equivalent. The dehydrated product is similar to Dex-Mo-Lass except that ammoniated hydrol was used instead of plain hydrol to dry on corn oil meal and corn gluten meal. Soybean oil meal was not used in Lot 2.

Results

Results of this test are shown in Table 39.

Observations

1. Rate and efficiency of gain were essentially the same in Lots 1 and 3. This indicates that liquid ammoniated hydrol can satisfactorily replace part of soybean oil meal in cattle rations.

2. Animals in Lot 2 made satisfactory gains; however, they were not so great or efficient as those of the other lots. This indicates that a product of this kind can be used alone; however, better results probably would be obtained when used with an ingredient such as soybean oil meal.

3. After being on feed about 60 days, animals in Lot 3 seemed to show greater watery discharge from the eyes than did the others. This cleared up in 30 to 40 days. No other harmful or ill effects or unusual behavior were observed.

Table 39

Results of Feeding Ammoniated Hydrol in the Wintering Ration of Beef Heifer Calves.

November 9, 1955, to April 11, 1956—154 days.

Lot number	1	2	3
Number heifers per lot	10	10	10
Av. initial wt., lbs.	400	399	398
Av. final wt., lbs.	656	609	645
Av. gain per heifer, lbs.	256	210	247
Av. daily gain per heifer, lbs.	1.66	1.36	1.60
Av. daily ration, lbs.:			
Sorghum silage	30.9	28.0	28.8
Soybean oil meal	1.0		0.6
Milo grain	2.9	1.9	1.8
Dehydrated am. hydrol product		2.0	
Liquid ammoniated hydrol			2.0
Mineral (bonemeal and salt)	.06	.05	.07
Salt	.09	.05	.09
Lbs. feed per 100 lbs. gain:			
Sorghum silage	1858.4	2053.6	1796.6
Soybean oil meal	60.2		37.4
Milo grain	172.7	137.1	110.4
Dehydrated am. hydrol product		146.7	
Liquid ammoniated hydrol			124.7
Mineral (bonemeal and salt)	3.6	3.9	4.3
Salt	5.6	3.9	5.6

The Use of Live-Yeast Suspensions in Beef Cattle Rations.

PROJECT 370

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The rumen, or paunch, of cattle and sheep normally contains innumerable microorganisms. It has long been recognized that these microscopic organisms help break down complex carbohydrates such as fiber and help synthesize nutrients for the host animal. The efficiency of utilization of rations fed to cattle and sheep is largely determined by the proper balance of these microorganisms in the rumen and a supply of certain basic nutrients such as protein, minerals, and readily available energy.

Two strains of live yeast were used as an additive in this experiment to study (1) their value in wintering and fattening rations of steer calves (2) their effect upon digestion and (3) any carryover effect from wintering to grazing.

Experimental Procedure

Thirty choice-quality Hereford steer calves were divided as equally as possible into three lots of 10 animals each. The feeding and management were the same for all lots throughout the wintering (168 days), grazing (89 days), and fattening (103 days) phases except for the addition of the yeast. Roughages used were Atlas sorghum silage in the wintering phase and prairie hay in the fattening phase. Soybean oil meal and milo grain were used as the concentrates. Grazing consisted of native bluestem pasture.

The two live-yeast strains used in this experiment were **Torula utilis** and **Saccharomyces cerevisiae.** The suspensions were prepared weekly by the bacteriology department and stored under refrigeration until used. They were prepared by adding 1 pound of peeled potatoes to a liter of water which was steamed for one hour, and then filtering through cheesecloth. Two percent sucrose was added to the filtrate which was then sterilized by autoclaving. The cells were then grown 48 hours in this potato-sucrose broth on a shaking machine at 30 degrees Centigrade. After growth of the cells, concentrations were adjusted by photoelectric turbidity measurements to give 3 billion cells per steer per day. The cells were not washed, but were diluted with sterile water to adjust the count to the desired level.

The yeast suspensions were mixed with approximately ½ pint of water and sprinkled over the feed. This was done each morning.

The digestion study was conducted with 11 yearling Hereford steers that averaged approximately 700 pounds. The ration consisted of 1 part chopped alfalfa hay to 3 parts ground milo grain. The yeast suspensions were added to the ration of each individual steer daily. Yeast cell counts were made to determine the number present in the feces. Fecal samples were obtained on the last day of the collection period during the digestion study. The counts were obtained by diluting 10 grams of moist feces in sterile water blanks and plating after making appropriate dilutions.

Results

A summary of the experiment, including the wintering, grazing, and fattening phases, is shown in Table 40. The results of the digestion study with 11 yearling steers on a fattening-type ration are shown in Table 39. Yeast cells per milliliter of feces are shown in Table 42.

Observations

Live yeast suspensions of **Torula utilis** and **Saccharomyces cerevisiae** were fed to beef steers in the feed lot and in digestion studies at the rate of approximately 3 billion cells per head per day. The following observations were made under the conditions of this experiment:

1. Rate of gain and feed efficiency were essentially the same for the wintering phase.

2. There was some but not a great difference in the rate of gain during the grazing phase. Animals that had been fed yeast did not gain quite so well as those that did not receive yeast.

3. Animals receiving **Torula utilis** did not gain so well in the fattening phase as the others. They also showed a decreased feed efficiency.

4. Fecal counts showed the presence of yeast in feces of beef cattle; however, the number of yeast cells was increased by feeding live yeast suspensions.

5. A more pungent fecal odor was observed among the steers fed yeast during the digestion study. It was not so great in the feed-lot tests.

6. Animals fed **Torula utilis** did not show the bloom and general appearance normally exhibited by animals in feed lots. There was a certain amount of scurfy or scaly condition of the skin, somewhat like

dandruff in the hair. A small amount of this was present in the animals fed Saccharomyces cerevisiae but none in the control animals.

7. No difference was observed in the quantity of grain in the feces of steers fed yeast and the control steers.

8. The addition of yeast did not improve the digestibility of the ration.

9. Under the conditions of this experiment, the addition of live yeast suspensions to beef cattle rations is not desirable.

Table 40

Feeding Live Yeast Cultures to Steer Calves.

Phase 1, Wintering, November 16, 1954, to May 3, 1955—168 days.

Lot number	1	2	3
Experimental treatment	Control	Torula utilis yeast	Saccharomyces cerevisiae yeast
Number steers in lot	10	10	10
Initial wt. per steer, lbs.	456	454	456
Final wt. per steer, lbs.	750	763	758
Gain per steer, lbs.	304	309	302
Daily gain per steer, lbs.	1.81	1.84	1.80
Lbs. daily ration per steer:			
Soybean meal	1.00	1.00	1.00
Ground milo	4.00	4.00	4.00
Atlas sorgo silage	29.04	28.93	29.04
Salt	.11	.10	.12
Mineral	.10	.10	.10
Lbs. feed per cwt. gain:			
Soybean meal	54.45	54.24	54.52
Milo	217.81	216.97	218.07
Atlas sorgo silage	1581.09	1569.15	1582.94
Salt	5.72	5.58	6.31
Mineral	5.60	5.66	5.69
Feed cost per cwt. gain, $	13.99	13.93	14.02
Feed cost per steer, $	42.53	43.04	42.34
Phase 2, Grazing, May 3 to August 1, 1955—89 days.			
Initial wt. per steer, lbs.	760	763	758
Final wt. per steer, lbs.	845	838	828
Gain per steer, lbs.	85	75	70
Daily gain per steer, lbs.	0.96	0.84	0.79
Phase 3, Full Feeding, August 1 to November 12, 1955—103 days. (All self-fed grain in dry lot)			
Initial wt. per steer, lbs.	845	838	828
Final wt. per steer, lbs.	1103	1073	1093
Gain per steer, lbs.	258	235	265
Daily gain per steer, lbs.	2.49	2.28	2.57
Daily ration per steer, lbs.:			
Soybean meal	1.51	1.51	1.51
Milo	19.73	18.28	19.22
Prairie hay	6.61	6.70	6.83
Limestone	.10	.10	.10
Lbs. feed per cwt. gain:			
Soybean meal	60.1	66.85	59.28
Milo	795.3	801.23	747.16
Prairie hay	266.3	293.82	265.47
Limestone	3.9	4.29	3.81
Feed cost per cwt. gain, $	23.48	24.15	22.32
Feed cost per steer (fattening phase), $	60.58	56.75	59.16
Total gain per steer (all phases), lbs.	647	619	637

Table 40 (Continued).

Daily gain per steer (all phases), lbs.	1.79	1.71	1.76
Feed cost per cwt. gain (all phases), $	17.99	18.71	18.45
Total feed cost per steer, $	119.11	115.79	117.50
Initial steer cost at $22.50 per cwt., $	102.60	102.15	102.60
Feed cost + steer cost, $	221.71	217.94	220.10
Selling price per cwt. at market, $	20.00	19.00	20.00
Selling price per steer, $	220.60	196.94	210.70
$ loss per steer above initial cost + feed cost[1]	−1.11	−21.00	−10.40
% wt. shrink to market	3.94	3.36	3.61
Dressing % (chilled)	60.44	61.07	60.21
Carcass grades:			
Low choice	1		1
Top good	3	2	
Av. good	3	4	4
Low good	3	2	4
Top commercial		2	1
Marbling:			
Moderate	3		1
Modest		3	1
Small amount	5	4	5
Slight amount	2	2	2
Traces		1	1

1. Cost of yeast not included.

Table 41

Digestion Coefficients for Cattle-Fattening Rations That Contained Live Yeast Suspensions.

	Crude protein	Ether extract	Crude fiber	Nitrogen-free extract	Total digestible nutrients
Control	66.1	64.0	57.5	79.6	69.0
Torula utilis	66.31	60.38	52.54	80.82	68.49
Saccharomyces cerevisiae	58.34	54.60	57.45	75.98	65.17

Table 42

Average Yeast Counts in Feces of Steers Used in the Digestion Study.

(Cells per milliliter)

Control	Torula utilis	Saccharomyces cerevisiae
1,122	1,575	9,632