

SUNFLOWER HULL and CORN ROUGHAGE PELLETS, TRITICALE and ERGOT in RATIONS FOR BEEF CATTLE

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As new grains, grain varieties or by-products are developed which have potential feed value, they need to be evaluated for their usefulness to the

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livestock industry. One such grain is triticale, resulting from a cross between durum (*Triticum*) and rye (*Secale*). The triticale used in this experiment was grown in Canada and averaged about 48 pounds per bushel. The triticale (Rosner) had been cleaned and was free of most weed seeds and foreign material except that it still contained from 0.043 per cent to 0.08 per cent ergot by weight (0.035 to 0.068 per cent by kernel count). The chemical analyses of the grains are given in Table 1. The oats and barley available for the comparisons had low bushel weights (Table 1), but were reasonably clean and bright.

Table 1. Chemical analysis of feeds - Experiment C-27.

Feedstuff	Bu. Wt. lbs.	Dry Matter	Phos.	Protein	Ash	Acid Det. Fiber	Acid Det. Lignin
Percentage							
Oats	30	88.9	0.41	12.9	-	14.1	2.8
Barley	42.6	88.0	0.38	13.12	-	7.3	1.2
Triticale	48	86.4	0.41	13.8	-	3.4	2.8
Sunflower hull pellets	-	90.6	0.10	5.4	3.4	56.9	17.3
Corn roughage pellets	-	92.7	0.15	6.4	8.9	35.2	4.0
Alfalfa pellets	-	89.5	0.20	16.0	9.8	33.3	5.4

Several reports have been published on the value of triticale as a feed grain since this experiment was conducted. McElroy (1968) reported Rosner triticale, used in these experiments, to be similar to barley for finishing steers. Lofgren et al (1970) reported triticale (variety unknown) to have similar energy values as barley and did not encounter palatability problems. McCloy et al (1971) reported that triticale (variety not specified) was not consumed as well as sorghum grain by finishing cattle.

Two by-products from the processing of agricultural products, pelleted sunflower hulls (PSH) and a corn roughage pellet (CRP), suggested a potential as ration ingredients for growing-finishing cattle. The sunflower hull pellets were a by-product from sunflower oil extraction.

The sunflower hull pellets were high in acid detergent fiber and lignin content, suggesting a rather low usable energy content, and therefore should be used in limited amounts for cattle. The alfalfa pellets were made from sun-cured hay of about average quality. The corn roughage pellet was made from the forage remaining after the corn syrup (for sugar extraction) was extracted from high sugar corn plants. Chemical analysis (table 1) suggested a usable roughage, comparable to the alfalfa pellets except for the lower protein content. However, the corn roughage pellets were dark brown and had an odor of burnt caramel and char, apparently caused by a pelleting difficulty such as using a grain die in the pellet mill instead of a roughage die. The corn roughage pellet was not accepted readily by the cattle, as indicated by the results.

Experiment C-27

In order to obtain information on these feeds at several levels in the rations, an experiment was designed to evaluate the pelleted roughages in wintering (growing) type rations as well as finishing rations. The design was for eight lots of six steers each. Four lots of steer calves were put on winter-

ing rations for 126 days, then shifted to a 40:60 concentrate-to-roughage ratio for 63 days. At the 189th day of experiment, they were shifted to a 60:40 ratio for 42 days, and at 231 days shifted to an 80:20 concentrate-to-roughage ratio until they reached slaughter weights. All changes were gradual over a period of 10 to 14 days. The second four lots of steer calves were started directly on the 40:60 ratios, shifted to 60:40 at 126 days and 80:20 ratio at 189 days to slaughter weights.

Three supplements were formulated (Table 2). Supplement C-27-1 was formulated for Lots 1 and 3 and C-27-2 for Lots 2 and 4 in the wintering phase only, and both were fed at a level of 3 pounds per head daily to provide 1¼ pounds of grain and about .8 pound of soybean meal to the wintering steers. Supplement C-27-3 was formulated to be fed at 2 pounds per head daily to all steers receiving at least 40 per cent concentrate (grain) in their rations.

The steer calves were good quality, uniform Herefords. They were fed inside and had access to

Table 2. Supplement formulas, Experiment C-27.

Number	C-27-1	C-27-2	C-27-3
Ingredients	%	%	%
Oats	58	—	—
Triticale	—	58	—
Alfalfa	10	10	50
Soybean oil meal	26.5	26.5	25
Urea	—	—	5
Trace mineral salt	1.7	1.7	7.5
Dicalcium phosphate	3.3	3.3	7.5
Wheat bran	—	—	4.5
Vitamins	(1)	(1)	(1)
Chemical analysis of supplements:			
Protein	27.1	23.3	29.2
Phosphorus	0.9	0.8	0.9
Acid det, fiber (ADF)	11.1	6.1	13.4
Acid det, lignin (ADL)	2.1	0.7	3.6
To be fed per head per day:	3	3	2

¹When fed at stated levels provided 15,000 I.U. of Vit. A; 1500 I.U. of Vit. D; and 10 mgm of stilbestrol per head per day.

Table 3. Experiment C-27 — 126 day "phase 1."

Roughage	Corn Roughage Pellet		Sunflower Hulls Alfalfa Pellets		Corn Roughage Pellet		Sunflower Hulls Alfalfa Pellets	
	Oats	Trit.	Oats	Trit.	Bly.	Trit.	Bly.	Trit.
Lot no.	1	2	3	4	5	6	7	8
Initial wt., lb.	426	427	429	428	450	432	423	426
Final wt., lb.	564	568	680	650	748	691	718	682
Avg. daily gain, lb.	1.09	1.11	1.99	1.76	2.54	2.05	2.34	2.03
Feed/day, lbs.	12.1	11.9	17.4	16.0	16.8	14.9	16.2	14.6
Roughage	9.36	9.15	14.6	13.2	7.0	6.2	6.8	6.2
Grain	—	—	—	—	8.0	6.9	7.5	6.6
Supplement	2.74	2.71	2.81	2.76	1.87	1.83	1.85	1.80
Feed/lb. gain, lb.	11.1	10.7	8.7	9.1	7.1	7.3	6.9	7.2
TDN/lb. gain, lb.	6.0	5.9	4.3	4.6	4.5	4.5	4.2	4.4
Conc.: roughage ratio	23:77	23:77	16:84	17:83	42:58	42:58	42:58	42:58

outside paved lots equipped with automatic waterers. A 50:50 mixture of trace mineral salt and dicalcium phosphate was also provided free choice.

Individual weights were obtained every 21 days with no feed fed for 16 hours prior to weighing. The steers were fed twice a day in amounts they would clean up. The inside pens were bedded with straw.

Pertinent results of the experiment are presented in Tables 3 to 6. Table 3 summarizes the performance for the first 126 days of the trial. Steers in the first four lots were fed primarily the roughage pellets. The only grain offered was the 1.6 pounds fed in the supplement. In Lots 1 and 2, where the main part of the ration was the corn roughage pellet, several feedings were skipped to force consumption of the CRP. This resulted in an intake of the supplement, designed to be fed at 3 pounds, of only about 2.75 pounds. In fact, the steers in these lots did so poorly initially because of

low intake of the CRP that after 70 days, 2 pounds of alfalfa pellets were fed per head daily in addition to the CRP. This seemed to increase consumption of the CRP. However, the gains in Lots 1 and 2 were much less than expected. In Lots 3 and 4, fed equal parts of alfalfa pellets and the sunflower hull pellets, consumption was over 3 pounds of ration per hundred pounds of body weight. This was more than expected because of the high fiber and lignin content of the PSH (Table 1). Apparently, the digestibility of the fiber in the PSH was reasonably good because the lignin (about 2.5 pounds lignin per head per day) is known to be indigestible. The fact that the sunflower hulls were finely ground and pelleted also contributed to the relatively high intake of this roughage. It is known that the finer that roughages are ground, the more rapid the rate of passage through the digestive tract. This and the pelleting, which made the feed more acceptable, contributed to a greater total intake of the rough-

Table 4. Experiment C-27 finishing phase.

Roughage	Corn Roughage Pellet		Sunflower Hulls Alfalfa Pellets		Corn Roughage Pellet		Sunflower Hulls Alfalfa Pellets	
	Bly.	Trit.	Bly.	Trit.	Bly.	Trit.	Bly.	Trit.
Lots	1	2	3	4	5	6	7	8
Days to finish	189	189	189	189	126	126	126	126
Initial wt., lb.	564	568	680	650	748	691	718	682
Final wt., lb.	1000	977	1136	1009	1071	913	1034	915
Avg. daily gain, lb.	2.31	2.17	2.41	1.90	2.56	1.78	2.51	1.74
Feed/day lb.	23.9	19.8	26.1	21.9	23.6	16.6	23.1	16.7
Roughage	9.5	7.9	11.2	9.3	6.5	4.4	6.3	4.4
Grain	12.3	9.9	12.8	10.5	15.3	10.2	14.9	10.3
Supplement	2.1	2.0	2.1	2.1	1.8	1.9	1.9	2.0
Feed/lb. gain, lb.	10.4	9.2	10.8	11.5	9.2	9.4	9.2	9.8
TDN/lb. gain, lb.	6.6	5.8	6.6	7.1	6.2	6.2	6.0	6.4
Avg. conc.: roughage ratio	60:40	60:40	57:43	57:43	65:35	62:38	65:35	62:38
Dressing % ¹	59.	59.6	59.8	62.4	59.9	60	59.5	58.8
Carcass grade ²	9.4	9.4	10.2	9.0	9.4	8.3	9.1	8.2
Abscessed livers ³	4/6	2/6	3/6	4/6	2/6	2/6	1/6	4/6

¹Hot carcass weights divided by final weights off experiment.

²8 equals avg. good, 9 equals high good, 10 equals low choice etc.

³4.6 means 4 out of 6 steers, etc.

ages. Alfalfa pellets (suncured) as half of this roughage also made the PSH more acceptable and improved the overall quality of the roughage. Where the PSH were used as the only roughage for wintering heifers, there was impaction and death (field reports).

In this 126-day initial period feeding, either the barley or the oats resulted in greater gains than with the triticale-fed steers. This may have been partly due to the ergot in the triticale and its effect on feed intake. It is interesting to note that the feed efficiencies were similar. The concentrate-roughage ratios varied more than expected. In Lots 1 and 2, less of the CRP was consumed than expected so the ratio was above the expected 20:80. In Lots 3 and 4, the opposite was true; a greater than expected intake of the PSH-AP resulted in a ratio of less than 20:80. The four remaining lots maintained the planned ratios.

Table 4 presents the results from the finishing period. Where barley replaced the oats, the gains were increased (Lots 1 and 3). However, these did not equal or exceed those where the higher level of barley had been fed in the first phase (Lots 5 and 7). It was expected that the gains in Lots 1 and 3 would exceed those in Lots 5 and 7 during this phase because the steers normally would have compensated by greater feed intake (and consequently greater energy intake) and greater gains. This was not the case and probably reflects the poor quality of the corn roughage pellets. In the case of the triticale-fed lots (Lots 2 and 4), the steers did gain more than those which had been fed at the higher levels of grain in the first 126 days (Lots 6 and 8). The

explanation for the poor gains is due mainly to the low feed intake (about 30 per cent less than Lots 5 and 7). The low feed intake may have resulted from the ergot in the triticale. The steers in Lots 6 and 8 had consumed an average of 6.5 to 7 pounds of triticale per day for the first 126 days as compared to only 1.6 pounds for Lots 2 and 4, and consequently had consumed larger amounts of ergot. The observed symptoms were identical to those seen in later experiments (Dinusson et al, N.D. Farm Research 29:2, 20-22, 1971), and therefore were due primarily to ergot and not the triticale.

Summaries of the entire experiment are shown in Tables 5 and 6. It took 315 days to finish Lots 1 to 4 as compared to 252 days for lots 5 to 8. The slower gaining lots needed about two months more to reach slaughter weights. This extra overhead, plus the extra labor, suggests that the practice followed for Lots 5 to 8 was more feasible and economical. The concentrate-to-roughage ratio for the first four lots for the entire experiment was about 50:50, while for the second four lots it was 66:34.

Table 6 presents a summary of the results grouped by treatment. Comparing the oats/barley lots with those receiving triticale shows that the oats/barley fed steers gained about 21 per cent faster than those on triticale with ergot with most of the poorer performance explained by the 18 per cent reduced feed intake probably due to the ergot contamination. Efficiency of feed utilization between these comparisons was similar. There was no difference in the number of abscessed livers (10 out of 24 or 12 out of 24) suggesting that the grains did not respond differently in this respect.

Table 5. Experiment C-27 — Results of entire experiment.

Roughage	Corn Roughage Pellets		Sunflower Hull & Alfalfa Pellets		Corn Roughage Pellets		Sunflower Hull & Alfalfa Pellets	
	Oats/Bly. 1	Trit. 2	Oats/Bly. 3	Trit. 4	Bly. 5	Trit. 6	Bly. 7	Trit. 8
Grain Lots								
Days total	315	315	315	315	252	252	252	252
Initial wt., lb.	426	427	429	428	450	432	423	426
Final wt., lb.	1000	977	1136	1009	1071	913	1034	915
Avg. daily gain, lb.	1.82	1.75	2.24	1.85	2.46	1.91	2.43	1.90
Feed/day, lb.	19.2	16.6	22.7	19.5	20.3	15.7	19.7	15.6
Roughage	9.4	8.4	12.6	10.9	6.7	5.3	6.6	5.4
Grain	7.4	5.9	7.7	6.3	11.7	8.5	11.2	8.3
Supplement	2.4	2.3	2.4	2.3	1.9	1.7	1.9	1.9
Feed/lb. gain, lb.	10.5	9.5	10.1	10.6	8.2	8.2	8.1	8.3
TDN/lb. gain, lb.	6.5	5.9	5.8	6.1	5.4	5.3	5.2	5.2
Avg.: roughage ratio	51:49	49:51	44:56	44:56	66:34	66:34	67:33	65:35
Dressing % ¹	9.4	9.4	10.2	9.0	9.4	8.3	9.1	8.2
Grade (USDA) ²	59.	59.6	59.8	62.4	59.9	60	59.5	58.8
Abscessed livers ³	4/6	2/6	3/6	4/6	2/6	2/6	1/6	4/6

¹Hot carcass weights divided by final weights off experiment.

²8 equals avg. good, 9 equals high good, 10 equals low choice etc.

³4/6 means 4 out of 6 steers, etc.

Table 6. Summary by grains, roughage or systems.

Treatment	Oats.Bly.	Triticale	Corn Roug. Pellets	Sunflower Hull-Alf	System 1	System 2
Lots	1,3,5,7	2,4,6,8	1,2,5,6	3,4,7,8	1,2,3,4	5,6,7,8
Avg. daily gain, lb. ¹	2.24	1.85	1.99	2.11	1.92	2.18
Feed/lb. gain, lb.	9.2	9.2	9.1	9.3	10.2	8.2
Feed/day, lb.	20.5	16.9	18.0	19.4	19.5	17.8
Abscessed livers	10/24	12/24	10/24	12/24	13/24	9/24

¹Difference significant at the 5% level for comparisons of grains.

Cattle receiving the sunflower hull pellets and alfalfa pellets (50:50) gained 6 per cent faster than those receiving the corn-roughage pellets. However, there was probably no difference in feed efficiency because the steers on the pelleted sunflower hulls and alfalfa pellets consumed, on the average, 7 per cent more feed for the 6 per cent faster gain. There was no apparent difference in the incidence of abscessed livers between the treatment groups.

In comparison between the two systems (first, a 126-day wintering-growing phase, and second, starting the calves on 40 per cent grain) showed that the steers on the second system gained 13 per cent faster, were on feed 63 fewer days and required 2 pounds less feed per pound of gain (24 per cent less) than the first system, primarily because of the larger percentage of roughage pellets fed in the first 126 days to the first four lots. In this regard, it took 3.07 tons of feed per calf in the first system of which about 1.44 tons was concentrate (grain plus supplement) and 1.63 tons was roughage pellets. In the second system, it took about 2.24 tons of feed per calf of which 1.48 tons was concentrate and 0.76 tons roughage pellets. It took 3 per cent less concentrate and 53 per cent more of the roughage pellets for the first system over the second. The ergot-infested triticale was fed to an equal number of steers in both systems, so these comparisons of differences should be valid. In regard to the incidence of abscessed livers, there was about a 38 per cent condemnation in System 1 and a 54 per cent incidence in System 2.

Steers on the triticale rations showed symptoms which are now known to be due to continuous low-level feeding of ergot (see Dinusson et al, N.D. Farm Research 29:2, 20-22, 1971). The first symptom was a reduced feed intake followed by increased water consumption, and increased urination resulting in wet bedding. The hair coats were matted, unthrifty and lacked bloom. During warm days (85°F. or above) these steers showed heat stress, panting and heavy respiration, with saliva slobbering. Some of the steers also had unpredictable behavior, sometimes showing nervousness and at other times very unresponsive to their environ-

ment. Some of the steers also showed a stance and walk suggesting discomfort in the feet and legs. The symptoms were not readily apparent during the 126-day wintering period for Lots 1 to 4, but progressively appeared as the grain portion of the ration was increased.

Summary

1. Cattle fed triticale (Rosner) containing from 0.043 to 0.08 per cent ergot gained 17 per cent less rapidly than cattle fed barley or oats and barley. This was probably due to the effect of the ergot and not the triticale.
2. The corn roughage pellets used were not as satisfactory a feed as an equal mixture of pelleted sunflower hulls and alfalfa pellets.
3. Calves "wintered" for 126 days prior to putting on finishing rations gained 13 per cent less per day and required 24 per cent more feed per pound of gain than those started on a concentrate-roughage ratio that averaged 66:34 for the entire experiment.

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