Sorting lambs into three weight groups and self-feeding a complete ration of wheat pasture appears to offer several advantages:

(1) Unless the heavy lambs are started on feed immediately, they may reach market weight without sufficient finish to top the market.

(2) The stocking rate per acre can be increased considerably.

(3) During snow storms or other inclement weather, the lambs on the self-feeder will continue to gain in weight.

(4) Practically all the lambs will sell at top market price.

Fattening Beef Calves—Supplements to High-Milo and All-Barley Rations, Grinding Vs. Steam Rolling Milo, Implanting with Different Amounts of Stilbestrol

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Fattening beef cattle has become a highly mechanized operation—geared to mass production and automated feeding methods. Two changes during the last decade have been of particular importance to cattle feeders. First, grain has become a cheaper source of energy than roughage when costs of feed, processing, handling, and storage are all considered. Secondly, new methods of feed processing are now available, and these may alter the nutrient value of fattening rations.

In the light of new developments, it is necessary to take another look at fattening rations and the relative value of feeds. Of current interest is the use of "all concentrate" rations, pelleting, steam rolling grains, hormones, and feed additives. Since most of these increase the cost of fattening cattle, they must result in better performance if they are to be justified.

Three feeding tests are now underway to help answer some of these problems. In Experiment 1, steer calves are fed steam-rolled milo or barley, plus supplements, with little or no additional roughage in the ration. The test is designed so that it is possible to compare milo and barley as fattening feeds in rations containing approximately the same fiber level, as well as to test the value of complex supplements and additional minerals vs. an oil meal supplement, with each grain.

In Experiment 2, a comparison is being made of the effect of pelleting a high concentrate (63 percent milo) ration, and the addition of certain minerals to increase the total "ash" in an attempt to improve the ration. In Experiment 3, steer calves are being self-fed complete mixed rations to study the value of fine or coarsely ground milo vs.

steam rolled milo. The rations contain 50 percent of either finely ground, coarsely ground, or steam-rolled milo, with each mixture fed in loose vs. completely pelleted forms. In addition a further comparison is being made of a conventional fattening ration containing 32 percent roughage vs. one with only 8 percent roughage (dehydrated alfalfa meal). Other comparisons include the use of 12 vs. 24 mg. stilbestrol implants for weaner calves starting on feed.

All tests are still in progress, thus the results are not final and may be modified by future developments. However, it is believed that all have progressed far enough to point up certain trends.

Experiment 1.

Milo and Barley Rations with Various Supplements

Sixty-three, choice, Hereford steer calves, averaging 525 pounds, were started on feed October 12 at the Ft. Reno station. These were fall-dropped calves from the Experiment Station herd at Lake Blackwell, and started the test at about 10-11 months of age. Some of the calves had been previously implanted with either 6 or 12 mg. stilbestrol at about 150 days of age, and this was considered in allotment, as well as shrunk weight, feeder grade, and previous treatment. Calves of Lots 1, 2, and 3 were full-fed steam-rolled milo, 1½ to 2 pounds of supplement and 2 pounds of cottonseed hulls, after the calves were on a full-feed of grain. Four lots (4, 5, 6, and 7) were started on steam-rolled barley, plus supplement and no cottonseed hulls, except Lot 7, after the calves had been worked up to a full feed of grain over a seven week period. Lot 7 received the same allowance of hulls (2 pounds per head daily) as the milo-fed lots. Thus a comparison was possible of milo vs. barley at approximately the same fiber level, and also at different fiber levels.

The supplements fed per head daily were:

Lots 1 and 4—1½ pound soybean meal plus 0.1 pound calcium carbonate and approximately 21,000 units of vitamin A.

Lots 2 and 5—2.2 pounds of a special mixture containing 65 percent soybean meal, 25 percent dehydrated alfalfa meal, 10 percent molasses, 2.5 percent calcium carbonate, trace minerals (2 gm. per steer per day) and dry, stabilized vitamin A (21,000 units).

Lots 3 and 6—1½ pound soybean meal, 21,000 units of vitamin A, plus 0.35 pound of a special mineral mix formulated to simulate the major and trace minerals contained in 4 pounds of alfalfa hay.

The steers were fed in dirt pens, without bedding. Each calf received a 24 mg. stilbestrol implant at the base of the ear at the start of the trial, and all calves received 250 mg. aureomycin per head daily, mixed with the protein supplement during a 10-day period early in the trial to help control disease.

All calves were started on 3 pounds of grain per head daily, plus supplement and nearly a full-feed of roughage. The roughage was gradually removed and the grain increased in step-wise fashion over a 50-day period until only 2 pounds of cottonseed hulls per head daily remained in the rations fed Lots 1, 2, 3, and 7; all roughage was removed from the barley rations fed Lots 4, 5, and 6. All cattle had free access to a mineral mixture of two parts salt and one part rock phosphate. The steam-rolled grains were prepared at a commercial mill and stored in 60 day batches.

Considerable scouring and looseness was prevalent in the barley-fed lots when the last few pounds of cottonseed hulls were withdrawn. This became less noticeable as the trial progressed and eventually cleared up. None of the milo cattle appeared to be affected. Several cases of founder occurred among cattle fed either milo or barley.

A summary of the results after 154 days on test are shown in Table 1. Barley-fed cattle outgained milo fed steers by 0.14 pound per head daily, and required 40 pounds less grain and supplement and 79 pounds less roughage per cwt. gain (Lots 1, 2, and 3 vs. Lots 4, 5 and 6). Test weight on the barley was 47 pounds per bushel, and for milo, 58 pounds. Under the current feed prices, steam-rolled barley cost $46 per ton and steam-rolled milo, $39 per ton. The feed cost per cwt.

Table 1.—Milo Vs. Barley Rations with Various Supplements (Nine Steers Per Lot,[1] 154 Days on Test)

Steam-rolled grain	Milo			Barley			
Lot Number and Supplement	1 Basal	2 Special Supplement	3 Basal + Mineral	4 Basal	5 Special Supplement	6 Basal + Mineral	7 Special Supplement + Hulls
Average daily gain, lbs.	2.29	2.45	2.31	2.31	2.55	2.60	2.80
Average daily ration, lbs.							
Milo	14.5	15.3	14.4				
Barley				14.1	14.9	15.1	14.9
Soybean Meal[2]	1.6			1.6			
Special Supplement		2.2			2.2		2.2
Soybean Meal[2] + Mineral			1.8			1.8	
Cottonseed Hulls[3]	2.7	2.7	2.7	.9	.9	.9	2.7
Feed per cwt. gain (lbs.)							
Grain	633	624	623	610	584	581	532
Supplement	70	90	78	69	86	69	79
Cottonseed Hulls	118	110	117	39	35	35	96
Feed cost per cwt. gain ($)[4]	16.59	16.79	17.32	17.25	16.97	17.08	16.28

[1] Two steers foundered badly in Lot 4 and were removed from test. Others slightly foundered but left on test included, one each in Lots 2 and 3, two in Lot 6.

[2] Soybean meal supplement fed Lots 1, 3, 4, and 6 supplied 0.1 lb. Ca CO_3 and 21,000 units Vitamin A per head daily.

[3] Hulls fed to Lots 4, 5, and 6 only during first seven weeks.

[4] Cost of supplements were $79.14, $72.00, and $95.14 per ton for the soybean basal, special supplement and basal + mineral, respectively.

gain was $16.90 for milo fed lots and $17.10 for barley cattle—almost identical values. Thus, in this type of feeding program, barley was worth about $7 per ton more than milo. Moreover, barley-fed cattle appear to be fatter than those receiving milo. This difference in fatness may appear later in carcass grades when the cattle are slaughtered. This would further improve the relative value of barley as a fattening feed.

The complex supplement containing dehydrated alfalfa meal, molasses, and trace minerals, in addition to the calcium and vitamin A added to all supplements, appeared to improve performance of calves in Lots 2 and 5. This is in contrast to the results of earlier experiments at this station in which no advantage could be shown for complex supplements when milo and sorghum silage were fed with soybean meal in conventional fattening rations. The beneficial effect in this trial may be explained on the basis of a need for certain factors contained in the complex formula where little or no roughage is fed. It is known that roughage supplies added minerals and other factors and in a fattening ration, may be necessary for normal fermentation in the rumen.

A mineral mixture simulating the composition of the minerals in 4 pounds of alfalfa hay was added to the average daily ration fed steers of Lots 3 and 6. In the case of milo and cottonseed hulls, the minerals appeared to be of little benefit (Lot 3). In contrast, the gains of Lot 6 cattle, where barley was fed, appeared to be improved by such an addition. It is possible that (1) the added minerals in the barley rations promoted a more "normal" fermentation in the paunch, thus resulting in certain nutrients needed by the steers, or (2) there may be fundamental differences in the mineral content of milo vs. barley—hence the difference in response. Recent Kansas research points up such a possibility. They were able to show a beneficial response from adding trace minerals to fattening rations containing corn, but not with milo. With the advent of "all concentrate" rations, it appears necessary to study more thoroughly the mineral composition of different grains, and variations within the grain itself.

Calves of Lot 7 fed steam-rolled barley and a special supplement, but with additional cottonseed hulls, showed the best gains and feed efficiency. Cost per cwt. gain was nearly $.82 less for Lot 7 than for the average of Lots 4, 5, and 6—or $.69 less than for Lot 5 getting the same barley and supplement, but without roughage after the first 50 days on test. These results and the better appearance and "bloom" of Lot 7 cattle, together with less scouring, suggest that a small quantity of roughage may be beneficial. Because of better performance, feed costs may actually be less per 100 pounds gain than where all roughage is removed from the ration.

Experiment 2.

Addition of Minerals to Pelleted High-Concentrate Rations

Since grain and protein supplements are so low in mineral or "ash", very concentrated rations may result in certain mineral deficien-

cies. To further study the value of added minerals in high-concentrate rations, three groups of individually fed steer calves were used in a feeding trial at the Ft. Reno station. Six, Hereford, steer calves in each lot were started on feed in early November. The mixture fed contained 63 percent ground or rolled milo, 9 percent cottonseed meal, 7 percent dehydrated alfalfa meal, 13 percent cottonseed hulls, 7 percent molasses, and 0.9 percent calcium carbonate plus vitamin A supplement.

The calves averaged 450 pounds at the start of the test and were all from one experimental herd, sired by closely related bulls. They were alloted to treatment on the basis of sire, age, feeder grade, and shrunk weight. They were gradually worked up to a full feed of their respective rations over a three-week period. The rations fed were:

Lot 1—Basal ration in meal form.

Lot 2—Basal ration pelleted (5/16-inch cubes).

Lot 3—Pelleted basal ration containing 2.4 percent of a complex mineral mixture simulating alfalfa ash in composition.

All calves had access to salt, but no additional minerals.

Initially, finely ground milo was used in the mixture. This proved quite unpalatable and after 45 days, steam-rolled milo was substituted in its place. This greatly improved the palatability of the ration and performance of the calves.

The results summarized in Table 2 show the characteristic decline in gain when very concentrated rations are pelleted. This has been demonstrated in numerous trials. In this instance, however, feed in-

Table 2.—Performance of Beef Calves Fed High-Concentrate Rations as Influenced by Pelleting and Addition of Minerals

Lot No. and Ration Fed	Average daily gain, lbs.	Average daily Feed Intake, lbs.	Feed per cwt. gain, lbs.
1. Meal	1.77	14.05	794
2. Pellets	1.68	14.74	867
3. Pellets + minerals	1.76	14.17	805

take was not depressed by pelleting, nor was feed efficiency improved. These two characteristics are often noted from pelleting rations containing over 65 percent concentrates.

The addition of 0.33 pound per head daily of a complex mixture fortified with sodium, potassium, calcium, phosphate, sulfate, and trace minerals appeared to improve performance and feed efficiency in Lot 3. These results are somewhat in contrast to those obtained in Experiment 1. The reason for the difference is not clear. Perhaps the nature of the ration (pellets vs. a loose mixture) influenced the results. The trial is still in progress and, as in other studies, further feedlot performance and carcass data will be obtained.

Experiment 3. Effects of Fine, Coarse Ground, and Steam Rolled Milo, High-Milo Rations, and Levels of Stilbestrol Implant

Previous tests have shown that pelleting milo for fattening calves resulted in decreased feed intake and rate of gain as compared to the ground product. Also, in previous tests, steam-rolled milo was less efficiently utilized than the finely ground product. A fundamental problem seemed to involve the best particle size of ground milo, or the best method of preparing milo grain. Since about 75 percent of the total cost of a fattening ration is the cost of the grain, it becomes important to study factors that affect this segment of the ration.

As one phase of Experiment 3, six lots of 10 Hereford steer calves each, averaging 460 pounds per head, were fed identical rations except for the method of preparing the milo. The mixtures contained 50 percent milo, with 9 percent cottonseed meal, 8 percent dehydrated alfalfa meal, 8 percent molasses, 24 percent cottonseed hulls, 1 percent salt, and calcium carbonate, plus sufficient vitamin A to furnish 21,000 units per steer daily. Lots 1 and 2 received finely ground milo, prepared by processing it through ⅛ inch screen hammer mill at 3500 R.P.M. Lots 3

Table 3.—Particle Size of Milo Grain Prepared by Different Methods (Experiment 3)[1]

	Percent Not Passing Through				
Screen Size (inches)	10/64	6/64	1/25	1/40	Remainder
Finely ground	---	---	26.1	36.3	37.2
Coarsely ground	---	4.4	40.6	24.5	29.8
Steam rolled	25.5	50.7	16.2	2.2	6.0

[1] Average of three batches sampled.

and 4 received cracked or coarsely ground milo, processed through a hammer mill without a screen. In the mixtures fed Lots 5 and 6, the milo was steam-rolled. The particle size of the differently processed milo is shown in Table 3. The mixtures self-fed calves in Lots 1, 3, and 5 were in the loose or meal form; while rations fed Lots 2, 4, and 6 were processed into 5/16-inch cubes. The composition of the mixtures fed is shown in Table 4.

Table 4.—Composition of Rations Self-Fed to Fattening Steer Calves in Experiment 3 (Percent)

	Lots 1 through 6	Lot 7
Milo[1]	50	74
Cottonseed meal (solvent)	9	9
Dehydrated alfalfa meal	8	8
Molasses	8	8
Cottonseed hulls	24	--
Calcium carbonate	.5	.5
Salt	.5	.5
Vitamin A premix.[2]	.05	.05

[1] Milo was finely ground for Lots 1 and 2, coarsely ground for Lots 3 and 4, and steam rolled for Lots 5, 6, & 7.
[2] Supplied approximately 21,000 U.S.P. units Vitamin A per steer daily.

Part of the calves used in this test were from the experiment station herd, the remainder were purchased from the L. H. Ham herds at Fitztown and Paoli. Allotment was based on shrunk weight, feeder grade, and source of the cattle. One half of the calves in each lot were implanted at the start of the trial with 12 mg. stilbestrol, the remainder with 24 mg. All calves were drenched with phenothiozine at the start of the trial, and received 250 mg. aureomycin mixed with the ration for 10 days prior to the start of the test to help control disease. The calves were shifted from a preliminary ration of milo, cottonseed meal, and sorghum silage to the mixed rations over a two-week period. All mixtures were self-fed. All calves had access to a mineral mixture of two parts salt and one part rock phosphate.

Calves in an additional group (Lot 7) were started on the same mixture as fed Lot 5, but were gradually shifted over to a mixture containing no cottonseed hulls, and 8 percent dehydrated alfalfa meal as the only roughage over a 6-week period. This change was made with no apparent set-back or digestive disturbance. As in the other lots, the mixture was self-fed and one-half the calves were implanted with 12 mg. stilbestrol, the remainder with 24 mg.

Preparation of milo. The results of this phase of the test are shown in Table 5. As in a previous study, finely ground milo appeared to promote better gains than the coarsely ground product. This difference was reversed when the rations were fed in pelleted form, rather than as meal. Pelleting appeared to improve performance slightly when coarsely ground or steam-rolled milo was fed, but not with finely ground milo. Overall averages showed a gain of 2.36 per head daily for Lots 1 and 2 vs. 2.27 each for Lots 3 and 4, or Lots 5 and 6. Daily feed intake was greatest for Lot 1 calves, although feed per cwt. gain was about 60 pounds less than for either calves fed coarsely ground milo (Lot 3) or for the steam-rolled grain (Lot 5). Differences in feed efficiency between the pelleted rations containing the differently processed grains were not as marked. Finely ground milo rations also proved to be the cheapest in producing 100 pounds gain.

"All concentrate" rations. Calves of Lot 7 were fed a fattening ration containing 74 percent steam-rolled milo and only 8 percent dehydrated alfalfa meal as the roughage. (See Table 6). These calves gained 2.30 pounds per head daily vs. 2.19 pounds for Lot 5 calves which served as controls. They did so on 108 pounds less feed per cwt. gain. The marked decline in feed intake of nearly 1.5 pounds per head daily for Lot 7, as shown in Table 6, is typical of what can be expected from feeding a very concentrated ration. Using current feed prices, the cost of producing 100 pounds gain was 88 cents less for Lot 7 than Lot 5.

Table 5.—Feedlot Performance of Steer Calves Self-Fed Mixtures Containing Fine, Coarsely Ground or Steam Rolled Milo, in Meal or Pelleted Rations (10 Calves Per Lot[1], 138 Days)

Milo preparation	Finely ground		Coarsely ground		Steam rolled	
Lot number and Ration fed as—	1 Meal	2 Pellets	3 Meal	4 Pellets	5 Meal	6 Pellets
Average daily gain, lbs.	2.42	2.29	2.20	2.34	2.19	2.35
Average daily feed intake, lbs.	18.97	17.28	18.60	17.30	18.52	18.06
Feed per cwt. gain, lbs.	784	755	845	739	846	769
Feed cost per cwt. gain, $[2]	16.86	16.98	18.17	16.63	18.60	17.68
Appraised value per cwt., $	23.25	22.90	23.10	23.22	23.30	23.20

[1] Two calves removed from Lot 1 and one from Lot 3 with urinary calculi; one calf removed from data in Lot 4 due to sickness of unknown origin last weigh period. Data on these calves not included. Initial feeder price was $27 per cwt.

[2] Feed costs per cwt. were ($): Lots 1 and 3, 2.15; Lots 2 and 4, 2.25; Lot 5, 2.20, and Lot 6, 2.30.

Table 6.—Comparison of an "All Concentrate" Ration with a Conventional Fattening Ration (10 Calves Per Lot,[1] 138 Days)

	Lot 5 Conventional ration (24% Cottonseed Hulls 8% dehyd. alf. meal)	Lot 7 "All Concentrate" ration (8% dehyd. alf. meal)
Average daily gain, lbs.	2.19	2.30
Average daily feed intake, lbs.	18.52	16.98
Feed per cwt. gain, lbs.	846	738
Feed cost per cwt. gain, $[2]	18.60	17.72
Appraised value per cwt. $	23.30	23.45

[1] One calf removed from Lot 7 with urinary calculi; data on this calf not included. Initial feeder price was $27 per cwt.
[2] Lot 7 mix cost.

Of course, it is misleading to say that Lot 7 calves were fed an "all concentrate" ration. The mixture contained 8 percent dehydrated alfalfa meal which is a roughage—but in meal form. All steers were bedded twice weekly with wheat straw and some was consumed, but these calves had no greater desire for it than those of other lots getting cottonseed hulls in the ration. As in Experiment 1 with "all-barley" rations, considerable scouring and looseness was prevalent in Lot 7 calves—but no cases of founder were observed in this experiment.

Future attempts will be made to improve on this type of ration. Results to date look promising for such a mixture when milo is cheap relative to roughage.

*Effect of 12 vs. 24 mg. implants.** Results of an extensive test on 0 vs. 24 mg. stilbestrol implants conducted on cattle the previous year are shown in Table 7. In this test, implants increased average daily gains by 0.18 pound, or 9 percent. There was virtually no effect on average carcass merit considering any of the measures used.

In Experiment 3, one-half of the calves were implanted with 12 mg., the remainder with 24 mg. Results show an improvement for the 24 mg. level of 0.08 pound per head per day. Judging by previous results, 12 mg. stilbestrol implants appear to give a response about mid-way between 0 and 24 mg. Detailed carcass analyses will also be made upon the completion of this test to determine any effect on the two groups.

Urinary calculi. A marked outbreak of urinary calculi ("water belly") resulting in a blockage of the urinary tract occurred during the

Stilbestrol implants for this study were supplied by Chas. Pfizer & Co., Terre Haute, Ind.

Table 7.—Stilbestrol Implant Studies with Fattening Steer Calves

	1959-60 Test		1960-61 Test	
	No Implant	24 mg.	12 mg.	24 mg.
No. steers per treatment	26	35	33	32
Average days on test	156	156	138	138
Average daily gain, lbs.	1.93	2.11	2.25	2.33
Final slaughter wt., lbs.	767	793	773	786
Estimated slaughter grade score[1]	6.77	6.54	6.60	6.30
Average yield, (Percent)[2]	62.2	62.3		
Slaughter data:				
Carcass conformation score[1]	5.65	5.50		
Average carcass grade[1]	6.92	7.05		
Average marbling score[3]	8.0	7.9		
Average rib eye area, sq. in.	9.25	9.27		
Average fat thickness (inches)	.84	.81		

[1] Choice = 4, Low Choice = 5, Good + = 6, Good = 7, etc.
[2] Hot carcass weight shrunk 2.5%
[3] Marbling score —8 = modest amount, 9 = slight, etc.

third and fourth months on test. Calves of Lots 1, 3, and 7 were most affected. At the mid-point of the trial, the calcium carbonate was reduced in the mixtures fed all lots. One case of calculi occurred after such a change was made.

The cause of urinary calculi is still obscure. For some reason, the rations fed in this trial appeared to promote considerable difficulty. It is of interest to note that all cases observed were among calves from one experiment station herd. Nearly 25 percent of these calves were affected.

Summary

Three experiments were initiated in the fall of 1960 to study different aspects of fattening rations for steer calves. While all trials are still in progress, and only preliminary results are available, certain trends may be observed.

Calves fed steam-rolled barley without additional roughage tended to outgain those fed steam-rolled milo plus a small amount of cottonseed hulls. In addition, barley-fed calves appear to be fatter. A complex supplement containing dehydrated alfalfa, molasses, minerals, and vitamin A proved superior to soybean meal, fortified calcium and vitamin A, in either milo or barley rations. The addition of more total "ash" or minerals to the ration appeared beneficial where barley was fed, but not with milo. Best overall results have been obtained with steam-rolled barley and a complex supplement—plus a small amount of additional cottonseed hulls.

In pelleted rations containing 63 percent ground or rolled milo, the addition of a complex mineral mix improved gains slightly.

In further experiments, mixed rations containing 50 percent milo in finely ground form proved superior to the same mixtures containing coarsely ground or steam-rolled milo. Less difference between milo preparation was apparent when the rations were pelleted. A ration containing 74 percent steam rolled milo and no roughage other than 8 percent dehydrated alfalfa meal proved superior to one containing only 50 percent steam-rolled milo, with dehydrated alfalfa meal and cottonseed hulls as the roughage. Approximately 13 percent less feed was required per cwt. gain with the "all concentrate" milo ration.

Implanting 8 to 9 month old calves with 24 mg. stilbestrol at the start of the trial improved gains, with no overall effect on carcass quality. Implanting with 12 mg. appeared to give less response than 24 mg. stilbestrol.

A Study of the Ratio of Concentrates to Roughage, Replacing Alfalfa Hay with Peanut Hulls, and Pelleting Vs. a Mixture for Fattening Lambs in Dry-Lot

Robert L. Noble, Kenneth Urban,
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In recent years the acreage of peanuts in Oklahoma has increased considerably. In a few areas, peanut shelling factories are in operation and peanut hulls are available as a by-product. With the volume of peanut hulls now available, it was felt desirable to test their value in replacing alfalfa hay in a lamb fattening ration.

Also included in this year's work is a study of the ratio of concentrates to roughages, and pelleting versus the same ration fed ground and mixed.

Procedure

One hundred and forty-five western feeder lambs were used in this study. The lambs were produced in the range area of Western New Mexico. They were purchased at Roswell and shipped by truck to the Ft. Reno Station. During the first two weeks, the lambs grazed dry-native grass pasture around the station's headquarters. For the next month the lambs grazed small lots of wheat pasture in the swine area. On