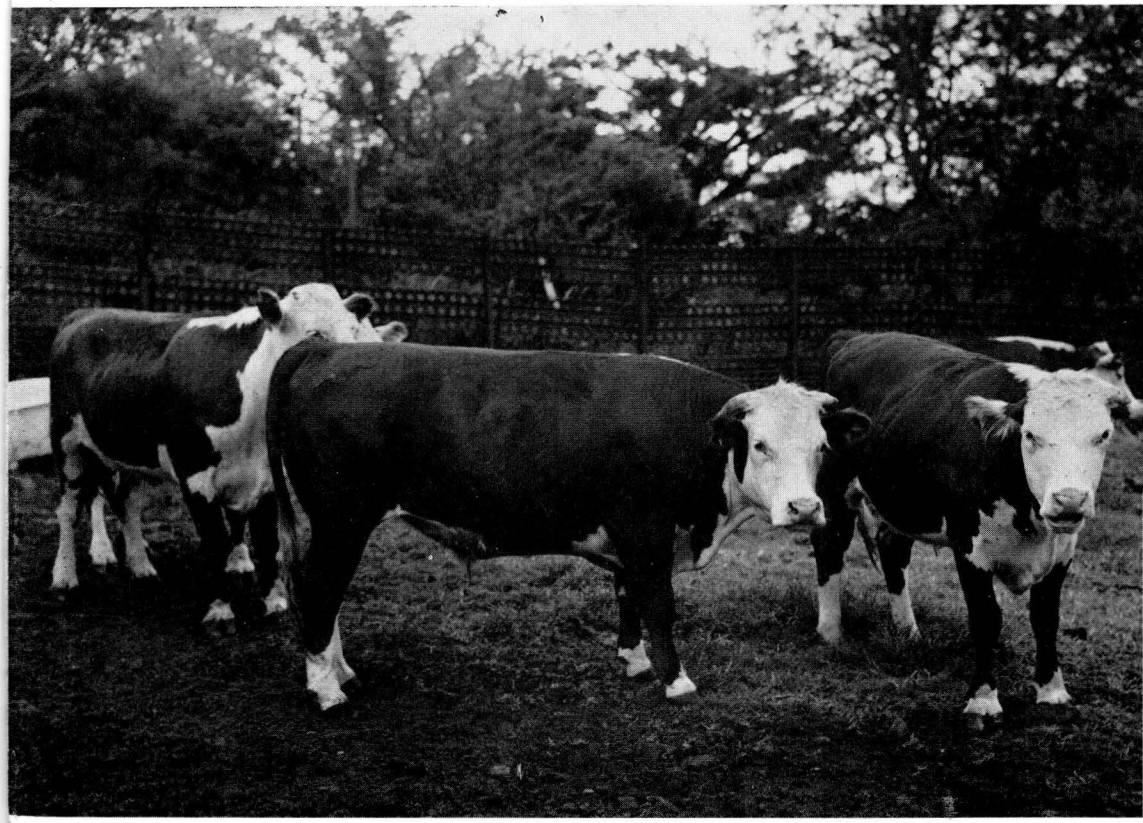
FATTENING STEERS ON SUGAR CANE BY-PRODUCTS

By

OLIVER WAYMAN
ISAAC I. IWANAGA
L. A. HENKE
HOWARD J. WEETH



Circular 43

UNIVERSITY OF HAWAII
AGRICULTURAL EXPERIMENT STATION

Honolulu, Hawaii December 1953

FATTENING STEERS ON SUGAR CANE BY-PRODUCTS

By

Oliver Wayman, Isaac I. Iwanaga,
L. A. Henke, and Howard J. Weeth

of the

Hawaii Agricultural Experiment Station

and
with the co-operation of

William Kenda, Alvin R. Lamb, and
W. A. Robinson

of the

Experiment Station of the
Hawaiian Sugar Planters' Association

Circular 43
UNIVERSITY OF HAWAII
AGRICULTURAL EXPERIMENT STATION
Honolulu, Hawaii December 1953

THE AUTHORS

OLIVER WAYMAN is Associate Animal Husbandman, **ISAAC I. IWANAGA** is Junior Animal Husbandman, **L. A. HENKE** is Associate Director and Animal Husbandman, and **HOWARD J. WEETH** is Assistant Animal Husbandman of the Hawaii Agricultural Experiment Station.

All photographs used herein were taken by **HARVEY M. VOLLRATH,** Associate Specialist in Animal Husbandry with the University of Hawaii Agricultural Extension Service, except that the photograph used in Figure 2 was taken by **R. I. LEFFINGWELL** of the Hawaiian Sugar Planters' Association.

FATTENING STEERS ON SUGAR CANE BY-PRODUCTS

GENERAL STATEMENT

This is a condensed report of the results of feeding cane molasses, sugar cane bagasse pith, and needed protein and mineral supplements to 32 steers secured from the Island of Maui. The average weight of these steers on arrival at the University Farm was 528 pounds.

This was a co-operative experiment between the Hawaii Agricultural Experiment Station of the University of Hawaii, where the actual feeding trials were conducted, and the Experiment Station of the Hawaiian Sugar Planters' Association, which mixed and supplied the feeds and additionally contributed many other services. The H.S.P.A. was aided by a grant from the Industrial Research Advisory Council.

The problem was to combine sugar cane bagasse pith with final or B-grade molasses and with needed protein and mineral supplements in such a manner that a friable, nutritious, and palatable feed for steers would result which would produce satisfactory and profitable gains.

Earlier trials along these lines, the results of which formed the basis for the feed mixtures and procedures used in this trial (265.11, Experiment VIII), were reported in Hawaii Station Progress Note No. 84, issued in October 1952. This publication also carried a full list of references on previous molasses and sugar by-product feeding trials done in Hawaii. The present series of trials was designed to find a friable feed which could be bagged, but which would use the maximum quantities possible of cane molasses and bagasse pith. Bagasse pith was incorporated largely because of its great power to absorb molasses and make a semidry product that would mix easily with the other feed ingredients.

CONCENTRATE MIXTURES USED

The initial phase of this trial was started October 15, 1952, and continued to March 4, 1953, a period of 140 days. Shown in table 1 are the four rations which were prepared and fed.

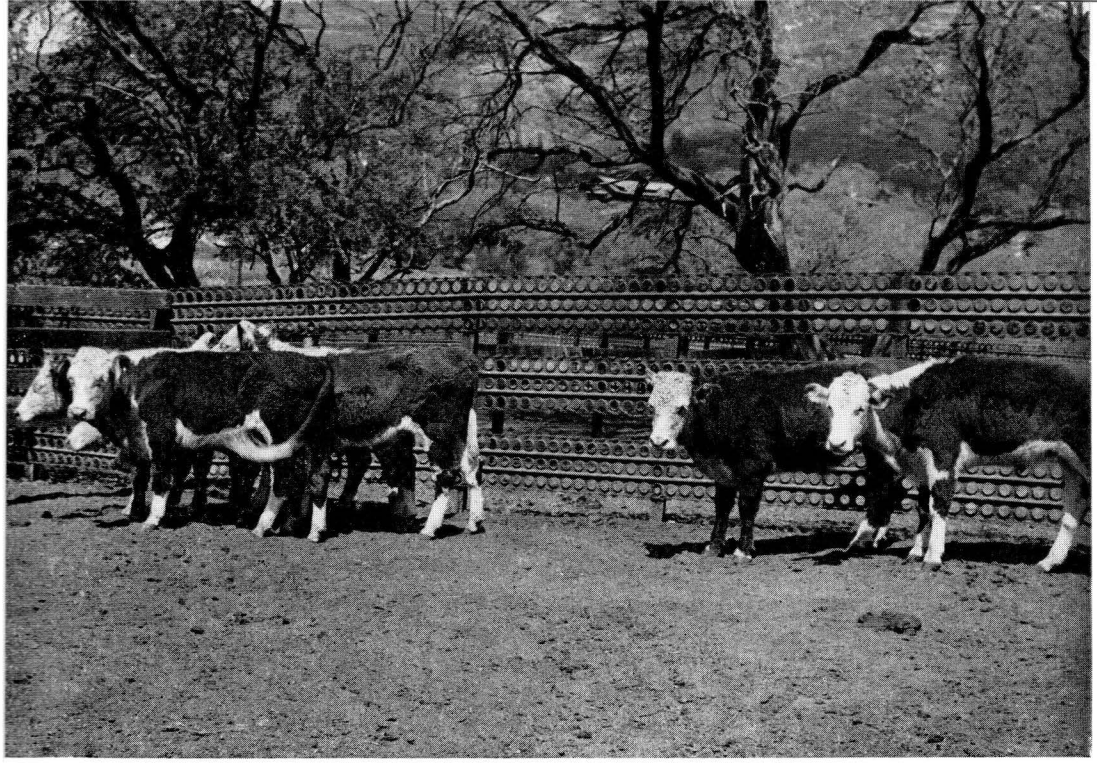
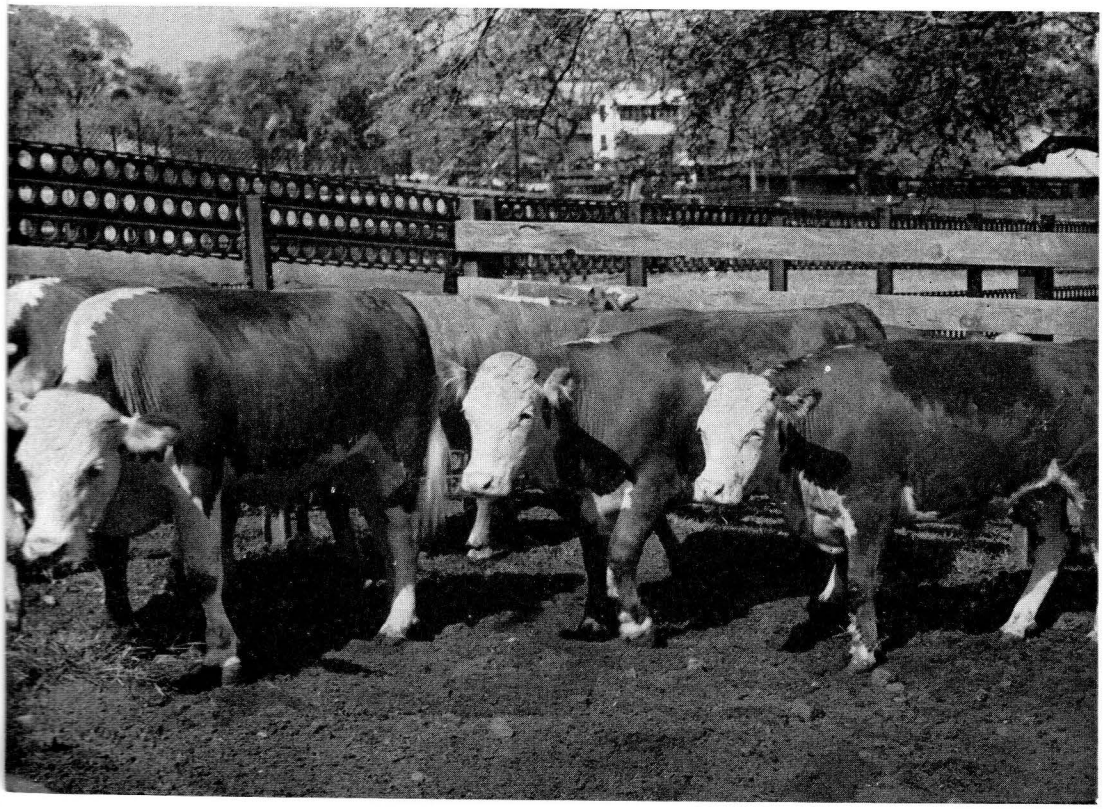


Figure 1. An unselected, unassorted sample of the 32 steers used, prior to assignment to lots and rations.

Figure 2. Steers 22, 10, and 31 prior to slaughter. All were fed on ration 25C 70 days for finishing, after being on the other rations during two preceding 70-day periods. (Photo by R. I. Leffingwell, H.S.P.A.)



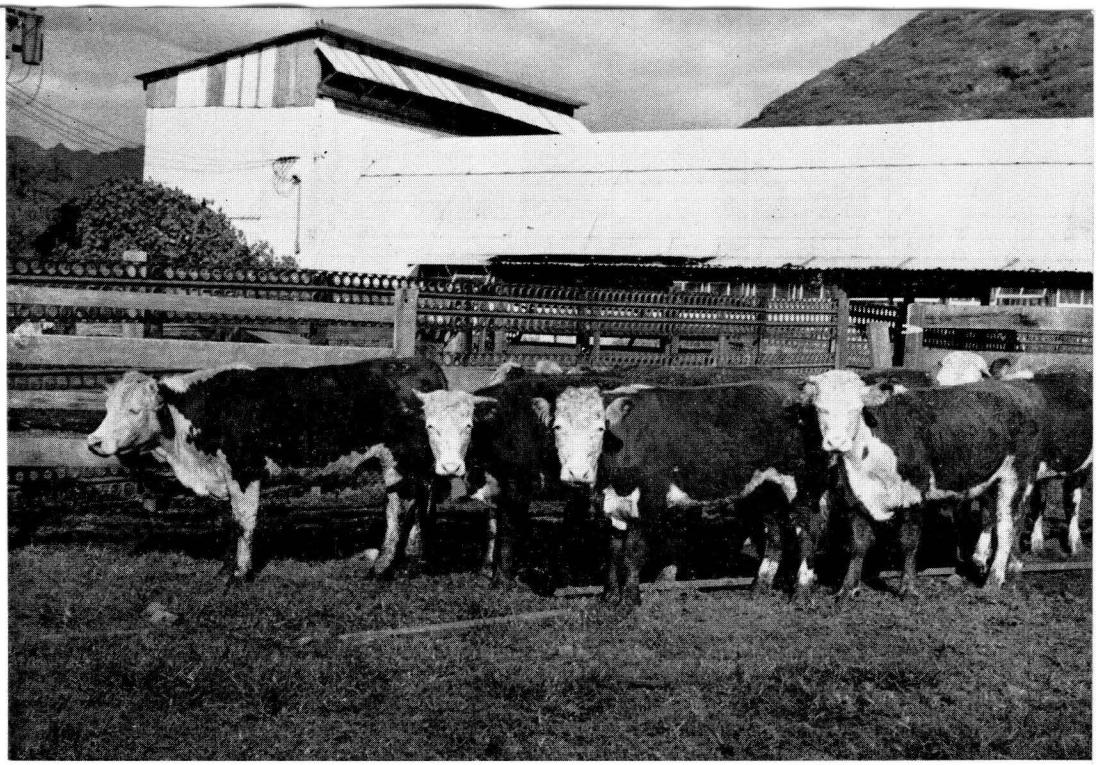


Figure 3. Lot I steers at the end of the first 70-day period. They were fed ration 25C containing B-grade molasses. Steers 22 and 10, left and center, also appear in figure 2.

Figure 4. Lot I steers at the end of the second period of 70 days on ration 25A, which was the same as 25C fed in the first period, except that the B-grade molasses in 25C was replaced with final molasses in 25A.

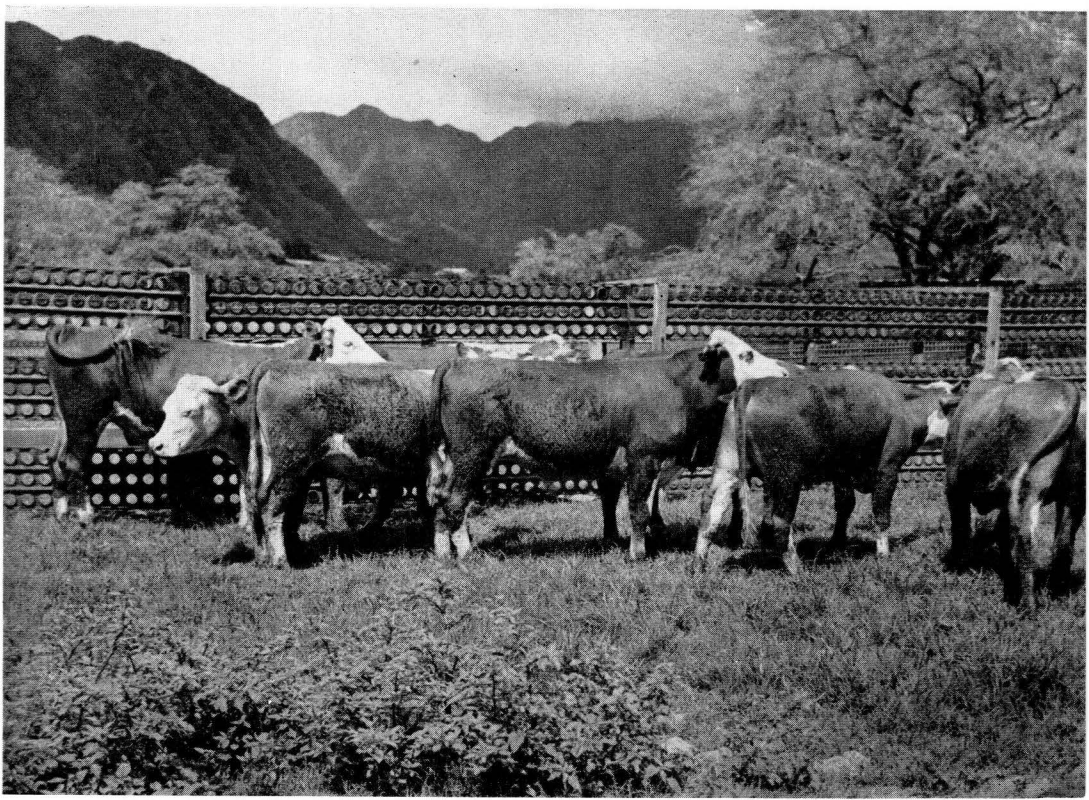


Table 1. Rations (in pounds) used in initial phase of trial.

Feed	Ration 25	Ration 25A	Ration 25B	Ration 25C
Molasses, final	50	60	70	0
Molasses, B-grade	0	0	0	60
Bagasse pith (dry screened)	30	20	10	20
Soybean oil meal	16	16	16	16
Urea	1	1	1	1
Bone meal	2	2	2	2
Salt	1	1	1	1
Total	100	100	100	100
Cost per 100 pounds*	$2.15	$2.16	$2.17	$3.28

*Based on the following prices current at the time the test was in progress:

Molasses, final	$12.67 per ton
Molasses, B-grade	50.00 per ton
Bagasse pith	10.00 per ton
Soybean oil meal	131.60 per ton
Urea	170.00 per ton
Bone meal	121.80 per ton
Salt	43.00 per ton
Napier grass, green chopped	10.00 per ton
Cobalt carbonate	140.00 per cwt.
Ferrous sulfate	60.00 per cwt.
Mixing, bagging, hauling	8.00 per ton

STEERS USED

The animals used were 32 Hereford steers, about 16 to 18 months of age. They were in good condition, off grass, when delivered to the Station from Maui on October 2, 1952. During the pretrial period they were fed chopped green Napier grass to the limit of appetite, and they were handled to get them accustomed to men on foot. They were paint branded with individual numbers on October 13. Initial and final weights were the averages of three weights taken on three consecutive days. Allotment was at random.

During the initial period of the feeding trial, the concentrate rations were increased gradually to reduce the possibility of upsetting the animals by too sudden feeding of high levels of molasses. Increase in the experimental concentrate rations was compensated for by replacing Napier grass on a dry matter basis. Twenty pounds of the concentrate mixture was offered each lot of eight steers the first day. This amount was increased 5 pounds every other day until the steers were on full feed.

To provide a record of actual consumption, a continuous record was maintained of the feed offered and of the weighbacks that resulted.

At the end of 70 days the rations were switched from one lot of steers to another in order to note whether different lots would respond the same to different rations. The plan followed is shown in table 2.

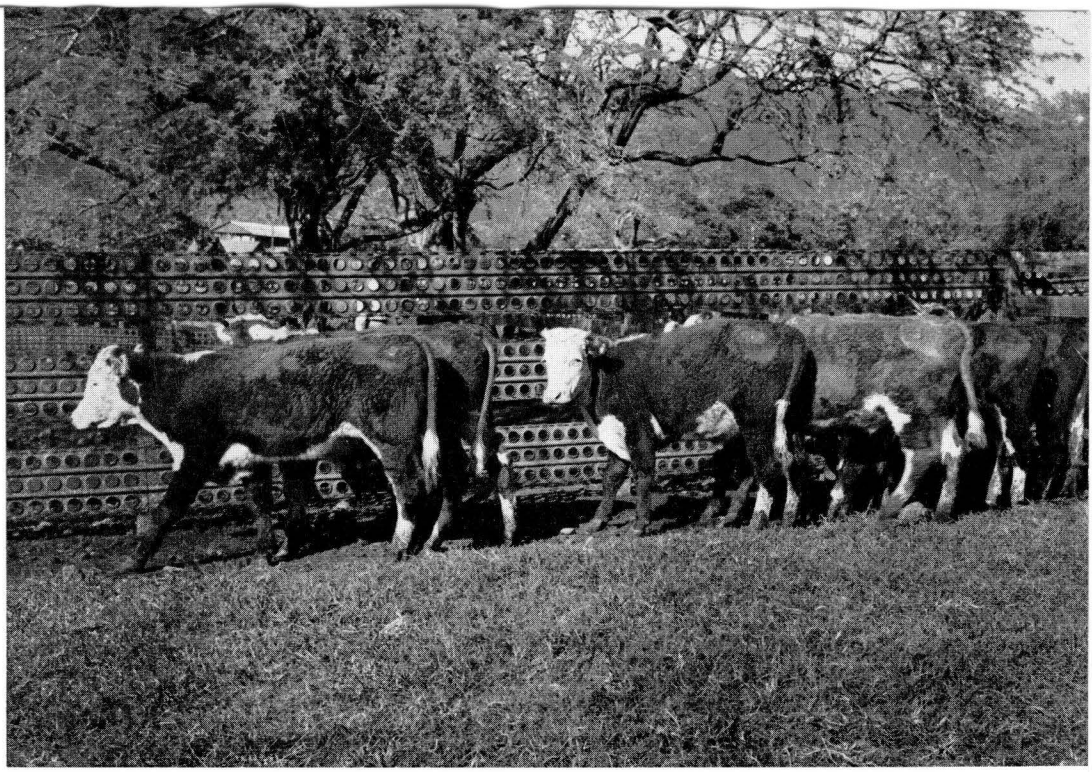


Figure 5. Lot II steers at the end of the first period showing the effect of 70 days on ration 25B. The animals barely maintained weight.

Figure 6. Lot II steers at the end of the second 70-day period. During this period they received ration 25. Note the light-colored steer in figures 5 and 6.

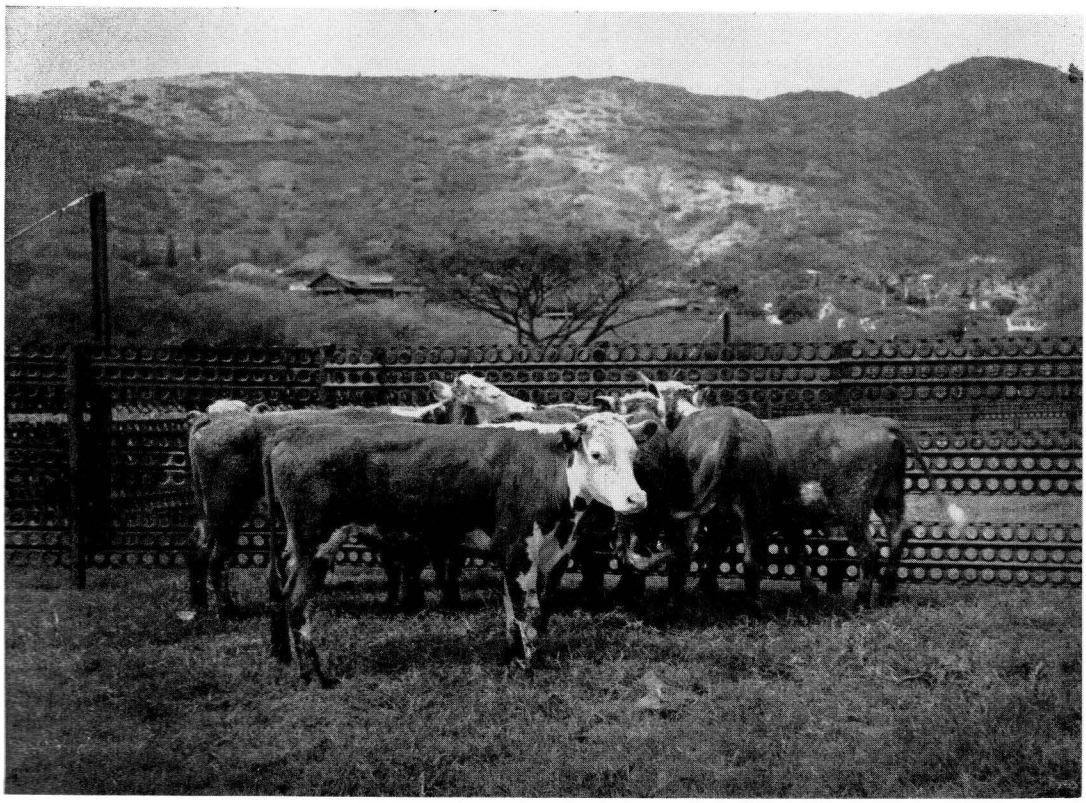


Table 2. Rations fed to steers in two 70-day periods.

Period	Lot I	Lot II	Lot III	Lot IV
1	Ration 25C	Ration 25B	Ration 25A	Ration 25
2	Ration 25A	Ration 25	Ration 25C	Ration 25B

The summarized data showing average initial weights, average daily gains, feed consumption, and feed costs per pound of gain are shown in table 3 on page 12.

Results during the first 70 days (period 1) were very unsatisfactory. Steers on rations 25 (30 percent bagasse pith) and 25A (20 percent bagasse pith) lost weight, and steers on ration 25B (10 percent bagasse pith) made an insignificant gain of .09 pound daily. Even the steers on ration 25C, which contained 60 percent B-grade molasses and 20 percent bagasse pith, made an unsatisfactory gain of .80 pound daily. Concentrate feed consumption was too low in all cases. It was lowest in the case of the lot of steers which was fed the ration with the highest bagasse pith content. Feed efficiency as measured by pounds of concentrates required per pound of gain was very low in all cases, but it was lowest on the ration containing the most bagasse pith.

Results during the second 70 days (period 2) were much better in all cases, but the same tendency noted above continued to be in evidence. Among the final molasses rations, those having the lower content of bagasse pith gave better results.

Feed costs in all cases were in excess of profitable returns at present beef prices. In only two cases, and both of these were in period 2, did the feed costs approach a level somewhat near to the value of the gains produced. Lot IV steers, which averaged 0.41 pound daily loss in period 1 on ration 25 (30 percent bagasse pith), showed an average daily gain of 1.40 pounds in period 2 when fed ration 25B (10 percent bagasse pith) at a feed cost of 33 cents per pound of gain. Lot III steers, which averaged 0.13 pound daily loss in period 1 on ration 25A (20 percent bagasse pith), showed an average daily gain of 2.62 pounds in period 2 when fed ration 25C (B-grade molasses in place of final molasses). This gain was produced at a feed cost of 31 cents per pound at prevailing prices.

Unanswered remains the question why all lots of steers, on each of the different rations, performed so much better in the second 70-day period. It is appreciated that some time is required to adjust steers to new feeds, in a new environment, after they have been accustomed to an open range, but normally the adjustment should be made in a relatively short time. By the beginning of the second period the steers were relatively tame. However, they had not been unduly wild when they arrived at the feeding pens.

SECOND PHASE OF THIS FEEDING TRIAL

Only about five of the steers were ready for market at the end of the two periods of the initial phase of trial (140 days). Since excellent gains were made on ration 25C in the second of the two 70-day periods, it was decided to continue the use of this ration, with some modification in mineral

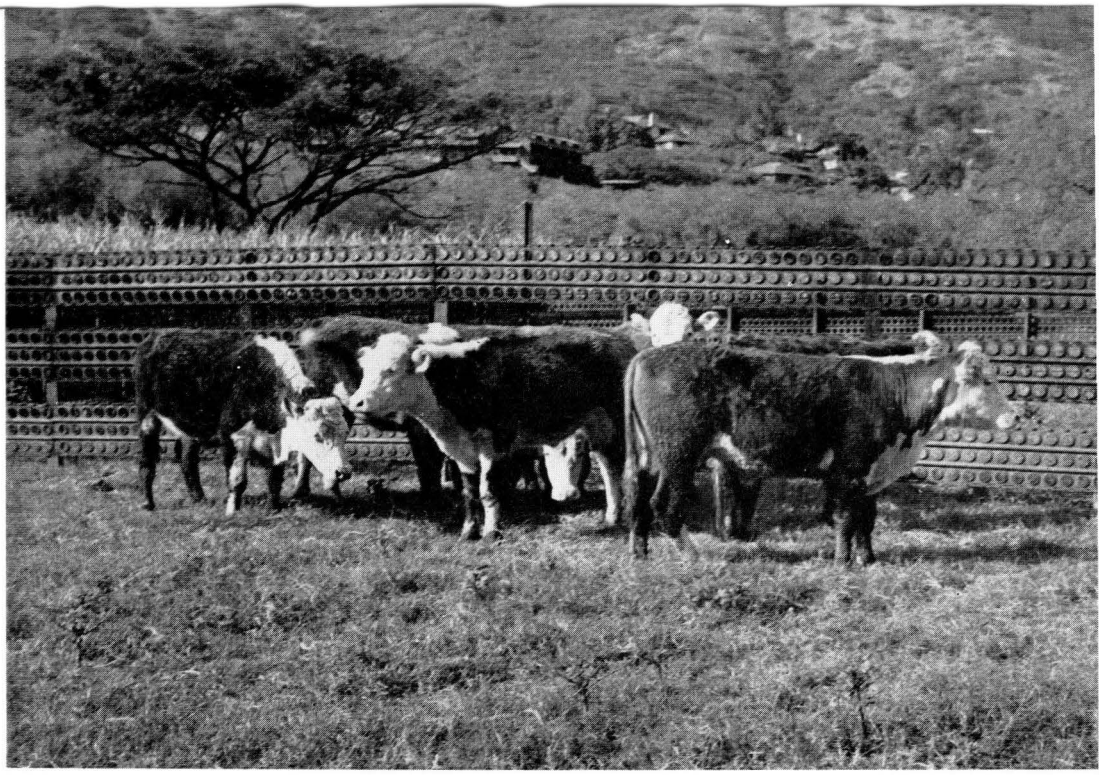


Figure 7. Steers in Lot III at the end of the first period showing the effect of ration 25A for 70 days. A small weight loss occurred in this period.

Figure 8. Steers in Lot III at the end of the second period showing remarkable improvement after 70 days on ration 25C with B-grade molasses in the ration instead of the final molasses contained in 25A.

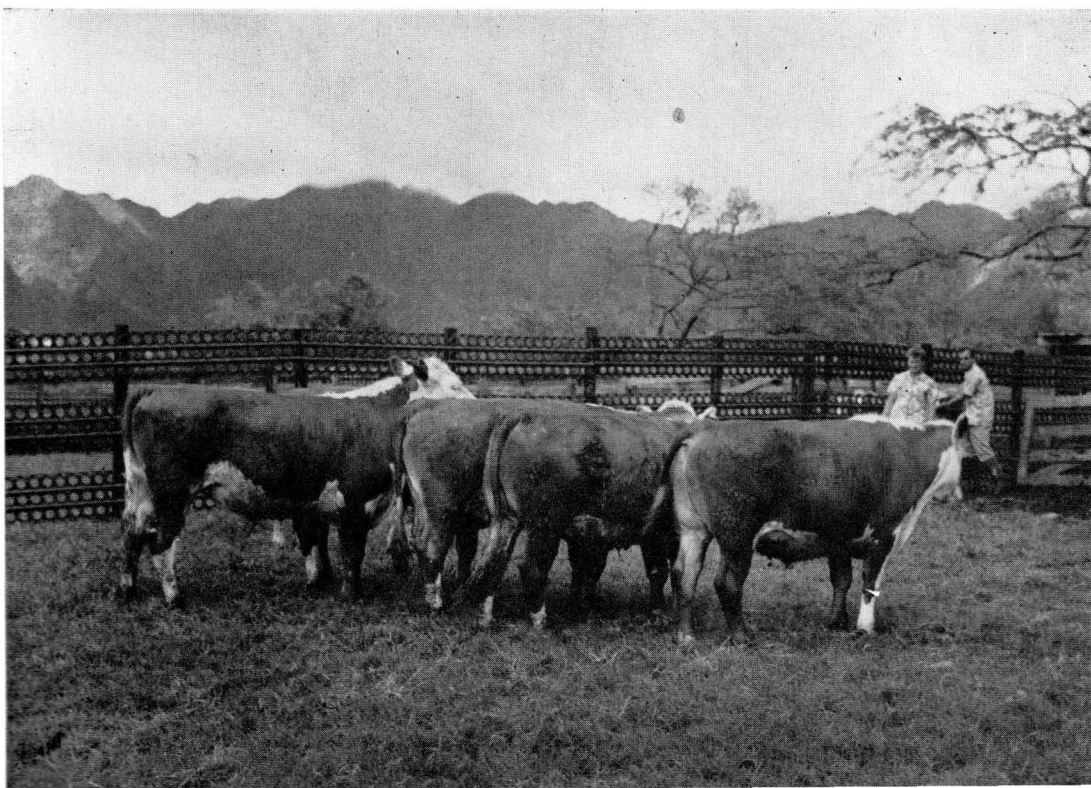


Table 3. Weights, gains, feed consumption, and feed costs during two consecutive 70-day trials.

Period	Lot	Animal days	Number of steers	Average† initial weight	Total† lot gain	Average† daily gain	Feed consumed				Feed cost per pound gain		
							Napier		Conc. ration				
							Average§ daily	Per lb.†† gain	Average§ daily	Per lb.†† gain	Napier	Concentrate	Total
				pounds	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*dollars*	*dollars*	*dollars*
Ration 25													
1	IV	560	8	554	—228	—0.41	12.95	lost wt.	9.31	lost wt.	—	—	—
2	II	560	8	563	397	0.71	8.59	12.12	14.49	20.44	0.061	0.439	0.500
Ration 25A													
1	III	560	8	556	— 75	—0.13	12.69	lost wt.	9.38	lost wt.	—	—	—
2	I	560	8	612	563	1.00	8.46	8.42	19.75	19.64	0.042	0.424	0.466
Ration 25B													
1	II	560	8	557	48	0.09	15.33	178.96	10.58	123.44	0.895	2.679	3.574
2	IV	495	8–6§§	541	588*	1.40	9.58	8.06	15.91	13.20	0.040	0.286	0.326
Ration 25C													
1	I	560	8	556	450**	0.80	12.50	15.56	12.81	15.94	0.078	0.523	0.601
2	III	468	8–6§§	576	1101**	2.62	5.10	2.17	21.76	9.25	0.011	0.303	0.314

*Significant statistically: P $<$.05.
†For animals finishing trial only.
§Total consumed by lot divided by animal days per lot.
**Highly significant statistically: P $<$.01.
††Total consumed by lot divided by gain of steers in lot finishing trial.
§§Two steers removed due to malnutrition.

Figure 9. Lot IV steers at the end of the first 70 days. Fed ration 25 during this period, they lost weight.

Figure 10. Lot IV steers at the end of the second period. A marked improvement resulted from 70 days on ration 25B. The steer in the foreground is number 31 shown in figure 2. The steer at the right is the steer in the right foreground of figure 9.

supplements, in a third 70-day feeding trial. The bone meal and salt used in ration 25C in the first two periods were deleted from ration 25C for two lots of steers, and the following mineral mixture was supplied free choice to these two lots. This modified ration 25C was designated 25C-1.

Mineral Mixture	Pounds
Ferrous sulfate	3.00
Copper sulfate	.20
Cobalt carbonate	.03
Steamed bone meal	60.50
Salt	36.30
	100.03

The remaining suitable steers (23) were segregated according to size and condition into two lots. One lot contained the top 12 animals and the other lot the remaining 11 animals. The two lots were again divided at random to make a total of four lots. These were fed for 70 days according to plan. The results are shown in table 4, which also includes slaughter data. The slaughter grade for all steers slaughtered was top good to choice.

Table 4. Results of 70-day finishing trial.

Trial data	Lot A	Lot B	Lot C	Lot D
Ration	25C-1	25C-1	25C	25C
Number of steers	6	5	6	6
Average initial weight, pounds	717	587	717	587
Average final weight, pounds	902	798	948	806
Average daily gain, pounds	2.64	3.01	3.30	3.13
Maximum gain, pounds	2.99	3.19	3.94	3.81
Minimum gain, pounds	2.40	2.51	2.70	2.60
Average daily feed consumed, pounds:				
Mineral mixture	.25	.42	—	—
Green Napier (chopped)	8.40	8.06	8.37	8.40
Concentrate ration	27.32	23.51	30.97	25.14
Feed consumed per pound gain, pounds:				
Mineral mixture	.09	.14	—	—
Green Napier (chopped)	3.17	2.68	2.54	2.69
Concentrate ration	10.30	7.81	9.38	8.04
Feed cost per pound liveweight gain*	$0.354	$0.274	$0.320	$0.277
Average shrunk† liveweight, pounds	854	798§	899	859§
Average chilled carcass weight, pounds	471	441§	508	459§
Average dressing percentage	55.2	55.3§	56.5	53.4§
Price received per pound carcass weight	$0.435	$0.435	$0.435	$0.435
Calculated** price received per pound liveweight	$0.240	$0.241	$0.246	$0.232

*Based on feed prices shown on page 8.
†Twenty-four hours without feed.
§Two animals only; others held for further fattening.
**Based on carcass price and dressing percentage.

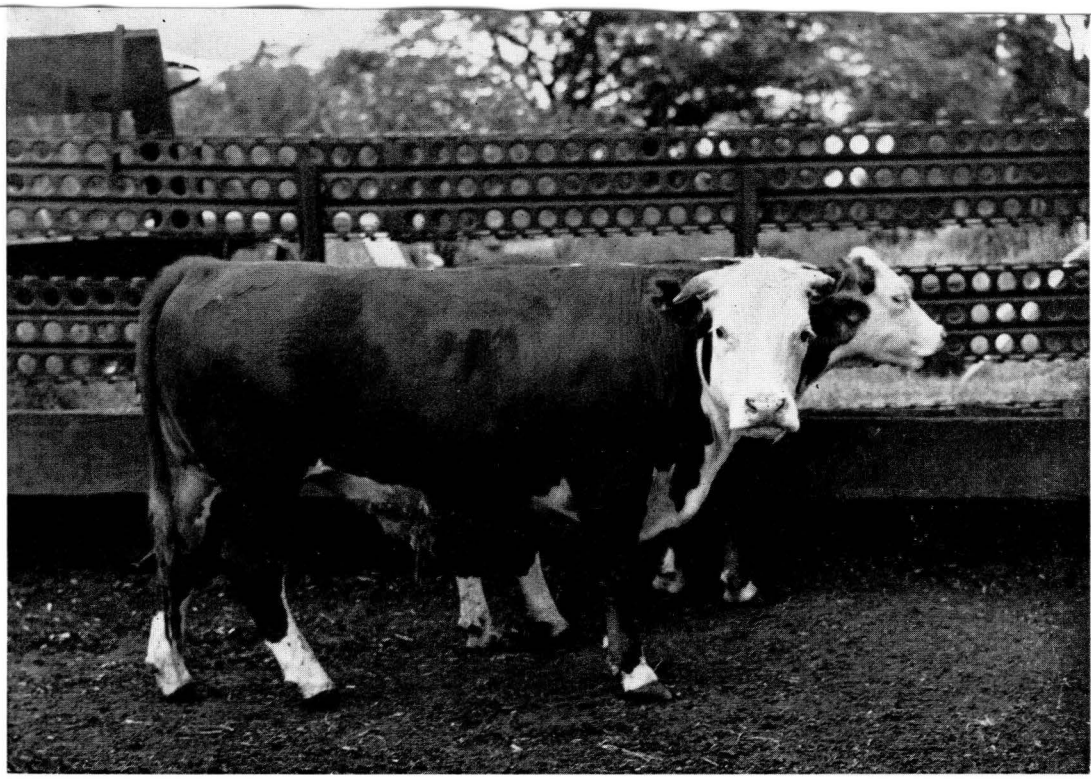
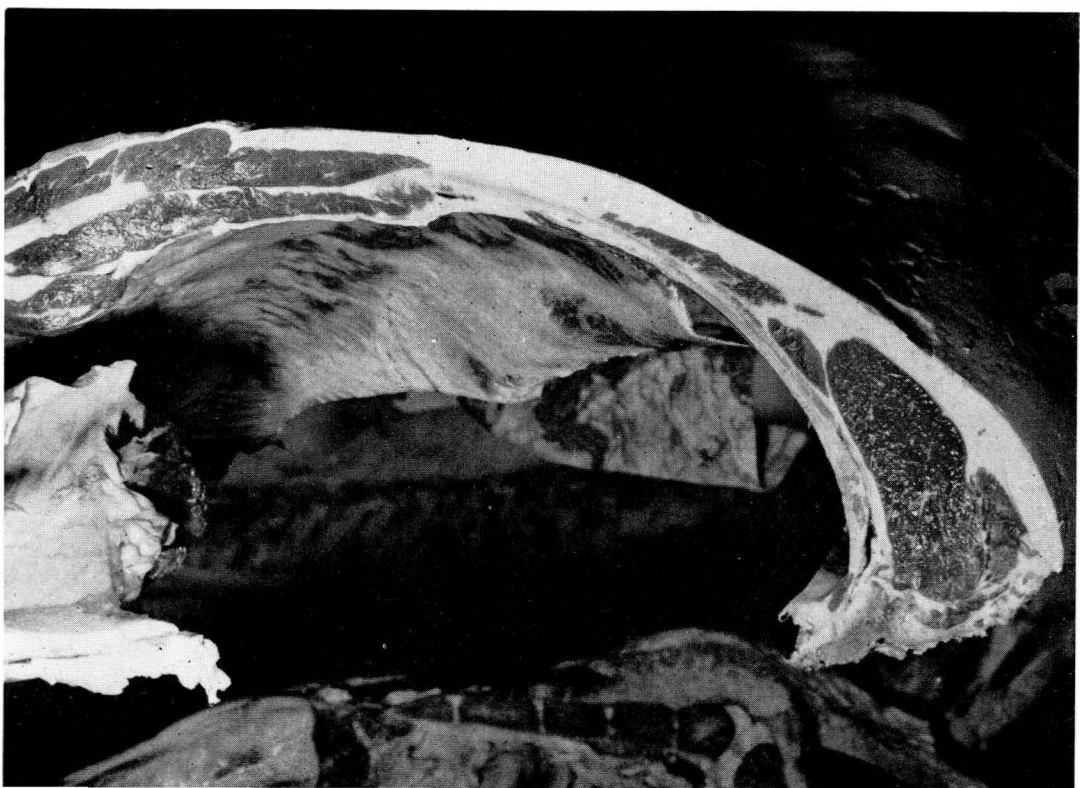


Figure 11. Steer number 5 from Lot II just prior to slaughter. This steer was one of five animals continued on ration 25C for 6 weeks beyond the second period, to bring them to market weight.

Figure 12. Quartered carcass from steer number 5. Notice the excellent marbling of fat and lean. This seems to be a characteristic of molasses-fattened beef.



Daily gains during the last 70 days were excellent. The average daily gain was 3.02 pounds per steer per day, with a range of 2.40 to 3.94 pounds. An average of 8.90 pounds of concentrate was consumed per pound of gain. The lots with the smaller steers, averaging 587 pounds initial weight, made the most efficient use of the feed. For these lots an average of 7.92 pounds of concentrate was consumed per pound of gain. The lots of steers having an average initial weight of 717 pounds required 9.84 pounds of the concentrate ration to make a pound of liveweight gain.

However, in all cases, the feed costs per pound of gain were too high. This was largely because of the high cost of the B-grade molasses which constituted 60 percent of the ration. It should be noted that the feed cost per pound of gain averaged 33.7 cents for the steers having an initial average weight of 717 pounds and 27.6 cents for steers with an initial average weight of 587 pounds at the start of this last 70-day feeding period.

The result of offering mineral mixture free choice rather than blended into the feed did not appear to be advantageous. Response to the feeds tended to be in relation to the salt and bone meal consumed. Lot A made the slowest and most expensive gains while consuming mineral mixture to the extent of only 0.9 percent of the concentrate feed. Lot C made the fastest gains. It received 3 percent salt and bone meal. Lot B also consumed a larger percentage of mineral mixture than Lot A (1.79 percent of concentrate feed) and gave faster and more economical gains than Lot A. Lot D gave faster gains on 3 percent salt and bone meal in mixture than did Lot B.

The steers, at the conclusion of this last 70-day feeding period, were in good condition generally. Judging by their appearance, it was anticipated that the dressing percentage would be higher than actually proved to be the case.

GENERAL SUMMARY AND CONCLUSIONS

Thirty-two Hereford steers from Maui, with an average initial weight of 528 pounds, were used in these trials. They had been grass fed and were in good condition.

The steers were divided into four lots of eight per lot and were fed rations containing 80 percent sugar by-products and 20 percent protein and mineral supplements. Three lots were fed sugar by-products which consisted of final molasses and bagasse pith in ratios of 50–30, 60–20, and 70–10, respectively. A fourth lot was fed 60 percent B-grade molasses with 20 percent bagasse pith and the same supplements used in the other rations.

During the first 70 days, either practically no gains or actual losses resulted from the final molasses rations. Steers fed the B-grade molasses averaged only 0.80 pound daily gains.

Lots were reversed during the second 70-day period, and gains resulted in all cases, the gains being increasingly larger for the lots receiving the larger amounts of cane molasses with correspondingly reduced amounts of bagasse pith. In this second 70-day phase, the lot which was fed B-grade molasses averaged 2.61 pounds daily gain.

Statistically, the differences between 50–30 and 60–20 final molasses-bagasse pith were not significant. In the first 70 days the superiority of 70–10 final molasses-bagasse pith over the 60–20 ratio approached significance,

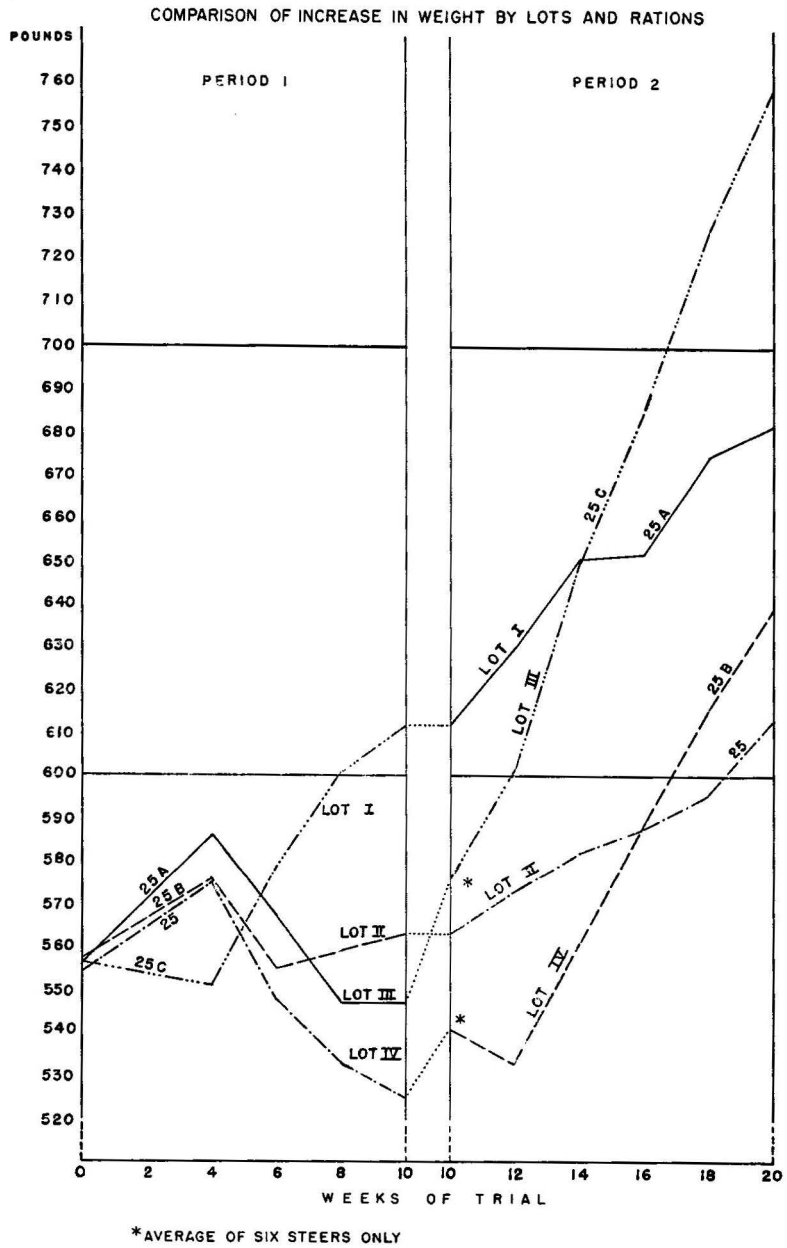


Chart 1. Average cumulative weight of steers by lot and ration during 140 days. Lots III and IV were reduced to only six animals each in the second 70-day period. All other lots contained eight steers throughout. Rations for the lots were changed at 10 weeks.

and in the second 70 days this was definitely established. The superiority of the B-grade molasses ration over those containing final molasses was statistically significant in all cases.

For the last of the three 70-day periods, all 23 steers remaining in the experiment were again reallotted and were fed the 60–20 B-grade molasses-bagasse pith ration. Good gains averaging 3.02 pounds per steer per day resulted, with good feed utilization of 8.88 pounds of concentrates per pound of gain. Steers were in good condition when slaughtered and graded top good to choice. However, because of the high cost ($50 per ton) of B-grade molasses, which was 60 percent of the ration, the feed costs were higher than the value of the gains at the price received (43.5 cents per pound, carcass weight).

In this trial, as in others which preceded it, results became progressively better the longer molasses feeding continued. The results ranged from practically no gains or losses during the first 70 days to fair gains the second 70 days and to good gains the last 70 days.

It is possible that if one lot had been fed final molasses the last 70 days, satisfactory gains might have resulted; and, because of the materially lower cost of final molasses, such gains might have been profitable.

In many previous trials, when final molasses was used to supplement the range feed, it has proved its value, but consumption in these cases rarely exceeded 6 pounds of final molasses per steer per day. In the second 70-day period of these tests, steers were consuming between 11 and 12 pounds of final molasses per day. It should be noted that, in the last 70 days, steers in Lot C averaged 18.6 pounds of B-grade molasses per day to make 3.3 pounds daily gain.

It is possible that combinations of B-grade and final molasses may permit greater consumption to secure good weight gains and, by reason of the lower cost of final molasses, result in profitable gains.

UNIVERSITY OF HAWAII
COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
HONOLULU, HAWAII
