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Cottonseed Meal to Hogs.

C. F. CURTISS.

Cotton-seed meal was quite extensively introduced as a stock food in the northern states last winter by reason of its heavy production in the southern states and the severe drouth prevailing in the corn belt in 1894, and consequent high price of corn and other grain feeds. The introduction of this feed brought the station many inquiries concerning the feeding value of cotton-seed meal and the practicability of adopting it in feeding rations. We have fed it to the extent of six and seven pounds per day to dairy cows and fattening cattle with good results and no apparent injury. This work is still in progress and will be reported in bulletin 29, soon to be issued, and the present report will be confined to the results of feeding cottonseed-meal to hogs. In February of this year the writer purchased of a neighboring farmer a thrifty, even lot of fifteen Poland China shotes weighing 1480 pounds. They were bred and reared alike and selected from a bunch of twenty-five, and furnished a desirable lot for experimentation. In order to detect any possible difference due to individuality, the fifteen shotes were on February 23rd, divided into five lots of three each and fed alike for two weeks on uniform rations of corn and cob meal and butter-milk, and weighed weekly. This period gave a gain of 61, 54, 46, 50, and 54 pounds respectively per lot in fourteen days, and the individual record showed that every shote was gaining and doing well in all respects. The feed given in the preliminary period consisted of 4 pounds each of corn and cob meal and four pounds of butter-milk per head daily.

PLAN OF EXPERIMENT.

At the beginning of the experiment Lot 1 was put on a ration of corn and cob meal and butter-milk; Lot 2, corn and cob meal; cottonseed meal and butter milk; Lot 3 the same except that the amount of cottonseed meal was double that of Lot 2; Lot 4, corn and cob meal, gluten meal and butter-milk; and Lot 5 corn and cob meal, cut clover hay and butter-milk.

The total amount of grain fed to each hog was the same in all lots. Lot 2 had at the beginning one half pound of cotton seed meal per day and Lot 3 one pound per day, substituted for an equivalent
amount of corn and cob meal in the ration. Lot 4 started on 1½ pounds of gluten meal per day. As the cotton seed meal and gluten were increased the corn and cob meal was correspondingly diminished. The butter-milk was practically the same to all lots (four pounds per head daily,) the only variation being due to irregularity in the supply. Lots 1 and 5 were fed for comparison with the cottonseed and gluten meal lots and also for comparison of corn and cob meal versus corn and cob meal fed with cut clover hay as lot 5 had in addition to the established amount of grain fed, a daily allowance of cut clover hay ranging from 1-2 to 1 pound per head daily mixed with the meal and soaked twelve hours. All grain fed was soaked twelve hours before feeding and it was found that the grain rations absorbed fifty per cent of their weight of water by the process. The grain was fed twice daily and the butter-milk given at noon. In addition each lot had a full allowance of water twice daily. A record of the water drunk by the several lots revealed no difference worth noting. Each lot had a cement floored pen with bell trap drain in a well lighted and ventilated feeding barn and the run of a gravel lot adjoining in favorable weather. Fresh bedding and salt and ashes were constantly provided for all lots. All feed was carefully weighed and any that was left was weighed back and deducted. In connection with this experiment three other similar shots were turned into a barn behind ten head of stall fed cattle, having seven pounds of cotton seed meal per head in their daily ration. This was done to determine the effect of allowing hogs to follow cattle being fed on cottonseed meal.

THE TEST PERIOD.

The test period begun on March 9 and continued until May 31. As the period advanced the allowance of grain was increased but the lots were fed in such a manner as to maintain a keen appetite and the daily rations were generally eaten promptly. The table herein presented furnishes a record of the feeding and gain in weekly periods.
<table>
<thead>
<tr>
<th>LOT I—3 Shots</th>
<th>LOT II—3 Shots</th>
<th>LOT III—3 Shots</th>
<th>LOT IV—3 Shots</th>
<th>LOT V—3 Shots</th>
<th>LOT VI—3 Shots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn and Cob meal</td>
<td>Corn and Cob meal</td>
<td>Corn and Cob meal</td>
<td>Corn and Cob meal</td>
<td>Corn and Cob meal</td>
<td>Corn and Cob meal</td>
</tr>
<tr>
<td>Feed, Weights and Gains</td>
<td>Feed, Weights and Gains</td>
<td>Feed, Weights and Gains</td>
<td>Feed, Weights and Gains</td>
<td>Feed, Weights and Gains</td>
<td>Feed, Weights and Gains</td>
</tr>
<tr>
<td>For week ending Mar 15</td>
<td>89</td>
<td>72</td>
<td>574</td>
<td>18</td>
<td>85.5</td>
</tr>
<tr>
<td>Apr 5</td>
<td>99</td>
<td>2</td>
<td>466</td>
<td>28</td>
<td>32.75</td>
</tr>
<tr>
<td>May 10</td>
<td>115</td>
<td>84</td>
<td>484</td>
<td>14</td>
<td>82.75</td>
</tr>
<tr>
<td>May 26</td>
<td>125</td>
<td>4</td>
<td>456</td>
<td>16</td>
<td>100.5</td>
</tr>
<tr>
<td>May 31</td>
<td>175</td>
<td>84</td>
<td>508</td>
<td>28</td>
<td>81</td>
</tr>
<tr>
<td>Totals</td>
<td>1304</td>
<td>984</td>
<td>296</td>
<td>857</td>
<td>82.2</td>
</tr>
</tbody>
</table>

- **Daily gains per head**: 1.13
- **Pounds of feed per Meal**: 456
- **100 pounds of gain. Milk**: 344
- **Pounds of gain in live weight per 100 lbs. dry matter in feed**: 23.7
- **Nutritive ratios**: 1 to 10.2

*One hog in this lot died the night before weighing and the gain given was made by two hogs.*
All lots made good gains; that of Lot 6, following the cattle being the lightest owing to the fact that the number of cattle was reduced to five and the ration of this lot of hogs was rather scant part of the time. The allowance of grain to each of the first five lots started at four pounds per head daily and was increased to 5 1/2 pounds.

The hogs in all lots of the experiment did well and appeared perfectly normal and healthy until in the sixth week, when it was observed that the droppings of Lot 3 were rather dark colored and somewhat hard. The hogs in this lot, however, appeared all right in every other respect and were consuming their full ration with apparent relish and vigorous appetite. To remedy the disorder of the alimentary canal indicated by hardened excrement, 1/4 of a pound daily of ground flax seed was given, with the desired result and all seemed well again until on the morning of April 29th when Mr. Hoover, our feeder, found one of the hogs in this lot dead. On the next morning a second one was dead. Both of these hogs had gained steadily up to the close of the previous week and had eaten their regular feed even to the last. On May 11th one hog in Lot 2 went in much the same manner except that it had shown some slight indisposition for a day or two previous. Its symptoms were failing appetite and quickened breathing. The same symptoms were manifested by both of the others in this lot, but they survived, but at the close of the experiment May 31st showed a gain of only one-half pound per head daily during the last 31 days. In Lott III the cottonseed was taken off and the remaining hog eventually got back to normal conditions though no gain was made for four weeks.

Dr. Niles of the veterinary department made post-mortem examinations of these hogs and reports that he failed to find evidence of any acute disorder to which he could ascribe their death.

A comparison of Lots 1 and 5 indicates no advantage in feeding corn and cob meal mixed and soaked with cut clover hay but rather a disadvantage. The hay used was second cut clover of No. 1 quality cut into inch lengths in a hand feed cutter.

In comparing the gains of the several lots it will be seen that Lot 3 having the larger amount of cottonseed meal (1 1/2 pounds per head daily) made the heaviest and most economical gain and that Lot 2 having less cotton seed meal and Lot 4 having gluten meal ranked next and were practically alike. This seems to establish good feeding qualities for cottonseed meal and the results of this experiment also seem to clearly to establish fatal qualities for the feed if used to sufficient extent. Lot 3 had consumed 116.5 pounds up to the
time of the first death and Lot 2 having the feed in smaller quantities only 82$\frac{3}{4}$ pounds or about 27 pounds per hog. The hogs following the cottonseed meal fed cattle were continued there until July 6th and maintained about their average gain until the close and gave no evidence of any evil effects from that kind of treatment. The trial with this lot covered a period of seventeen weeks in all and the indications are that hogs may safely follow cattle fed on cottonseed meal, as fed here, for a period of four or five months at least. The hogs were practically confined to the droppings as they had but very little other grain feed during this time and were also fed a little cottonseed meal in addition as shown in the table. This was during a time when new cattle were being put in and not much cottonseed meal was being fed.

The effect of cottonseed meal in feeding hogs in this experiment quite closely agrees with similar work at other stations. While the cause for this result is more or less enshrouded in mystery, the fatal effects may be considered safely established, though it is of interest to note that in this experiment hogs followed cattle fed liberally on cottonseed meal for seventeen consecutive weeks without suffering any evil consequences.

In relation to the injurious effect of cottonseed meal when fed to hogs, Director Geo. W. Curtis after an investigation extending into two years made the following report in bulletin 21 of the Texas experiment station in 1892. “Sickness and usually death uniformly occurred within a period of six to eight weeks from time of first feeding cottonseed or cottonseed meal. In tests for 1892 the feeding begun February 8, and the first death occurred March 13—almost exactly seven weeks later. In the outbreaks noted as occurring in the college herd, the trouble began each time in less than ten weeks from the time of feeding cottonseed meal. The trouble continues for a period of about 30 days and those animals that are not attacked within that time may be safely regarded as cottonseed proof.”

Dr. Francis, veterinarian of the Texas station also reported in the same bulletin as follows: “On post mortem examination the digestive organs appeared normal throughout. The other abdominal organs appeared normal. The respiratory organs were full of foam, some few Nematodes were found in the bronchi—probably Strongylus paradoxus. The lungs themselves were bright red and very much congested and doughy. No examination of the nervous system was made. An experiment was made to determine the toxic agent, but the results were altogether negative, and the question remains unsolved.”

In the work done at the Texas station larger amounts of cottonseed meal, three pounds per head daily, were fed and the gains made were not equal to those fed on corn. It is also stated that the hogs disliked the feed and finally refused to eat more than sufficient to sustain life.

GAINS CONSIDERED.

An interesting feature of this experiment is found in a comparison of the economy of gains made on different rations. It is plainly ap-
parent that cottonseed meal is by no means devoid of nutritive and fattening qualities when used moderately in supplementing a corn meal ration. The lot having the largest allowance of cottonseed meal led in gains almost from the start and continued until the end of the last weekly period before the first death occurred. Lot II having a smaller amount of cottonseed meal made larger gains than either of the lots fed on corn alone and ranked practically equal to the lot having gluten meal and corn. These results seem to indicate superiority for the balanced ration in fattening. The results of a single experiment however do not warrant conclusions on this point as it is uncertain whether the increased gain was due to the protein or fat elements in the cottonseed and gluten meals as the former is rich in fat as well as protein. The hogs having these meals in their rations not only gained faster but fattened and finished better than lots I and V having no grain except corn.

It will be seen by reference to the table presented that hogs in Lot III made rather exceptional gains. The average daily gain was 1.4 pounds per day each. The summary shows that one hundred pounds of gain in live weight were made for each 343 pounds of grain and 250 pounds of buttermilk consumed, which is the equivalent of 31.1 pounds of gain for every 100 pounds of dry matter in feed consumed. I am not aware of any case where this has been exceeded under similar conditions. In the Fifth Annual Report of the Wisconsin Experiment Station, Prof. Henry tabulates the records of 37 feeding trials at that station including 97 hogs, ranging in weight from 71 to 254 pounds and the average number of pounds of grain alone for 100 pounds of gain is given at 555, and where grain and sweet skim milk were used the average amounts required for 100 pounds of live weight were 319 pounds of grain and 432 of milk. The gains of this experiment are exceeded in only one instance and that where corn meal and a large amount of sweet skim milk were fed for a comparatively short time.

Attention is called to the preceding results only to indicate the efficiency of cottonseed meal as a factor in producing economical gains when fed moderately within certain limits, and yet we have the apparently conflicting evidence that its use is practically certain to prove fatal in a majority of cases. The fact that 25 or 30 pounds of cottonseed meal even when fed in the most careful manner is sufficient to kill shotes weighing 100 pounds or over is abundant reason for using cottonseed meal with extreme caution, if it is used at all, in feeding hogs. While investigators have thus far failed to discover the exact reason why cottonseed meal kills hogs, yet the fact that it does kill them is reason for guarding against general use of the feed for this purpose.
SUMMARY OF RESULTS.

The results of this investigation seem to warrant for the following conclusions and statement of results.

1—Cotton seed meal is fatal to hogs when fed in sufficient quantity; the total amount required to prove fatal being in this case from 27 to 33 pounds per hog.

2—Hogs in this experiment were fed without injury for seventeen weeks following cattle that were fed from four to seven pounds of cotton seed meal per head daily.

3—Cotton seed meal added to a corn and cob meal ration for hogs materially increased and cheapened the gains over corn and cob meal alone.

4—Cut clover hay added to a corn and cob meal ration and soaked twelve hours before feeding gave no advantage in gain over corn and cob meal alone.