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WINTERING CATTLE ON GRASS STRAW

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The winter feeding program for beef brood cows must provide for maintenance, production and reproduction as well as be economical under today's production costs. Since the ruminant is capable of converting rather poor quality roughage to useful energy, as well as provide a means of degradation for this bulk, grass and cereal grain straw should be considered.

Oregon produces about a half million tons of grass straw annually with about 90 percent of it in the Willamette Valley and the rest in central and northeastern counties. Variety, production and harvest practices contribute to the quality of this roughage as a livestock feed. Consequently, there is a large range in quality with respect to feed value.

These straws are generally high in fiber and lignin and low in crude protein as well as digestible protein and energy. Carotene or vitamin A is generally low. This low protein and digestibility, coupled with the high fiber and general physical characteristics of the straw result in limited intake, making at least some type and level of supplementation essential to the maintenance of cattle.

Straw has been chopped, ground, (Levy et al., 1972; Hackett et al., 1975), pelleted (Bart, 1966), ensiled (Shultz and Ralston, 1974) and treated with numerous chemicals (Anderson and Ralston, 1973; Garrett et al., 1974; Summers and Sherrod, 1975; Shin et al., 1975) in an attempt to improve nutritional value. The processing of straw is time and energy consuming and in many instances economically questionable.

The studies reported herein involved the use of grass straws, as either the total or part of the roughage portion, with various combinations of supplements for the wintering ration of beef cows.

STRAW QUALITY

Crude protein (CP) is one indication of straw quality, but other factors are also important. Straw will range from a low of 2 percent crude protein to a high of 8 or 9 percent (table 1). Bluegrass and fescue straws produced in Union county ranged from 2.8 to 8.1 and 2.1 to 5.2 percent crude protein, respectively. The bluegrass varieties, Delta, Campus and Newport ranged from 6.0 to 8.1, 3.8 to 5.7 and 2.8 to 3.2 percent crude protein, respectively. Ralston (1973) reported crude protein values ranging from 3.5 to 5.0 percent for ryegrass straw produced in the Willamette Valley. Dry matter digestibility of grass straw is generally less than 50 percent.

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TABLE 1. CRUDE PROTEIN VALUES FOR GRASS STRAW HARVESTED IN 1974

Straw	Crude Protein
	%
Delta bluegrass	5.99
Delta bluegrass	8.07
Newport bluegrass	3.20
Newport bluegrass	2.84
Merion bluegrass	7.41
Pennlawn red fescue	2.14
Pennlawn red fescue	5.16

EXPERIMENTAL PROCEDURE

A series of trials were conducted at the Union and Squaw Butte Stations in Eastern Oregon involving different classes of cattle and types of straw. These involved the feeding of Hard fescue and Merion bluegrass straws at Union and ryegrass straw at Squaw Butte.

Hard fescue and Maerion bluegrass trials. In December of 1972 and 1973, sixty non-lactating pregnant mature Hereford cows were allotted by age into three groups of twenty cows each. Merion bluegrass straw, Hard fescue straw and alfalfa-orchardgrass hay were fed to cows in the three treatment groups. The trial ran for 63 days in 1972 and 56 days in 1973. Trials were terminated about 2 weeks prior to calving. The Merion bluegrass and Hard fescue straw was fed to provide 25 pounds per head daily.

During the 1972 trial each cow fed Hard fescue received 1.3 pounds of cottonseed meal (CSM) daily and additionally received 2.0 pounds of barley during the last 33 days of the trial. The Merion bluegrass straw-fed cows received 0.50 pounds CSM per head daily during the entire trial.

During the 1973 trial the Hard fescue straw-fed cows received 2.0 pounds and the Merion bluegrass straw-fed cows recived 1.0 pound per head daily of a supplement containing 2 parts oats and 1 part cottonseed meal.

All animals in both years received an injection of one million I.U. of vitamin A prior to the beginning of the trial. Water and a trace mineralized salt-dicalciumphosphate mixture was avialable at all times. Initial, final and 28-day weights were taken on each animal.

In October of 1974, sixty non-lactating pregnant Hereford cows were allotted to three groups of twenty animals each. The treatments were: Hard fescue ad libitum plus 4 pounds of alfalfa-orchardgrass hay, Hard fescue ad libitum plus 9 pounds of alfalfa-orchardgrass hay, and Hard fescue ad libitum plus 2 pounds of a 3:1 mixture of oats:CSM. The trial ran for 82 days. The cows were managed in the same manner as the two previous trials.

Fifty-three Hereford heifer calves averaging about 500 pounds were allotted to two treatments in November of 1974. One group received a mixture of alfalfa-orchardgrass hay and Merion bluegrass straw ad libitum plus barley and cottonseed meal and the second group received the roughage combination plus barley and liquid molasses supplement. The diets were calculated to be isonitrogenous and isocaloric. Intake of the liquid supplement was measured weekly. Based on the liquid supplement intake, the dry supplement formulation was adjusted weekly so that protein and energy intake would be approximately equal for the two treatments. The liquid supplement was a urea-molasses formulation with vegetable oil added for energy. The liquid supplement was fed in a lick-wheel feeder and dry supplement was fed daily in an open trough.

The animals had access to fresh water and a trace mineralized salt-dicalciumphosphate mixture at all times. Initial, final and periodic 28-day weights were taken. The experimental feeding period was 83 days.

Ryegrass straw trials. Ryegrass straw was fed as the primary roughage source for wintering the cow herd at the Squaw Butte Station in the winter of 1973-74. Normally these cattle are wintered on native flood meadow hay which will provide for maintenance and low levels of production depending on the quality of the ahy and the severity of the environment.

Ninety-six fall-calving cows on a long term winter feeding study to determine nitrogen and energy requirements were switched from the traditional roughage of meadow hay to a roughage mixture of 2 parts ryegrass straw and 1 part alfalfa hay. This combination was calculated to provide the same nutrient level as the meadow hay. One half of the cows received the roughage combination alone and the other half received a mixture of barley and biuret to provide a nutrient level equal to 121 percent of the roughage alone.

The straw and alfalfa were fed in bales with bales weighed and fed to maintain the 2:1 ratio. The group receiving supplements was supplemented daily. Water, salt and salt-bonemeal were available at all times.

The feeding program began December 13, 1973 and continued to April 10 when the cattle were moved onto range. Individual cow weights were taken at the initiation of the trial, mid-way through the wintering period and at the time cattle were taken to the range.

In a second study, 112 spring-calving cows were stratified by age and weight to one of four treatments. Treatments were: (1) a control group supplemented with barley and biuret calculated to provide for maintenance; (2) a standard urea-molasses liquid supplement; (3) a standard urea-molasses supplement fortified with propolene glycol; and (4) a urea-molasses-vegetable oil product. Ryegrass straw was fed free choice to each of these treatment groups. Cattle were wintered without shelter on the meadows. Aftermath and regrowth had been removed earlier by grazing. The dry supplement (2.0 pounds of barley and 0.2 pounds of biuret) was fed daily. Liquid supplements were fed free choice in lick-wheel feeders. Water, salt and a salt-bonemeal mixture were available at all times. Cattle were weighed initially and each 28 days during the study.

RESULTS AND DISCUSSION

Intake and average daily gain data for the 1972 feeding trial are given in table 2. Cows fed Merion bluegrass straw consumed more straw than cows fed Hard fescue straw (29.5 vs. 22.5 pounds). Merion bluegrass straw was higher in crude protein and lower in acid detergent fiber (7.55% vs. 4.36; 34.63% vs. 46.37%, respectively).

TABLE 2. AVERAGE DAILY GAIN AND ROUGHAGE INTAKE OF COWS ON THE 1972 STUDY.

Treatments	Daily roughage intake	Average Daily Gain		
		28 days	28-63 days	0-63 days
	(lb.)	(lb.)	(lb.)	(lb.)
Merion bluegrass straw	29.5	2.10[a]	1.75[a]	1.87[a]
Hard fescue straw	22.5	1.02[b]	0.55[b]	0.72[b]
Alfalfa-orchard-grass hay	26.0	0.81[b]	1.90[a]	1.43[a]

a, b Means with different superscripts within the same column differ significantly. ($P < 0.50$)

After the first 28 days on trial the cows fed Merion bluegrass gained more than the cows fed Hard fescue straw or alfalfa-orchardgrass hay. The 28-day gains reflect a fill condition rather than an actual body weight gain. The weight gains from the 28th to the 63rd day are the best indication of animal performance. The groups fed Merion bluegrass straw and alfalfa-orchardgrass hay gained more than the group fed Hard fescue straw. One cow became impacted after 29 days on test and a second cow became impacted after 49 days on test. The first cow died and the second cow responded to treatment.

Data from the 1973 trial are presented in table 3. Again, this year the cows fed Merion bluegrass straw consumed more straw than the cows fed Hard fescue (25.2 vs. 20.1). The Merion bluegrass straw was of better quality than the Hard fescue straw as determined by crude protein and acid detergent fiber analysis (6.34% vs. 5.76%; 44.17 vs. 48.21%, respectively). The daily weight change from the 28th to the 56th day for the Merion bluegrass straw-fed cows was a -0.24 pounds and Hard fescue straw-fed was -0.82 pounds. One cow became impacted on the 56th day. She did not respond to treatment and died. On postmortem examination she was found to have an impacted abomasum. There were no differences in conception or calf birth weights with respect to treatment.

TABLE 3. AVERAGE DAILY GAIN AND ROUGHAGE INTAKE OF COWS ON THE 1973 STUDY.

Treatments	Daily roughage intake	Average Daily Gain		
		28 days	28-56 days	0-56 days
	(lb.)	(lb.)	(lb.)	(lb.)
Merion bluegrass straw	25.4	0.59[a]	-0.24[c]	0.17[a]
Hard fescue straw	20.1	0.08[b]	-0.82[b]	-0.37[b]
Alfalfa-orchard-grass hay	25.4	-0.37[c]	1.51[a]	0.60[a]

a, b, c Means with different superscripts within the same column differ significantly. ($P \leq 0.05$)

Table 4 shows the results of the trial where cows were fed two levels of alfalfa-orchardgrass hay or grain supplement with Hard fescue straw ad libitum. The cows fed 2.0 pounds of supplement plus straw lost 0.5 pounds from the 28th to the 82nd day on feed, while the cows fed 8.6 pounds alfalfa-orchardgrass plus straw lost 0.16 pounds daily. When fed with hard fescue straw, 4.7 pounds of alfalfa-orchardgrass hay had the same replacement value as 2 pounds of 3:1 mixture of oats:CSM. Two cows became impacted on the fescue straw plus 8.7 pounds of alfalfa-orchardgrass hay. The first cow became impacted after 55 days on feed. She responded to medication and lived. The second cow became impacted after 69 days on feed and died, even though she was treated the same as the first animal.

TABLE 4. AVERAGE DAILY GAIN AND ROUGHAGE INTAKE OF COWS ON THE 1974 STUDY.

	Average daily straw intake	Average daily hay intake	Average daily roughage intake	Average Daily Gain		
				28-day	28-82 day	0-82 day
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
Straw + 4.7 lb. alfalfa grass hay	17.6	4.7	22.3	2.38[a]	-0.54[a]	0.46[a]
Straw + 8.6 lb. alfalfa grass hay	16.0	8.6	24.6	3.43[b]	-0.16[b]	1.06[b]
Straw + concentrate supplement	19.8	---	19.8	1.85[c]	-0.53[a]	0.28[a]

a, b, c Means within period with different superscripts differ at the $P < 0.50$.

The results of feeding Merion bluegrass straw to yearling heifers are shown in table 5. There was no difference in weight gain between dry supplemented and liquid supplemented animals. Heifers fed liquid supplement consumed slightly more roughage. The liquid supplement intake was lower than expected, therefore, barley was supplemented to maintain weight gains of approximately 1 pound per day.

TABLE 5. AVERAGE DAILY GAIN AND FEED INTAKE OF YEARLING HEIFERS WINTERED ON ALFALFA-GRASS HAY AND BLUEGRASS STRAW WITH DRY OR LIQUID SUPPLEMENTS.

Items	Treatments	
	dry supplement	liquid supplements
	(lb.)	(lb.)
Alfalfa-grass hay	6.43	6.67
Merion bluegrass straw	3.57	3.70
Barley	3.19	3.11
Cottonseed meal	0.79	----
Molasses supplement	----	1.06
Average daily gain	1.15	1.12

Feeding ryegrass straw. Weight data for fall-calving cows fed ryegrass straw are presented in table 6. Basically no difference was observed in regards to turn-out weight when compared with previous years. Average daily intake was 16.7 pounds of straw and 8.7 pounds of alfalfa hay making a total of 25.4 pounds of roughage which is similar to the intake of meadow hay.

TABLE 6. INTAKE OF ROUGHAGE AND WEIGHTS FOR FALL-CALVING COWS FED ALFALFA HAY AND RYEGRASS STRAW.

Treatments	Daily intake		Body Weights		
	Straw	Hay	Turnout 4-19-73	start of straw feeding 12-13-73	Turnout 4-9-74
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
Low energy	18	9	934	1026	964
High energy	19	9	926	995	956

Cattle fed the low level of energy (straw:alfalfa mix only) exhibited the highest weight loss; however, this loss was not extreme for winter conditions or harmful in total animal performance. The high level energy group appeared to maintain themselves throughout the winter period on the straw:alfalfa mix with a modest supplementation to boost protein and energy to the lactating fall-calving cow. Conception rate for the fall-calving herd was 85 percent, which is lower than the previous year and below the long term average, but not as low as reported in other single years.

Weight data for spring-calving cows fed ryegrass straw are presented in table 7. Cattle went on range at about the same weight as the previous year. In comparing weight changes between the supplemented groups, little difference is noted between these groups.

Average daily intake of ryegrass straw was 19.8 pounds per day for the barley supplemented group and 13.8 pounds per day for the combined molasses supplemented groups. Intake of molasses supplement with all groups was very erratic and had to be controlled very carefully.

The 6.0 pound reduction in straw intake of the molasses-supplemented animals over the grain-supplemented group suggests some imbalance of diet with the molasses group. It was observed that the cattle with molasses supplements scavenged the meadows for stubble whereas the dry supplemented group seemed to be content with the straw. Molasses intake over this period ranged from 2.0 to 6.0 pounds with an overall average of 4.2 pounds per head per day. This was twice the amount they were projected to eat, making the economics of the molasses supplement highly unfavorable when compared to the dry supplement.

TABLE 7. INTAKE AND WEIGHTS FOR THE SPRING-CALVING COWS FED RYEGRASS STRAW.

Supplemented Treatment	Daily straw intake	Turnout 4-19-73	start of straw feeding 12-5-73	pre-calving 2-27-73	Turn-out 4-9-74
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
Barley	19.8	869	992	1024	866
Molasses	13.8	875	1010	1029	870

SUMMARY

The large amount of variation in straw quality makes it essential that the quality of the straw be determined before initiating a feeding program. Grass straw is probably best suited as a roughage source for mature cattle. Also, the level of production should be considered when planning a feeding program so that adequate supplement can be provided.

Merion bluegrass or ryegrass straw can be used to make up a major portion or all of the roughage in a wintering program for mature cattle. The protein and energy deficiencies in grass straw must be made up by a good quality roughage, feed-grain, or other type of protein and energy supplement to meet maintenance, production and reproduction requirements. The condition of the cattle going on winter feed and the production and reproduction goals need to be considered in developing the supplementation program.

Performance of animals fed Hard fescue straw with a balanced supplementation program will probably be satisfactory. However, the problems of impaction cannot be overlooked. Hard fescue straw in combination with alfalfa hay or grain can cause impaction in mature cows. If Hard fescue straw is fed, a close watch should be kept for those cows that are becoming impacted as early treatment is essential. It appears that Hard fescue straw is the least desirable of the grass seed straws studied thus far for animal feeding.

Literature Cited

Anderson, D. Craig and A. T. Ralston. 1973. Chemical treatment of ryegrass straw: In vitro dry matter digestibility and compositional change. J. Anim. Sci. 37:148.

Burt, A. W. A. 1966. The nutritive value of ground and pelleted barley straw. I. Ground and pelleted vs. long straw for growing Ayrshire heifers. J. Agric. Sci. 66:131.

Garrett, W. N., H. G. Walker, G. O. Kohler, A. C. Waiss, Jr., R. P. Graham, N. E. East and M. R. Hart. 1974. Nutritive value of NaOH and NH_3 treated rice straw. Proc. West. Sec. Amer. Soc. Anim. Sci. 25:317.

Hackett, M. R., J. K. Hillere, R. P. Kromann and E. L. Martin. 1975. Evaluation of wheat straw in feeder lamb rations. J. Anim. Sci. 41:35 (abstr. 353).

Levy, D., S. Amir, Z. Holzer and H. Neumark. 1972. Ground and pelleted straw and hay for fattening Israeli-Priesian male calves. Anim. Prod. 15:157.

Ralston, A. T. 1973. Grass straw as a beef feed: A research review. Oregon State University Agricultural Experiment Station, Circular of Information No. 641.

Shin, H. T., U. S. Garrigus and F. N. Owens. 1975. NaOH treated wheat straw rations for sheep. J. Anim. Sci. 41:417 (abstr. 683).

Shultz, T. A. and A. T. Ralston. 1974. Effect of various additives on nutritive value of ryegrass straw silage. II. Animal metabolism and performance observations. J. Anim. Sci. 39:(5) 926.

Summers, C. B. and L. B. Sherrod. 1975. Sodium hydroxide treatment of different roughages. J. Anim. Sci. 41:420 (abstr. 696).