralized salt	2.5	2.5	2.5
Vitamin A (5,000 IU/lb)	+	+	+

TABLE 3. PHYSICAL CHARACTERISTICS OF ROUGHAGE

Type of roughage	Rice straw			Wheat straw			Oat hay		
Physical form*	M	C	P	M	C	P	M	C	P
Avg bulk density lb/cu ft	3	24	43	4	20	42	4	22	43
Modulus of fineness	3.29	2.80	1.74	3.74	3.49	2.14	3.28	3.36	2.40
Modulus of uniformity	2:5:3	1:5:4	0:2:8	2:7:1	1:7:2	0:4:6	2:5:3	2:6:2	0:5:5

* M-milled, C-cubed, P-pelleted

TABLE 4. RESULTS OF 98-DAY WINTER FEEDING OF STEER CALVES ON THREE ROUGHAGES IN THREE PHYSICAL FORMS

Type of roughage	Rice straw			Wheat straw			Oat hay		
Physical form*	M	C	P	M	C	P	M	C	P
Initial wt lb	584	583	587	568	591	579	579	578	583
Daily intake of roughage†	12.6	12.9	17.6	10.6	10.4	12.7	14.4	14.7	18.0
Avg daily gain	0.48	0.74	1.16	0.27	0.18	0.83	1.48	1.64	1.86

* M-milled, C-cubed, P-pelleted
† Plus supplement at the rate of 3 lb/hd/day

TABLE 5. RESPONSE OF STEERS ON GRASS FOLLOWING WINTERING—64 DAYS

Previous roughage	Rice straw			Wheat straw			Oat hay		
Physical form*	M	C	P	M	C	P	M	C	P
Wt onto grass	631	656	700	595	608	660	724	739	765
Avg daily gain	0.91	0.52	0.12	1.29	1.07	0.71	0.22	0.07	0.03

* M-milled, C-cubed, P-pelleted

TABLE 6. RESPONSE OF STEERS—FULL 162-DAY TRIAL

Previous roughage	Rice straw			Wheat straw			Oat hay		
Physical form*	M	C	P	M	C	P	M	C	P
Final wt lb	689	689	711	678	677	706	738	**744**	**767**
Avg daily gain lb	0.65	0.65	0.75	0.68	0.53	0.78	0.98	1.02	1.14

* M-milled, C-cubed, P-pelleted