A phosphorus balance study with lambs also indicated efficient utilization of phosphorus from phosphoric acid. This test was conducted to further evaluate phosphoric acid as a source of phosphorus in the wintering ration of beef calves in dry lot.

Experimental Procedure

Seventy-four Hereford heifer calves were divided into five lots as equally as possible on the basis of weight and type. Lot 12, which served as the control lot, contained 10 animals and the others 16 animals each.

The control ration consisted of ¾ pound of soybean oil meal, ½ pound of dehydrated alfalfa meal, 2 pounds of dehydrated ammoniated hydrol product (Dex-Mo-Lass made with ammoniated hydrol), and all of a corncob-blackstrap molasses mixture that the animals would clean up each day. The corncob-molasses mixture contained approximately 22 percent molasses for the first 84 days. It was then increased to 40-45 percent molasses. When the molasses concentration was increased, 1½ percent each of ground limestone and salt was added to retard "setting up" of the mixture. The limestone was decreased to ¾ of 1 percent after about 30 days. The soybean oil meal and dehydrated alfalfa meal were made into pellets containing approximately 10 percent molasses. The added phosphorus was put in these pellets in the form of phosphoric acid or steamed bonemeal. A mixture of ground limestone and salt and salt alone were available to all animals free choice.

The control ration supplied approximately 6 grams of phosphorus per head per day. This is one-half of the National Research Council recommendation of 12 grams per head per day. Source and amount of phosphorus in the ration was the only variation. The treatments were as follows, which indicate the amount of added phosphorus per head per day:

Lot 12—Control ration.

Lot 13—Control ration + 3 grams phosphorus from phosphoric acid.

Lot 14—Control ration + 6 grams phosphorus from phosphoric acid.

Lot 15—Control ration + 3 grams phosphorus from steamed bonemeal.

Lot 16—Control ration + 6 grams phosphorus from steamed bonemeal.

Blood samples will be taken at the end of the experiment to determine serum phosphorus and calcium levels.

Results and Discussion

The feed-lot results are presented in Table 38. The reader should recognize that the experimental ration used in this test was designed to contain a low amount of phosphorus. Therefore, the roughage and source of energy had to be from ingredients low in phosphorus. There was considerable variation from time to time in consumption of the corncob-molasses mixture; however, no difficulty was experienced in keeping the animals on feed. After increasing the percentage of molasses, the animals were getting approximately 1 pound of molasses per 100 pounds body weight. Trouble with scouring was observed when the consumption of molasses exceeded this amount.

Observations

1. No harmful or ill effects of any kind were observed from feeding phosphoric acid as a source of phosphorus.
2. No deficiency symptoms, phosphorus, vitamin A, etc,. were observed. Animals in all lots gnawed on the fence; however, there were no differences among lots.
3. Feed containing phosphoric acid was highly palatable and the total consumption tended to be greater.
4. Rate of gain and feed efficiency increased as the level of phosphorus was increased. There was no difference between steamed bonemeal and phosphoric acid as a source of phosphorus at the higher level; however, phosphoric acid tended to be more efficient at the lower level.

Table 38

Sources of Phosphorus for Beef Heifer Calves.

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

Lot number	12	13	14	15	16
Added phosphorus	None	3 gm. from phos. acid	6 gm. from phos. acid	3 gm. from steamed bonemeal	6 gm. from steamed bonemeal
Number heifers per lot	10	16	16	16	16[1]
Av. initial wt., lbs.	441	442	440	441	442
Av. final wt., lbs.	603	612	623	606	624
Av. total gain, lbs.	162	170	183	165	182
Av. daily gain, lbs.	1.05	1.11	1.18	1.07	1.18
Av. daily ration, lbs.:					
Corncob-molasses mixture	9.02	10.37	10.03	9.87	9.80
Soybean oil meal-dehydrated alfalfa pellets	1.30	1.30	1.30	1.30	1.30
Dehydrated am. hydrol product	2.00	2.00	2.00	2.00	2.00
Limestone and salt	.03	.02	.02	.02	.02
Salt	.05	.04	.02	.04	.03
Lbs. feed per 100 lbs. gain:					
Corncob-molasses mixture	857.7	939.8	844.1	921.0	828.8
Soybean oil meal-dehydrated alfalfa pellets	123.5	118.8	110.4	122.4	111.0
Dehydrated am. hydrol product	190.1	181.2	168.3	186.7	169.2
Limestone and salt	2.6	1.8	1.7	1.9	1.4
Salt	5.1	3.8	1.7	3.7	2.6

1. Data on 15 animals, one sick animal removed.

The Value of Ammoniated Hydrol in Beef Cattle Wintering Rations, 1955-56.

PROJECT 537[1]

D. Richardson, E. F. Smith, and R. F. Cox

This is the second test in an experiment to determine the value of ammoniated hydrol (corn molasses) in the wintering ration of beef heifer calves.

Experimental Procedure

Thirty Hereford heifer calves averaging about 400 pounds each were divided as equally as possible into three lots of 10 animals each. All lots received all the sorghum silage they would clean up each day. A mineral mixture of equal parts steamed bonemeal and salt and salt alone were fed free choice. Other ingredients, which varied in the different rations, were as follows:

Lot 1—Control, 1 pound soybean oil meal + 3 pounds milo grain.

Lot 2—Two pounds dehydrated ammoniated hydrol product + 2 pounds milo grain.

Lot 3—0.6 pound soybean oil meal, 2 pounds liquid ammoniated hydrol, and 1.9 pounds milo grain.

All rations were calculated to contain approximately the same amount of protein equivalent and total digestible nutrients. The liquid ammoniated hydrol contained 14.4 percent protein equivalent and the dehydrated ammoniated hydrol product contained 21.2 percent protein

1. This project was partially supported by Clinton Foods, Inc., Clinton, Iowa.

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

D. Richardson, F. H. Baker, J. O. Harris, E. F. Smith, R. F. Cox, and O. M. Bowman

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