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Oregon State University
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AUTHORS: A. T. Ralston is Professor of Animal Science and T. P. Davidson is Superintendent of the Umatilla Experiment Station, Oregon State University.

VARIATIONS IN STEER PERFORMANCE AND CARCASS CHARACTERISTICS DUE TO HAY QUALITY AND/OR PREPARATION

A. T. Ralston and T. P. Davidson

The value of hay has, in the past, been based either on its protein or crude fiber content. There is little question that these two constituents of hay reflect its digestibility at a normal intake. A recent comprehensive review of pelleted rations and the results of work at this station conclusively show that the pelleting of roughages stimulates intake to a point above average expectations. With above average intakes, the expected digestibility of the feed is seldom reached. When this is true and the protein content of the diet is not a limiting factor, the question arises as to whether protein content remains a reliable criterion for measuring the value of hays.

The main objective of this experiment was to compare the effects of pelleting, chopping, or baling on two different qualities of hay (12 and 16% protein). In the past, we have measured differences in weight gains and related this back to the cost of gain. This type of comparison assumes that the value of extra gain would be the same for each unit produced by all treatments. This is not always true. Consequently, an effort was made to equilibrate gains so that the comparison of costs would be more realistic. The final effects of these prefinishing treatments were measured on the finish gains, costs, and carcass characteristics. Other comparisons included corn silage with two levels of concentrates, chopped hay and grain mix (50:50), and 80:20 hay and grain pellet.

Methods

One hundred and twenty weanling steer calves were divided equally into 10 lots. The calves initially weighed 447 pounds and remained on the prefinishing treatments shown in Table 1 until they reached approximately 700 pounds. At this weight, they were all placed on a common finishing ration consisting of 77% steam rolled barley, 10% beet pulp, 5% alfalfa, 7% molasses, and 1% salt for 56 days. They were then changed to a ration consisting of 82% steam rolled barley, 10% beet pulp, 7% molasses, and 1% salt. Animals in pens 2 and 3 were on the initial finishing ration 10 days less and animals in pen 10 for 16 days longer than those in the other treatments because of differences in prefinish gains.

The steers were marketed in three groups of equal numbers from each treatment at 92, 110, and 120 days on the finishing ration or an average of 110 days for the finishing period. The average time on feed from weaning to slaughter was 219 days. Carcass data including carcass warm weights, physiological ages, conformation, marbling scores, ribeye areas, backfat thicknesses, and USDA grades were collected.

Table 1. Rations Fed During the Prefinishing Period

Pen No.	Ration
1	Pelleted alfalfa (12% protein) <u>ad lib.</u>
2	Chopped alfalfa (12%) <u>ad lib.</u> + 1% B.W. (1) in concentrate (2).
3	Long alfalfa (12%) <u>ad lib.</u> + 1% B.W. in concentrate.
4	Corn silage <u>ad lib.</u> + 3 pounds chopped alfalfa (12%) + 1% B.W. in concentrate.
5	Pelleted alfalfa (16%) <u>ad lib.</u>
6	Chopped alfalfa (16%) + 1½% B.W. in concentrate.
7	Long alfalfa (16%) + 1½% B.W. in concentrate.
8	Corn silage <u>ad lib.</u> + 3 pounds chopped alfalfa (16%) + 1½% B.W. in concentrate.
9	Chopped alfalfa (12%):concentrate. (1:1) <u>ad lib.</u>
10	12% alfalfa:concentrate pellets (4:1) <u>ad lib.</u>

(1) B.W. = Body weight.

(2) Concentrate = 80% steam rolled barley, 15% beet pulp, and 5% molasses.

Results and Discussion

The pelleting of hay or a hay-concentrate ration (80:20) (pens 1, 5, and 10) stimulated intake to a level either equal to or greater than a combination of hay and grain (pens 2, 3, 6, 7, and 9). This was actually somewhat less total digestible nutrient (TDN) intake per day, but was utilized with approximately 14% greater efficiency (Table 2). In both cases (pens 3 and 7), the use of long hay reduced the animal intake somewhat, and although the gains were slightly less than for the animals receiving chopped hay (pens 2 and 6), the utilization of TDN was comparable to the chopped hay. There was a noticeable carryover effect in stimulated intake from the pelleting of 12% protein hay or the 80:20 alfalfa-concentrate rations (pens 1 and 10) during the subsequent finishing period. This was not true of the pelleted 16% alfalfa hay (pen 5).

Table 2. Daily Consumption of Feeds and Total Digestible Nutrient Utilization During the Prefinishing Period and Finishing Period

Pen	Prefinish					Finish	
	Daily intake			Daily TDN ^a intake	TDN/ cwt gain	Daily TDN intake	TDN/ cwt gain
	Hay	Silage	Conc.				
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	19.6	---	---	9.1	456	23.1	552
2	11.0	---	6.7	10.1	537	18.2	562
3	10.4	---	6.6	9.8	527	17.8	538
4	3.2	18.7	6.6	10.2	565	21.0	548
5	18.2	---	---	9.3	456	21.7	553
6	9.1	---	8.4	10.9	517	20.9	542
7	7.0	---	8.2	9.7	500	21.7	515
8	3.1	15.0	8.6	11.1	558	20.8	543
9	9.6	---	8.8	11.5	556	20.4	552
10	16.0	---	3.8	11.0	493	27.0	538

^a TDN values are estimates derived from Morrison's Feeds and Feeding, 22nd Edition (1959).

The intake of 12% alfalfa pellets was somewhat greater than that of the 16% pellets; they resulted in comparable average daily gains of 1.99 and 2.04 pounds, respectively. The use of 16% pellets produced beef with greater efficiency than the 12% pellets, saving almost 100 pounds of feed per hundredweight of gain. This 11% feed saving indicated that if the cost of 16% alfalfa pellets was \$38.30 per ton, the 12% pellets would be worth only \$34.09 (Table 3).

When total digestible nutrient values for alfalfa hays of comparable quality were used to determine TDN intake, the efficiency of TDN utilization was the same.

The pelleting process was too costly when compared with chopped or long hay and grain when only prefinish gains were considered (Table 4). These differences in cost of gain were reduced when the finishing period was considered. The addition of small amounts of grain to the pellet improved gain response and reduced costs to a very competitive level. This treatment produced significantly more marbling than the straight hay pellet without significantly increasing the amount of backfat (Table 5).

Table 3. Ration Ingredient Costs

Ingredient	Cost per cwt
12% protein alfalfa long	\$1.2636
12% protein alfalfa chopped	1.4000
12% protein alfalfa pelleted	1.7959
16% protein alfalfa long	1.3700
16% protein alfalfa chopped	1.5200
16% protein alfalfa pelleted	1.9149
Concentrates	2.5594
Finishing ration 1	2.5620
Finishing ration 2	2.6590
Silage	0.5000
OSU supplement	3.2926

The corn silage plus concentrates at 1% of the steer's body weight produced less prefinishing gain and showed no compensatory gain during the finishing period, which resulted in a reduction of marbling score and less backfat. In such cases, the feed costs per pound of gain are misleading for they represent costs of a product of less value.

The differences in backfat thickness were not related to rapidity of gain or TDN intake.

The use of a prefinishing ration of chopped hay-concentrates (50:50) produced carcasses with significantly more backfat than all other treatments, although the steers did not consume the greatest amount of feed or make the greatest gains.

Table 4. Summary of Prefinishing and Finishing Performance

Pen No.	Prefinish ADG(1)		Prefinish FE(2)		TDN/cwt	Prefinish ADG		Prefinish FE		Finish ADG		Finish FE		Overall ADG	Overall FE	Overall cost/cwt
	lbs.	lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.			
1	1.99 ^{bc}	985	456	\$17.59	3.12	747	\$19.46	2.55 ^{ab}	840	\$18.73	2.55 ^{ab}	840	\$18.73	2.55 ^{ab}	840	\$18.73
2	1.89 ^{bc}	934	537	17.19	2.89	753	19.77	2.34 ^{bc}	833	18.64	2.34 ^{bc}	833	18.64	2.34 ^{bc}	833	18.64
3	1.86 ^c	953	550	16.86	2.97	721	18.95	2.32 ^c	818	18.07	2.32 ^c	818	18.07	2.32 ^c	818	18.07
4	1.80 ^c	842	564	17.10	2.84	740	19.35	2.32 ^c	765	18.47	2.32 ^c	765	18.47	2.32 ^c	765	18.47
5	2.04 ^{ab}	898	460	17.04	2.92	749	19.51	2.47 ^{abc}	811	18.49	2.47 ^{abc}	811	18.49	2.47 ^{abc}	811	18.49
6	2.11 ^{ab}	829	558	16.72	2.83	744	19.50	2.47 ^{abc}	779	18.31	2.47 ^{abc}	779	18.31	2.47 ^{abc}	779	18.31
7	1.94 ^{bc}	784	546	15.82	3.15	691	18.12	2.54 ^{abc}	726	17.24	2.54 ^{abc}	726	17.24	2.54 ^{abc}	726	17.24
8	1.99 ^{bc}	779	557	17.25	2.87	729	19.12	2.45 ^{abc}	750	18.36	2.45 ^{abc}	750	18.36	2.45 ^{abc}	750	18.36
9	2.07 ^{ab}	886	537	18.25	2.81	740	19.41	2.44 ^{abc}	802	18.91	2.44 ^{abc}	802	18.91	2.44 ^{abc}	802	18.91
10	2.23 ^a	828	547	16.76	3.00	724	18.91	2.66 ^a	763	18.11	2.66 ^a	763	18.11	2.66 ^a	763	18.11
Av.	1.99	868	512	17.06	2.94	734	19.21	2.45	789	18.33	2.45	789	18.33	2.45	789	18.33

(1) ADG = average daily gain. Gains with different superscripts were significantly different (P < .05).

(2) FE = pounds of feed per hundredweight of gain.

Table 5. Summary of Carcass Characteristics

Pen No.	Marbling score ⁽¹⁾	Grade ⁽²⁾	Backfat ⁽³⁾ in.	Yield ⁽⁴⁾ %
1	14.5 ^a	16.7	.53 ^{ab}	48.9
2	14.5 ^a	16.8	.52 ^{ab}	48.9
3	15.3 ^{ab}	16.7	.49 ^{ab}	49.4
4	13.9 ^a	16.5	.46 ^a	49.1
5	14.8 ^a	16.4	.49 ^{ab}	48.8
6	15.9 ^{ab}	17.0	.55 ^b	49.1
7	14.5 ^a	16.6	.57 ^b	49.1
8	15.2 ^{ab}	17.1	.54 ^{ab}	49.0
9	17.1 ^b	17.3	.73 ^c	47.7
10	17.5 ^b	16.9	.57 ^b	48.6

- (1) Marbling score: 12 = small; 15 = modest; 18 = moderate. Marbling scores with different superscripts are significantly different (P < .05).
- (2) Grade: 14 = good; 17 = choice; 20 = prime.
- (3) Different superscripts are significantly different (P < .05).
- (4) Yield = estimated yield of closely trimmed, boneless, retail cuts from round, loin, rib, and chuck.

Summary

Although the prefinish rations used were quite varied as to bulk, energy concentration, or percent of protein, all produced satisfactory gains. The following variations were noted:

1. Pelleting of alfalfa hay or a predominantly hay mixture stimulated intake.
2. There was a carryover effect on intake from the pelleted alfalfa (12%) and the pelleted 80:20 alfalfa-concentrate mixture.
3. The addition of concentrates in small amounts (80:20) in pelleted hay reduced costs of gain and produced a more valuable carcass.
4. The use of alfalfa pellets of 16% protein saved approximately 100 pounds of feed per hundredweight of gain. Consequently, if 16% pellets were worth \$38.30 per ton, the 12% pellets were only worth \$34.09.

5. The use of unsupplemented pelleted hay was more costly than supplemented hays, but these differences can be minimized through the addition of some grain to the hay pellet.
6. The use of corn silage prefinish rations produced economical gains, but the gains were of less value than gains from the other treatments.
7. Chopped hay-concentrate (50:50) mixture produced significantly more backfat, although the steers did not consume the greatest amount of this feed or make the greatest gains.