

UNIVERSITY OF MISSOURI

COLLEGE OF AGRICULTURE

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The Use of a Limited Amount of Molasses In Feeding Yearling Steers



One section of the beef cattle feedlots at the Missouri Agricultural Experiment Station

COLUMBIA, MISSOURI

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How to Judge a Ration

Three of the most important factors in judging the results of a cattle feeding enterprise are:

1. The rapidity of gain; that is, the average daily gain in weight of the cattle (Table 4) and the weights of the cattle at the beginning and the close of the feeding period; and the total gain in weight on cattle and hogs which follow them. (See Table 5).

2. The amount of feed consumed per pound of gain produced during the various stages of the feeding period and in total. (See Table 6).

3. The condition of the cattle at the close of the feeding period as judged by dressing percentages, the finished appearance of the cattle, and any other factors which may be available. (See Table 7).

The Use of a Limited Amount of Molasses In Fattening Yearling Steers

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Abstract.—Forty yearling grade Shorthorn steers were divided into five uniform lots for the purpose of the experiment here reported. The check lot received shelled corn, linseed meal, corn silage and alfalfa hay. In a second lot cane molasses was added to this ration, and in the other lots molasses was used to replace linseed meal, corn silage, or both. An analysis was made of these feeds and a record kept of the amounts consumed by each lot. The daily gains made by each lot are reported together with the total gains, and the amounts of feed consumed per pound of gain. The gains of pork produced behind the several lots are also compared. The condition, selling price and dressing percentage of each lot are also reported. The relative costs of the feeds replaced by the molasses are considered in connection with the differences in gain and condition.

Molasses has been used in rations for fattening cattle under varying circumstances and with varying results. The kind, quality, availability and cost of the molasses; the cattle to which it has been fed, the other constituents of the ration and conditions surrounding its use, have doubtless had much to do with the variation in results produced. Its use has been sought as an important and cheap source of nutrients in localities where it is plentiful. In sections where it is not produced in large quantities it has been used with the thought that it would add variety and palatability to rations and also increase the appetites of cattle. It has been occasionally used or recommended for use in rations for fattening cattle in Missouri. Molasses is sometimes suggested as a substitute for nitrogenous concentrates, such as linseed or cottonseed meal, but its chemical composition indicates that as a feed it should be used like corn and similar grains; or in other words, it is primarily a source of carbohydrates, and experimental results indicate that such is the case.

PLAN AND PURPOSE OF EXPERIMENT

This initial test was conducted in order to secure information concerning the use of molasses in conjunction with some of the more generally used Missouri rations for fattening cattle.

The following rations were used:

Lot 1.—Shelled corn. Linseed meal (*approximately 1 pound to 6 pounds of corn*). Corn silage. Alfalfa hay.

Lot 2.—Shelled corn. Linseed meal (*approximately 1 lb. to 6 lbs. of corn.*) Corn silage. Alfalfa hay. One pound cane molasses.

Lot 3.—Shelled corn. Alfalfa hay. Corn silage. One pound cane molasses.

Lot 4.—Shelled corn. Linseed meal (*approximately 1 lb. to 6 lbs. of corn.*) Alfalfa hay. One pound cane molasses.

Lot 5.—Shelled corn. Alfalfa hay. One pound cane molasses.

Lot 1 received a ration of shelled corn, linseed oil meal, corn silage and legume hay, which has given generally satisfactory results in Corn Belt feeding operations, hence this lot served as a check lot for comparison with the others.

The ration fed Lot 2 differed from that fed Lot 1 only by the addition of approximately one pound of cane molasses daily.

The ration fed Lot 3 differed from that fed Lot 1 in that the linseed oil meal was eliminated, and approximately one pound daily of cane molasses was added.

The ration fed Lot 4 differed from that fed Lot 1 in that corn silage was eliminated and approximately one pound daily of molasses added.

In the case of Lot 5 the ration differed from the "check" ration fed Lot 1 in that both silage and linseed meal had been eliminated, and approximately one pound of molasses was added.

The cattle were full fed on the respective rations.

CATTLE USED IN THE EXPERIMENT

The cattle used in this experiment were native steers purchased on the Kansas City market. They were grade Shorthorn yearlings, averaging about 650 pounds in weight and grading as "good to choice" feeding cattle when put in the feed lots. They were shipped from Kansas City on January 8, 1924, arriving in Columbia the next day. They were allowed four days, to rest and obtain a normal fill, and were then put on experiment January 13. The cattle were divided as near equally as possible into five lots of eight head each and the experimental records started. The average cost of the cattle in Kansas City was \$6.97 per cwt., while the cost in the feed lots including commission, yardage, freight and feed, was \$7.38 per cwt.

WEIGHT RECORDS

The weights of the cattle, and the hogs which followed them, were taken in the morning before feeding and watering. Hog troughs were emptied and water tank lids closed after feeding on the evenings before the cattle and hogs were weighed. Steers were identified by neck strap numbers and individual weights were taken. The hogs were not weighed individually.

To secure more nearly correct weights of the animals at the beginning of the test, they were weighed on three consecutive mornings. The

average of these weights was taken as the initial weight and the test started on the second day. Similar averages were taken for the final weights. The cattle were weighed at the close of each 30-day feeding period, the last period including only 20 days. In calculating financial returns, market weights are used.

QUALITY AND COST OF FEEDS

Carefully taken composite samples of the various feeds used were collected throughout the experiment and analyzed by the department of agricultural chemistry.

TABLE 1.—FEED ANALYSES

Feed	Water	Nitrogen	Protein	Fiber	N.-Free extract	Fat	Ash
	%	%	%	%	%	%	%
Shelled corn -----	12.80	1.38	8.625	2.09	72.29	2.94	1.25
Linseed oil meal ----	8.40	5.60	35.00	8.49	36.74	5.47	5.90
Alfalfa hay -----	6.22	2.11	13.187	29.65	39.95	1.84	9.15
Molasses -----	44.20	.59	3.687	-----	46.58	-----	5.53
Silage on fresh basis..	68.39	----	2.71	7.32	18.18	.87	2.51

Table 1 gives the chemical composition of the feeds used. Part of the corn graded "No. 2 yellow;" the remainder "No. 3 mixed." The linseed oil meal was of the best quality old process, pea size. The alfalfa hay was choice, being rather light in color and, on the average, free from undue coarseness. The molasses was blackstrap cane molasses, purchased in barrels through a St. Louis firm.

The silage used was made from corn grown on the University Farm on creek bottom land, yielding between fifty and sixty bushels of grain per acre; was of good quality with a satisfactory percentage of grain.

TABLE 2.—PRICES OF FEEDS

Feed	Price
Shelled corn-----	\$ 0.76 per bushel
Linseed oil meal-----	50.00 per ton
Corn silage -----	6.00 per ton
Alfalfa hay -----	20.00 per ton
Molasses -----	45.00 per ton

Table 2 shows the prices which were charged for each of the feeds used and they are considered representative of Missouri conditions during the time of the experiment. The molasses was purchased at 22 cents per gallon and weighed 11.6 pounds per gallon. The charge for the molasses includes, therefore, original cost, freight and hauling charge.

EQUIPMENT AND METHOD OF FEEDING

The test was conducted at the University experimental feeding plant, which includes a series of lots 19 ft. wide and 100 ft. long, with a

shed 20 ft. deep and open to the south, along the north end of the lots. The lots slope to the south, allowing reasonably good surface drainage, but are not paved and become muddy during wet weather.

The cattle were fed twice daily at regular hours, morning and evening. The silage was fed in flat bottom feed bunks in the lots. Where linseed meal was fed, it was mixed with the corn. The grain was fed first and the cattle were given an opportunity to consume it, after which silage was fed. The hay was fed in mangers under the shed. Fresh water was supplied in galvanized steel tanks located in the lots. The cattle were given salt frequently and an effort was made to keep them well bedded with straw. Where the cattle received molasses it was diluted with hot water and poured over the silage, or the grain or the hay.

FEEDING THE MOLASSES

The molasses was kept in barrels in a steam heated building where the temperature rarely was below freezing. When the molasses was not kept in a warm place it became very thick and was handled with difficulty. In order to pour it evenly and freely over other feed it was necessary at all times to mix it with warm water.

More or less difficulty was experienced in keeping the cattle and feed bunks clean when molasses was fed. This was more noticeable as the cattle became fatter and the spring weather advanced.

MEASURING RESULTS

Three of the most important factors in evaluating the results of a cattle feeding enterprise are:

1. The rapidity of gain; that is, the average daily gain in weight of the cattle (Table 4), and the weights of the cattle at the beginning and the close of the feeding period, and the total gain in weight on cattle and hogs which follow them. (Table 5).
2. The amount of feed consumed per pound of gain produced during the various parts of the feeding period and in total. (Table 6).
3. The condition of the cattle at the close of the feeding period as judged by dressing percentages, the finished appearance of the cattle, and any other factors which may be available. (Table 7).

FEED LOT DATA AND DISCUSSION

As soon as possible after the experiment began, the cattle were given all the silage and alfalfa hay that they would consume, and the grain was increased more gradually. All cattle were practically on full feed at the end of 40 days.

Table 3 gives the average daily ration for each period and the total feed consumed per steer for the entire test, and is here presented in order

that the data may be most conveniently used in application to feed lot problems on farms.

A study of this data shows, in detail, the progress of this phase of the experiment. In practically all lots the daily grain consumption increased gradually during the first three months of the feeding period and remained stationary or decreased slightly thereafter. The greatest quantities of silage and hay were eaten during the first month, decreasing gradually during the next two months and remaining relatively constant thereafter. The amount of molasses varied but little throughout the test.

TABLE 3.—AVERAGE DAILY RATION PER STEER

Lot Feed	1st period 30 da.	2d period 30 da.	3d period 30 da.	4th period 30 da.	5th period 20 da.	Avg. da. ration 140 da.	Total feed con- sumed per steer
	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>
Lot 1							
Shelled corn---	10.85	16.70	19.41	18.80	18.85	16.78	2349.37
Linseed O. M.---	1.81	2.78	3.23	3.13	3.14	2.79	391.28
Corn silage---	17.10	13.80	10.26	7.69	8.00	11.68	1636.00
Alfalfa hay---	3.62	3.03	2.62	1.53	1.65	2.55	357.35
Lot 2							
Shelled corn---	10.85	16.38	19.41	18.32	18.90	16.61	2325.50
Linseed O. M.---	1.81	2.72	3.23	3.05	3.15	2.76	386.86
Corn silage---	16.56	11.06	8.43	6.86	7.22	10.25	1435.25
Alfalfa hay---	3.72	2.70	2.70	1.88	1.60	2.59	363.00
Molasses-----	.98	.95	1.00	1.00	1.00	.98	137.75
Lot 3							
Shelled corn---	10.85	16.70	19.37	19.18	19.85	17.00	2380.75
Corn silage---	15.90	13.86	10.36	7.00	7.25	11.14	1560.12
Alfalfa hay---	3.73	3.33	2.83	2.01	1.85	2.82	395.37
Molasses-----	.98	1.00	1.00	1.00	1.00	.99	139.25
Lot 4							
Shelled corn---	10.85	16.76	20.23	18.48	18.74	16.89	2365.62
Linseed O. M.---	1.81	2.79	3.37	3.07	3.12	2.81	393.54
Alfalfa hay---	9.15	6.81	3.30	2.91	3.25	5.22	731.62
Molasses-----	.95	1.00	1.00	1.00	1.00	.98	138.50
Lot 5							
Shelled corn---	10.85	16.76	20.22	21.15	21.97	17.92	2509.37
Alfalfa hay---	11.18	7.33	5.33	3.48	3.65	6.40	904.00
Molasses-----	.98	1.00	1.00	1.00	1.00	.99	139.25

The daily ration fed Lot 1, which was the check lot receiving shelled corn, linseed meal, silage and hay, shows the gradual increase in grain and decrease in roughness for the first three months and only slight variations beyond that point.

Lot 2, which received a ration differing from that fed Lot 1 only by the addition of 1 pound daily of molasses, shows food consumption

comparing closely in amounts to Lot 1. The slightly lower daily consumption of corn, linseed meal and silage in the lot indicates that the molasses was replacing some of the other feed in the ration.

Comparing Lot 3, where no linseed meal was fed, but where 1 pound daily of molasses was added, with Lot 1, it is seen that for the entire test the average corn consumption was 0.22 pounds more daily, the alfalfa 0.27 pounds more daily, while the silage consumption was about $\frac{1}{2}$ pound less daily. These cattle did not consume enough more corn and roughness to make up for the elimination of the linseed meal, so far as daily poundage of feed consumed was concerned. The slight increase in the consumption of alfalfa hay may indicate a tendency on the part of the steers to secure more protein. These cattle got on to full feed somewhat more slowly than Lot 1 and their grain consumption increased during each period of the test.

Lot 4, where the ration differed from that of the check lot by the elimination of corn silage and the addition of 1 pound daily of molasses, consumed practically the same amount of grain as the check lot through the entire test. While they consumed no silage, they ate approximately twice the amount of hay that was consumed by the check lot and in addition, the 1 pound daily of molasses. Similar periodic variations in the amount of roughage and grain are noted.

The ration fed Lot 5 differed from the ration fed the check lot by the elimination of both corn silage and linseed meal and the addition of 1 pound daily of molasses.

While these cattle consumed over 1 pound more corn daily than Lot 1, and more than a pound more hay daily than Lot 4, this did not bring the daily feed consumption up to equal that in Lots 1 and 4, where linseed oil meal was fed. Similar periodic changes in daily consumption of various feeds are noted here as in other lots.

TABLE 4.—AVERAGE DAILY GAINS PER STEER

Lot	1st period 30 da.	2d period 30 da.	3d period 30 da.	4th period 30 da.	5th period 20 da.	Avg. daily gain 140 da.
	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>
1	3.66	3.30	2.55	2.91	2.04	2.96
2	3.58	2.77	3.24	2.81	2.46	3.00
3	2.71	3.07	2.55	2.51	2.90	2.73
4	2.69	3.60	3.40	2.90	2.33	3.40
5	3.01	2.94	2.97	2.92	3.06	2.97

Table 4 shows the average daily gain per steer by periods and for the entire test.

Four of the five lots, namely, Lot 1, 2, 4, and 5, made average daily gains varying less than 0.1 pound during the entire experiment.

Lot 1, the check lot, receiving shelled corn, linseed meal, corn silage and alfalfa hay, gained 2.96 pounds daily, while Lot 2, which received the same ration plus 1 pound of molasses daily, gained 3.0 pounds daily.

Lot 4, where the ration differed from the check lot by the elimination of corn silage and the addition of 1 pound daily of molasses, gained 3.04 pounds daily.

Lot 5, receiving shelled corn, alfalfa hay and 1 pound of molasses, gained practically the same as the check lot.

Lot 3, where the ration differed from that fed the check lot by the elimination of linseed meal and the addition of 1 pound daily of molasses, gained approximately $\frac{1}{4}$ pound less daily than the check lot. This is the most noticeable variation in daily gain in the entire experiment and indicates, as does the composition of molasses, that it should not be considered as a substitute for nitrogenous supplements for yearling cattle.

Table 5 shows the average weight of the steers in each lot, at the beginning and the close of the experiment, the total gain per steer and the amount of pork produced per steer in each lot. Three hogs followed each lot of cattle.

TABLE 5.—SUMMARY OF WEIGHTS AND GAINS ON STEERS AND PIGS

Lot	Rations fed	Avg. weight per steer		Av. gain per steer 140 da.	Gain on pigs produced per steer 140 da.
		Beg. of test	Close of test		
		<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>
1	Shelled corn, linseed oil meal, corn silage, alfalfa hay.....	638.23	1052.5	414.27	33.75
2	Shelled corn, linseed oil meal, corn silage, alfalfa hay, molasses.....	651.62	1072.25	420.63	28.12
3	Shelled corn, corn silage, alfalfa hay, molasses.....	643.87	1027.47	383.60	24.37
4	Shelled corn, linseed oil meal, alfalfa hay, molasses.....	653.71	1079.5	425.79	43.00
5	Shelled corn, alfalfa hay, molasses.....	650.08	1066.37	416.29	21.50

It will be seen that the steers in Lot 4 made an average gain of 425.79 pounds in the 140 days, which was a slightly greater gain than was made by the steers in any other lot. The cattle in Lot 2 made an average gain of 420.63 pounds in the 140 days, or approximately 5 pounds less than the cattle in Lot 4.

The cattle in Lot 1, the check lot, made an average gain of 414.27 pounds, or approximately 11 pounds less per steer than the cattle in

Lot 4. The cattle in Lot 5 gained 516.29 pounds in the 140 days, or practically the same amount as those in Lot 1.

The steers in Lot 3 made an average gain of 383.6 pounds in 140 days, which was 42.19 pounds less than the cattle in Lot 4 where the largest daily gain occurred.

With the exception of Lot 3, it will be noted that the variations in average gains on the steers were less than 12 pounds for the 140-day period.

The hogs in the lots where the cattle received linseed oil meal made greater gains than the hogs in the other lots. Forty-three pounds of pork per steer were produced in Lot 4 where linseed meal but no corn silage was fed, 33.75 pounds of pork per steer were produced in Lot 1, the check lot, while in Lot 2 there were produced 28.12 pounds of pork per steer, in Lot 3 there were produced 24.37 pounds of pork per steer, and in Lot 5, where neither linseed oil meal nor corn silage was fed, the pork produced per steer was 21.5 pounds.

So far as these data show, the small quantity of molasses fed was not a considerable factor in the production of pork behind the cattle.

TABLE 6.—POUNDS OF FEED CONSUMED PER POUND OF GAIN ON CATTLE

Feed	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>
Shelled corn.....	5.67	5.52	6.21	5.55	6.02
Linseed oil meal.....	.94	.91	---	.92	---
Corn silage.....	3.94	3.38	4.06	---	---
Alfalfa hay.....	.86	.84	1.03	1.71	2.17
Molasses.....	---	.32	.36	.32	.33

There was very little difference in the amount of feed consumed to produce a pound of gain in Lots 1 and 2. In Lot 2, where the cattle ate 0.32 of a pound of molasses per pound of gain in addition to the ration of corn, linseed oil meal, corn silage and legume hay, the 0.32 of a pound of molasses replaced 0.15 of a pound of corn, 0.03 of a pound of linseed meal, 0.56 of a pound of silage and 0.02 of a pound of hay. The cattle in Lot 3, which received no linseed oil meal, required an appreciably larger amount of shelled corn, silage and hay to produce a pound of gain than was required in Lots 1 and 2, where linseed oil meal was fed. It will be remembered that Lot 3 showed less rapid gain than the other lots. Lot 4 which received no silage, ate slightly less corn and linseed oil meal, but 100 per cent more hay to produce a pound of gain than was required in Lot 2, fed otherwise the same ration.

Lot 5, receiving no silage or linseed oil meal, ate materially more corn and hay per pound of gain, in addition to the molasses, than was required in Lot 2, fed otherwise the same ration.

The amount of grain fed, as compared with the amount of roughness in all the lots, was relatively greater than would have been the case in a shorter test, because of the fact that cattle advantageously consume larger quantities of roughness in the earlier days of a feeding period.

Relatively little difference is noted in the feed required per pound of gain in the various lots and this fact makes imperative a close study of feed, cattle and hog prices, for the most efficient use of this data.

TABLE 7.—SELLING PRICES, DRESSING PERCENTAGES AND PROFITS

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Selling price per cwt.	\$10.00	\$10.00	\$ 9.25	\$10.00	\$ 9.65
Dressing percentage.....	59.04%	59.85%	59.24%	59.83%	58.17%
Profit per steer.....	\$ 5.06	\$ 3.08	-\$0.41	\$ 4.86	\$ 5.06

While the rapidity and total amount of gain and the feed required to produce it may be accurately recorded, the quality of the product is less easily measured. The factors involved in measuring this phase of the results are the dressing percentage and the quality of the carcass. Dressing percentages can be, and are, secured by packing firms which slaughter the cattle. The fatness of the cattle and the quality of the meat are estimated by the buyers of cattle for the large packing firms and commission salesman, and these estimates are reflected in the relative prices that they pay for cattle. From the feeders' standpoint the profit or loss resulting from the operation is a record of the most important factors involved in the operation and is set forth in the above table, together with the selling prices of the lots of cattle and the dressing percentages. The relative grading of the carcasses as they hung in the coolers is also mentioned in the following paragraphs. From these, a fair estimate of the product in the various lots may be had. It should be borne in mind, however, that with the daily changes in the prices of feeds, cattle and pork, that these statements of profit and loss would undergo changes in accordance therewith.

The cattle were valued by a commission merchant in the feed lots at the Experiment Station May 30, 1924; the values being estimated as what the cattle would bring on the East St. Louis market. The various lots of cattle were sold exactly as valued on the East St. Louis market on June 2, 1924. Lots 1, 2, and 4 were valued at \$10.00 per cwt. which was the top for the day on which they were sold. While valued at the same price, it was estimated that Lot 4 was slightly better in finish followed closely by Lots 2 and 1. It was thought that the difference was, so slight that they would sell equally well, which proved to be the case. Lot 5 was valued at \$9.65 per cwt. and showed clearly that they were not so well finished as Lots 1, 2, and 4. Lot 3 clearly showed less finish than

the other lots and was valued at \$9.25 per cwt. A reference to the table showing the gains in the various lots shows these estimates and values to be in general agreement with the gains produced. While the differences in the dressing percentages are not great or particularly significant they are in general agreement with the estimates and prices placed on the cattle. The carcasses of the cattle in the various lots were inspected and graded in the packing house coolers by dressed meat experts. They reported that the carcasses from the cattle in Lot 1 were the best lot, but differed only slightly from the carcasses produced in Lots 4 and 2, which were about equal. All of these carcasses are described as of good shape and fat.

The carcasses from the cattle in Lot 5 were ranked as the fourth best; well covered with fat, of fairly good shape, but a few having "shallow loins."

Lot 3 produced carcasses which graded somewhat below the others. While fairly fat, they were not as well covered with fat as the other lots and rounds were described as somewhat "flat" and loins "shallow."

From these data it may be concluded that there was little difference in the cattle produced in Lots 1, 2, and 4; that the cattle in Lot 3 were the least desirable of the groups, and that those of Lot 5 were somewhere between the best and the least desirable. It is also evident that all the cattle were very desirable from the packer's standpoint.

Marketing and Financial Statements

At the close of the feeding period the cattle were shipped to St. Louis and sold, in separate lots as fed, on the open market. No change in the feed was made preparatory to shipping, other than substituting timothy for alfalfa hay the last morning before shipping, after the experiment had been closed.

The actual selling prices, weights, and expenses of marketing were used in the financial calculations. The itemized financial statement shows that no charge was made for the labor involved in feeding or the bedding and salt used. On the other hand, no credit is given for the value of manure produced. Under ordinary farm conditions it is thought that these items will about balance. The following itemized financial statements give a record of each lot during the test:

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LOT 1.—STEERS FED SHELLED CORN, LINSEED OIL MEAL, CORN SILAGE AND ALFALFA HAY

To 8 steers, weight 5,105.84 lbs. at \$7.38 per cwt.	\$376.81
18,794.96 lbs. shelled corn at 76c per bu.	255.072
3,130.24 lbs. linseed oil meal at \$50 per ton	78.26
13,088.00 lbs. corn silage at \$6 per ton	39.26
2,858.80 lbs. alfalfa hay at \$20 per ton	28.59
Marketing expense: freight, yardage, feed, commission	27.76
Total expenditure	805.75
By 8 steers, weight 8,300.00 lbs at \$10.00 per cwt.	830.00
270.00 lbs. pork at \$6.00 per cwt.	16.20
Total receipts	846.20
Total expenditure	805.75
Total profit	40.45
Profit per steer	5.06

LOT 2.—STEERS FED SHELLED CORN, LINSEED OIL MEAL, CORN SILAGE, ALFALFA HAY, AND MOLASSES

To 8 steers, weight 5,212.96 lbs. at \$7.38 per cwt.	\$384.72
18,604.00 lbs. shelled corn at 76c per bu.	252.48
3,092.88 lbs. linseed oil meal at \$50 per ton	77.32
11,582.00 lbs. corn silage at \$6 per ton	34.74
2,904.00 lbs. alfalfa hay at \$20 per ton	29.04
1,102.00 lbs. molasses at \$45 per ton	24.80
Marketing expense: freight, yardage, feed, commission	27.76
Total expenditure	830.86
By 8 steers, weight 8,420 lbs. at \$10.00 per cwt.	842.00
224.96 lbs. pork at \$6.00 per cwt.	13.50
Total receipts	855.50
Total expenditures	830.86
Total profit	24.64
Profit per steer	3.08

LOT 3.—STEERS FED SHELLED CORN, CORN SILAGE, ALFALFA HAY, AND MOLASSES

To 8 steers, weight 5,150.96 lbs. at \$7.38 per cwt.	\$380.14
19,046.00 lbs. shelled corn at 76c per bu.	258.48
12,480.96 lbs. corn silage at \$6 per ton	37.44
3,162.96 lbs. alfalfa hay at \$20 per ton	31.63
1,114.00 lbs. molasses at \$45 per ton	25.07
Marketing expense: freight, yardage, feed, commission	27.76
Total expenditure	760.52
By 8 steers, weight 8,060.00 lbs. at \$9.25 per cwt.	745.55
194.96 lbs. pork at \$6 per cwt.	11.70
Total receipts	757.25
Total expenditures	760.52
Total loss	3.27
Loss per steer	0.41

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LOT 4.—STEERS FED SHELLED CORN, LINSEED OIL MEAL, ALFALFA HAY AND MOLASSES

To 8 steers, weight 5,229.68 lbs. at \$7.38 per cwt.....	\$385.95
18,924.96 lbs. shelled corn at 76c per bu.....	256.84
3,148.32 lbs. linseed oil meal at \$50 per ton.....	78.71
5,852.96 lbs. alfalfa hay at \$20 per ton.....	58.53
1,108.00 lbs. molasses at \$45 per ton.....	24.93
Marketing expense: freight, yardage, feed, commission.....	27.76
Total expenditures.....	832.72
By 8 steers, weight 8,510 lbs. at \$10.00 per cwt.....	851.00
344 lbs. pork at \$6.00 per cwt.....	20.64
Total receipts.....	871.64
Total expenditures.....	832.72
Total profit.....	38.92
Profit per steer.....	4.86

LOT 5.—STEERS FED SHELLED CORN, ALFALFA HAY, AND MOLASSES

To 8 steers, weight 5,200.64 lbs. at \$7.38 per cwt.....	\$383.81
20,074.96 lbs. shelled corn at 76c per bu.....	272.45
7,232.00 lbs. alfalfa hay at \$20.00 per ton.....	72.32
1,114.00 lbs. molasses at \$45.00 per ton.....	25.07
Marketing expense: freight, yardage, feed, commission.....	27.76
Total expenditure.....	781.41
By 8 steers, weight 8,410.00 lbs. at \$9.65 per cwt.....	811.56
172 lbs. pork at \$6 per cwt.....	10.32
Total receipts.....	821.88
Total expenditures.....	781.41
Total profit.....	40.47
Profit per steer.....	5.06

TABLE 8.—SUMMARY OF DATA

Lot	1	2	3	4	5
Number of steers.....	8	8	8	8	8
Avg. initial wt. in lots.....	638.23	651.62	643.87	653.71	650.08
Avg. final wt. in lots.....	1052.5	1072.25	1027.47	1079.5	1066.37
Total gain per steer.....	414.27	420.63	383.60	425.60	416.29
Avg. daily gains per steer.....	2.96	3.00	2.73	3.04	2.97
Avg. daily ration per steer					
Shelled corn.....	16.78	16.61	17.00	16.89	17.92
Linseed oil meal.....	2.79	2.76	---	2.81	---
Corn silage.....	11.68	10.25	11.14	---	---
Alfalfa hay.....	2.55	2.59	2.82	5.22	6.40
Molasses.....	---	.98	.99	.98	.99
Gains on hogs per steer, lbs.....	33.75	28.12	24.37	43.00	21.50
Cost of feed per steer.....	50.14	52.29	44.08	52.37	46.23
Cost of gain per 100 lbs. on cattle (less gain on hogs at \$6.00 per cwt).....	11.37	12.03	11.11	11.69	10.79
Selling price in St. Louis.....	\$ 10.00	\$ 10.00	\$ 9.25	\$ 10.00	\$ 9.65
Percentage of dressed beef.....	59.04	59.85	59.24	59.83	58.17
Shrinkage per head in shipping (lbs.).....	15.00	19.75	19.97	15.75	15.12
Cost of marketing per steer.....	\$ 3.47	\$ 3.47	\$ 3.47	\$ 3.47	\$ 3.47
Money from which to pay interest, depreciation, insurance, profit, etc., per steer.....	\$ 5.06	\$ 3.08	-\$0.41	\$ 4.86	\$ 5.06

SUMMARY

Forty head of steers in five lots of eight head each were full-fed for 140 days as follows:

Lot 1.—Shelled corn, linseed meal, corn silage, alfalfa hay.

Lot 2.—Shelled corn, linseed meal, corn silage, alfalfa hay, and cane molasses.

Lot 3.—Shelled corn, corn silage, alfalfa hay and cane molasses.

Lot 4.—Shelled corn, linseed meal, alfalfa hay, and cane molasses.

Lot 5.—Shelled corn, alfalfa hay, and cane molasses.

The average daily gain for the steers in Lots 1, 2, 4, and 5, was 2.99 pounds, with less than 0.1 pound difference in daily gains among the four lots. The cattle in Lot 3, where no linseed meal was fed, made an average daily gain of 2.73 pounds, or practically $\frac{1}{4}$ pound less than was made in the other lots.

The amount of molasses was limited to not to exceed 1 pound daily. Other feeds were fed in quantities, such as the cattle would consume, increasing the grain gradually.

The cattle in Lots 1, 2, and 4 were sufficiently similar in condition at the close of the test to sell at the same price, \$10.00 per cwt. on the market. The cattle in Lot 3, which received no linseed meal, were not so fat as those in the three lots above mentioned, and brought \$9.25 per cwt. The cattle in Lot 5, which received neither linseed meal nor corn silage, were between the cattle in Lot 3 and those in Lots 1, 2, and 4 in condition and brought \$9.65 per cwt.

The daily consumption of feed increased gradually during the first 90 days of the period, after which it remained stationary or decreased slightly.

The largest quantities of roughness were consumed during the early part of the feeding period.

Thirty-two pounds of molasses replaced 17 pounds of shelled corn, 3 pounds of linseed oil meal, 56 pounds of corn silage, and 2 pounds of alfalfa hay in the production of 100 pounds of gain.

Where 2.79 pounds of linseed meal were eliminated from and 0.99 pounds of molasses added to a full fed ration of shelled corn, corn silage, and alfalfa hay, the consumption of hay and corn increased slightly; the rate of gain was reduced by about $\frac{1}{4}$ pound per day and the selling

price of the cattle at the end of the 140-day period was reduced by 75c per cwt.

Where corn silage was eliminated and 0.98 pounds of molasses daily added to a ration otherwise consisting of shelled corn, linseed meal and alfalfa hay, the gains produced were slightly greater, the final selling price the same, and the 32 pounds of molasses and 85 pounds of alfalfa hay were equivalent to 12 pounds of shelled corn, 2 pounds linseed meal and 394 pounds of corn silage.

Where corn silage and linseed meal were eliminated and 0.99 pounds daily of cane molasses was added to a ration of shelled corn and alfalfa hay, the amount of corn and hay consumed increased materially, the daily gain was about the same, and the final selling price was reduced 35c per cwt.