THE UNIVERSITY OF TENNESSEE
AGRICULTURAL EXPERIMENT STATION
Knoxville

BULLETIN NO. 144 OCTOBER, 1930

# A COMPARISON OF NORMAL CORN SILAGE WITH GRAINLESS CORN SILAGE FOR FINISHING BEEF CATTLE

By
M. JACOB
and
H. R. DUNCAN

**Fig. 1—Farmers viewing lot 1, fed normal silage, at the conclusion of the third year.**

They all readily detected the marked difference in finish between the cattle fed normal silage and those fed grainless silage.

HOLSTON PRINTING CO.

# THE UNIVERSITY OF TENNESSEE AGRICULTURAL EXPERIMENT STATION
## Knoxville

H. A. MORGAN, President

### AGRICULTURAL EXPERIMENT STATION COMMITTEE

W. S. SHIELDS W. P. COOPER W. B. STOKELY

### STATION OFFICERS

C. A. MOOERS, Director and Agronomist
M. JACOB, Veterinarian and Animal Husbandman
S. H. ESSARY, Botanist
W. H. MACINTIRE, Chemist
C. E. ALLRED, Agricultural Economist
S. MARCOVITCH, Entomologist
C. D. SHERBAKOFF, Plant Pathologist
J. A. MCCLINTOCK, Horticulturist and Associate Plant Pathologist
MARGARET B. MACDONALD, Biochemist
W. M. SHAW, Associate Soil Chemist
H. P. OGDEN, Associate Agronomist
G. A. SHUEY, Associate Chemist
H. L. FACKLER, Associate Horticulturist
L. S. MAYER, Assistant Agronomist*
J. B. YOUNG, Assistant Soil Chemist
J. O. ANDES, Assistant Plant Pathologist
MRS. HELEN B. HUTCHENS, Assistant Plant Pathologist
BROOKS ROBINSON, Assistant Soil Chemist
NORABELLE DUNCAN, Assistant Biochemist
WALTER W. STANLEY, Assistant Entomologist
NEWMAN HANCOCK, Assistant Botanist
E. J. HOPKINS, Assistant Agricultural Economist
P. B. BOYER, Assistant Agricultural Economist
G. H. HATFIELD, Assistant Agricultural Economist
M. V. ANTHONY, Assistant in Entomology
BEN P. HAZLEWOOD, Supt. West Tenn. Exp. Station, Jackson
L. R. NEEL, Supt. Middle Tenn. Exp. Station, Columbia
LESTER WEAKLEY, Assistant, Mericourt Exp. Sta., Clarksville
K. T. HUTCHINSON, Assistant in Cooperative Experiments, Murfreesboro
SARAH C. CURRELL, Assistant Librarian
F. H. BROOME, Secretary
E. G. FRIZZELL, Office Assistant
WANDA M. SMITH, Stenographer
NEDA SWANNER, Stenographer
MILDRED GALLAHER, Stenographer

*Cooperative with Office of Cereal Investigations, U. S. D. A.

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 sent, upon request, free of charge, to any farmer in the State.**

# A COMPARISON OF NORMAL CORN SILAGE WITH GRAINLESS CORN SILAGE FOR FINISHING BEEF CATTLE

By

M. JACOB
Veterinarian and Animal Husbandman

and

H. R. DUNCAN
Associate Professor of Animal Husbandry

## INTRODUCTION

In Tennessee, corn silage and cottonseed meal is a common ration for winter-finishing beef cattle. Cottonseed meal is produced in large quantities in this and adjacent states and is considered one of the most economical feeds, especially when combined with a succulent, bulky roughage, such as silage. It furnishes protein in the cheapest form for balancing the silage ration. It is richer in nitrogen, phosphoric acid, and potash than any other feed except high-grade tankage, and has a high manurial value, estimated at $23.00 per ton, after being fed. Since $45.00 is charged for cottonseed meal for the 3 years, its manurial value is more than half of its original value. The extensive feeding of cottonseed meal for maintaining and building up the nitrogen- and mineral-improverished soils is a commendable farm practice. Corn silage is one of the best feeds for use with cottonseed meal and can be produced abundantly and cheaply on Tennessee farms.

## PRACTICES IN THE MAKING OF SILAGE IN TENNESSEE

In making silage for finishing beef cattle many feeders in the State have developed the practice of pulling the corn off and ensiling only the stalks and fodder. The reason usually given for this practice is that "it does not pay to include corn in silage for beef cattle." In many cases the corn pulled off is fed in the early fall to fattening hogs and is available early for feeding. Many farmers use the corn for feeding work stock and for other purposes, while a few sell it on the market. More definite information was secured through the following questionnaire:

### Silage Questionnaire Sent to 400 Cattle-Feeders

1. How many cattle do you usually finish on silage each year?
2. Do you remove the ears in making your silage?
3. Are the ears removed in making silage for feeding beef cattle in your own community?

4. Do you consider pulling the corn off a good practice?
5. What use do you make of the corn pulled off?

TABLE 1—*Information secured through questionnaire*

| | |
|---|---|
| **GENERAL INFORMATION** | |
| 1. Number of feeders replying to questionnaire | 71 |
| 2. Number of cattle fed by those reporting | 2700 |
| 3. Number of counties heard from | 28 |
| **PRACTICES OF THE INDIVIDUAL FEEDERS RESPONDING** | |
| 1. Percentage of feeders making normal silage | 45 |
| 2. Percentage of feeders making grainless silage | 46 |
| 3. Percentage of feeders following both practices | 9 |
| **PRACTICES PREVAILING IN COMMUNITIES AS REPORTED BY FEEDERS** | |
| 1. Percentage of communities producing normal silage | 31 |
| 2. Percentage of communities producing grainless silage | 54 |
| 3. Percentage of communities divided on practice | 15 |
| **OPINIONS OF THE FEEDERS REGARDING THEIR PARTICULAR PRACTICES** | |
| 1. Percentage of normal silage-makers believing in their practice | 94 |
| 2. Percentage of grainless silage-makers believing in their practice | 80 |
| 3. Percentage of grainless silage-makers doubting their practice | 15 |
| 4. Percentage of grainless silage-makers not believing in their practice | 5 |
| **USE OF CORN PULLED OFF IN MAKING GRAINLESS SILAGE** | |
| 1. Percentage using corn for hogs | 93 |
| 2. Percentage using corn for other purposes | 7 |

While only a small number of cattle-feeders are represented in the data of table 1, they furnish, perhaps, a fair cross-section of the State, and clearly indicate that there is a distinct division among the feeders both in the methods of making silage and in their opinions as to the merits of the two methods. Fully 90 per cent of the feeders were positive regarding the merits of their particular practices.

With the idea of getting definite information on the question, the Experiment Station began feeding trials in the fall of 1927. The experiment has been continued for 3 winters, comparing normal corn silage with grainless corn silage for finishing beef cattle. In this work "normal silage" means silage made from the entire corn plant, including the ear, and "grainless silage" means silage made from the stalk and fodder only, the ears having been removed.

So far as known, no other station has reported a similar experiment, although considerable work has been done with a view to comparing normal silage with stover silage made from cured corn fodder without the ears. Stover silage is inferior to green "grainless" silage because of the losses in curing the corn fodder, due to weathering,

leaching, and fermentation. The Vermont and Wisconsin Stations, in the nineties, compared normal silage and grainless silage for dairy cows, with results adverse to the grainless. The Kansas Station, in Circular 92, reports a comparison of normal silage with grainless silage, made from corn cut 6 weeks after it had passed the dent stage, for finishing yearlings. The results were unfavorable to the late-cut grainless silage. This silage, made 6 weeks after the ideal stage, would no doubt be inferior to grainless silage made at the proper time.

## OBJECTS OF THE EXPERIMENT

The objects of this experiment were:

1. To compare normal silage with grainless silage, when fed with cottonseed meal, for finishing steers.

2. To determine the effect of "pulling the ears" upon the yield of silage.

3. To determine the amount and cost of labor required to pull the corn from the stalk, handle it in the field, and haul it to the barn.

4. To determine the effects of removing the corn from the stalk; running over the crop with the corn harvester, wagons and teams; and weathering, upon the quality, market grade, and price of the corn.

It was necessary to make some changes in the original plan, but none of them materially affected the objects or results of the experiment.

## PLAN OF THE EXPERIMENT

### Equipment Used

The main wing of one of the barns on Cherokee farm, at the Knoxville Station, was used for feeding the steers. The part used consists of two large stalls, 50 feet long by 14 feet wide. Each stall provides ample space for 20 steers. There is an automatic water tank in each stall, to which the steers had access at all times. Two concrete silos were used, each 12 by 42 feet, with an estimated capacity of 100 tons. The first year only one was used. This was divided through the center by a temporary partition of shiplap, and normal silage was put in one side and grainless silage in the other. As this silo, of 100 tons estimated capacity, actually held only 50 tons, the two lots of cattle emptied it in 61 days, exclusive of the preliminary feeding period. The second and third years the two kinds of silage were put into separate silos.

### Silage-Making

The first and second years, Jarvis Golden Prolific corn was used, with a light mixture of sorghum, and the third year Neal Paymaster was used without any sorghum. Each year the corn was well ripened

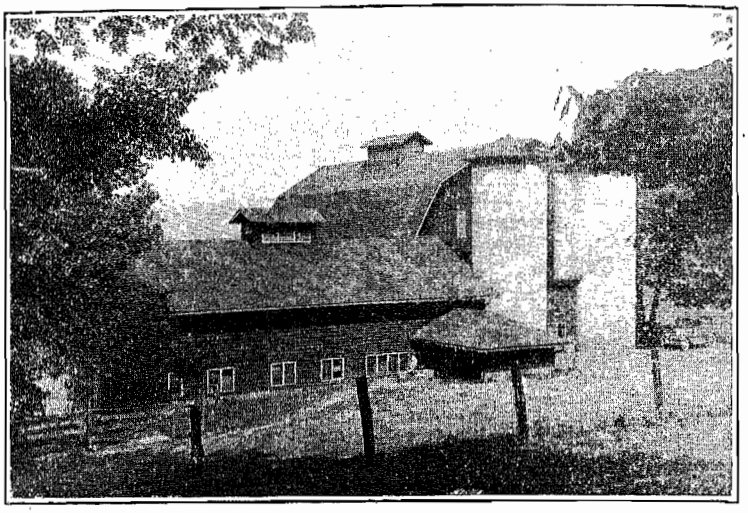

Fig. 2—Barn and silos used in the experiments.

before being put into the silo. In most cases the shuck was entirely yellowed, so that the stage of maturity was most favorable for the corn pulled off. Had the silage been put up earlier it might have been of slightly better quality. Water was added when necessary to produce a good pack. During the 3 years there was only occasional evidence of mold due to the overripe and dry condition of the corn.

The first and third years alternate strips of corn of 20 rows each were taken for each silo—the ears being removed from the standing corn in every other strip. This method tended to average any possible unevenness in yield or stage of maturity in different parts of the field. The second year, owing to drouth and thinness of soil, alternate strips did not give a sufficiently high or uniform yield of corn for the normal silage. Hence, the normal silage was made from those parts of the fields having the heaviest yield of grain, and the grainless silage from those parts having light yields.

## Cattle Used

A total of 120 head of steers were used during the 3 years' work. The first and third years, native East Tennessee steers were used. They were of grade Shorthorn, Hereford, and Angus breeding, and would grade "common" to "choice," varying considerably in type and quality. They were, however, about as good native cattle as can be bought in droves without a great deal of sorting. These steers were bought in the early part of October and run on grass until started on

feed. The second year the cattle were bought during the latter part of August at the National Stock Yards, Illinois. They were lighter and plainer than the native cattle used.

Each year the cattle were divided into 2 lots as nearly uniform as possible, from the standpoint of breeding, quality, and weight. Lot 1 received normal silage and lot 2 received grainless silage.

### Feeding, Management, and Weighing of Cattle

The cattle were fed silage and cottonseed meal twice daily, at 6:00 a. m. and 5:00 p. m. A small amount of dry roughage of either hay or corn stover was fed after the morning feed was cleaned up. The plan was to feed the maximum amount of silage the steers would consume in addition to the cottonseed meal. Lot 2 usually cleaned up their feed more quickly than lot 1, and would have eaten more of the grainless silage; but the amount fed was regulated by the lot having the dullest appetite. Each lot received the same amount.

TABLE 2—*Rations fed during the three years*

| LOT 1 | |
|---|---|
| Normal silage | 30 lbs. |
| Cottonseed meal— | |
| First month | 4 lbs. |
| Second month | 5 lbs. |
| Third month | 6 lbs. |
| Fourth month | 7 lbs. |
| Corn stover or hay | 3 lbs. |
| Molasses during the last month | 2 lbs. |
| **LOT 2** | |
| Grainless silage | 30 lbs. |
| Cottonseed meal— | |
| First month | 4 lbs. |
| Second month | 5 lbs. |
| Third month | 6 lbs. |
| Fourth month | 7 lbs. |
| Corn stover or hay | 3 lbs. |
| Molasses during the last month | 2 lbs. |

Each year for about 10 days the cattle were given a preliminary feed of silage and a light cottonseed meal allowance, in order to accustom them to their quarters and feeds. They were bedded as comfortably as the supply of straw would permit, and were kept confined to the stalls in which they were fed.

The cattle were weighed at the beginning and at the end of each experiment and at the end of each 30-day interval. Weighings of each individual steer were made on 3 consecutive days, and the average of the 3 weights was considered the weight of the steer for that date.

Fig. 3—Cattle fed second year, while on pasture on Cherokee farm, before the beginning of the feeding period.

## RESULTS OF THE EXPERIMENT

TABLE 3—*Summary of the first year's work*

WEIGHTS AND GAINS

| | Lot 1 Normal silage | Lot 2 Grainless silage |
|---|---|---|
| Length of experiment in days | 61 | 61 |
| Number of cattle in each lot | 19 | 20 |
| Average initial weight | 921.0 lbs. | 954.8 lbs. |
| Average weight at end of 61-day period | 1037.3 " | 1042.9 " |
| Average gain per steer in 61 days | 116.3 " | 88.1 " |
| Average daily gain per steer in 61 days | 1.906 " | 1.444 " |
| Per cent gain made by lot 2 compared with lot 1 | | 75.7 |

FEED CONSUMPTION AND COST OF GAINS

| | | |
|---|---|---|
| Average daily ration | | |
| Cottonseed meal | 4.19 lbs. | 4.19 lbs. |
| Corn silage (normal) | 31.5 " | |
| Corn silage (grainless) | | 31.5 lbs. |
| Corn fodder | 6.2 lbs. | 6.2 " |
| Salt | .06 " | .06 " |
| Feed per 100 pounds gain | | |
| Cottonseed meal | 220 lbs. | 290 lbs. |
| Corn silage (normal) | 1656 " | |
| Corn silage (grainless) | | 2185 lbs. |
| Corn fodder | 325 lbs. | 423 " |
| Salt | 3 " | 4 " |
| Total feed per 100 pounds gain | 2204 " | 2902 " |
| Cost of 100 pounds gain | $13.32 | $12.66 |

PRICES OF FEEDS PER TON

| | |
|---|---|
| Cottonseed meal | $45.00 |
| Normal silage | 8.50 |
| Grainless silage | 4.00 |
| Corn fodder | 8.00 |
| Salt | 20.00 |

TABLE 4—*Summary of the second year's work*

WEIGHTS AND GAINS

| | Lot 1 Normal silage | | Lot 2 Grainless silage | |
|---|---|---|---|---|
| Length of experiment in days | 150 | | 150 | |
| Number of cattle in each lot | 19 | | 19 | |
| Average initial weight | 707.0 | lbs. | 723.4 | lbs. |
| Average weight at end of 150-day period | 998.8 | " | 951.7 | " |
| Average gain per steer in 150 days | 291.8 | " | 228.3 | " |
| Average daily gain per steer in 150 days | 1.945 | " | 1.521 | " |
| Per cent gain made by lot 2 compared with lot 1 | | | 78.2 | |

FEED CONSUMPTION AND COST OF GAINS

| | Lot 1 Normal silage | | Lot 2 Grainless silage | |
|---|---|---|---|---|
| Average daily ration | | | | |
| Cottonseed meal | 5.1 | lbs. | 5.1 | lbs. |
| Molasses | 1.1 | " | 1.1 | " |
| Corn silage (normal) | 32.0 | " | | |
| Corn silage (grainless) | | | 32.0 | lbs. |
| Hay | 1.0 | lbs. | 1.0 | " |
| Corn fodder | .9 | " | .9 | " |
| Salt | .05 | " | .05 | " |
| Feed per 100 pounds gain | | | | |
| Cottonseed meal | 265 | lbs. | 339 | lbs. |
| Molasses | 59 | " | 74 | " |
| Corn silage (normal) | 1673 | " | | |
| Corn silage (grainless) | | | 2141 | lbs. |
| Hay | 90 | lbs. | 116 | " |
| Corn fodder | 49 | " | 63 | " |
| Salt | 2.7 | " | 3.7 | " |
| Total feed per 100 pounds gain | 2138.7 | " | 2736.7 | " |
| Cost of 100 pounds gain | $14.54 | | $13.77 | |

PRICES OF FEEDS PER TON

| | |
|---|---|
| Cottonseed meal | $45.00 |
| Normal silage | 8.50 |
| Grainless silage | 4.00 |
| Hay | 10.00 |
| Corn fodder | 8.00 |
| Molasses | 26.50 |
| Salt | 20.00 |

TABLE 5—*Summary of the third year's work*

WEIGHTS AND GAINS

| | Lot 1 Normal silage | Lot 2 Grainless silage |
|---|---|---|
| Length of experiment in days | 120 | 120 |
| Number of cattle in each lot | 21 | 21 |
| Average initial weight | 867.9 lbs | 881.3 lbs. |
| Average weight at end of 120-day period | 1069.5 " | 1030.0 " |
| Average gain per steer in 120 days | 201.6 " | 148.7 " |
| Average daily gain per steer in 120 days | 1.679 " | 1.230 " |
| Per cent gain made by lot 2 compared with lot 1 | | 73.8 |

FEED CONSUMPTION AND COST OF GAINS

| | | |
|---|---|---|
| Average daily ration | | |
| Cottonseed meal | 5.4 lbs. | 5.4 lbs. |
| Molasses | .46 " | .46 " |
| Corn silage (normal) | 33.0 " | ..... |
| Corn silage (grainless) | ..... | 33.0 lbs. |
| Hay | 3.0 lbs. | 3.0 " |
| Salt | .04 " | .04 " |
| Feed per 100 pounds gain | | |
| Cottonseed meal | 325.0 lbs. | 441.0 lbs. |
| Molasses | 27.0 " | 37.0 " |
| Corn silage (normal) | 2016.0 " | ..... |
| Corn silage (grainless) | ..... | 2738.0 lbs. |
| Hay | 188.0 lbs. | 256.0 " |
| Salt | 2.5 " | 3.4 " |
| Total feed per 100 pounds gain | 2558.5 " | 3475.4 " |
| Cost of 100 pounds gain | $17.22 | $17.19 |

PRICES OF FEEDS PER TON

| | |
|---|---|
| Cottonseed meal | $45.00 |
| Normal silage | 8.50 |
| Grainless silage | 4.00 |
| Hay | 10.00 |
| Molasses | 26.50 |
| Salt | 20.00 |

### Variation in Cost of Gain with Normal Silage at $8.50 and Grainless Silage at $4.00 per Ton

It will be noticed that the same prices for feeds are used in figuring the costs of gains for each year. This is done for the sake of uniformity. The price actually paid for cottonseed meal varied from $38.00 to $50.00 per ton. The price charged for hay was fixed at $10.00 per ton. The hay was second-crop, consisting of sweet clover, some alfalfa and red clover, crab-grass, and Johnson grass. The charge for corn stover fed was $8.00 per ton. The price of grainless silage was fixed at $4.00 per ton. It was found that when $8.50 per ton

was charged for normal silage the cost of 100 pounds gain for lot 1 was approximately the same as for lot 2; hence, this price was used for normal silage. If the above values are used, the variation between the normal- and grainless-silage groups in the cost of 100 pounds gain is as follows: First year, 66 cents; second year, 77 cents; third year, 3 cents. There is some variation in the cost of 100 pounds gain from year to year. The first year is the lowest and out of line with the other 2 years because the cattle were fed on the silage-comparison ration only 61 days. The cost of gains the third year were somewhat higher than for the second year, although the feeding period was shorter. The fact that the cattle used the second year were younger and lighter and went on feed in a thinner condition than those used the third year might account for this difference.

### Rate of Gain

Each year the cattle receiving normal silage made faster gains and gained more uniformly from month to month than those receiving grainless silage. They were inspected at the end of each trial by both experts and novices, and the differences in finish and general thrift were apparent to all. For the average of the 3 years, grainless silage produced only 75.9 per cent as much gain as normal silage.

TABLE 6—*Yields of silage and corn per acre*

| Year | Silage | Acreage in silo | Yield per acre from silo Tons | Yield of corn per acre Bushels | Bu. of corn per ton silage | Percentage yield of silage |
|---|---|---|---|---|---|---|
| First (one silo divided) | Normal | 3.15 | 7.7 | 31.0 | 4.0 | 100 |
| | Grainless | 4.45 | 5.5 | 31.0 | .... | 71 |
| Second | Normal | 9.3 | 6.2 | 38.0 | 6.2 | 100 |
| | Grainless | 14.0 (est.) | 4.0 (est.) | ..... | .... | 65 |
| Third | Normal | 7.73 | 7.5 | 52.2 | 7.0 | 100 |
| | Grainless | 10.51 | 4.7 | 52.2 | .... | 63 |

As the corn used for silage was rather dry and a little past the ideal silage stage each year, the yields of silage given in table 6 appear rather low. The silage had 9 per cent less moisture in it than the average analysis of corn silage given by Henry and Morrison. The yields given, however, represent the weight of the silage as it was fed. Two methods were used in determining the yield of corn per acre. The first year the corn from the area that went into the grainless silage was kept separate until thoroughly dry, when it was weighed and the yield per acre calculated. The second and third years a sufficient number of square-rod areas were cut from different parts of the field to give a very close average of the yield of stover and of grain. The stover and grain were weighed separately and a

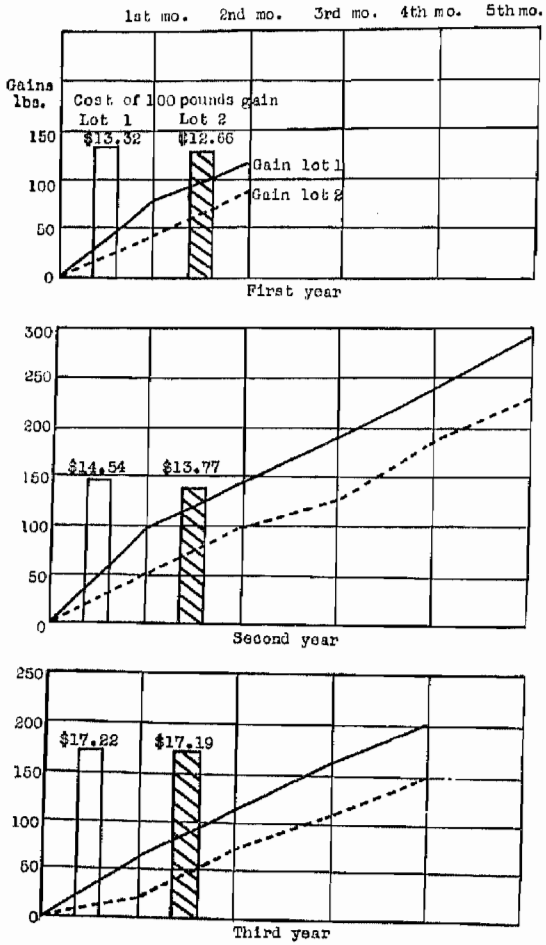


Fig. 4—Showing rate of gain and cost of 100 pounds gain for the 3 years.

sample of the ear corn was kept for drying. Moisture tests were run on the air-dry corn and the yield on the basis of 14 per cent moisture was calculated from the green weights.

The third year the yield of silage per acre as fed from the silo, exclusive of top, was only 70 per cent of the yield of freshly cut corn in the field. As the corn harvester was run about a half day ahead of the wagons, the corn dried considerably before going into the silo. Taking the corn off reduced the yield of silage per acre approximately 33 per cent. The number of bushels of corn per ton of silage varied

considerably, being 4.0, 6.2, and 7.0 bushels for the respective years. Weather conditions and the presence of considerable sorghum in the first year's crop were no doubt the most important factors affecting the yield of grain for that year.

TABLE 7—*Feed saved by normal silage in producing* 100 *pounds gain*

| Feed | | | 1st year | | 2nd year | | 3rd year | |
|---|---|---|---|---|---|---|---|---|
| | | | Amt. Lbs. | Value | Amt. Lbs. | Value | Amt. Lbs. | Value |
| Cottonseed meal | @ $45.00 | per ton | 70 | $1.58 | 74 | $1.66 | 106 | $2.36 |
| Molasses | @ 26.50 | " " | ..... | ..... | 15 | .19 | 10 | .12 |
| Grainless silage | @ 4.00 | " " | 529 | 1.05 | 468 | .92 | 722 | 1.44 |
| Hay (mixed) | @ 10.00 | " " | ..... | ..... | 26 | .13 | 67 | .33 |
| Corn fodder | @ 8.00 | " " | 98 | .39 | 14 | .05 | ..... | ..... |
| Total | | | 697 | $3.02 | 597 | $2.95 | 905 | $4.25 |

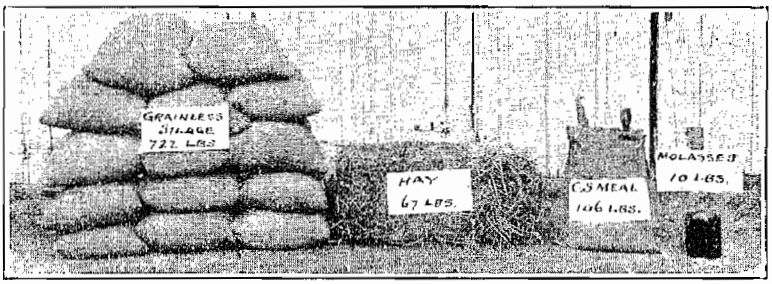


**Fig. 5—Feed replaced by normal silage in producing 100 pounds gain third year. Worth $4.25 and gives a feed-replacement value of 60 cents for each bushel of corn in normal silage. This figure is based alone on cost of gain.**

## Replacement Value of Corn in the Normal Silage, Based on the Cost of 100 Pounds Gain Only

The difference in feeding value of the two kinds of silage was evidently due to the presence of corn in the normal silage. It required practically one ton of normal silage with other feeds to produce 100 pounds of gain the third year. This ton of silage contained 7 bushels of corn. As the value of feed replaced by the corn was $4.23, each bushel of corn fed had a replacement value of 60 cents. The second year the replacement value was 58 cents for each bushel of corn fed in the silage. These values represent the difference in value of the feed requirements for producing 100 pounds of gain in each lot, and do not include the enhanced value of the cattle in lot 1 over lot 2 due to their extra finish and dressing percentage. This replacement value of 58 and 60 cents per bushel is at least as much as the corn would be worth if pulled off. Our data indicate that it costs approximately 15 cents per bushel to pull this immature corn off the

stalk, haul it to the barn when dry, and stir it to prevent heating. The ears are hard to pull, bulky, and tedious to haul, since they contain all the shucks and shanks. It also requires more barn space to store the corn than the average farm affords, since it should not be piled deeper than 12 to 15 inches.

### Corn Removed Badly Damaged

Again, corn pulled off in making grainless silage will depreciate in value from 15 to 40 cents per bushel, depending on weather conditions and storage facilities. The corn rots badly or becomes dark at the heart during wet weather. The bullwheel of the corn harvester, and the wagons and teams, will also break and shatter considerable corn. It is safe to estimate that the market or feeding value will be reduced, on the average, 25 cents per bushel.

TABLE 8—*Value of corn saved from grainless silage*

| Year | Grade | Value compared to No. 2 corn @ $1.00 per bushel |
|---|---|---|
| First | No. 5 | 85 cents |
| Third | Sample (19% damaged) | 60-75 cents |

The first-year conditions were very favorable for saving the corn, as it was hauled to the barn before there was any rain on it. The weather was also very hot and the ground dry, which facilitated the drying of the corn. But even then it was considerably damaged, and graded No. 5, U. S. Standard. Conditions were unfavorable the third year. The corn was nearly ready to go to the barn when a 3-weeks spell of rainy weather came on. Much of it sprouted and a great deal of it turned black at the heart or had a white, moldy appearance. Nineteen per cent of the kernels were damaged and the corn was not satisfactory even for feeding to hogs.

### Margins Secured

TABLE 9—*Actual initial costs, selling prices, and margins secured for the three years*

| | First year | | Second year | | Third year | |
|---|---|---|---|---|---|---|
| | Lot 1 | Lot 2 | Lot 1 | Lot 2 | Lot 1 | Lot 2 |
| Initial cost of cattle per 100 pounds..... | $ 7.94 | $ 7.94 | $10.73 | $10.73 | $ 8.00 | $ 8.00 |
| Price of finished cattle per 100 pounds.... | *11.00 | *11.00 | 12.00 | 11.00 | 10.50 | 9.78 |
| Margin secured ..... | 3.06 | 3.06 | 1.27 | 0.27 | 2.50 | 1.78 |

*Sold after 60 days' supplementary feeding following the 61 days on silage experiment.

It will be noticed that the buying and selling prices and the margins varied considerably for the 3 years. This is not unusual, as prices for feeder cattle or for finished cattle are seldom the same for two consecutive years. Each year the cattle were sold locally; the first and third years to shippers and the second year to the East Tennessee Packing Company. Each year, though there was a marked difference in finish between the two lots, buyers would try to buy the two lots for the same price. They simply made an average bid on the drove, as was their usual practice, and it was therefore hard to arrive at a valuation of the two lots upon their merits.

### Dressing Percentages and Carcass Values

As the cattle were sold the second year to the East Tennessee Packing Company at Knoxville, it was possible to get dressing percentages for each lot and to observe the appearance of the dressed carcasses. With the selling weights of the cattle and the chilled dressed weights of the carcasses being used as a basis of calculation, lot 1 dressed 56.27 per cent and lot 2, 52.07 per cent—a difference of 4.20 per cent. With dressed-beef carcasses at 20 cents per pound, this amounts to 84 cents per 100 pounds on the live weight of the steer. The carcasses of lot 1 had more purse, kidney, and outside covering of fat and were more attractive in appearance than those of lot 2, and should have commanded a higher price, based on the extra finish alone. Although the two lots were sold at the same price—$11.50 per 100 pounds—after the cattle were dressed and hung in the cooler the Packing Company readily agreed that there was fully $1.00 per 100 pounds difference in the values of the live cattle. Therefore lot 1 was figured as sold at $12.00 per 100 pounds and lot 2 at $11.00 per 100 pounds.

The third year there was a difference in price of 72 cents per 100 pounds between lot 1 and lot 2. Competent judges and packers, however, appraised lot 1 at from $0.75 to $1.25 higher than lot 2. In the attempt to summarize the returns expected from corn in silage, based upon these experiments, a spread of $1.00 per 100 pounds between lot 1 and lot 2 has been used. In this final analysis only the last 2 years' results are considered, as the first experiment was too short.

### Main Object in Cattle-Feeding

The main object in feeding beef cattle is to provide a market for feeds grown on the farm, which in many cases are rough feeds and can not be marketed profitably or conveniently in any other way. The feeds thus marketed constitute the feeder's main source of income. The production of manure for improving the farm and the net profit above feed costs are important secondary considerations. However,

the amount of net profit from finishing beef cattle is usually small—from $3.00 to $5.00 per head—unless an abnormal margin between buying and selling prices is secured, and should not be made the yardstick by which profit in cattle-feeding is measured.

### Margins of $2.66 and $1.66 Used in Interpreting the Results

In winter-feeding cattle, a margin between buying and selling prices is necessary for the success of the venture, because gains usually cost considerably more than will be realized on the market. In the summary of the results of these experiments the same price of feeder cattle, $9.00 per 100 pounds, and the same margins, $2.66 for lot 1 and $1.66 for lot 2, have been used in order to give uniformity to the results of the years compared. A margin of $1.66 was taken for lot 2 because it requires about this much margin to break even after paying for grainless silage at $4.00 per ton and for the other feeds at the prices used. Cattle shrink from 3 to 5 per cent in marketing. A 5 per cent shrink was deducted from the final experimental weights in order to take care of marketing shrinkage and to make the computations conservative.

TABLE 10—*Value of corn in normal silage*

| | Second year | | Third year | |
|---|---|---|---|---|
| | Normal | Grainless | Normal | Grainless |
| Initial value of feeder steer @ 9c | $ 63.63 | $ 65.10 | $ 78.11 | $ 79.31 |
| Value of feed consumed per head (exclusive of silage) | 21.59 | 21.59 | 17.44 | 17.44 |
| Total cost of steer (ex-exclusive of silage fed) | 85.22 | 86.69 | 95.55 | 96.74 |
| Value of steer with 5% shrink @ $10.66 for lot 2 | ..... | 96.39 | ..... | 104.36 |
| Value of steer with 5% shrink @ $11.66 for lot 1 | 110.65 | ..... | 118.46 | ..... |
| Profit per steer (including silage) | 25.43 | 9.70 | 22.91 | 7.62 |
| Silage consumed per steer | (Tons) 2.44 | (Tons) 2.44 | (Tons) 2.03 | (Tons) 2.03 |
| Value of each ton of silage consumed | $ 10.42 | $ 4.00 | $ 11.29 | $ 3.75 |
| Corn in each ton normal silage | (Bu.) 6.2 | ..... | (Bu.) 7.0 | ..... |
| Value of each bushel corn in one ton normal silage (exclusive of grainless silage value) | $ 1.03 | ..... | $ 1.07 | ..... |

### Cattle Returned $1.05 per Bushel for the Corn in the Normal Silage

The interpretation in table 10 is of course partially hypothetical, but it is not far off in expressing average expectations in cattle-feeding or in showing the actual returns from the two kinds of silage fed during the 3 years' work. The actual average cost of the feeder cattle for the 3 years was $8.89, and the actual average margin secured on lot 1 for the 3 years was $2.28 per 100 pounds. Had the cattle the second year been bought in October, as the other cattle were, instead of midsummer, the average margin for the 3 years would have been about $2.85 per 100 pounds. In any event, this interpretation shows what may be expected under these conditions. One dollar per bushel for corn is considered a good farm price. The 3 years' results indicate that steers bought right, sold right, and fed a ration of normal silage and cottonseed meal, will pay a good price for every bushel of corn consumed in the silage.

## DISCUSSION OF OTHER PHASES OF THE EXPERIMENT

### Less Acreage of Corn Is Required for the Silo

It requires only 66 per cent as much acreage to fill the silo with normal silage as with grainless silage. Therefore, less corn can be planted for the silo, or the extra one-third area of the crop which would normally be required to fill the silo with grainless silage could be used for other purposes.

### Lessens Labor Requirements

Less labor is required for making normal silage than grainless silage either on the acre or on the ton basis. There was no attempt to make an accurate cost accounting study of the two methods, because of insufficient help on the project. Enough data were collected, however, to indicate clearly that an acre of corn can be converted more cheaply into normal silage than into grainless silage. The difference lies in the amount of extra labor required to pull and take care of the corn removed from the stalk. The charges for corn harvester and twine and for running through the ensilage cutter are practically the same for the two processes. In many cases the ensilage cutter will handle the normal silage with less delay from pipe-stoppage than when the corn has been pulled. The loading and unloading of wagons is largely a matter of handling bundles in either case. Of course the bundles with ears are somewhat heavier, but not enough to make much difference. Since it requires about one-third more bundles to fill the silo with grainless silage than with normal silage, the advantage from a labor standpoint is in favor of normal

silage. A load, as a rule, is more a matter of bulk than of weight. Usually as many bundles with the ears on may be hauled, and in some cases more, because they pack better on the wagon than when the ears are removed.

### Early Seeding of Small Grain Possible

The crop is cleaned off the land entirely at one operation and a small-grain crop may be put in much earlier. When normal silage is made, the land is ready for small-grain preparation from 3 to 6 weeks earlier than when grainless silage is made. With early corn, this

**Fig. 6—Part of the University flock grazing, in February, on winter barley sown after a crop of normal silage had been removed.**

The silage crop was removed September 1, and, after a good seed-bed was prepared by subsoiling and discing, the barley was sown September 20. By November 1, the barley covered the ground completely. It furnished abundant pasture for the ewes from then until about March 20. Had grainless silage been made, the seeding of the barley would have been delayed considerably and the value of the pasture materially reduced. There was no winter washing on this field.

means that the small grain may be seeded by about the middle of September. With late corn this advantage becomes more apparent. It often means the difference between success and failure with the small-grain crop. An important advantage of the silo is that the corn crop is removed early enough so that a small-grain crop may be put in on time. The making of grainless silage often defeats this advantage, as the corn pulled off must lie in the field to dry from 3 to 6 weeks before it can be saved at the barn.

## Normal Silage Produced Greater Net Returns per Acre Than Grainless Silage (Inclusive of Corn)

TABLE 11—*Returns per acre from normal silage and grainless silage, with silage at* $8.50 *and* $4.00 *per ton, respectively*

(The two kinds of silage at the above prices produced gains at approximately the same cost).

| Methods of utilizing the corn crop | First year | Second year | Third year |
|---|---|---|---|
| Normal silage @ $8.50 per ton | $66.45 | $52.78 | $63.75 |
| Grainless silage @$4.00 per ton | 22.00 | 16.00 | 18.80 |
| Grainless silage @ $4.00 per ton and corn produced per acre @ $0.75 per bushel | 45.25 | 44.50 | 57.95 |
| Corn harvested in usual manner @ $1.00 bu. | 31.00 | 38.00 | 52.20 |

TABLE 12—*Returns per acre from silage based on profits from steers*

(Margins of $2.66 for lot 1 and $1.66 for lot 2 used as a basis of calculation with all feeds except silage at cost and all profits thrown to silage).

| Methods of utilizing the corn crop | Second year | Third year |
|---|---|---|
| Normal silage—2nd year @ $10.42, 3rd year $11.29 per ton | $64.60 | $84.67 |
| Grainless silage—2nd year @ $4.00, 3rd year $3.75 per ton | 16.00 | 17.62 |
| Grainless silage and corn produced @ $0.75 bushel | 44.50 | 56.77 |
| Corn harvested in the usual manner @ $1.00 bushel | 38.00 | 52.20 |

Tables 11, 12, and 13 emphasize the value of normal silage in finishing beef cattle from a profit-making standpoint, and show, likewise, the weak position that the practice of making grainless silage occupies. With corn harvested in the usual manner valued at $1.00 per bushel, the average acre return for 2 years was $45.10. The average acre return from the feeding of grainless silage was only $16.81—an amount which seems insufficient to justify the extra expense of producing grainless silage and the risks involved in cattle-

TABLE 13—*Returns per acre from various methods of utilizing the corn crop. Average of second and third years' work from table* 12

| Methods of utilizing the corn crop | Value per acre | Per cent return |
|---|---|---|
| Normal silage | $ 74.63 | 165 |
| Grainless silage | 16.81 | 37 |
| Grainless silage, including corn removed @ $0.75 per bushel | 50.63 | 112 |
| Mature corn harvested for grain @ $1.00 per bushel | 45.10 | 100 |

feeding. Even when the value of the corn saved in the making of grainless silage was included, the average acre return was only $50.63, which is $5.53 more than the returns from the corn harvested in the usual manner. This amount would not cover the extra costs in pulling and saving the corn and putting the green stover into the silo. Unless the manure produced was placed at a very high value, or some particular scheme of feeding or farm management was involved, the use of grainless silage for finishing beef cattle would seem, from these results, to be a poor, risky, and uneconomical practice.

The average acre return from normal silage was $74.63, which is $29.53, or 65 per cent, greater than from the corn harvested in the usual manner. From corn averaging 45.1 bushels per acre, $74.63 is a good return—a higher return, probably, than can be expected from any other method of utilizing the corn crop. Apparently, the green stover ensiled has its greatest value when combined with the grain. Its acre value when so combined is $29.53, but when fed as grainless silage, the acre value was only $16.81. As previously indicated, 93 per cent of the corn pulled off by farmers in this State in making grainless silage is fed to hogs. Granting that hogs would return as much as $1.50 per bushel for the corn pulled off, the combined returns from grainless silage and corn fed to hogs would not equal the returns from normal silage by $6.00 to $7.00 per acre. Hogs would not return the above amount, except in unusual instances, from immature, watery, and, in many cases, badly damaged corn. There is also to be considered the labor of pulling off the corn, storing it in some instances, and feeding it to the hogs.

Pulling corn from the silage crop for hogs involves sometimes as many as five handlings that would not be necessary were it put into the silo and fed to cattle. The results of this work indicate that farmers are not justified in pulling corn off their silage crop for hog-feeding, where silage is fed for finishing beef cattle.

### Silo Most Efficient Means of Utilizing the Corn Crop

Many experiments show that the silo is one of the most economical means known of cribbing or storing the corn crop, where cattle are involved. Some show that grain loses less dry matter in the silo than in the crib. The silo is certainly the best means of saving the stover part. Investigations have shown that approximately one-third of the feeding value of the corn crop is in the stover. In Tennessee, thousands of acres of stover are left standing in the fields unutilized. This study indicates that the best method of utilizing the corn crop, so far as acre returns are concerned, is to put the entire crop into the silo. The stover when combined with the grain was worth $29.53 per

acre. The silo should be used more extensively in the State in converting corn and cornstalks into money.

## GRAINLESS SILAGE MAY BE USED TO ADVANTAGE

In these trials normal silage proved superior from every angle; yet there are conditions under which grainless silage might be used to advantage:

1. For wintering breeding cows and stockers, where little more than a maintenance ration is desired. Grainless silage in this case would probably appear to good advantage, and, when properly supplemented, make a very economical ration.

2. For fattening cattle for markets where extra finish is not demanded. One of the buyers in commenting on the lot fed grainless silage said that they had enough finish to satisfy his trade, indicating that cattle might still be fattened under these conditions, and the corn used for other purposes. The cottonseed meal would balance the ration and would prove very beneficial in the manure.

3. For the man who raises only a small crop of corn, and who needs the grain for his work stock, hogs, and poultry. The use of grainless silage might make it possible for him to carry cattle through the winter, which would otherwise be impossible. On these farms there might be sufficient labor and storage facilities to produce grainless silage without the usual handicaps.

4. For the producer of sweet or field corn for canning or roasting-ear purposes. The acreage of sweet corn for canning is on the increase in the State, and large areas are devoted to the production of market roasting ears. In these instances the stalks and fodder may be used to good advantage as grainless silage. This silage would make a succulent, palatable carrier for the necessary concentrates. Based on the conditions upon which this work is interpreted, such silage should be worth approximately $4.00 per ton.

## SUMMARY

1. Steers fed grainless corn silage gained, on an average, for 3 years, only 75.9 per cent as fast as those fed normal corn silage.

2. With other feeds at the same price for both lots, normal corn silage at $7.70 per ton the first year, $7.56 the second year, and $8.50 the third year produced 100 pounds gain at the same cost as grainless silage at $4.00 per ton.

3. The steers receiving normal silage, due to their extra finish and dressing percentage, were worth about $1.00 more per 100 pounds live weight than those receiving grainless silage.

4. Counting feeder steers at $9.00 per 100 pounds and allowing margins on the finished steers of $2.66 for lot 1, fed normal silage, and $1.66 for lot 2, fed grainless silage, the average value per ton of normal silage for the past 2 years was $10.85, and of grainless silage $3.87. Under these conditions the grainless silage was worth only 36 per cent as much as normal silage.

5. Under the same conditions each bushel of corn in normal silage was worth $1.05, as an average for the 2 years.

6. The yield of silage was reduced one-third by the removal of the ears.

7. The market value of corn pulled off in the making of grainless silage was reduced, by its immaturity, weathering, and heating, from 15 to 40 cents per bushel, depending upon the conditions under which it was handled.