OBJECT.

The object of this experiment is to determine the relative merits of silage and shock corn as factors in beef production. The comparison is made both by weight of feeds and area used in their production. Everything considered it seemed best to begin with eight-months-old calves; to feed them liberally through the winter months without attempting to fatten them or to secure the greatest possible gains; to turn them to grass with or without grain according to the season, and the abundance and kind of pasturage available; and, finally, to finish them during the second fall and winter on rations similar to those used in wintering them as calves. The calves were purchased in Kansas during the early fall of 1901, by Mr. E. D. Funk, an extensive cattle feeder of Bloomington, McLean County, Illinois, upon whose farm this experiment was conducted and to whom the Experiment Station is indebted for his active interest and cooperation.
The feeding extended over a period of 88 days. Equal areas of the same kind of corn were harvested as silage and shock corn for use in this experiment, a careful record being kept of the cost of harvesting and feeding each. After the termination of the winter feeding the calves were turned to grass May 17, 1902. Their gains will be noted at frequent intervals during the grazing season. Next fall and winter they will again be placed in the feed lot where they will receive rations similar to those of the first winter for a time sufficient to finish them for the market. The experiment will be terminated by a slaughter test.

Plan of Experiment—Animals used.

Fifty eight-months-old grade Hereford and grade Shorthorn calves were selected for this experiment. Upon their arrival at Mr. Funk's farm the calves were given the run of blue grass pasture and stalk fields until within a few weeks of the date of beginning the experiment when they all received shock corn and mixed hay. The calves as they arrived from Kansas were quite thin, showing the effect of short pastures; but by the time they were put in the experiment, February 5, 1902, they were in good thrifty condition and of about 500 pounds average weight. It was a decided advantage to be able to get calves that were so nearly uniform and that had been similarly treated. They were divided into two lots of twenty-five each, care being taken to make the lots equal as to age, thrift and quality.

Ten shots averaging 65 pounds each were placed with each lot of calves, the object being to reduce the waste of shock corn feeding to the minimum by converting the corn in the droppings into pork and to determine what benefit, if any, pigs would get in following silage-fed steers.

Shelter for Calves and Pigs.

The calves and pigs were given the run of feed lots in which they had access to the shelter of a large shed adjoining the barn in which were the mixed hay and the stave silo containing the silage used in this experiment. The shelter provided for these calves was warmer and more protected than the average feed lot shed, owing to its location and to the fact that it was not all open on one side. The calves and pigs gained access to it by large doorways opening to the south. The kind of shelter afforded is specified because it is generally believed, and rightly so, that cattle fed largely on silage or other succulent food should have warmer quarters than those fed on a dry ration. Then, again, it should be remembered that the animals used in this experiment were calves which
we were not attempting to fatten, but simply to keep growing nicely. It is economy to give such calves reasonably warm winter quarters even in localities where there might be a question as to the economy of furnishing to fleshy cattle on full feed anything more than shelter from wet storms and cold driving winds.

Every effort was made to surround both the silage and the shock corn lots with conditions equally favorable for securing the best results from each feed.

**Rations fed.**

The amount of corn put into the silo represented an area of 5.33 acres. An equal acreage of corn was also cut and shocked in the field where it remained until needed for feeding to the calves during the winter and spring months. All of the corn was cut with a corn binder.

There was a total of 101,200 pounds or 50.60 tons of corn put into the silo. As taken out there were 86,178.81 pounds, or 43.09 tons. There was, therefore, a total loss of 7.51 tons, or 14.88 per cent. in the siloing of 5.33 acres of corn. Of this loss two tons were taken from the top of the silo in a condition unfit for use. This would leave 5.51 tons, or 10.88 per cent. as shrinkage in gross weight. This is not an unusually high percentage. When it is remembered that a total of only 50.60 tons of corn were put into the silo from 5.33 acres it will be seen that the yield of silage per acre was about ten tons or below what an average crop should be for Illinois. It is well known that there was a short corn crop last season. Add to this the fact that in this case the corn was of a small early maturing variety and it is easy to account for the low tonnage secured. This shortage in yield per acre was not as apparent in the case of the silage as with the shock corn. Had the plot which was fed as shock corn been husked and the stover field-cured there would have been a yield of only thirty-two bushels of shelled corn per acre, while the yield of cured stover per acre would have been 1.68 tons. Of the yield of shock corn 38.4 per cent. was ear corn (70 pounds to the bushel) and 61.6 per cent was stover. It will be seen that the proportion of corn to stover in this instance was altogether too small and the total yield of corn and stover much below a normal crop. The stover usually represents from 50 to 55 per cent. of the total tonnage of the corn crop, the average generally being something above 50 per cent.

While these small yields interfere with our making a good showing as to the total number of pounds of beef it is possible to produce from an acre of corn either as silage or as shock corn, they
do not interfere with our comparing the results of feeding the corn crop by these two methods.

The shock corn from the 5.33 acres was weighed as fed out. The total amount fed was 29,095 pounds, or 14.55 tons, very close to one-third of the gross weight of the silage as fed out.

The rations were made up as follows:

Lot 1. Silage, whole oats, and mixed hay.
Lot 2. Shock corn; whole oats, and mixed hay.

That we might be able to make as direct a comparison of the corn part of these rations as possible, the same amounts of whole oats and mixed hay were fed to each lot except as noted below, while the amount of silage and shock corn fed varied with the appetites of the calves. It was thought advisable, too, to keep the amounts of food-stuffs other than shock corn and silage as small as possible, since corn and its products are bound to remain the greatest factors in beef production.

As all the calves had been getting shock corn and mixed hay up to the beginning of the experiment the calves in Lot 2 naturally took to their ration more readily than did the calves in Lot 1, which were started on silage, a food-stuff with which they were entirely unfamiliar. It should be said, however, that the steers in Lot 1 never failed to relish their silage after the first few days.

The average daily ration for each steer at the beginning of the experiment, February 5, 1902, was as follows:

<table>
<thead>
<tr>
<th>Lot 1</th>
<th>Silage</th>
<th>15 lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oats</td>
<td>2 lb.</td>
</tr>
<tr>
<td></td>
<td>Mixed hay</td>
<td>4 lb.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lot 2</th>
<th>Shock corn</th>
<th>11.5 lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oats</td>
<td>2 lb.</td>
</tr>
<tr>
<td></td>
<td>Mixed hay</td>
<td>4 lb.</td>
</tr>
</tbody>
</table>

The amount of mixed hay fed to Lot 1 was increased on the second day of the experiment to 6 pounds per head per day as the ration given above did not seem to satisfy the calves. On the third day the amount of silage was increased to 20 pounds per head per day. It took about three weeks to get the proportions of food-stuffs used satisfactorily adjusted; especially was this true with the lot receiving silage. Each steer in Lot 1 would have consumed 25 pounds of silage after the first ten days. The average daily ration for each steer on March 3, 1902, was as follows:

<table>
<thead>
<tr>
<th>Lot 1</th>
<th>Silage</th>
<th>25 lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oats</td>
<td>2 lb.</td>
</tr>
<tr>
<td></td>
<td>Mixed hay (clover and timothy)</td>
<td>4 lb.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lot 2</th>
<th>Shock corn</th>
<th>13.8 lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oats</td>
<td>2 lb.</td>
</tr>
<tr>
<td></td>
<td>Mixed hay (clover and timothy)</td>
<td>4 lb.</td>
</tr>
</tbody>
</table>
In a week's time it was found that the shotes following the calves getting silage were not only failing to make satisfactory gains, but were actually losing in weight quite rapidly, a condition which was anticipated. The feeding of one pound of ear corn to each of the shotes in Lot 1 began February 13th. Under this treatment the pigs maintained a constant weight until March 3d when the ear corn was increased from one to two pounds per pig per day. During the week following this increase in feed the pigs made an average daily gain of nearly a pound per head. During the next week however they lost about a tenth of a pound and it was thought best to increase still further the amount of corn to three pounds per pig per day. This ration in addition to what was secured from the droppings of the steers getting silage produced satisfactory gains. By this system, however, we were not able to arrive at any very definite conclusion as to just how much of the gain of the pigs could be credited to the droppings of the silage-fed steers. It will be remembered that ten shotes were following twenty-five steers. It was thought best to decrease the number to five and not to give them any additional corn. For the first week following this change each of the five pigs made a daily gain of .4 of a pound. There appeared to be sufficient food in the droppings of the twenty-five steers to keep five 100-pound shotes growing nicely; however, the next week the pigs lost 1.14 pounds per head, showing the necessity of still further reducing the number of pigs if they were expected to thrive on the droppings alone. Subsequently the number of pigs with Lot 1 was decreased to one. By this system of reducing the number of pigs following silage-fed calves which received a daily ration of 25 to 30 pounds of silage, two pounds of whole oats and four pounds of mixed hay to each steer, it was observed that the droppings from twenty-five such calves would keep one and possibly two pigs growing nicely. Figured out more accurately we might say that it would be fair to credit Lot 1, the silage-fed steers, in addition to the beef made, with the production of 87 pounds of pork in 88 days. The matter of pigs following silage-fed steers will bear further study.

The ten shotes following the twenty-five steers getting shock corn, oats and mixed hay received no corn or other food stuff in addition to what they secured from the droppings of the steers. The total amount of pork made by the pigs following the shock corn lot was 587 pounds in 88 days. During the first 70 days of the experiment, only ten pigs were run with the steers getting shock corn. During this period they made a total gain of 476 pounds. In other words the steers in Lot 2 receiving shock corn should be credited in
addition to the beef made during the first ten weeks with the production of 6.8 pounds of pork per day. During the last 18 days of the experiment, fifteen shotes were run with the shock corn lot and these pigs made a total gain of 89 pounds or an average total daily gain for the fifteen of 4.9 pounds. This clearly indicates that when the pigs are expected to get their feed from the droppings of the steers better results in pork production were secured when ten and not fifteen shotes ran with the twenty-five steers getting shock corn, oats and mixed hay in the quantities above mentioned, than when fifteen pigs followed the same lot of steers. It should be remembered that these steers were calves and that they were not on full feed. More pigs could be run with older cattle on full feed to advantage.

Weight of Steers at the Beginning and End of the Experiment and Total Number of Pounds of Beef Produced.

Lot 1, Silage-fed.
Total weight of 25 steers February 5, 1902 ............... 12,606.66 lb.
Total weight of 25 steers May 5, 1902 .................. 16,300.00 lb.
Total gain of 25 steers in 88 days .................. 3,693.34 lb.
Average weight of steers at beginning of experiment ... 504.24 lb.
Average weight of steers at end of experiment .......... 652.00 lb.
Average total gain per steer in 88 days ............... 147.76 lb.
Average daily gain per steer .......................... 1.68 lb.

Lot 2, Shock-Corn-fed.
Total weight of 25 steers February 5, 1902 ............... 12,296.66 lb.
Total weight of 25 steers May 5, 1902 .................. 15,430.00 lb.
Total gain of 25 steers in 88 days .................. 3,133.34 lb.
Average weight of steers at beginning of experiment ... 491.86 lb.
Average weight of steers at end of experiment .......... 617.2 lb.
Average total gain per steer in 88 days ............... 125.34 lb.
Average daily gain per steer .......................... 1.42 lb.

The steers in Lot 1 (with silage as a part of their ration) made uniformly satisfactory gains from the start. Except during two weeks each steer in this lot made an average daily gain of one pound or more. The average daily gain per steer for the whole period of 88 days was 1.68 pounds. The highest average daily gain for a period of one week was made during the week ending April 14th, when the steers gained 2.74 pounds per day per animal. The lowest average daily gain per steer was made during the week ending March 17th, when the gain was .85 of a pound. The total number of pounds of beef produced during the 88 days of the experiment was 3,693.34.
The steers in the shock-corn lot, or Lot 2, were much more variable in their gains, and the average daily gain was not so great. To indicate the wide range in the average daily gain of the steers in this lot it may be stated that, during the week ending March 3d, there was an average daily gain of only .28 of a pound per steer, while during the week ending April 7th, the average daily gain of each steer was 3.2 pounds. The shock corn from 5.33 acres, the acreage used in this experiment, was exhausted on May 5th. The shock corn lot, therefore, should be credited only with the beef made by the steers in Lot 2 between the dates February 5th and May 5th, a period of 88 days. During this time the shock corn steers made a total gain of 3,133.34 pounds, or an average daily gain of 1.42 pounds per steer.

These figures show that 14.55 tons or 5.33 acres of shock corn together with 137½ bushels oats, and 4.4 tons clover and mixed hay made 3,133.34 pounds of beef and 587 pounds of pork, or a total of 3,720.34 pounds of beef and pork. All of the shock corn produced on the 5.33 acres was consumed. In case of the silage only 69.95 per cent. of the total amount of silage was used. This 69.95 per cent. of 5.33 acres of corn (3.73 acres) or 283½ tons silage fed together with 137½ bushels oats and five tons clover and mixed hay made 3,693.34 pounds of beef and 87 pounds of pork or a total of 3,780.34 pounds of meat. The acreage required for crops other than corn was computed on a basis of an average crop of fifty bushels of oats per acre and one and one-half tons of hay per acre.

The silage remaining, 24,678.81 pounds (1.6 acres) fed together with 2.15 tons (1.43 acres) of hay and 59 bushels (1.18) acres of oats would produce 1,622.53 pounds of beef and 33 pounds of pork at the same rate of gain per pound of food consumed as that which prevailed during the progress of the experiment. Had the silage all been fed the amount of land used in the production of the corn, oats and hay consumed would have been 14.02 acres, of which 5.33 acres would have been devoted to corn, 4.93 acres to oats 4.76 acres to hay, or 8.69 acres of crops other than corn. In the case of shock corn, the amount of land used in the production of corn, oats and hay consumed was 11.01 acres of which 5.33 acres were devoted to corn, 2.75 acres to oats, 2.93 acres to hay or 5.68 acres to crops other than corn. From these figures we see that in feeding shock corn and corn silage from equal areas of land, the additional acreage requiring to be devoted to crops other than corn is 53 per cent. more in the feeding of the silage than in the feeding of the shock corn. On the basis of the total area involved 62 per cent in case of silage, and 51.6 per cent. in case of shock corn were
FIGURE 1. LOT I. SILAGE-FED STEERS AS THEY LOOKED MAY 5, 1902, AT END OF EXPERIMENT.
devoted to growing crops other than corn. It should be borne in mind that this refers to the acreage involved and not the meat made. From these data we can compute the number of pounds of meat (beef and pork) produced per acre. Where silage, oats and hay were fed, 385.35 pounds of meat were produced per acre. Where shock corn, oats and hay were fed, 337.91 pounds meat were produced per acre. As the amounts of hay and oats fed to the two lots were practically the same, it is reasonable to suppose that this difference of 47.45 pounds of meat produced per acre was due to the different form in which the corn plant was fed. As the better results were secured with the lot of steers receiving their corn in the form of silage, we may conclude that this experiment indicates that it is possible to get 47.45 pounds more meat from an acre of corn put in the silo than when fed as shock corn to calves which are being wintered rather than fattened.

This experiment indicates that there are at least nine advantages of a system of silage feeding over that of shock corn in the wintering of calves intended for beef production.

First, the corn can be hauled from the field and stored in the silo at a time when little damage is done to the soil by getting on the land when it is too wet.

Second, the manure and litter incident to the feeding of steers where silage is used, are in much more convenient form to handle, and probably more readily available as plant food than where shock corn is fed.

Third, the quality of silage and the cost and convenience of feeding is but little, if any, affected by bad weather which in Illinois so frequently makes it next to impossible to feed shock corn to advantage.

Fourth, the calves in the spring are in better thrift and flesh.

Fifth, more rapid gains can be secured.

Sixth, in case of an epidemic of cholera or other contagious swine disorder, the pigs as a factor in economical production of beef may be eliminated without any considerable loss, which would be impossible in case of steers feeding on shock or whole corn.

Seventh, more pounds of meat can be produced per acre where silage is fed to steers than where shock corn is used; even though the greater amount of pork produced in case of a system of shock corn feeding is taken into account.

Eighth, a much larger proportion of the meat produced is beef.
FIGURE 3. A TYPICAL REPRESENTATIVE OF LOT 1, FED ON SILAGE.

FIGURE 4. A TYPICAL REPRESENTATIVE OF LOT 2, FED ON SHOCK-CORN.
Ninth, the corn may be harvested earlier in the season, generally before danger of frosts, and at a season, in Illinois at least, when other farm work is not pressing. In speaking of the advantages of the silo it should not be overlooked that silage may be stored for late summer feeding when pastures are often short and the new corn crop is too immature to feed to good advantage.

The disadvantages appear to be:

First, that in feeding equal acreages of corn as silage and as shock corn a greater acreage of crops other than corn is required to supplement silage than shock corn. This is an item which cannot consistently be overlooked, as economical beef production in the corn belt involves the utilization of as large a proportionate amount of corn as possible; nevertheless, when we consider the ultimate effect upon the fertility of the soil, the clover acreage, at least, may very profitably be increased.

Second, it is believed that warmer quarters must be provided for silage fed steers than for those receiving shock corn.

Third, a system of feeding steers on silage involves more capital and labor.

Before attempting to draw final conclusions from the results of this experiment as to the value of silage in beef production the reader should bear in mind that wintering calves is but one factor in beef production and that this experiment will not be complete until we have an opportunity to study the subsequent development of these two lots and the quality of the finished product. Conclusions are withheld, therefore, until the experiment is completed.

This experiment is but one of a series in which it is the purpose to investigate thoroughly this subject of silage as a factor in beef production.

**Summary.**

1. The results secured in this experiment were from a yield of ten tons of corn silage per acre and 32 bushels of shelled corn and 1.68 tons of corn stover per acre.

2. Of the 50.60 tons of corn put into the silo, but 43.09 tons were available for feeding, there being a loss of 7.51 tons. Two tons, or about four per cent, were spoiled silage taken from the top of the silo and 5.51 tons or 10.88 per cent, were shrinkage in gross weight.

3. The gross weight of silage available for feeding was about three times as great as that of shock corn.

4. In the feeding of 5.33 acres of silage to calves 8.69 acres of crops other than corn were used. In the feeding of 5.33 acres
of shock corn to calves 5.68 acres of crops other than corn were used. This difference may or may not be found unavoidable.

5. It requires a third longer time to feed an acre of corn silage than an acre of shock corn.

6. The average number of pounds of meat made per acre from a system of silage feeding where oats and hay were used as supplementary feeds was 385.35, where shock corn with oats and hay were fed 337.91 pounds—a difference of 47.45 pounds per acre in favor of a system of silage feeding.

7. So far as the cost of harvesting and feeding crops for the production of beef is concerned, in the net profits of the enterprise, it should be borne in mind that it will probably require nearly twice as great an expenditure of labor and capital in a system of silage feeding as in a system of shock corn feeding.

8. The silage-fed steers were in much better thrift and flesh at the end of the experiment than were the shock-corn-fed steers.

9. In case of the silage-fed steers 97.69 per cent. of the meat produced was beef and 2.31 per cent pork. In case of the shock-corn-fed steers 84.22 per cent. of the meat produced was beef and 15.78 per cent. was pork. This clearly shows that pork production is an important factor in a system of feeding shock corn for beef production, while it may be entirely eliminated from a system of silage feeding for beef production practically without loss.

10. It should be noted that the silage-fed lot consumed less feed than the shock corn lot and less feed per pound of gain whether beef alone is considered or beef and pork combined. The amount of dry matter required to produce a pound of gain of meat where the corn was fed in the form of silage was 6.52 pounds; where fed in the form of shock corn it was 8.57 pounds.

11. With an average daily ration to each steer in Lot 1 of 26 pounds silage, two pounds oats and 4.55 pounds of mixed hay, an average daily gain of 1.68 pounds was secured for a period of 88 days. With an average daily ration to each steer in Lot 2 of 13.22 pounds shock corn, two pounds oats and four pounds mixed hay an average daily gain of 1.42 pounds was secured for a period of 88 days.

12. Under conditions comparable with those prevailing in this experiment one steer would be able to make an average daily gain of 1.68 pounds for a period of six months on .82 of an acre of silage, oats, and hay, of which .31 of an acre would be devoted to corn for silage, .23 of an acre to oats and .28 of an acre to hay. One steer receiving shock corn, oats and hay would be able to make an average daily gain of 1.42 pounds for a period of six
months on .92 of an acre, of which .45 of an acre would be devoted to growing the corn, .23 of an acre to oats, and .24 of an acre to hay, making a difference of .26 of a pound of meat per day per steer and one-tenth of an acre of land for the season, both being in favor of the steers receiving their corn in the form of silage for the period designated.