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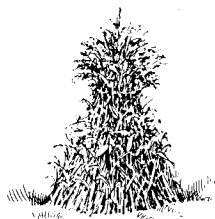
COMPARISON OF SHOCK CORN, CRIB CORN,
AND CORN SILAGE ON AN ACRE BASIS
FOR FINISHING TWO-YEAR-OLD CATTLE

By

M. JACOB AND H. R. DUNCAN

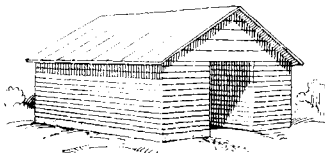
Which acre will bring the best financial returns—

Fed as
Shock Corn



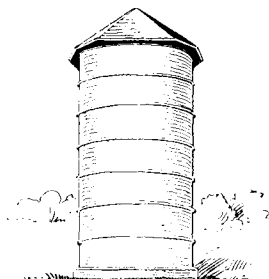
?

Fed as
Crib Corn



?

Fed as
Silage



?

KNOXVILLE, TENNESSEE

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AGRICULTURAL EXPERIMENT STATION
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The Agricultural Building, containing the offices and laboratories of the Experiment Station, the College class rooms, and the headquarters of the Agricultural Extension Service, is located at the University Farm, on Kingston Pike, about one mile west of the main campus. Farmers are cordially invited to visit the building and the experimental grounds.

Bulletins of this Station will be mailed free to any farmer in the State. Write Agricultural Experiment Station, University of Tennessee, Knoxville, Tennessee.

INTRODUCTION

As early as 1891, at farm meetings and in the press, Tennessee farm leaders were advocating the use of silage for cattle. Several silos were built in the State prior to 1900, and between 1910 and 1920 there was a boom in silo building. Several hundred silos of various types were built. This boom was due, in part, to the following factors: (1) Experimental work had shown conclusively that silage was a superior feed. (2) During the war period considerable pressure was put on farmers for increased production of milk, butter, and beef; prices were good, and the silo looked like a good investment for increasing the farm income and the Nation's food supply. (3) Farmers were enjoying good times and good credit; bankers were willing, and anxious, to loan them money for farm investments. (4) High-pressure salesmanship brought about a wide distribution of silos and the construction of many different types.

The extent of silage production and use from 1919 to 1939, as revealed by the census, is shown in table 1.

TABLE 1—*Extent of silage production and use in Tennessee*

Year	Acres of all silage crops	Number of farms reporting corn silage cut	Acres of corn cut for silage
1919	30,579	.....	.....
1924	.....	1,918	22,954
1929	.....	1,736	19,374
1939	.....	1,241	14,982

These data are by no means complete, since considerable sorghum as well as corn-and-sorghum mixture is used for silage and there is no way of telling how definite the census takers and farmers were in separating corn silage from sorghum silage or a mixture of the two. The sorghum acreage is reported as cut for hay, silage, or fodder. According to these data, corn silage was made on only .5 percent of the farms in the State in 1939. This figure appears to be low. Many silos, however, have fallen down or are standing idle, and the use of silage in the State is not of great economic importance. Dairymen are making greater use of silage than are beef-cattlemen. Very little is fed to beef cattle, even though it has been advocated for over 50 years.

Since 1909, the Tennessee Agricultural Experiment Station has conducted and reported several series of cattle-feeding experiments in which silage was used with satisfactory results. Many other stations have shown that silage gave an excellent account of itself when fed to cattle. It is unusual to find a feeding trial that

does not show that silage is a good and an economical feed; yet Tennessee cattle feeders have not adopted the silo generally as a means of utilizing the corn crop. Many explanations have been offered for the absence of silos in farm-operating plans.

Since farmers have not seen fit to adopt a method of corn utilization which has been proved to be experimentally sound, it seemed fitting for the Tennessee Station to conduct some studies involving the economics of silage production along with the use of silage as a feed for beef cattle. This experiment therefore goes farther than any previously undertaken by the Station, having been planned to study the practicability of the silo from a farm-management viewpoint. It was carried out during the winters of 1938-39, 1939-40, and 1940-41.

OBJECTS OF THE EXPERIMENT

The objects of the experiment are stated below:

1. To compare the beef yields from acres of corn processed and fed as follows (see rations in table 5):

Lot 1—Corn silage plus a medium ration of cottonseed meal.

Lot 2—Corn silage plus a light ration of cottonseed meal.

Lot 3—Corn silage plus a light ration of cottonseed meal and legume hay.

Lot 4—Shock corn plus a light ration of cottonseed meal and legume hay.

Lot 5—Ground ear corn plus a light ration of cottonseed meal and legume hay.

2. To study the effects of the various rations and corn preparations upon the carcasses and dressing percentages of 2-year-old cattle.

3. To compare all the costs of processing an acre of corn as silage, shock corn, and crib corn for feeding.

4. To compare the net acre-returns from the various methods of corn utilization.

5. To compare the manurial value of the combinations of feeds used.

CATTLE

Most of the cattle used during the 3 years were native East Tennessee steers, but a few branded Herefords, originating in the West, were included. Angus and Hereford blood predominated; a small percentage were Shorthorns. The cattle varied from purebreds to high-grades, grades, and crossbreds. The quality was much above the average for native steer cattle. As feeders, most of the steers were graded "good," several "choice," and a few "medium." The average initial weight of each of the 5 lots of cattle for the 3 years was close to 960 pounds, although in some instances there were variations of as much as 300 pounds between cattle in the same lot. Each year the cattle were furnished by a local packing company and were fed 150 days on contract.



Fig. 1—The finished steers in lot 5, fed 1939-40.

This lot of cattle, full-fed on ground ear corn and supplement, gained 55 pounds more in 150 days than lot 1, full-fed corn silage and 5 pounds of cottonseed meal per day. It dressed 59.40 percent, 2.15 percent more than lot 1. Even though lot 5 gained more, dressed higher, and produced somewhat better carcasses than lot 1, it gave less return per acre of corn fed than lot 1, fed corn silage. The steers in lot 1 consumed .30 acre of corn per head in 150 days, while those in lot 5 consumed .739 acre of corn, yielding 61.5 bushels per acre.

FEEDS

Each ration involved the feeding of corn in some form or preparation comparable to definite practices of cattle feeders. Corn was fed as normal corn silage, corn fodder, and ear corn.

The corn used was produced on the bottom or river upland of the University's Cherokee Farm at Knoxville. This land had received liberal applications of manure, lime, and phosphate, and

was in a good state of fertility. The fields of corn used were laid off in uniform strips and the acreage of each was determined. Every other strip was put into the silo, and the remaining strips were cut and shocked. An acre of silage corn, therefore, was comparable to an acre of shock corn.

Neal Paymaster corn, planted rather thick, was used each year. As the corn was ripe when made into silage, some water was used to insure plenty of moisture for a good pack. A very palatable grade of silage was produced each year. A sack division was placed between the silages from each acreage ensiled so that an accurate record of yields could be kept.

The shock corn was made on about the same date as the silage. As soon as the shock corn was dry enough, and the weather permitted, the ears were snapped from the stalks and put into the crib, and the stover was run through a silage cutter and blown into the mow for feeding. The ear corn (corn-cob-shuck) was ground before being fed. Ground ear corn and cut stover were fed in proportions which insured the consumption of the acre productions of each in the same number of days. Long shock corn is very commonly fed to fattening cattle in some sections of the country. In some cases, since the advent of adequate feed mills, the shock corn is ground. The above preparation of shock corn, however, seemed more practical from the standpoint of the labor and machinery available and the convenience of feeding on the University Farm. It was not planned to have hogs following any of the lots of cattle; hence, it was highly desirable that the ear corn be ground.

The ear corn used for lot 5 was not grown on the University Farm, but was of similar variety and quality to that used for the other lots; the same yields per acre and the same feeding value were used. The average yield of ear corn grown on the University Farm for the 3 years was 52.2 bushels. This yield was obtained from the shock-corn areas.

EQUIPMENT

Each lot of cattle was fed in a stall approximately 14 x 25 feet, provided with a constant supply of water. The cattle were comfortably bedded with straw and shavings, and remained in their stalls throughout the experiment, except during weighing and manure hauling.

FEEDING

All feeds, except the hay, which the cattle received once daily at noon, were fed regularly at 6:30 a.m. and 4:30 p.m. Silage was fed ad libitum to those lots receiving silage. Cottonseed meal was

fed at a planned level, on top of, or mixed with, the rest of the ration. Some cattlemen believe that cattle crave and need some dry roughage when fed silage, and it was planned to feed a relatively small amount of legume hay to lot 3 in order to study this point. Lot 4 was fed all the ground corn and the cut stover the cattle would clean up reasonably well and still eat their hay. The stover and corn were fed in the proportions grown, as nearly as possible. These cattle soon learned to work the ground corn to the bottom of the trough, from which they could eat it without getting too much of the stover. They were not forced to clean up the stover, but were fed so that approximately 28 percent of it was refused. Lot 5 was given all the ground ear corn the animals would eat in addition to the hay and cottonseed-meal allotments. Salt was kept constantly before all lots of cattle in conveniently located boxes.

WEIGHING, APPRAISING, AND MARKETING

Individual weights were taken upon 3 consecutive days at the beginning of the experiment and at the end of each of the five 30-day periods. The live cattle were graded as feeder and as slaughter cattle at the beginning of the experiment and as slaughter cattle at the end of the experiment. Since these cattle were fed on contract and were not sold at the end of the experiment, they were appraised as to their market value before leaving the barn. After slaughter, the carcasses were graded by packer representatives and data upon dressing percentages and carcass grades were obtained.

RESULTS

For the sake of brevity, only a summary of the data for the 3 years' work is presented.

Table 2 shows a detailed cost accounting of the processing of corn, by 3 different methods, for cattle feeding, as found on the University Farm. Some of these costs are higher than may prevail under some farm conditions. Hours and hour costs of the various operations are given, so that anyone familiar with silage or other methods of corn harvesting may possibly apply these data in part, or entirely, to his own situation. The machinery costs—covering tractor, corn harvester, ensilage cutter, and feed grinder—probably are more representative than some of the other costs, as good machinery was used and it was operated with the best labor available. The labor cost of many of the operations is high because of the greenness and inefficiency of the labor used. Most of the time the machines were operated at full capacity.

TABLE 2—*Cost of processing one acre of corn for cattle feeding*
Three-year average

Item	Silage route	Shock-corn route	Corn-crib route
Harvesting with corn harvester and tractor			
Use of tractor 1.2 hrs. @ 50c per hr.			
Use of harvester 1.2 hrs. @ 25c per hr.			
Man labor 2.4 hrs. @ 15c per hr.			
Twine used by harvester, 3¾ lbs. @ 9½c per lb.			
Fuel for tractor 1.8 gal. @ 9½c per gal.			
Gasoline for tractor, 2c; oil for tractor and harvester, 5c			
	\$1.85	\$1.85	
Putting into silo			
Man labor 37 hrs. @ 15c per hr.			
Horse labor 21 hrs. @ 7½c per hr.			
Wagon use 10¼ hrs. @ 2c per hr.			
Ensilage cutter hrs. 1.8 @ 57c per hr.			
Tractor (belt work) 1.8 hrs. @ 40c per hr.			
Fuel for tractor, 3.6 gal. @ 9½c per gal.			
Oil and grease for tractor and cutter			
	\$9.49	9.49	
Shocking			
Man labor 18.1 hrs. @ 15c per hr.			
Twine for tying shocks 2.7 lbs. @ 9½c per lb.			
	\$2.96	2.96	
Snapping from shocks			
Man labor 22.6 hrs. @ 15c per hr.			
	\$3.39	3.39	
Cribbing			
Man labor 5.4 hrs. @ 15c per hr.			
Horse labor 7.7 hrs. @ 7½c per hr.			
Wagon use 3.8 hrs. @ 2c per hr.			
	\$1.46	1.46	1.46
Running stover through ensilage cutter			
Man labor 13.1 hrs. @ 15c per hr.			
Horse labor 11.1 hrs. @ 7½c per hr.			
Wagon use 5.6 hrs. @ 2c per hr.			
Ensilage cutter 2 hrs. @ 57c per hr.			
Tractor (belt work) 2 hrs. @ 40c per hr.			
Fuel 3.4 gal. @ 9½c per gal.			
Gas and oil			
	\$5.23	5.23	
Pulling from standing corn (estimated)			
Basis: One man pulling 60 bu. per day.			
Man hrs. 8½ @ 15c per hr. (2½c per bu.)	\$1.27		1.27
Storing silage			
Basis: 10c per cu. ft.—approximate cost of concrete silo			
Depreciation—2% on full investment	\$1.41		
Interest—6% on ½ investment	2.11		
Taxes, insurance, and repairs (estimated)	.92		
	\$4.44	4.44	
Storing ear corn			
Depreciation—4% on full value of crib space	\$.33		
Interest—6% on ½ value of crib space	.25		
Taxes, insurance, and repairs (estimated)	.27		
	\$.85	.85	.85
Storing stover (in barn of moderate construction)			
Depreciation on barn space, 2% on initial cost	\$.45		
Interest—6% on ½ initial cost of space	.68		
Taxes, insurance, and repairs (estimated)	.57		
	\$1.70	1.70	

TABLE 2—(concluded)

Item	Silage route	Shock-corn route	Corn-crib route
Grinding ear corn			
Interest on $\frac{1}{2}$ value, mill and motor (\$650.00 value) at 6%			
Depreciation on mill and motor, 10% on full value			
Yearly repairs			
Yearly cost of mill and motor			
On basis of 151,000 pounds yearly grind, machine cost per 1000 pounds is			
Cost of electricity per 1000 pounds (5 kilowatt hours @ 1c)			
Machine and electricity cost per 1000 pounds			
Machine and electricity cost per bu. (74 lbs.)			
Labor cost of sacking corn, hauling to and from grinder, grinding, and sacking, per bu.			
Making the total cost of grinding 10c per bu. or \$5.22 per acre on a 52.2-bu yield		5.22	5.22
Cost per acre	\$15.78	\$22.66	\$8.80
Cost per ton of silage	\$ 1.60		

Note: These costs are higher than should prevail on the average farm. The "pickup" labor used was green and not very efficient, and operations were slowed down considerably by the cutting of alternate strips for silage and stover, completing operations on one area before starting another, keeping records of weights, and other items connected with the experiment.

Summary of acre-yields			
Yield of silage per acre (amount fed from silo) tons	9.82		
Yield of stover per acre (approx. 15% moisture) lbs.		4349	
Yield of ear corn per acre (approx. 15% moisture) lbs.		3862	3862
Yield of ear corn per acre (approx. 15% moisture) bu.		52.2	52.2

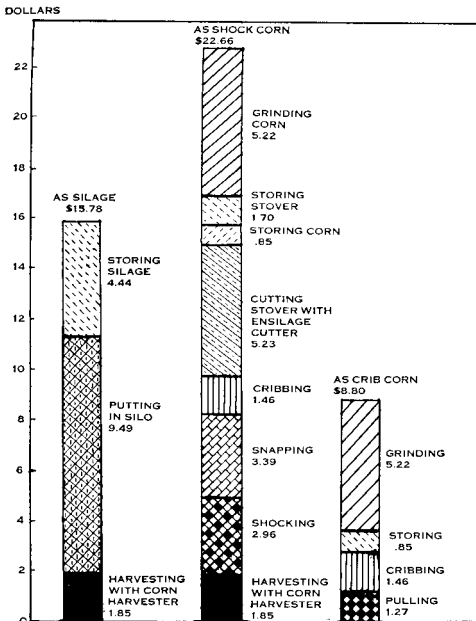


Fig. 2—The 3-year average costs of processing an acre of corn yielding 52.2 bushels per acre, for cattle feeding, by three methods.

Some of the most common complaints against silage making are that "it costs too much" and that "machinery is not available." The accounting in table 3 does not show that the costs are exorbitant. A cost of \$15.78 per acre, or \$1.60 per ton, for processing and storage of an acre of heavy 52.2-bushel corn cannot be said to be high in comparison with the cost of \$8.80 for gathering and storing an acre of the same corn as crib corn. Of this cost, \$4.44, or 28 percent, is represented by the cost of the silo.

TABLE 3—*Summary of silage costs on an acre basis*

Item	Amount	Percent of total costs
Tractor, fuel, and oil	\$1.97	12.6
Harvester, ensilage cutter, wagons, and twine.....	1.89	11.9
Man labor	5.91	37.4
Horse labor	1.57	10.0
Storage (silo)	4.44	28.1
Total	\$15.78	100.0

It certainly is not high compared with the cost of \$22.66 for processing an acre of the same kind of corn as shock corn. Fifty-nine percent of the processing cost for the crib corn and 23 percent for the shock corn were for grinding. This cost can be eliminated in whole or in part by the feeding of ear corn or broken-ear corn to the cattle and having hogs follow them to pick up the waste.

A factor not always considered in silage making is that the corn is removed from the land early, thus permitting an early seeding of small grain for pasture and grain. An early or medium-early corn crop can be ensiled about September 1. Allowing 2 weeks for the preparation of the seedbed and doing other farm jobs, a crop of small grain, crimson clover, or some type of winter pasture can be seeded by the middle of the month. This is early enough for the new seeding to make a good growth before winter. Small grain may be seeded reasonably early if the corn is shocked, but the shocks are in the way of preparation and seeding. Furthermore, in the removal of the dry shock corn after the seeding is made, some damage to the land and the new seeding may occur. The shock-corn method appears too expensive to be practicable. Usually when corn is harvested as crib corn, there is not time enough to harvest the crop, prepare the land, and get a new seeding in before the middle or latter part of October, and frequently seedings must be made in November. The presence of the corn stalks makes seedbed preparation more expensive and difficult, and the crop is not as productive for either pasture or grain because of the late seeding. It is considered by many farmers that the ad-

vantage to the succeeding crop of ensiling the corn crop more than compensates for the higher acre processing costs of silage corn over those of crib corn.

Tables 4 and 5 give the average weights and gains and feed requirements for the 3 trials. In order to call attention to some specific items of interest applicable to farming and to cattle feeding, data by years are presented in tables 6, 7, 8, 9, 10, and 11.

TABLE 4—Weights and gains on cattle
Three-year average

Item	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5 ¹
	Pounds	Pounds	Pounds	Pounds	Pounds
Average initial weight	956.0	963.3	958.3	961.5	954.9
Average final weight	1260.3	1237.9	1217.2	1199.0	1284.8
Average gain per head, 150 days	304.3	274.6	258.9	237.5	329.9
Average daily gain, 150 days	2.028	1.827	1.726	1.583	2.199
Gains per acre of corn fed (includes gain from other feeds fed in ration)	877.2	722.4	783.2	555.7	380.3

¹Two years only.

TABLE 5—Rations and feed requirements
Three-year average

Item	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5 ¹
Average daily ration fed:					
Corn silage (lbs.)	45.5	49.9	43.6	.....	.....
Corn stover (lbs.) .....	.....	.....	.....	² 11.9	.....
Cottonseed meal (lbs.)	4.98	1.65	1.65	² 1.65	1.65
Corn-cob-shuck meal (lbs.) .....	.....	.....	.....	11.1	21.7
Lespedeza or red clover hay (fair quality) lbs. ....	.....	.....	2.34	2.34	2.37
Salt (lb.)	.05	.07	.05	.03	.07
Days one acre would feed one steer	435	396	454	358	174
Bushels of corn consumed per steer	17.7	19.7	17.1	22.5	44.3
Average daily ration refused:					
Corn silage (lbs.)	.29	.27	.32	.....	.....
Corn stover (lbs.) .....	.....	.....	.....	3.36	.....
Lespedeza or red clover hay (lbs) .....	.....	.....	.35	.18	.01
Feed for 100 pounds gain (based on amount fed):					
Corn silage (lbs.)	2245.9	2728.1	2527.6	.....	.....
Corn stover (lbs.) .....	.....	.....	.....	760.0	.....
Cottonseed meal (lbs.)	247.0	90.9	96.2	105.0	75.3
Corn-cob-shuck meal (lbs.) .....	.....	.....	.....	703.5	988.8
Lespedeza or red clover hay (fair quality) lbs. ....	.....	.....	136.5	148.2	108.0
Salt (lbs.)	2.5	3.8	2.7	2.2	3.5

¹Two years only.

²Stover and ground ear corn were fed in approximately the same proportions in which they grew; hence, the proportion of roughage and grain was the same as that fed as silage in the other rations.

The silage yields shown in table 6 were determined by dividing the amount of silage actually fed by the acreage of corn ensiled. Hence, the silage yields reported are lower than would have

TABLE 6—*Yields of silage, stover, and ear corn per acre, by years*

Year	Silage	Stover	Ear corn
	Tons	Pounds	Pounds
First	9.00	4148	4004
Second	19.53	4916	4551
Third	9.93	3984	3034
Average	9.82	4349	3862 (52.2 bu.)

been the case had the freshly cut green corn been weighed and the silage yields determined from the weight, as is commonly done in reporting silage yields. The stover and ear-corn yields are the yields from the field at the time of processing the stover, corrected to a moisture content of approximately 15 percent.

The third-year crop of corn was grown on the same field on which the second-year crop was grown. This bottom land was seeded to a winter pasture crop soon after the second-year crop of corn was removed. Most of it had liberal applications of manure during the winter and spring. The pasture made good growth and was used for sheep before being turned under, about May first, for the next crop of corn. The yield of ear corn from this crop was 21.5 bushels less than that of the preceding crop on the same land. The corn produced a good growth of stalk and fodder, but the grain yield suffered from drouth and possibly from reduced fertility of the land.

The gains varied slightly from year to year because of differences in cattle, feeds, and weather conditions, but the relative gains of the different lots are fairly consistent, by years, with the possible exception of lot 5 for the third year. Even though this lot of cattle was full-fed on corn, the gain was practically the same as

TABLE 7—*Average gains of cattle, per head, by years*

Year	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
	Pounds	Pounds	Pounds	Pounds	Pounds
First	306.5	287.8	269.7	224.7	328.8
Second	273.3	248.3	242.5	258.6	331.1
Third	333.1	287.6	264.3	229.3	
Average	304.3	274.6	258.9	237.5	329.9

that of lot 1, which received all the corn silage they would eat and 4.98 pounds of cottonseed meal per head daily. Lot 5 was added to the experiment the second year because the ration fed resembles that fed by many cattle feeders of the State who do not have, or

believe in, silos. It was thought that a comparison of this ration with one involving silage would be worth while and possibly have a practical farm application. The small difference in gain between lots 5 and 1 is interesting. During the 3 years, lot 1, fed only silage and cottonseed meal for 150 days, made a daily gain of 2.028 pounds; while lot 5, fed for 2 years on a full feed of corn and small amounts of cottonseed meal and legume hay, gained only 2.199 pounds per day.

Lot 2, receiving only enough cottonseed meal (1.65 pounds) to balance the ration, made a daily gain of 1.827 pounds. This is a good gain, considering the small amount of concentrates fed. The only difference in the ration of lot 2 and that of lot 3 was that lot 3 received a small amount of legume hay (2.34 pounds per steer per day). Since lot 3 received hay, it did not consume as much silage as lot 2. The introduction of hay into this ration did not improve the gains of lot 3 as compared with those of lot 2—they were 15.7 pounds less per head for the 3 years.

The gains of lot 4, receiving processed shock corn, cottonseed meal, and legume hay, were low. Greater gains might have been secured had more corn been fed, but this would have meant the consumption of less stover and hence a smaller percentage of the acre's feed. As the cattle were fed, they refused approximately 30 percent of the stover. The rations of lots 3 and 4 were similar except in the form in which the corn was fed. The superiority of silage over shock corn is represented by 21.4 pounds gain per steer.

Gains per steer is only one measure of performance. Gains per acre, shown in table 8, is another interpretation, which brings out interesting points on practical cattle feeding. Lot 1, receiving more cottonseed meal but somewhat less silage than lot 2, shows

TABLE 8—*Beef gains per acre of corn fed, by years.*
Includes gains from other feeds fed in rations

Year	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
	Pounds	Pounds	Pounds	Pounds	Pounds
First	844.1	698.5	747.1	514.1	445.2
Second	910.9	749.8	868.5	675.3	315.5
Third	876.5	719.0	734.1	477.7	
Average	877.2	722.4	783.2	555.7	380.3

155 pounds more gain per acre. The cattle in lots 3, 4, and 5 received approximately the same amounts of cottonseed meal and legume hay per day, but had a full feed of corn as silage, shock

corn, and ear corn, respectively. The acre gains of these 3 lots—783.2, 555.7, and 380.3 pounds—are significantly in favor of silage as compared with shock corn or ear corn.

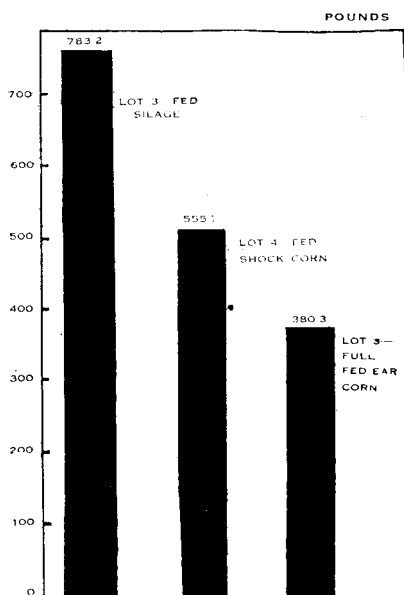


Fig. 3—Pounds of beef produced per acre.
Includes gain from other feeds fed.

At the conclusion of the experiment each year the 5 lots of cattle were appraised as to their market value by three appraisers acquainted with local and terminal markets and the costs of marketing cattle. The basis of the appraised price was what the cattle would bring at the barn on the final experimental weight less 3 percent. This weight-base would be approximately equivalent to that obtained by weighing the cattle early in the morning without feed or water—a common custom in weighing out cattle.

TABLE 9—*Margins secured, by years*

Year	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
First	\$3.87	\$3.50	\$3.50	\$3.25	¹ \$4.16
Second	.92	.50	.42	.67	1.25
Third	2.42	2.00	1.75	1.50	2.67
Average	\$2.40	\$2.00	\$1.89	\$1.81	¹ \$2.69

¹Estimated.

Profit in fattening cattle depends upon the margin between cost and selling price. Table 9 shows the margins made on these cattle by lots and by years. Table 12, among other items, shows the average appraised price per lot for the 3 years. These tables show the spasmodic and uncertain conditions in price of cattle and margins which confront cattle feeders. This project hit 2 years of satisfactory margins and profits and 1 year of unsatisfactory margin and profit.

As the lots were uniform in initial grade, the difference in appraised values were due to the finish and appearance of the cattle. Lot 5 had gained more, had more finish, and appeared to have less middle, and was appraised higher than any other lot. Since lot 5 was included only the last 2 years and missed the year of big margins, the average margin as shown in table 9 is an estimate based on the comparable margins secured for 2 years. The average margin of lot 1 for the last 2 years is \$1.67, compared with \$1.96 for lot 5—a difference of only 29 cents.

Most packer and butcher buyers and feeders have the idea that full-feeding corn to fattening cattle will produce cattle much



Fig. 4—Steer 730, lot 1, 1940-41.

Feeder grade October 23, 1940	choice
Slaughter grade October 23, 1940	medium good
Final weight March 22, 1941	1323 pounds
Gain in 150 days	343 pounds
Slaughter grade March 22, 1941	choice
Carcass grade March 22, 1941	choice
Dressing percentage (final experimental-weight and chilled-carcass-weight basis)	60.09

This steer was above the average of the lot in quality, 10 pounds above average in gain, and 3 percent above in carcass yield. He shows the kind of cattle it is possible to make from mature, well-conditioned feeders with a ration of corn silage ad libitum and an average of 5 pounds cottonseed meal daily.

superior to those fed heavily on silage and cottonseed meal. Such was not the case in this experiment. Tables 10 and 11, giving dressing percentages and carcass grades, show further that full-feeding corn did not produce carcass beef much superior to that

TABLE 10—*Dressing percentages*
Final-experimental-weight and chilled-carcass-weight basis

Lot	First year	Second year	Third year	Average
	Percent	Percent	Percent	Percent
1	56.89	57.25	57.15	57.09
2	55.97	56.37	56.14	56.16
3	56.81	56.79	56.90	56.83
4	56.31	56.65	56.57	56.51
5	.....	59.40	59.92	59.66

TABLE 11—*Average carcass grade*

Lot	First year	Second year	Third year
1	High good	High good	High good
2	High good	Low choice—	Low good
3	High good	High good	Good
4	High good	High good	Good—
5	.....	Low choice—	High good+

produced by feeding silage, as in lot 1. The differences in carcass gradings between lots 1 and 5 were border-line differences.

These dressing percentages and carcass grades indicate that a good grade of beef was produced by each of the 5 rations. It should be remembered that the cattle used were 2-year-olds in reasonably good condition at the start of the experiment. Any cattle that will dress from 56.16 to 59.66 percent on the final experimental-weight, and chilled-carcass-weight basis are sufficiently well finished to supply the average consumer with satisfactory and economical beef. Most of the carcasses were well covered and showed considerable marbling when cut down. About one-half of the carcasses were shipped to New York to find the best market. Some were too heavy for the local trade.

Lots 1 and 5 produced the best cattle. There was a difference of 2.57 percent in the dress of these lots. This difference is sufficient to be a considerable factor in the price of the live cattle and the beef on the hook. There was not much difference, however, as the packer graded and sold the carcasses of these two lots. The difference in dressing percentage in favor of lot 5 might be attributed to lack of middle rather than to superior covering. The silage-fed lots were noticeably heavier-middled than the shock-corn-

and the ear-corn-fed lots. The cattle in lots 2, 3, and 4 were not quite as good as those in lots 1 and 5, but all of them produced superior beef for the local trade.



Lot 1

Fed corn silage plus a medium ration of cottonseed meal.



Lot 2

Fed corn silage plus a light ration of cottonseed meal.



Lot 3

Fed corn silage plus a light ration of cottonseed meal and legume hay.



Lot 4

Fed shock corn plus a light ration of cottonseed meal and legume hay.



Lot 5

Fed ground ear corn plus a light ration of cottonseed meal and legume hay.

Fig. 5—Finished cattle, third year of experiment, 1940-41.

FINANCIAL ANALYSIS

Results of most cattle-feeding experiments are summarized by profit or loss per head. This figure is the difference between gross returns and such costs as initial investment in cattle, interest on

investment, feed, labor, and marketing. Not all of these costs are included in every analysis. In many reports, feed is the only item considered. That type of report is valuable to feeders, but it leaves many of them in a confused state of mind when they attempt to apply results to practical cattle feeding, crop production, and farm management back on the farm.

Two different types of summaries of this work are presented in the hope that the results may be interpreted and applied with profit by cattle feeders and farmers.

The profits shown in table 12 appear to be somewhat above average expectations in feeding cattle. They were due to the very satisfactory margins secured during these years. They show that lot 4, compared with the other lots, gave poor returns from shock corn, and that the returns of lots 1, 2, and 5 are close. One might conclude that it would not make much difference which ration was fed—1, 2, or 5. This type of interpretation probably suits the man who buys most or all of his feed.

TABLE 12—*Profit per head.*
Three-year average

Item	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5 ¹
Average initial cost per head (cost per cwt. by years, \$7.00, \$8.00, \$8.00)	\$73.28	\$73.82	\$73.41	\$73.65	\$73.20
Average appraised value per cwt. (at barn with 3% off final weight)	10.07	9.66	9.56	9.47	10.35
Average margin received	2.40	2.00	1.89	1.81	2.69
Average cost of 100 lbs. gain ²	10.72	9.67	9.99	12.70	11.79
Average feed cost per head	32.62	26.55	25.86	30.16	38.89
Average value of finished cattle per head	123.30	116.29	113.06	110.18	128.99
Average profit per head above feed and initial cost	17.40	15.92	13.79	6.37	16.80

¹Average partially estimated. Based on performance and appraisals for 2 years.

²Corn silage, \$6.00 per ton; corn stover, \$8.00 per ton; legume hay, \$12.50 per ton; ground ear corn, 74c per bu.; C.S.M., \$32.00 per ton; salt, \$20.00 per ton.

The interpretation in table 13 is designed to show the farmer who has an acre of corn to feed cattle how he can get the most out of it. Table 12 shows that there was little difference in the returns from feeding ground ear corn full-fed and feeding corn silage and a medium cottonseed-meal ration. Table 13 shows that an acre of corn fed as silage has more than twice the value of a similar acre fed as ground ear corn. This fact is more significant when one considers that the costs of processing in each case have been deducted. It shows that the costs of silage making are justi-

TABLE 13—Returns per acre
Three-year average

Item	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5 ¹
	Dollars	Dollars	Dollars	Dollars	Dollars
Appraised value of finished cattle per cwt. (value at barn with 3% off final experimental weight)	10.07	9.66	9.56	9.47	10.35
Initial cost per head (cost per cwt. by years, \$7.00, \$8.00, \$8.00)	73.28	73.82	73.41	73.65	73.20
Margin received	2.40	2.00	1.89	1.81	2.69
Average value of finished cattle per head (3% off final experimental-weight basis)	123.30	116.29	113.06	110.18	128.99
Gross returns on feed per head	50.02	42.47	39.65	36.53	55.79
Value of feeds other than corn fed per head ²	12.00	4.15	6.35	6.33	6.41
Gross returns from corn fed per head	38.02	38.32	33.30	30.20	49.38
	Acres	Acres	Acres	Acres	Acres
Corn consumed per head	.349	.382	.335	.438	.897
	Dollars	Dollars	Dollars	Dollars	Dollars
Gross returns per acre of corn fed	108.94	100.31	99.40	68.95	55.05
Cost of processing per acre	15.78	15.78	15.78	22.66	8.80
Returns per acre of corn less cost of processing for feeding	93.16	84.45	83.62	46.29	46.25
Returns per ton of silage	9.48	8.60	8.51		
Returns per bushel of corn	1.78	1.61	1.60	.88	.88
Net returns per acre (gross returns less processing cost and a production cost of \$25.00 per acre)	68.16	59.45	58.62	21.29	21.25
Net returns per ton of silage	6.93	6.05	5.97		
Net returns per bu. of corn	1.30	1.13	1.12	.40	.40

¹Average partially estimated. Based on performance and appraisals for 2 years.²Prices as shown in table 12.

fied by increased acre returns. The argument that silage costs too much is not sustained by this work.

The feeding of an acre of shock corn, as one might reasonably expect, since 70 percent of the stover was utilized, gave greater gross returns than an acre fed as ground ear corn; but as the processing costs were high for the shock corn, the net returns per acre were about the same. These two systems returned 88 cents per bushel for the corn consumed. This means that the stover was not worth anything for feeding, so far as profit was concerned. The returns per bushel of corn fed in silage to lots 1, 2, and 3 were: \$1.78, \$1.61, and \$1.60 respectively. If a return per bushel of 88 cents, as secured in lot 5, is taken as the net value of corn for cattle feeding under these conditions, the stover part of the crop used as silage, and fed as in lot 1, was worth as much as the ear corn (\$1.78—\$0.88=\$0.90). All the silage-fed lots gave excellent returns, compared with the other lots, as interpreted in table 13.

The feeding of just enough cottonseed meal to balance the silage ration, as in lot 2, gave lower acre returns for the silage fed. In comparing lots 2 and 3, in which the only difference was a substitution of a small amount of legume hay for silage, it is noted that the addition of the hay did not increase the acre returns from the corn silage.

The returns per acre, less processing costs, were \$93.16, \$84.45, \$83.62, \$46.29, and \$46.25, for the 5 lots. These returns may be slightly higher than would prevail over a long period of years. The returns are high because good margins were received and the acres of land used were very productive, yielding about two and one-half times the average for the State. It would cost approximately \$25.00 to grow an acre of this corn to harvest time, if one included interest on good land, taxes, fertilizer, liberal applications of barnyard manure, labor, power, seed and machinery costs. Deducting this charge of \$25.00 from the above returns we have as the net acre returns: lot 1, \$68.16; lot 2, \$59.45; lot 3, \$58.62; lot 4, \$21.29; and lot 5, \$21.25.

Granting that the margins were higher than would prevail over a long period of years, and that they might be cut in half, lot 1, fed silage, still would return \$26.00 net per acre, compared with \$2.55 for lot 5, which was fed ear corn. These returns are net, all the costs for processing and \$25.00 for growing the corn being deducted in each case. A feeder might stay in the business under these conditions by feeding silage as in lot 1, but certainly not by feeding ear corn, as in lot 5.

All of these cattle were confined and fed inside the barn during the 150-day feeding period. They were bedded regularly and the manure was conserved in an efficient and a practical way. While no record was kept, load after load of valuable fertilizing material was hauled out and applied to the land. It was largely through the use of manure from steer feeding on the University Farm that 52.2 bushels of ear corn and 9.82 tons of silage per acre were produced for the steers fed in this experiment. The production of this land was increased from 15 to 20 bushels of corn per acre in 1916 to a 3-year average of 52.2 bushels in 1938-1941.

TABLE 14—*Amount of feed fed per acre of corn*

Feed	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
	Pounds	Pounds	Pounds	Pounds	Pounds
Corn silage	19,640	19,640	19,640		
Corn stover				4,349	
Lespedeza or red clover hay			1,062	814	412
Corn-cob-shuck meal				3,862	3,862
Cottonseed meal	2,160	653	749	574	287

Table 15 shows the manure angle of this project. Note the estimated manurial values of the feeds fed the 5 lots. The amount of cottonseed meal and stover fed had a very important bearing on the value of the manure produced on an acre basis. These

TABLE 15—*Manurial value of feeds fed per acre of corn fed¹*

Feed	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Corn silage	\$7.36	\$7.36	\$7.36	.....	.....
Corn stover .....	.....	.....	.....	{ \$7.36	.....
Corn-cob-shuck meal .....	.....	.....	.....	.....	\$4.00
Lespedeza or red clover hay .....	.....	.....	1.96	1.48	.76
Cottonseed meal	11.38	3.42	3.93	3.01	1.50
Total	\$18.74	\$10.78	\$13.25	\$11.85	\$6.26

¹Based upon recovery and application to the land of 70 percent of the phosphorus and potassium, and 50 percent of the nitrogen.

data indicate that it is good business to feed heavy rations of cottonseed meal, particularly when the cattle pay for the meal and make a profit besides. The feeding of a full feed of ground ear corn, with a minimal protein supplement, does not produce a rich manure; it is low in nitrogen, phosphorus, and potash.

SUMMARY

1. The following 5 different methods of processing and feeding corn on an acre basis were compared:

Lot 1—Corn silage + 4.98 pounds of cottonseed meal per steer per day.

Lot 2—Corn silage + 1.65 pounds of cottonseed meal per steer per day.

Lot 3—Corn silage + 1.65 pounds of cottonseed meal and 2.34 pounds of legume hay per steer per day.

Lot 4—Shock corn + 1.65 pounds of cottonseed meal and 2.34 pounds of legume hay per steer per day.

Lot 5—Ground ear corn + 1.65 pounds of cottonseed meal and 2.37 pounds of legume hay per steer per day.

2. The net returns in dollars per acre, after deducting an estimated production cost of \$25.00 per acre and all the processing costs, were \$68.16, \$59.45, \$58.62, \$21.29, and \$21.25 for the respective lots.

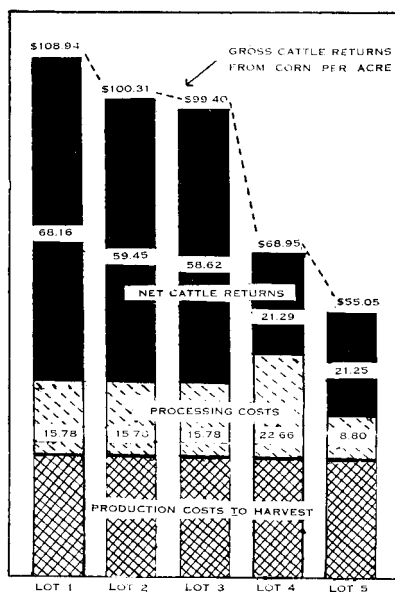


Fig. 6—A graphic picture of the production costs, processing costs, and net returns from an acre of 52.2-bushel corn fed in five different ways.

3. Average yields per acre secured from the corn used for the 3 years were: Ear corn, 52.2 bushels; silage, 9.82 tons, as weighed from the silo.

4. Costs of processing an acre of corn for feeding were: \$15.78 for corn silage, \$22.66 for shock corn, and \$8.80 for ear corn.

5. Days one acre would feed one steer as fed: lot 1, 435; lot 2, 396; lot 3, 451; lot 4, 348; lot 5, 174.

6. Acre-beef yields for the various rations were: 877.2, 722.4, 783.2, 555.7, and 380.3 pounds for the respective lots.

7. Each of the 5 rations fed to these fleshy 2-year-old steers produced satisfactory slaughter cattle for Tennessee markets.

8. The use of the silo appears to be the most economical way of processing and using the corn crop for fattening cattle. Net acre-returns from feeding silage were 3 times those from feeding shock corn or ear corn.

9. The cost of a silo and the labor and machinery necessary for silage making are justified by this study as a good business investment. Increase in the use of silage for fattening cattle is recommended.

10. The simple ration of corn silage and medium amount of cottonseed meal (lot 1) excelled all the other rations in net acre-returns and in manurial value. The practicability of this ration is confirmed by several other experiments conducted by the Tennessee Station.