

TEXAS AGRICULTURAL EXPERIMENT STATIONS.

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Agricultural Section—DECEMBER 1899—Live Stock.

I.—FEEDING STEERS.
II.—FEED VALUE OF COTTON SEED AND
ITS PRODUCTS.

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FEEDING STEERS.

Experiment Conducted by the Texas Station at the Request
of the Texas Live Stock Association.

By
J. H. Connell,
and
H. C. Kyle.

The ranges of Texas have long been recognized as the most productive and economic breeding grounds for the supply of cattle and horses, and with the coming of better beef breeds the "feeding business" has been added to the range interest, until now the *fat cattle* exported from this State annually represent an important proportion of the stock placed upon the market from this State. The numbers of cattle fattened for local and foreign markets in this State range from 100,000 to some 300,000 head per annum, and these animals furnish markets for vast quantities of feed stuffs that are produced upon our farms and ranches. As the blood of our ranch cattle continues to improve, because of the breeding and importation of the best class of males, the stockman is forced to depend more upon feeding and less upon the natural rustling capacity of his stock; and, therefore, the feeding problem grows in importance from year to year as the native long horn disappears from our ranges.

The plan of the experiment herein reported was, briefly, as follows: Forty-two steers were divided into six pens, the odd numbered pens (one, three, and five) are fed entirely different rations, while pen two is fed nearly the same ration as pen one; pen four nearly the same ration as pen three; and pen six nearly the same as pen five—thus dividing the six pens into three distinct ration groups with fourteen steers in each group.

The questions asked of the steers are: (1) "Can corn meal, or hay, be added profitably to a cottonseed meal and hull ration?" (2) "In what proportions should corn meal, cottonseed meal, and hulls be fed for best results?" (3) "Can oats be profitably used as companion food for meal and hulls?" (4) "What is the best proportion of oats, meal, and hulls to be fed in fattening steers?" (5) "Which of the three groups that are fed different rations will give the best finish in 100 to 140 days?" (6) "What profit may be expected in feeding well bred Texas cattle until they are thoroughly ripe?"

WHAT THE EXPERIMENT SHOWS.

I. *Sorghum hay is more than equal to cottonseed hulls, when fed with hulls and cottonseed meal.*

II. *The common practice of "topping out" the hull and meal ration with corn chops is not so profitable, as to feed the same amount of corn chops from the beginning.*

III. *Steers fed 100 days only will make rapid gains on the several rations used.*

IV. *When corn chops is combined with hulls and meal, a feed of two pounds of chops made more gain at less cost than when four pounds of chops were used.*

V. *Equal parts of oats, corn chops, and cottonseed meal, combined with hulls, make an excellent ration.*

VI. *Corn chops and shelled oats are of equal value for fattening steers when fed with hulls and meal.*

VII. *Steers eating corn chops shrink largely in live weight, when shipped, if the chops is combined with hulls and meal.*

ORIGIN OF THE EXPERIMENT.

Since the establishment of the oil mill interest in the South, fattening cattle upon hulls and meal has become so much the practice that we may safely consider the "hull and meal ration" to be the standard among the feed stuffs used by those who fatten cattle in the South for market, and when the committee of the Texas Live Stock Association, appointed at its January, 1898, meeting, requested the Station authorities to conduct a feeding experiment, it is but natural that hulls and meal were chosen to form the basis of the rations suggested by the committee, and that such other materials should be added to the hulls and meal as were thought most important.

The committee, consisting of Mr. M. Sansom of Alvarado, Mr. Jos. Green of Encinal, and Mr. Vorhies P. Brown of San Antonio, Texas, visited the Station in July, 1898, and the following plan of experiment was agreed upon and carried out during the next fall and winter season:

PLAN OF THE EXPERIMENT.

PART I. The first part of the experiment was planned to test SORGHUM HAY against COTTONSEED HULLS, CORN and COB CHOPS against COTTONSEED MEAL, and OATS against COTTONSEED MEAL. These last feeds replaced a part of the cottonseed meal, while in all pens some hulls was fed continuously. In Pens A and B the rations were changed at the end of 100 days, to finish off these steers with corn chops.

100 Days.

140 Days.

*

PEN A.....	Hulls and Meal.....	Hulls, Meal, and Chops.
PEN B.....	Hulls, Meal, and Sorghum Hay.....	Hulls, Meal, Sorghum Hay, Chops.
PEN C.....	Hulls, Meal, and Chops.....	(As before.)
PEN D.....	Hulls, Meal, Chops, and Oats.....	(As before.)

While one pen was fed a ration of HULLS and MEAL, another was fed HULLS, MEAL, and SORGHUM HAY. Another was fed HULLS, MEAL, and CORN CHOPS, and the fourth pen was fed HULLS, MEAL, CORN CHOPS, and SHELLED OATS. In the pens where corn and oats were fed continuously there were fourteen steers to the pen, while in the first two pens, only seven steers were used.

Topping Out the Hulls and Meal.—After feeding Pen A on hulls and meal for 100 days, corn chops was added to finish off the steers, and the cottonseed meal was correspondingly decreased. The results were not entirely favorable to this plan of feeding corn chops.

PART II. The purpose of this feature of the experiment was to determine the proper amount of CORN CHOPS or CORN and OATS when feeding hulls and meal.

		100 Days.	140 Days.
GROUP I.	Pen A.	Hull and Meal.	Hulls, Meal, and Chops.
	Pen B.	Hulls, Meal, and Sorghum Hay.	Hulls, Meal, Sorghum, and Chops.
GROUP II.	Pen A.	Hulls, Meal, and <i>small</i> amount of Chops.	(As before.)
	Pen B.	Hulls, Meal, and <i>large</i> amount of Chops.	(As before.)
GROUP III.	Pen A.	Hulls, Meal, and <i>small</i> amounts of Chops and Oats.	(As before.)
	Pen B.	Hulls, Meal, and <i>large</i> amounts of Chops and Oats.	(As before.)

In feeding corn chops a portion of "Pen C" of Part I was fed a small amount of chops, while the other half of the pen was fed freely upon this material. In a similar manner a combination of oats and corn chops was tested in varying amounts with the steers of Pen D, in order to determine the best proportion in which to use these, when fed in combination with hulls and cottonseed meal.

It was thought that this manner of varying the amounts of feed would also serve as a check upon all divisions of the experiment.

THE STEERS USED.

The cattle fed in this experiment consisted of forty-eight head of short two-year-olds, principally of high grade, Short horn breeding, raised in Nueces county on the ranch of the Kennedy Pasture Company. They were bought of N. R. Powell of Petus, and arrived at College Station November 4, very much drawn because of the hard conditions to which they had been subjected for twelve days before their arrival. They were run on good grass until November 15, to allow them to regain their normal weights, and were then weighed up and tagged before beginning the preliminary feeding. It was found, during the preliminary feeding, which began November 16, that nearly all of the steers were accustomed to eating, and promised to gain regularly and stay in good health while under experiment. The same ration was given all of the steers during this preliminary feeding in order that they might all be brought to the same basis

of comparison. They were fed six days in an open lot upon a ration of 12 pounds of hulls and 3 pounds of meal per day; then the amount was changed to 4½ pounds of meal and 18 pounds of hulls for four days, and again changed to 4 pounds of meal and 20 pounds of hulls, which was fed for ten days. Thus the preliminary feeding embraced 20 days of light feeding.

DISTRIBUTION OF STEERS.

On December 4 all of the steers used were weighed and distributed into three "groups" of six pens, with 14 steers per group and 7 steers in each pen. Care was used to distribute fairly, so that individual original weights might not impair the accuracy of the experiment.

(1) The six *heaviest steers* were first selected and distributed according to weight throughout the pens, from numbers one to six. (2) The six steers that had made the *largest gains* during the preliminary period were next distributed through the pens, from pens numbers six to one, reversing the first order of distribution. (3) The six steers that had made the *least gains* during the preliminary period were next selected and were distributed from pens numbers six to one. (4) The six steers weighing the least and in *poorest general condition* were then selected from the remaining bunch and were *thrown out of the experiment*. (5) A selection was then made of the *six lightest* steers, and these were distributed according to weight in pens one to six. (6) The average weights of the eighteen remaining steers (indifferent) were then taken, and these were distributed in such a manner as to make the average weight for all pens practically the same in all respects.

FEEDING, WATERING AND WEIGHING.

The rations agreed upon were prepared by mixing the grain ration with the hulls in each case for all of the steers of a given pen. The feed was put in early in the morning, once a day, and all of the cattle were fed what it was thought they would eat up clean. If any waste occurred, it was removed from the trough every other day, weighed, and the amount deducted from the gross weight fed.

The "corn chops" referred to here, consisted of corn and cob ground together moderately fine; better results might have been secured had this grain been more finely ground, but the burr stones of the Station mill would not grind fine without greatly increasing the cost of the work.

The shelled oats were fed dry and unground, but were mixed with the other grains before feeding.

The feeding troughs were located in a low shed, and in cold, wet weather each pen of cattle was kept shut up and were thus largely prevented from exposing themselves to the weather. The shed space for each pen was 20x15 feet square, while adjoining the shed there were pens for the use of these cattle, 25x25 feet. There was but one severe spell of weather experienced during the period—February—when the thermometer went

below zero, and for several days was below 20° F. During this time, the cattle in all of the pens suffered from the extreme cold, but some of the pens felt the severe weather much more keenly than did others.

A large open lot, connected with the feeding pens, contained fresh artesian water, and the steers were given access to this water from 8 o'clock a. m. until 2 p. m., at which time they were put into pens and returned to their feed.

The weights mentioned in this report were secured as the average of separate weighings, taken upon three consecutive days, and are, therefore, considered more reliable than if a single weighing had been depended upon. We recognize the fact that the live weight of the animal is easily influenced by such factors as gain flesh, amount of food eaten, quantity of water drunk, the daily passage of food through the digestive tract, and the action of the kidneys. These conditions are so active and variable that animals often vary as much as forty to sixty pounds per day, without considering the two or three pounds live weight gain in flesh, for which the feeder anxiously watches.

The steers were weighed regularly upon every 20th day, and the day preceding and following that day, and the three weights averaged, according to these 20 day "periods," may be found by referring to page 138.

PART I.

WEIGHTS AND GAINS.

FEEDING 100 DAYS.

For the convenience of the reader, the experiment with the four pens was broken up into a 100-day and a 140-day experiment, and the results are here shown at the end of 100 days (March 14, 1899), because a large number of steers fattened on meal and hulls in this State are now fed less than 100 days. Tables marked "1a" or "2a," refer to the 100-day test, while those marked "1b" or "2b," refer to the 140-day trial.

Table 1a shows the weights of steers at the beginning of the experiment, the actual gain in pounds according to pens, and the gain per thousand pounds live weight during the 100 days. The rate of gains for all of the steers was rapid and was quite satisfactory up to the weights of February 22, when the rate suddenly fell off about fifty per cent in all pens. This was due to the excessive cold weather of February.

A study of the table shows that the steers gained steadily, but that those receiving the corn chops in addition to the hulls and meal gained at a greater rate per thousand pounds during the 100 days than did pen "C." This pen made gains at the rate of something more than three pounds per day on the original thousand pounds live weight, while pen "A," fed plain hulls and cottonseed meal, gained but 271 pounds during the entire hundred days, or at the rate of 2.7 pounds per day. All other rations produced better gains than did simple hull and meal ration during the first 100 days.

TABLE NO. 1a.

Weights and Gains by Periods—100 Days.

(Stated per Steer and by Pens.)

Twenty Day Period.	End of Periods.	PEN A.			PEN B.			PEN C.			PEN D.		
		Hulls and Meal.			Hulls, Meal and Hay.			Hulls, Meal and Chops.			Hulls, Meal, Chops and Oats.		
		Weight.	Gain.	Gain per 1000.	Weight.	Gain.	Gain per 1000.	Weight.	Gain.	Gain per 1000.	Weight.	Gain.	Gain per 1000.
(1) Dec. 24.		745.49	61.85	90.47	777.51	53.43	73.79	749.35	57.32	82.81	737.45	57.71	85.08
(2) Jan. 13.		791.85	46.35	67.81	850.36	72.85	100.61	814.28	64.93	93.84	791.35	52.90	79.16
(3) Feb. 2.		828.57	36.71	53.71	864.55	14.18	19.59	844.24	29.96	43.23	825.47	34.12	50.34
(4) Feb. 22.		838.57	10.00	14.63	878.81	14.26	19.70	863.35	19.11	27.67	845.68	20.21	29.68
(5) Mar. 14.		868.92	30.36	44.39	922.33	43.51	60.10	902.42	39.07	56.41	879.14	33.46	50.64
Total gains 100 days			213.89	271.01		198.23	273.79		210.39	303.96		198.40	294.90

FEEDING 140 DAYS.

In arranging the experiment for feeding steers 140 days, it was the opinion of the committee and the Station authorities that in all probability the steers that were fattened in our feed lots were too generally shipped out before they were thoroughly ripe, and it was thought advisable to continue the experiment for forty or fifty days longer, after having checked up the result of the 100-day fattening period.

The data here presented include that already shown, and is a continuation for forty additional days, the same cattle being used and divided up into the same pens, but a change, was made in the rations fed to pens "A" and "B" by adding corn and cob chops to the rations of both pens for the purpose of "topping out" these cattle and giving them a finish, such as was thought could not be done with the hulls and meal alone.

Table "1b," presented below, indicates the weight of the cattle at the beginning of the experiment and for every twenty days through the 140 days feeding. The manner of distributing the feed to the pens, taking the weights of the cattle and management in all respects, was the same as has been described for the 100-day experiment.

The weights of April 3 and April 23, for pens "A" and "B," show the results of adding the corn meal to these pens, and the use of this material seems to be fully justified by the fact that the steers in both of these pens continued to gain rapidly after having passed the one hundredth day. The amount of corn meal added to these rations amounted to 6.47 pounds per head per day for pen "A," and 6.40 pounds per head per day for pen "B."

By referring to page 138 it will be noticed that pen "A" and "B" gained practically the same in weight to the end of the first 100 days, but during the following forty days the steers in pen "B" gained 103.3 pounds, while the steers of pen "A" gained but 88.7 pounds, showing that the corn meal, when added to the ration of hulls, meal, and sorghum hay, was more fully appreciated by the steers than when added to pen "A," fed upon hulls and meal alone during the first 100 days.

It will be noticed that the ration to which hulls, meal, and corn chops was fed regularly throughout the 140 days (Pen "C"), and the steers in pen "D" receiving oats in addition to these feeds, gained practically the same amount 395 and 397 pounds, respectively, per thousand pounds live weight.

The history of the gains made during these 140 days shows that for the first twenty days to be enormously large, amounting to as much as nine per cent. of the original live weight in the case of the hull and meal fed group. These gains tend to gradually decrease as the steers approach the fat stage, because the proportional increase towards the latter part of the feeding experiment consists more largely of flesh and less of paunch gains.

It will be noticed that the steers in three of the pens gained during the *last twenty days* at the rate of about two pounds per day per thousand

pounds weight in two of the pens ("C" and "D"), indicating that continued feeding would have probably proved profitable had not warm weather interfered. It is not sufficient for us to know that the steers sold for the top price upon the St. Louis market the day they were slaughtered, for it is probable that had they been fed longer they would have sold for relatively a higher price, but, in this connection, it would be well to bear in mind that the steers were only three years old and did not carry the same per cent. of carcass fat that older steers would have shown for 140 days feeding. This is because these immature steers both *grew and fattened* upon the ration fed. Their immaturity supplies a reason for the rapid daily gains of these steers, and also partly explains the small amount of "waste fat" found in the slaughter test.

TABLE NO. 1b.

Weights and Gains by Periods—140 Days.

(Stated per Steer and by Pens.)

Twenty Day Period.	End of Period.	PEN A.			PEN B.			PEN C.			PEN D.		
		Hulls, Meal and Chops.*			Hulls, Meal, Hay and Chops.*			Hulls, Meal and Chops.			Hulls, Meal, Chops and Oats.		
		Weight.	Gain.	Gain per 1000.	Weight.	Gain.	Gain per 1000.	Weight.	Gain.	Gain per 1000.	Weight.	Gain.	Gain per 1000.
(1) Dec. 24.		745.49	61.85	90.47	777.51	53.43	73.79	749.35	57.32	82.81	737.45	57.71	85.08
(2) Jan. 13.		791.85	46.35	67.81	850.36	72.85	100.61	814.28	64.93	93.84	791.35	53.90	79.16
(3) Feb. 2.		828.57	36.71	53.71	864.55	14.18	19.59	844.24	29.96	43.23	825.47	34.12	50.34
(4) Feb. 22.		838.57	10.00	14.63	878.81	14.26	19.70	863.35	19.11	27.67	845.68	20.21	29.68
(5) Mar. 14.		868.92	30.36	44.39	922.33	43.51	60.10	902.42	39.07	56.41	879.14	33.46	50.64
(6) Apr. 3.		890.21	21.28	31.15	958.50	36.16	49.95	931.28	28.86	41.56	896.77	17.63	24.28
(7) Apr. 23.		927.50	37.43	54.54	993.16	37.66	53.40	965.49	34.21	49.54	943.23	46.46	68.38
Total gains 140 days.			243.98	356.70		272.05	377.14		273.46	395.06		263.49	397.56

*Chops fed after the 100th day.

THE FEED EATEN AND GAINS.

RESULTS FOR 100 DAYS.

As indicated in the table below, the appetites of the steers in all pens were quite uniform throughout the first 100 days. The amount of feed consumed by the several pens is conveniently shown in Table 2a, where the amount eaten by each steer during each twenty days of this 100-day experiment, may be found.

In the line showing the *totals of feed consumed* and the gain per thou-

sand pounds for each pen, it will be noticed that during the first 100 days pen "B" ate 596 pounds of sorghum hay, 1439 pounds of cottonseed hulls, as opposed to 2225 pounds of hulls consumed by pen "A." The cottonseed meal fed both pens was practically the same, and the gains in live weight are about equal. It is, therefore, fair to assume that the sorghum hay used (596 pounds) replaced, and proved equal to, some 800 pounds of hulls. While this is a difference of some twenty-five per cent. in favor of a ton of hay, as compared to a ton of hulls, it is not necessarily true that sorghum as a sole ration, fed in combination with cottonseed meal, will prove equal to hulls fed in combination with cottonseed meal. Further investigation is needed to establish the best proportions in which to feed sorghum hay in combination with hulls, cottonseed meal, and other feeding stuffs; similar to the experiments on ratio of feeds reported in these pages in the trials with corn chops and oats.

It will be noted that the steers in pen "C," receiving hulls, meal and chops, gained more rapidly than those receiving hulls, meal, chops, and oats, but there was not a wide difference unfavorable to the use of oats. In the second part of this experiment, a report is made upon the best proportion to be used in combining chops with hulls and meal, and the reader is referred to page 151 for a further discussion of this subject. The best method to combine oats and chops with a hull and meal ration, is also discussed, and will be found upon page 151.

FEEDING 140 DAYS.

The change in the ration of pen "A" consisted of an addition of *corn chops* at the rate of 6.64 pounds per head. It will be noticed that when the corn chops was added, the ration of hulls was decreased correspondingly by 6.09 pounds per day, because the steers would not eat all of the old ration and the chops in addition. As before stated, the rate of gain continued to be uniform and satisfactory; therefore, it would seem that the ration of 6.64 pounds chops per day proved a substitute for only 6.09 pounds of hulls.

In pens "C" and "D" the daily ration continued without material change other than a slight reduction in the amount consumed per day as compared with the fifth period of twenty days, extending from February 22 to March 14, but it will be noted that they ate rather more during the last twenty days than during the second period of feeding.

TABLE NO. 2a.

Feed Eaten and Grains—100 Days.

(Stated by Periods of 20 Days for 1 Steer in Each Pen.)

		Pen A.			Pen B.				Pen C.				Pen D.				
		Ration: <i>Hulls, and Meal,</i>			Ration: <i>Hull, Hay, and Meal.</i>				Ration: <i>Hulls, Meal and Chops.</i>				Ration: <i>Hulls, Meal, Chops and Oats.</i>				
20 Day Periods.	End of Periods.	C. S. Hulls.	C. S. Meal.	Gain per 1000 pounds.	C. S. Hulls.	S.—Hay.	C. S. Meal.	Gain per 1000 pounds.	C. S. Hulls.	C. S. Meal.	Chops.	Gain per 1000 pounds.	C. S. Hulls.	C. S. Meal.	Chops.	Oats.	Gain per 1000 pounds.
1st.....	Dec. 24...	443.8	82.68	90.47	275.8	120.4	77.85	73.79	358.0	82.29	53.04	82.84	342.9	60.80	30.29	30.25	85.08
2nd.....	Jan. 13....	427.0	80.22	67.81	272.7	95.3	81.09	100.61	375.6	82.69	56.08	93.85	368.7	64.64	33.44	33.44	79.16
3rd.....	Feby. 2....	443.3	77.23	53.71	274.5	99.4	81.25	19.59	391.5	85.92	58.58	43.23	363.8	67.00	33.79	33.96	50.34
4th.....	Feby. 22..	444.1	80.23	14.63	281.6	134.6	83.45	19.70	392.0	86.40	58.68	27.67	360.9	68.28	33.96	33.50	29.68
5th.....	Mch. 14....	467.7	86.03	44.39	335.0	146.3	95.86	60.10	418.1	91.85	62.99	56.41	413.4	72.72	36.09	36.08	50.64
Totals for 100 days.....		222.59	406.39	271.01	1439.6	596.0	419.15	273.79	1935.2	429.15	289.37	304.0	1849.7	273.44	167.56	167.23	294.90

TABLE NO. 2b.
Feed Eaten and Gains—140 Days.
(Stated per Steer and Pen.)

Period of 20 days.	Pen A.				Pen B.				Pen C.				Pen D.					
	Hulls.	C. S. Meal.	Chops.	Gain per 1000 weight.	Hulls.	Hay.	C. S. Meal.	Chops.	Gain per 1000 weight.	Hulls.	C. S. Meal.	Chops.	Gain per 1000 weight.	Hulls.	Meal.	Chops.	Oats.	Gain per 1000 weight.
1st.....	443.8	82.68	.....	90.47	275.8	120.4	77.85	.....	73.79	358.0	82.29	53.04	82.84	342.9	60.80	30.29	30.25	85.08
2nd.....	427.0	80.22	.....	67.81	272.7	45.3	81.09	.....	100.61	375.6	82.69	56.08	43.84	268.7	64.63	33.44	33.44	79.16
3rd.....	433.3	77.23	.....	53.71	274.5	39.4	81.25	.....	19.59	391.5	85.92	58.57	43.23	363.8	67.00	33.79	33.96	50.34
4th.....	444.1	80.23	.....	14.63	281.6	134.6	83.45	.....	19.70	392.0	86.39	58.08	27.67	360.9	68.28	33.50	33.50	29.68
5th.....	467.7	86.03	.....	44.39	335.0	146.3	93.86	.....	60.10	418.1	91.85	62.99	56.41	413.4	72.73	36.08	36.08	50.64
6th.....	345.9	87.54	132.88	21.15	221.3	170.7	96.80	128.03	49.85	396.5	87.01	57.95	41.61	398.8	70.24	33.89	33.89	24.28
7th.....	312.3	85.25	126.11	54.54	221.3	170.7	96.80	128.03	53.40	387.3	84.93	57.88	49.54	373.6	66.60	33.50	33.51	63.38
Totals per head 140 days.....	2984.1	576.18	238.99	356.70	1882.2	1037.4	613.10	236.06	377.14	2725.0	551.09	405.21	385.12	2622.1	470.28	234.97	234.64	387.56

In some sections of the State, where oats are largely grown and must be hauled a long distance before reaching market, this crop can be successfully and cheaply used in fattening steers, if fed freely in combination with corn chops and some cottonseed meal, using sorghum hay, or hulls and hay, for the roughness. By referring to the "3d case" supposed, under Table 4a, it will be found that where oats was largely used and all of the grains were counted at low cost, the steers fed a ration containing oats produced gains almost as cheaply as any of the rations fed.

COST FOR 140 DAYS.

The financial results of the experiment running for 140 days are materially changed from those obtained in feeding 100 days, since the cheapest pound gain changes from pen "A" to the steers in pen "C," using the cheapest prices, as quoted on page 144. The gains per hundred pounds for pen "C" were made at a cost of \$3.63, while for pen "A" the same gain was made at a cost of \$4.00. Pen "D," fed the oat ration, ranks second to pen "C." In feeding the 100 days, it was noted that the cost per 100 pounds gain for pen "A" was \$2.98; when feeding for 140 days, the figures change to \$4.00, because of the addition of corn and cob chops as a finishing ration. The cost per hundred pounds gain for pen "C," during 100 days, was \$3.48, while for 140 days the cost per day was only slightly increased—\$3.63. It is, therefore, evident that for long term feeding rations (such as that given to pen "C"), a small amount of corn and cob chops fed continuously in combination with meal, is to be preferred to one of hulls and cottonseed meal, "topped out" with an addition of corn chops. It is worthy of notice that the amount of corn chops fed per day in topping out this bunch of cattle was not sufficiently great to sour during digestion, or to cause any degree of scouring*.

Throughout the entire experiment, the steers of pens "C" and "D" seemed to be more thrifty and more uniform eaters, and showed less disposition to go off feed than did the steers of any other pen. Next to these in appetite were the steers of pen "B," where sorghum hay was fed.

TABLE NO. 3b.

Cost of Feed and Gain—140 Days.

(Stated for average steer per pen.)

	Hulls.		S. Hay.		C. S. Meal.		Chops.		Oats.		Cost of total feed.	Gain in weight.	Per cent. live weight gain.	Cost per pound gain.
	lbs.	Cost. \$	lbs.	Cost. \$	lbs.	Cost. \$	lbs.	Cost. \$	lbs.	Cost. \$				
Pen A.	2884.1	4.326	.....	.....	576.18	4.321	258.98	1.077	.....	.....	9.754	243.86	35.67	2.000
Pen B.	1882.2	2.823	1037.4	3.112	613.10	4.598	256.06	1.065	.....	.....	11.598	272.08	37.71	4.263
Pen C.	2725.0	4.087	.....	.....	551.09	4.133	405.21	1.685	.....	.....	9.935	272.47	39.58	3.639
Pen D.	2622.1	3.933	.....	.....	470.28	3.522	234.97	.977	234.64	1.699	10.119	263.49	38.70	3.837

*The same statement is also applicable to the steers of Pen "II" B where sorghum hay was fed.

VARYING THE PRICES OF FEED STUFFS.—140 DAYS.

As in the case of the 100-day rations, five supposed cases of feeds, taken at various prices, are presented to show how the results of the experiment would vary from a financial standpoint, according to the local prices of feed stuffs. See page 144.

In all of the cases here stated, the steers in pen "C" (fed a uniform ration of hulls, meal, and corn chops), produced gains at least cost, and since the actual gains were equal to the best made by any of the pens, this ration seems to recommend itself, especially to those who wish to fatten for a long time. On account of the large amount of grain consumed, it might be supposed that in cases where grain is high priced that the ration fed pen "C" would prove so expensive as to render the gains more costly than in other pens, but investigation of the data presented, showing the cost of each item of feed, proves this supposition to be untrue, because of the very uniform and rapid gains resulting from this ration.

It may be noticed in the "5th case" what may appear to some as unusually low prices for hay, etc., but in many cases coming under our observation all of the feeding materials mentioned are bought and fed, at times, at prices fully as low as those mentioned in the "5th case."

In some portions of the State, sorghum hay is produced upon farms at a cost of less than \$1.50 per ton, while within the last two or three seasons cottonseed hulls have been contracted for by feeders at \$2.00 per ton, throughout the season. Two years ago, good bright cottonseed meal sold for less than \$12.00 per ton at a number of mills in the State. Upon many of the grain growing farms, where cattle can be fed, corn and cob chops have a value not exceeding \$5.54 per ton, and the same can be said of oats at \$9.32 per ton.

These facts only serve to indicate the very large amounts of cheap and valuable feeds that are available in our State for beef production, and that these should be utilized to the fullest possible extent.

TABLE NO. 4b.

Cost of Feeds at Varying Prices—140 Days.

		(1.) Medium Prices for 100 Pounds.				(2.) High Prices per 100 Pounds.				(3.) Very High Hulls and Hay—Low Grain.				
Pen A.....	4.336	Hulls at 10c.	2.884	2.074	7.202	1.707	5.768	5.761	1.437	12.966	5.317	7.210	4.320	1.077
Pen B.....	2.823	Hay at 30c.	1.892	2.074	7.063	1.717	5.764	6.131	1.421	15.465	4.705	6.187	4.598	1.063
Pen C.....	4.087	C. S. M. at 75c.	2.723	2.074	6.888	2.812	5.450	5.510	2.248	13.208	4.833	6.812	4.133	1.085
Pen D.....	3.933	Chops at 41.6c.	2.622	2.074	5.578	1.630	5.244	4.702	1.304	13.462	5.103	6.365	3.527	.978
		Oats at 72.4c.												
		Cost of Feed.												
		Cost per pound Gain.												
		Hulls at 20c.												
		Hay at 40c.												
		C. S. M. at 100c.												
		Chops at 55.5c.												
		Oats at 93.9c.												
		Cost of Feed.												
		Cost per pound Gain.												
		Hulls at 25c.												
		Hay at 50c.												
		C. S. M. at 75c.												
		Chops at 41.6c.												
		Oats at 72.4c.												
		Cost of Feed.												
		Cost per pound Gain.												

		(4.) Low Hulls and Hay and Very High Grain.				(5.) Very Low Prices (per 100 Pounds).			
Pen A.....	2.884	Hulls at 10c.	2.884	2.074	3.837	7.17	7.438	3.045	3.045
Pen B.....	1.892	Hay at 20c.	1.892	2.074	4.083	7.09	8.748	3.215	3.215
Pen C.....	2.723	C. S. M. at 125c.	2.723	2.074	3.670	1.122	7.517	2.750	2.750
Pen D.....	2.622	Chops at 69.4c.	2.622	2.074	3.132	.650	7.504	2.895	2.895
		Oats at 117c.							
		Cost of Feed.							
		Cost per pound Gain.							
		Hulls at 10c.							
		Hay at 20c.							
		C.S. M. at 66.6c.							
		Chops at 27.7c.							
		Oats at 46.6c.							
		Cost of Feed.							
		Cost per pound Gain.							

SHIPPING THE STEERS.

Having been fed 140 days, in addition to twenty days preliminary feeding, all of the steers were shipped via the H. & T. C. R. R., after driving them five miles to Bryan, where they were loaded on cars about dark of April 24. The two cars of cattle were shipped to St. Louis, consigned to Strahorn, Hutton & Evans Commission Co., in charge of Mr. H. C. Kyle, Station Foreman, who took the necessary notes upon the cattle while on cars and after arriving at St. Louis. They reached Paris, Texas, at 11:30 a. m. April 25, where they were promptly unloaded and allowed to stand without eating or drinking, when they were reloaded at 6:30 p. m. The steers arrived in St. Louis April 26, at 5 a. m., and were unloaded, fed, and watered. During the trip 11.1 pounds of prairie hay was fed per head.

On arriving in St. Louis, it was noticed that the steers of pen "C" were drawn less because of their shipment than were the other lots; the next, as to condition, were the steers of pen "B." These two pens of steers ate readily after unloading in St. Louis, and seemed to relish water and hay more than did the steers in the other pens. The steers in pen "D" were considerably drawn by the trip, but seemed quite hungry, while the steers of pen "A" were very badly drawn, and one of the animals seemed a little sick. It was noticed that steers of pen "A" seemed to have scoured badly, while pen "B," receiving sorghum hay, did not show any evidence of this trouble. The steers in all other pens appeared to scour slightly, but no marked results were noted. Having been fed 140 days, all of the steers had shed off clean and looked much smoother and in better condition than did any other cattle seen upon the market that day.

The steers were offered for sale to several buyers, by pens as fed, grouped according to pens "A," "B," "C" and "D." The prices offered by the first bidder were for pen "A," 4.15¢; for "B," "C" and "D," 4.25¢. Second bid: "A," 4.15¢; "B," "C," and "D," 4.30¢. At 11 a. m. the steers were sold to the St. Louis Dressed Beef and Provision Co., as a bunch, @ 4.35¢ all round, which firm agreed to give us the dressed weights of the steers, together with St. Louis live weights, and such other data as were wanted. The data thus secured are presented in the table below and are valuable, because they show that wherever hulls and meal alone were fed 100 days the per cent. of "waste fat" was excessive, whereas this fat did not show upon the carcass.

The waste fat reported for the individual steers would indicate that none of them were ripe and well fattened, unless we consider the immaturity of the steers. The live weight gains secured in feeding these steers were quite satisfactory, and probably consisted of both growth and fat. A much larger proportion of the gain going into the *tissues* of the carcasses than would be the case if older and better matured steers are fed, hence the comparatively small amount of waste fat reported.

TABLE NO. 5.

Dressed Weights and Summary of Results—140 Days.

(Stated per Steer and by Pens.)

	Live Weight Gains.	Cost per Pound Gain. Ct.	Per Cent. Gain.	Daily Gain per 1000 lbs.	Shipping Weight at Station.	Live Weight at St. Louis.	Dressed Market Weight.	Shrinkage in Shipment per cent.	Dressed Car- cass—per cent.	Waste Fat per Steer.
Pen A.....	243.86	4.000	35.67	2.512	927.50	867.1	497.1	6.5	57.19	37.0
Pen B.....	272.08	4.263	37.71	2.690	996.16	938.3	528.6	5.9	56.20	37.5
Pen C.....	273.46	3.639	39.51	2.819	965.49	898.4	516.9	6.7	57.43	33.3
Pen D.....	263.49	3.837	38.75	2.766	943.23	881.3	501.4	6.6	56.75	33.8

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Pen D.....	263.49	3.837	38.75	2.766	943.23	881.3	501.4	6.6	56.75	33.8

PART II.

VARYING THE AMOUNTS OF GRAIN USED.

The custom of feeding corn meal, or corn and cob chops to finish fattening steers that have been fed a *hull and meal* ration for 80 or 100 days has become well established among the feeders of the cotton oil mill districts. In changing the ration in this manner, it is customary to use four to six pounds of corn meal or corn and cob chops per head for steers of 800 to 1000 pounds, and the time of feeding is continued twenty to forty days, as permitted by weather, ripeness of cattle, market conditions, etc. Many oil mills have set up corn-crushing machinery to assist the feeder in combining corn with oil mill feed. It was the opinion of the committee appointed by the Live Stock Association that the chances for the profitable feeding of a uniform ration of *hulls, meal, and corn chops*, and possibly with the addition of *oats* to the ration, were most favorable; but the question of just how much corn chops should be fed daily throughout the experiment, or just how much shelled oats should be used in combination with the meal and chops, as companion grains, were undetermined matters, and it was agreed to test the proper proportion of these grains.

FEEDING 100 DAYS.

The following system of feeding was agreed upon for the first 100 days: Chart I shows the actual arrangement of the pens, as grouped under the feeding shed. The two pens, "A" and "B," that formed group I, are identical with pens "A" and "B" in the first part of this report. The fourteen steers of Group II, pens "A" and "B," are identical with pen "C" in the first part of this report. These steers were fed upon the same materials, but they were differently proportioned to determine the best results that might be secured. The fourteen steers of Group III, shown here as pens "A" and "B," composed pen "D" of the first part of this experiment. The same materials were used in feeding both pens "A" and "B" of Group III, but the feeds were differently proportioned.

The proportions of the several ingredients of each ration are here stated. The average daily ration for 100 days is given in each case, together with the per cent. gained by each pen. The chart will enable the reader to understand the plan of the experiment in which arrangement pen "A," fed 1 pound of cottonseed meal to 5.5 pounds cottonseed hulls, is the standard, or check pen, by which the others are measured.

FEEDING 140 DAYS.

The most marked results obtained during the experiment were noted in feeding 140 days, using the grains in varying proportions to test their

adaptability. The steers of Group II, Pen A, gained faster than did any of the other pens. *They were fed a ration of 4.1 pounds cottonseed meal, 2 pounds of chops, 19.8 pounds hulls per day, and gained 404 pounds on the original thousand pounds live weight.* The other pen, fed a similar ration, but contained a larger amount of chops and somewhat less cottonseed meal, gained 19 pounds less per thousand pounds weight during the same time, and the ration proved more expensive. Pen B, Group III, to which equal parts of cottonseed meal, chops, and oats were fed in combination with 18.4 pounds hulls, gained almost as rapidly as the best pen, and the cost of the ration was not excessive. Chart II, shown below, presents the results of the plan.

CHART I.

Group I.

PEN A.*

(7 steers.)

1 lb. C. S. M.: 5.5 lbs. Hulls.

Daily Ration.	}	4.06 lbs. C. S. M.
		22.26 lbs. Hulls.

Gain, 27.1 per cent.

PEN B.

(7 steers.)

1 lb. C. S. M.: 3.4 lbs. Hulls,

1.6 lbs. S. Hay.

Daily Ration.	}	4.19 lbs. C. S. M.
		14.40 lbs. Hulls.
		5.96 lbs. S. Hay.

Gain 27.3 per cent.

Group II.*

PEN A.

(7 steers.)

1 lb. C. S. M.: 4 lbs. Hulls,

and 4 lbs Chops.

Daily Ration.	}	4.85 lbs. C. S. M.
		1.98 lbs. Chops.
		19.62 lbs. Hulls.

Gain, 30.7 per cent.

PEN B.

(7 steers.)

1 lb. C. S. M.: 5.1 lbs. Hulls,

and 1 lb. Chops.

Daily Ration.	}	3.73 lbs. C. S. M.
		3.81 lbs. Chops.
		19.10 lbs. Hulls.

Gain, 30 per cent.

Group III.†

PEN A.

(7 steers.)

1 lb. C. S. M.: 4.2 lbs. Hulls,

.25 lbs. Chops: .25 lbs. Oats;

Daily Ration.	}	4.45 lbs. C. S. M.
		1.13 lbs. Chops.
		1.13 lbs Oats.
		18.79 lbs. Hulls.

Gain, 28.3 per cent.

PEN B.

(7 steers.)

1 lb. C. S. M.: 8.2 lbs. Hulls;

1 lb. Chops; 1 lbs. Oats.

Daily Ration.	}	2.21 lbs. C. S. M.
		2.21 lbs. Chops.
		2.21 lbs. Oats.
		18.20 lbs. Hulls.

Gain, 30.6 per cent.

Rations Fed for 100 Days.

* The two pens here shown formed Pen "C" of the first part of this report.

† The two pens here shown formed Pen "D" of the first part of this report.

CHART II.
Group II.

Group I.

Group III.

PEN A.

(7 steers.)

1. C. S. M.: 4.8 Hulls; .45 Chops.

Daily Ration. { 4.1 lbs. C. S. M.
1.8 lbs. Chops.*
20.6 lbs Hulls.

Gain, 35.7 per cent.

PEN A.

(7 steers.)

1. C. S. M.: 4.8 Hulls; .5 Chops.

Daily Ration. { 4.1 lbs. C. S. M.
2. lbs. Chops.
19.8 lbs. Hulls.

Gain, 40.4 per cent.

PEN A.

(7 steers.)

1. C. S. M.: 4.2 Hulls; .25 Chops;
.25 Oats.

Daily Ration. { 4.5 lbs. C. S. M.
1.1 lbs. Chops.
1.1 lbs. Oats.
19.0 lbs. Hulls.

Gain, 38.4 per cent.

PEN B.

(7 steers.)

1. C. S. M.: 3.7 Hulls; .4 Chops;

1.7 S. Hay.

Daily Ration. { 4.4 lbs. C. S. M.
1.8 lbs. Chops.*
17.5 lbs. Hulls.
7.4 lbs. S. Hay.

Gain, 37.7 per cent.

PEN B.

(7 steers.)

1. C. S. M.: 5.1 Hulls; 1. Chops.

Daily Ration. { 3.7 lbs. C. S. M.
3.7 lbs. Chops.
19.0 lbs. Hulls.

Gain, 38.6 per cent.

PEN B.

(7 steers.)

1. C. S. M.: 8.2 Hulls; 1. Chops;

1. Oats.

Daily Ration. { 2.2 lbs. C. S. M.
2.2 lbs. Chops.
2.2 lbs. Oats.
18.4 lbs. Hulls.

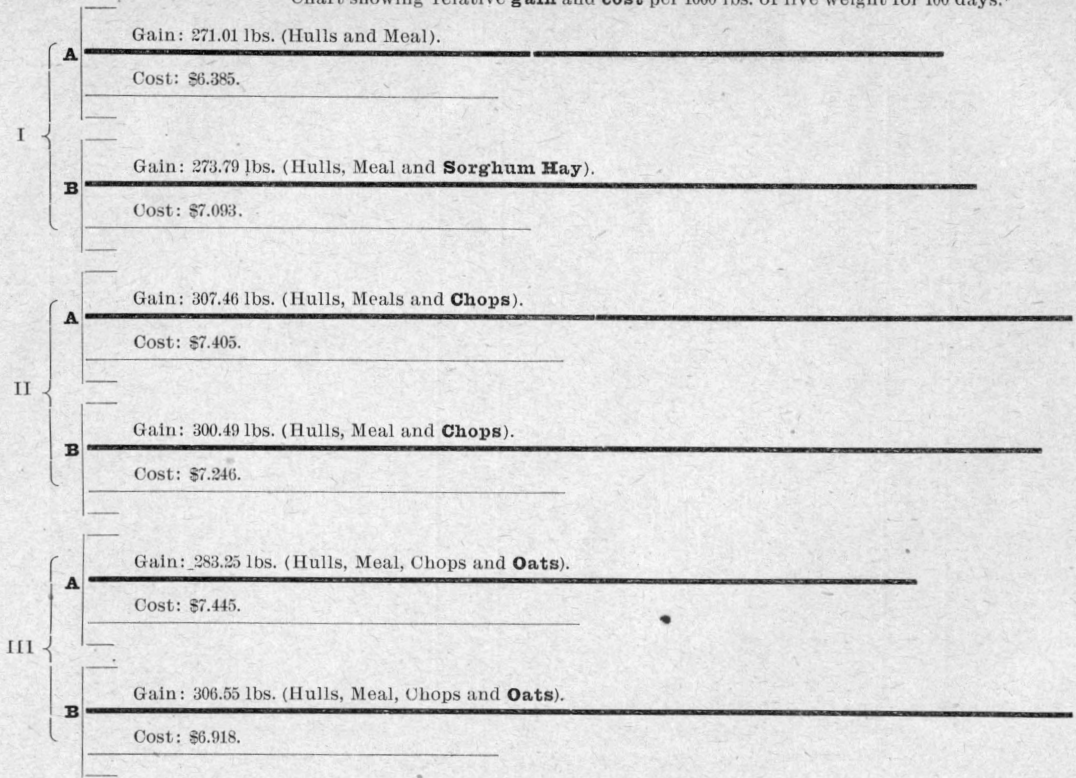
Gain, 39.0 per cent.

Rations Fed for 140 Days.

* This Corn Chops was fed during the last 40 days only at the rate of 6.47 and 6.4 pounds per day for pens "A" and "B," respectively.

CHART III.—(Feed 100 Days.)

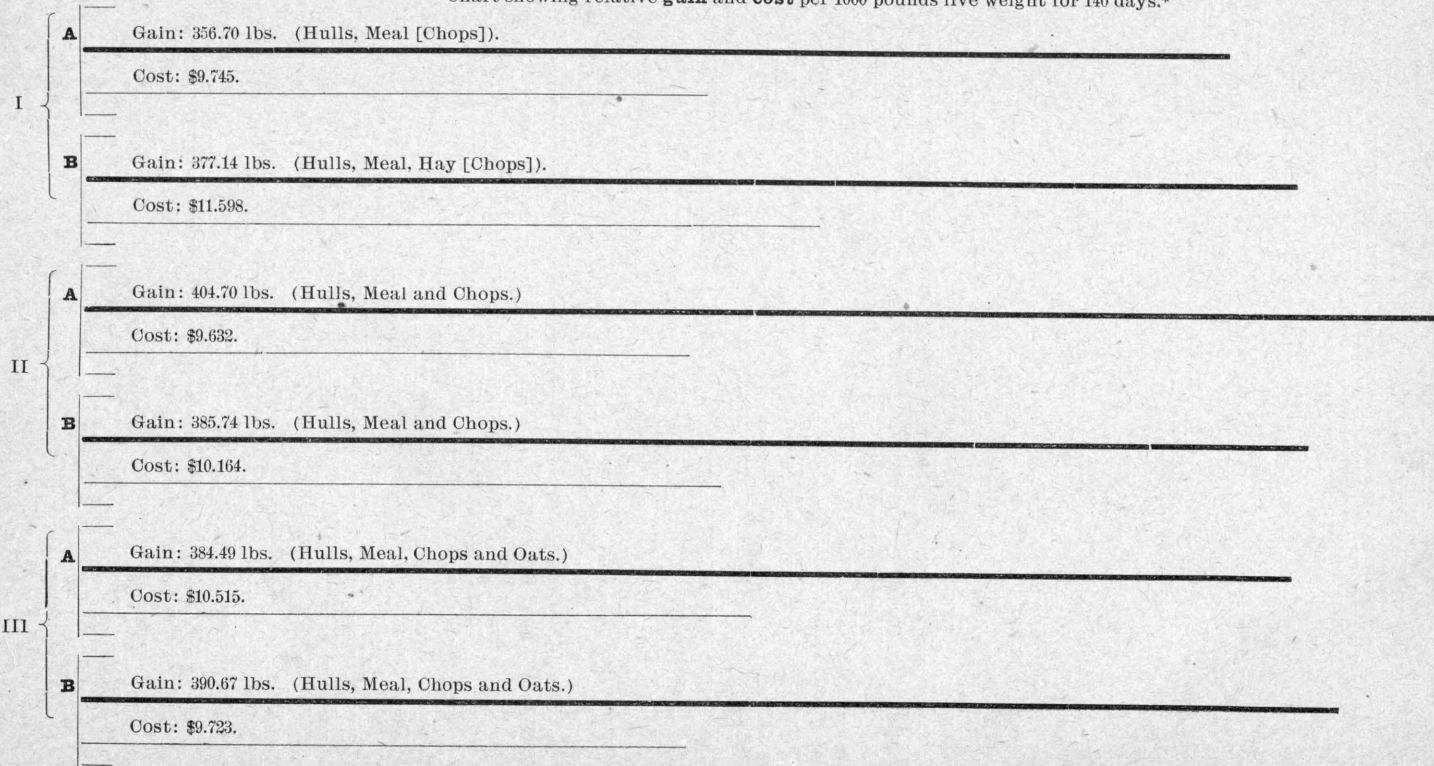
Chart showing relative **gain** and **cost** per 1000 lbs. of live weight for 100 days.*



*NOTE.—(a) Each inch of **gain** represents 60 lbs. of gain in live weight.
 (b) Each inch of **cost** represents \$3.00 worth of food eaten.

CHART IV.—(Feed 140 Days.)

Chart showing relative **gain** and **cost** per 1000 pounds live weight for 140 days.*



*NOTE.—(a) Each inch of **gain** represents 60 lbs of gain in live weight.
 (b) Each inch of **cost** represents \$3.00 worth of food eaten.

THE GAINS RESULTING FROM VARYING THE GRAIN RATION.

RESULTS FOR 100 DAYS.

In the first experiment it was reported that the greatest gain was secured from the pen fed hulls, cottonseed meal, and chops, and this second part of the experiment was planned to show just what ration of chops, hulls and cottonseed meal should be fed.

Rations Containing Chops.

TO PEN "A" WAS FED:

4 lbs. hulls.
1 lb. cotton seed meal.
4 lbs. chops.

TO PEN "B" WAS FED:

5.1 lbs. hulls.
1 lb. cotton seed meal.
1 lb chops.

These rations were fed freely, with the result that during the first 100 days pen "A," receiving 1.98 pounds chops per day, gained 213 pounds per steer, while pen "B," which received 3.81 pounds chops, gained 206 pounds per head. The difference between the rate of gain, resulting from these two rations is not so marked when fed for 100 days, as when fed for 140 days (see page —).

In the trials to determine the best proportion of oats, chops, and cottonseed meal, in combination with hulls, the following proportions were tested:

Rations Containing Oats.

PEN "A" WAS FED:

4.2 lbs. hulls.
1 lb. cotton seed meal.
2.5 lbs. chops.
2.5 lbs. oats.

PEN "B" WAS FED:

8.2 lbs. hulls.
1 lb. cotton seed meal.
1 lb. chops.
1 lb. oats.

At the end of the 100 days feeding, it was shown that the steers in pen "B," receiving equal parts of cottonseed meal, chops, and oats, gained more rapidly than did pen "A," which received 1 pound cottonseed meal and the $\frac{1}{4}$ pound each of oats and chops. The equal parts of the grains produced 306 pounds gain upon the original thousand pounds live weight, where the other ration gave but 283 pounds gain.

RESULTS FOR 140 DAYS.

By referring to Table "1b," it will be noted that the steers of Group III, Pen A, receiving the uniform ration of hulls, cottonseed meal, and chops, gained more rapidly and steadily than did the steers of the other pens, and that the food consumed during the last 40 days of the trial indicates that the health of the cattle was excellent. The warm weather, occurring during the last period, resulted in a slight decrease of appetite, but otherwise, the cattle were in a generally thriving condition.

In the last line of the table, the total gains in the weight for the 140 days by the average steer are shown, and the tables indicate clearly the actual rations throughout the feeding period.

TABLE 1a.
Weights and Gains by Periods—100 Days.

(Stated per Steer and per 1000 lbs. Weight.)

20 Day Periods.	End of Periods.	GROUP I—Hulls, Hay and C. S. M.					
		Pen A { 5.5 lbs. Hulls to 1 lb. C. S. Meal.			Pen B { 3.4 lbs. Hulls to 1 lb. C. S. Meal, 1.6 lbs. S. Hay.		
		Weight.	Gain.	Gain per 1000 lbs.	Weight.	Gain.	Gain per 1000 lbs.
(1).....	Dec. 24....	745.49	61.85	90.47	777.51	53.43	73.79
(2).....	Jan. 13....	791.85	46.35	67.81	850.36	72.85	100.61
(3).....	Feb. 2.....	828.57	36.71	53.71	864.55	14.18	19.59
(4).....	Feb. 22....	838.57	10.00	14.63	878.81	14.26	19.70
(5).....	Mar. 14....	868.92	30.36	44.39	922.33	43.51	60.10
Total Gains 100 Days.....			213.89	271.01		198.23	273.79
20 Day Periods.	End of Periods.	GROUP II—Hulls, C. S. M. and Chops.					
		Pen A { 4 lbs. Hulls to 1 lb. C. S. Meal, 4 lbs. Chops.			Pen B { 5.1 lbs Hulls to 1 lb C. S. Meal, 1 lb. Chops.		
		Weight.	Gain.	Gain per 1000 lbs.	Weight.	Gain.	Gain per 1000 lbs.
(1).....	Dec. 24....	750.71	54.92	78.94	748.00	59.71	86.70
(2).....	Jan. 13....	813.64	62.92	90.45	814.92	66.02	97.24
(3).....	Feb. 2.....	853.57	39.92	57.40	894.92	20.00	29.06
(4).....	Feb. 22....	864.64	11.07	15.90	862.07	27.14	39.44
(5).....	Mar. 14....	909.71	45.07	64.77	895.14	33.07	48.05
Total Gains 100 Days.....			213.90	307.46		206.84	300.49
20 Day Periods.	End of Periods.	GROUP III—Hulls, C. S. M., Chops and Oats.					
		Pen A { 4.1 lbs. Hulls to 1 lb. C. S. Meal, .25 lbs. Chops, .20 lbs. Oats.			Pen B { 8.2 lbs. Hulls to 1 lb. C. S. Meal, 1 lb. Chops, 1 lb. Oats.		
		Weight.	Gain.	Gain per 1000 lbs.	Weight.	Gain.	Gain per 1000 lbs.
(1).....	Dec. 24....	747.57	53.52	77.11	727.33	61.92	93.05
(2).....	Jan. 13....	806.42	58.85	73.56	776.28	48.95	84.76
(3).....	Feb. 2.....	836.42	30.00	57.46	814.51	38.23	43.22
(4).....	Feb. 22....	856.57	20.14	30.34	834.80	30.28	29.02
(5).....	Mar. 14....	895.78	39.21	44.78	862.50	27.70	56.50
Total Gains 100 Days.....			201.72	283.25		197.08	306.55

TABLE 1b.
Weights and Gains—140 Days.

(Stated per Steer and per 1000 lbs. Weight.)

20 Day Periods.	End of Periods.	GROUP I—Hulls, Hay and C. S. M. and Chops.					
		Pen A { 4.8 lbs. Hulls to 1 lb C. S. M. and .45 lbs. Chops.			Pen B { 3.7 lbs. Hulls to 1 lb. C. S. M. .4 lb. Chops, 1.7 lb.S. Hay.		
		Weight.	Gain.	Gain per 1000 lbs.	Weight.	Gain.	Gain per 1000 lbs.
1st....	Dec. 24....	745.49	61.85	90.46	777.51	53.43	73.79
2nd....	Jan. 13....	791.85	46.35	67.81	850.36	72.85	100.61
3d....	Feby. 2....	828.57	36.71	53.71	864.55	14.18	19.59
4th....	Feby. 22....	838.57	10.00	14.63	878.81	14.26	19.70
5th....	Mch. 14....	868.92	30.36	44.39	922.33	43.51	60.10
6th....	Apr. 2....	890.21	21.28	31.15	958.50	36.16	49.95
7th....	Apr. 23....	927.50	37.43	54.54	996.16	37.66	53.40
Total Gains 140 Days.....			243.86	356.70		272.08	377.14
20 Day Periods.	End of Periods.	GROUP II—Hulls, C. S. M. and Chops.					
		Pen A { 4.8 lbs. Hulls to 1 lb. C. S. Meal and .5 lbs. Chops.			Pen B { 3.7 lbs. Hulls to 1 lb. C. S. M. and 1 lb. Chops.		
		Weight.	Gain.	Gain per 1000 lbs.	Weight.	Gain.	Gain per 1000 lbs.
1st....	Dec. 24....	750.71	54.92	78.94	748.00	59.71	86.70
2nd....	Jan. 13....	813.64	62.92	90.45	814.92	66.92	97.24
3rd....	Feb. 2....	853.57	39.92	57.40	834.92	20.00	29.06
4th....	Feb. 22....	864.64	11.07	15.90	862.07	27.14	39.44
5th....	Mar. 14....	909.71	45.07	64.77	895.14	33.07	48.05
6th....	Apr. 3....	946.78	37.07	53.14	915.78	20.64	29.99
7th....	Apr. 23....	977.21	30.42	43.88	953.78	38.00	55.21
Total Gains 140 Days.....			281.43	404.48		265.50	385.74
20 Day Periods.	End of Periods.	GROUP III—Hulls, C. S. M., Chops and Oats.					
		Pen A { 4.2 lbs. Hulls to 1 lb. C. S. M., .25 lbs. Chops, .25 lbs. Oats.			Pen B { 8.2 lbs. Hulls to 1 lb. C. S. M., 1 lb. Chops, 1 lbs. Oats.		
		Weight.	Gain.	Gain per 1000 lbs.	Weight.	Gain.	Gain per 1000 lbs.
1st....	Dec. 24....	747.57	53.52	77.11	727.33	61.92	93.05
2nd....	Jan. 13....	806.42	58.85	73.56	776.28	48.95	84.76
3rd....	Feb. 2....	836.42	30.00	57.46	814.51	38.23	43.22
4th....	Feb. 22....	856.57	20.14	30.34	834.80	20.28	29.02
5th....	Mar. 14....	895.78	39.21	44.78	862.50	27.70	56.50
6th....	Apr. 3....	918.71	25.58	15.53	874.83	12.30	33.04
7th....	Apr. 23....	965.21	46.50	69.76	921.25	46.41	67.00
Total Gains 140 Days.....			271.14	384.48		255.84	390.65

FEED EATEN AND GAINS.

100 DAY RATIONS.

In Table 2a, the amounts of feed consumed by the steers in each of the six pens is presented and the rate of gain is also shown, for the purpose of indicating just how the amount of food eaten influenced the rate of gains.

It will be found that in all cases the gains were quite uniform and regular, with the exception of the twenty days ending February 22 (during a part of which time the weather was severely cold and the steers failed to gain normally, regardless of the food eaten). This fact emphasizes the advisability of placing steers upon feed as early as practicable in the fall, in order that they may be marketed before the severe temperatures occurring during the latter part of January and February occurs. In this respect, we have a great advantage over the feeders living far to the North, where cold weather usually occurs during the months of October and December. If these cold snaps can be avoided, the rapid and steady gains of the cattle under feed will fully repay the foresight and care of the feeder.

TABLE NO. 2a.
Feed Eaten Per Steer and Gains—100 Days.

20 Day Periods.	End of Periods.	GROUP I } See Rations Below, Pens A. and B.									
		Pen A { 5.5 lbs. Hulls to 1 lb. C. S. M.			Per Cent. Gain.	Pen B { 3.4 lbs. Hulls, 1.6 lbs. S. Hay to 1 lb. C. S. M.			Per Cent. Gain.		
		Hulls.	C. S. Meal.	Hulls.		S. Hay.	C. S. Meal.				
1st.....	Dec. 24...	443.8	82.68	9.04	275.8	120.4	77.85	7.37			
2nd.....	Jan. 13...	427.0	80.22	6.78	272.7	95.3	81.09	10.06			
3d.....	Feb. 2...	443.3	77.23	5.37	274.5	99.4	81.25	1.95			
4th.....	Feb. 22...	444.1	80.23	1.46	281.6	134.6	83.45	1.97			
5th.....	Mar. 14...	467.7	86.03	4.43	335.0	146.3	95.86	6.01			
Totals for 100 days.....		2225.9	406.39	27.08	1439.6	596.0	419.50	27.36			
20 Day Periods.	End of Periods.	GROUP II } Hulls, C. S. Meal and C. Chops.									
		Pen A { 4 lbs. Hulls to 1 lb. C. S. M. and 4 lbs. Chops.			Per Cent. Gain.	Pen B { 5.1 lbs. Hulls to 1 lb. C. S. M. and 1 lb. Chops			Per Cent. Gain.		
		Hulls.	C. S. Meal.	Chops.		Hulls.	C. S. Meal.	Chops.			
1st.....	Dec. 24...	365.4	102.04	36.66	7.89	350.60	62.55	69.43	8.67		
2nd.....	Jan. 13...	382.0	91.63	38.41	9.04	369.2	73.75	73.75	9.72		
3d.....	Feb. 2...	398.7	95.73	40.82	5.74	384.4	76.11	76.33	2.90		
4th.....	Feb. 22...	395.7	95.08	39.44	1.59	390.3	77.71	77.93	3.94		
5th.....	Mar. 14...	420.6	100.85	42.55	6.47	415.6	82.85	83.43	4.80		
Totals for 100 days.....		1962.4	485.33	197.88	30.73	1910.1	372.97	380.87	30.30		
20 Day Periods.	End of Periods.	GROUP III } Hulls, C. S. Meal, Chops and Oats.									
		Pen A { 4.2 lbs. Hulls to 1 lb. C. S. M., .25 lbs. Chops and .25 lbs. Oats.				Per Cent. Gain.	Pen B { 8.2 lbs. Hulls to 1 lb. C. S. M., 1 lb. Chops and 1 lb. Oats.			Per Cent. Gain.	
		Hulls.	C. S. Meal.	Chops.	Oats.		Hulls.	C. S. Meal.	Chops.		Oats.
1st.....	Dec. 24...	353.8	81.50	20.43	20.35	7.71	332.0	40.10	40.16	40.15	9.30
2nd.....	Jan. 13...	376.6	86.01	23.63	23.02	7.35	360.9	43.25	43.26	43.26	8.47
3d.....	Feb. 2...	386.9	89.37	22.95	23.17	5.74	340.7	44.63	44.63	44.76	4.32
4th.....	Feb. 22...	340.5	91.00	22.35	22.43	3.03	381.3	45.57	45.57	44.57	2.90
5th.....	Mar. 14...	420.9	97.10	23.81	23.81	4.47	405.8	48.35	48.36	48.36	5.65
Totals for 100 days.....		1878.7	444.98	113.17	113.39	28.30	1820.7	221.91	221.98	221.0	30.64

140 DAY RATIONS.

A full statement of the gains made during the 140 days resulting from the use of feeds divided among the six pens, is shown in the following table by periods of twenty days and by totals.

It will be noted that when the "topping out" plan began in pens "A" and "B," Group I, that the cottonseed meal was held up to the former amount (which was small), and the five or six pounds of chops was added. When this was done, the steers *ate the grain clean*, but began to refuse hulls, so that this part of the ration was reduced. This fact probably accounts for the scouring noticed in Pen "A" of this group on arrival at St. Louis, as before reported. It was unavoidable. It does not offer any explanation, however, for the excellent condition in which the steers of Pen "B," receiving *sorghum hay and the same corn chops*, arrived in market.

Similar interesting facts are presented in this table when the exact amounts of the feed eaten are shown, together with the proportions of each feed used and the gain in live weight. Steers eating the larger ration of corn chops, gained less than those eating one-half pound of chops to every pound of cottonseed meal fed. When oats was employed, it was necessary to reduce the amount of cottonseed meal and increase proportionally the chops and oats.

TABLE NO. 2b.

Feed Eaten Per Steer and Gains—140 Days.

(Stated per Steer and by Pens.)

20 Day Periods.	End of Periods.	GROUP I { See Rations Below— Pens A and B.									
		Pen A { Hulls and C. S. M. Finished on Chops.				Pen B { Hulls, Hay, C. S. M. Finished on Chops.					
		Hulls, lbs.	C. S. M., lbs.	Chops, lbs.	Gain per 1000 lbs.	Hulls, lbs.	Hay, lbs.	C. S. M., lbs.	Chops, lbs.	Gain per 1000 lbs.	
1st....	Dec. 24....	443.8	82.61		90.47	275.8	120.4	77.85		73.79	
2nd....	Jan. 13....	427.0	80.22		67.81	272.7	95.3	81.09		100.61	
3d....	Feb. 2....	443.3	77.23		53.71	274.5	99.4	81.25		19.59	
4th....	Feb. 22....	444.1	80.23		14.63	281.6	134.6	83.45		19.70	
5th....	Mar. 14....	467.7	86.03		44.39	335.0	146.3	95.86		60.10	
6th....	Apr. 3....	345.9	87.54	132.88	31.15	221.3	170.7	96.80	128.03	49.95	
7th....	Apr. 23....	312.3	82.25	126.11	54.54	221.3	170.7	96.80	128.03	53.40	
Total per Steer — 40 Days.....		2884.1	576.18	258.99	356.70	1882.2	1037.4	613.10	256.06	377.14	
20 Day Periods.	End of Periods.	GROUP II { Ration: Hulls, C. S. Meal and Chops.									
		Pen A { 4.8 lbs. Hulls, 1 lb. C.S.M. and .4 lbs. Chops.				Pen B { 5.1 lbs. Hulls, 1 lb. C.S.M. (1 lb. Chops.					
		Hulls, lbs.	C. S. M., lbs.	Chops, lbs.	Gain per 1000 lbs.	Hulls, lbs.	C. S. M., lbs.	Chops, lbs.	Gain per 1000 lbs.		
1st....	Dec. 24....	365.4	102.04	36.66	78.94	350.6	62.55		69.43	86.75	
2nd....	Jan. 13....	382.0	91.63	38.41	90.45	369.2	73.75		73.75	97.24	
3d....	Feb. 2....	398.7	95.73	40.82	57.40	384.4	76.11		76.33	29.06	
4th....	Feb. 22....	395.7	95.08	39.44	15.90	390.3	77.71		77.93	39.44	
5th....	Mar. 14....	420.6	100.85	42.55	64.77	415.6	82.85		83.43	48.05	
6th....	Apr. 3....	413.3	98.38	40.27	53.14	379.7	75.64		75.64	29.99	
7th....	Apr. 23....	391.0	93.43	39.34	43.88	383.6	76.43		76.43	55.21	
Total per Steer —140 Days.....		2766.7	577.14	277.49	404.48	2673.4	535.04		532.94	385.74	
20 Day Periods.	End of Periods.	GROUP III { Ration: Hulls, C. S. Meal, Chops and Oats.									
		Pen A { 4.2 lbs. Hulls, 1 lb. C. S. M., .25 Chops, .25 Oats.				Pen B { 8.2 lbs. Hulls, 1 lb. C.S.M. (1 lb. Chops, 1 lb. Oats.					
		Hulls, lbs.	C. S. M., lbs.	Chops, lbs.	Oats, lbs.	Gain per 1000 lbs.	Hulls, lbs.	C. S. M., lbs.	Chops, lbs.	Oats, lbs.	Gain per 1000 lbs.
1st....	Dec. 24....	353.8	81.50	20.43	20.35	77.11	232.0	40.10	40.16	40.15	93.05
2nd....	Jan. 13....	376.6	86.01	23.63	23.63	73.56	360.9	43.26	43.26	43.26	84.76
3d....	Feb. 2....	386.9	99.37	22.95	23.17	57.46	340.7	44.63	44.63	44.76	43.22
4th....	Feb. 22....	340.5	99.00	22.35	22.43	30.34	381.3	45.57	45.57	44.57	29.02
5th....	Mar. 14....	420.9	97.10	23.81	23.81	44.78	405.8	48.35	48.36	48.36	56.50
6th....	Apr. 3....	406.2	95.00	22.32	22.32	15.53	391.4	45.46	45.46	45.46	33.04
7th....	Apr. 23....	386.1	88.28	22.08	22.08	69.76	361.1	44.93	40.93	44.93	67.00
Total per Steer —140 Days.....		2671.0	628.26	157.57	157.79	384.48	2573.2	312.30	312.37	311.49	390.65

COST OF GAINS.

FEEDING 100 DAYS.

The cost of feeds and the gains per 100 days are presented in tabular form, in order that the items of cost may strike the eye of the reader more easily, and that the cost of feeds, the gains in pounds, the per cent. gained, and the cost of each pound so gained, may more readily be understood.

Careful study of the table will show that the steers of Group II, Pen "A," gained more rapidly than did the other lots, but that the cost per pound gain for this pen is not so low as for Pen "A," of Group I, which was fed the simple hull and meal ration, and it is assumed that the value of the steers, per 100 pounds upon the markets, would be about the same, since there was no material difference in the degree of fat shown by the steers in the two pens. In other words, it seems impossible to so arrange a ration containing corn chops as to cause cheaper gains than those made from hulls and meal (at the price quoted) *when feeding only 100 days*. A greater gain can be secured by addition of chops, and in many instances its use is advisable. For cost of feeding 140 days, see page 165.

VARYING PRICES AND VARYING RATE OF GAIN.

CALCULATED FOR 100 DAYS.

In applying the scale of variable prices to the feeding materials used, a study of results obtained in the four pens of Groups II and III, the columns of cost per pound gained, show that the simple hull and meal ration was the cheapest of those used at all of the supposed prices. Next in point of economy was the pen of steers fed a ration of hulls and meal combined with sorghum hay. *This statement applies to all of the cases during the 100-day feeding.* The prices at which both corn chops and oats are available in South Texas are merely relative, as compared with other points in the State, and the warning given with reference to adapting the results to the prices that may prevail in any locality during any season, as appearing in another part of this bulletin, should be constantly borne in mind by the practical feeder.

A greater gain can be secured by an addition of chops and in many instances its use is advisable. For cost of feeding 140 days see page 166.

TABLE NO 3a.
Feed, Cost and Gains—100 Days.

(Stated Per Steer and Pen.)

Groups.	Pens.	Hulls.		S. Hay.		C. S. Meal.		Chops.		Oats.		Cost of Feed. \$	Gain in Pounds.	Per Cent. Gain.	Cost per Pound Gain. Ct.
		lbs.	\$	lbs.	\$	lbs.	\$	lbs.	\$	lbs.	\$				
I	A	2225.9	3.331	.....	.....	406.39	3.047	.....	.....	.....	.....	6.385	213.89	27.10	2.985
	B	1439.6	2.159	596.	1.788	419.50	3.146	.....	.....	.....	.....	7.093	198.23	27.37	3.583
II	A	1962.4	2.943	.....	.....	485.33	3.639	197.88	.823	.....	.....	7.405	213.90	30.74	3.461
	B	1910.1	2.865	.....	.....	372.97	2.797	380.87	1.584	.....	.....	7.246	206.84	30.04	3.503
III	A	1878.7	2.818	.....	.....	444.98	3.337	113.17	.470	113.39	.820	7.445	201.72	28.32	3.690
	B	1820.7	2.731	.....	.....	221.91	1.664	251.98	.923	221.10	1.600	6.918	197.08	30.65	3.510

TABLE NO. 4a.
Cost of Feed at Varying Prices—100 Days.

Groups.	Pens.	(1.) Medium Prices (per 100 pounds).						(2.) High Prices (per 100 pounds).						(3.) Very High Hulls and Hay—Low Grain (per 100 pounds).								
		Hulls at 15c.	Hay at 30c.	C. S. M. at 75c.	Chops at 41.6c.	Oats at 72.4c.	Cost of Feed.	Cost per pound Gain.	Hulls at 20c.	Hay at 40c.	C. S. M. at 100c.	Chops at 55.5c.	Oats at 93.9c.	Cost of Feed.	Cost per pound Gain.	Hulls at 25c.	Hay at 50c.	C. S. M. at 75c.	Chops at 41.6c.	Oats at 72.4c.	Cost of Feed.	Cost per pound Gain.
I	Pen A.....	3.338	.....	3.047	.....	.....	6.385	2.985	4.451	.....	4.063	.....	.....	8.514	3.980	5.564	.....	3.047	.....	.....	8.611	4.021
	Pen B.....	2.159	1.788	3.146	.....	.....	7.093	3.583	2.879	2.384	4.195	.....	.....	9.458	4.771	3.599	2.980	3.146	.....	.....	9.725	4.905
II	Pen A.....	2.943	.....	3.639	.823	.....	7.405	3.461	3.924	.....	4.853	1.098	.....	9.876	4.617	4.906	.....	3.639	.823	.....	9.368	4.037
	Pen B.....	2.865	.....	2.797	1.584	.....	7.246	3.503	3.820	.....	3.729	2.113	.....	9.664	4.672	4.575	.....	2.797	1.584	.....	8.956	4.329
III	Pen A.....	2.818	.....	3.337	.470	.820	7.445	3.690	3.757	.....	4.449	.628	1.064	9.797	4.856	4.696	.....	3.337	.470	.820	9.323	4.621
	Pen B.....	2.731	.....	1.664	.923	1.600	6.918	3.510	3.641	.....	2.219	1.231	2.076	9.165	4.650	4.551	.....	1.664	.923	1.600	8.738	4.433
Groups.	Pens.	(4.) Low Hulls and Hay—High Grain (per 100 pounds).						(5.) Very Low Prices (per 100 pounds).														
		Hulls at 10c.	Hay at 20c.	C. S. M. at 125c.	Chops at 69.4c.	Oats at 117c.	Cost of Feed.	Cost per pound Gain.	Hulls at 10c.	Hay at 20c.	C. S. M. at 66.6c.	Chops at 27.7c.	Oats at 46.9c.	Cost of Feed.	Cost per pound Gain.							
I	Pen A.....	2.225	.....	5.079	.....	.....	7.304	3.414	2.225	.....	2.706	.....	.....	4.931	2.350							
	Pen B.....	1.439	1.192	5.243	.....	.....	7.874	3.972	1.439	1.192	2.793	.....	.....	5.424	2.736							
II	Pen A.....	1.962	.....	6.066	1.373	.....	9.451	4.395	1.962	.....	2.232	.548	.....	5.742	2.684							
	Pen B.....	1.910	.....	4.662	2.643	.....	9.215	4.455	1.910	.....	2.483	1.055	.....	5.448	2.633							
III	Pen A.....	1.878	.....	5.562	.785	1.326	9.551	4.734	1.878	.....	2.963	.313	.531	5.685	2.818							
	Pen B.....	1.820	.....	2.773	1.540	2.586	8.719	4.426	1.820	.....	1.477	.614	1.036	4.949	2.510							

FEEDING 140 DAYS.

At the moderate, or fair, prices used in calculating the cost of gains in Table 3a, it will be noticed that the actual cost of the rations consumed was less for the steers of Group "II.A" and Group "III.B," while, at the same time, these pens gained most rapidly, reducing the cost of pound gain to a minimum in this instance—3.42¢ for Pen "II.A," and 3.80¢ for "Pen III.B."

By referring to the data presented in Table "4b," it will be noticed that the cost of feeding these two pens is *lower* than that of others at "medium rates," at "high prices," and at "very low prices," and also when hulls are rated as "high and grain low." In one case only (where the estimates were made with *low* prices on hulls and hay, and *high* prices on grain), were these pens outclassed by the ration of hulls and meal, topped out with corn chops. The inference then, is clear, that in case the steers are to be fed longer than 100 days, it is well to begin feeding corn chops or oats in small amounts very early, in preference to waiting until about the one hundredth day before adding the grain. Where chops, only, are to be added to the hull and meal ration, but one-half as much chops as cottonseed meal should be fed, and the total weight of grain to hulls should be as 1 to 4.

If oats are to be included in combination with chops, cottonseed meal, and hulls, equal parts of the grain should be fed, and the total grain to hulls should be proportioned as 1 to 3, since the rough coat of the oat is a partial substitute for the hulls.

TABLE NO. 3b.
Feed, Cost and Gains—140 Days.

(Stated per Steer by Pens.)

Groups.	Pens.	Hulls.		S. Hay.		C. S. Meal.		Chops.		Oats.		Cost of Feed. \$	Gain in Pounds.	Per Cent. Gain.	Cost per Pound Gain. Ct.
		lbs.	¢	lbs.	¢	lbs.	¢	lbs.	¢	lbs.	¢				
I	A	2884.1	4.326	.....	.....	576.18	4.321	258.99	1.077	.....	.....	9.754	243.86	35.67	4.000
	B	1882.2	2.823	1037.4	3.112	613.10	4.598	256.06	1.065	.....	.....	11.598	272.08	37.71	4.263
II	A	2766.7	4.150	.....	.....	577.14	4.328	277.49	1.154	.....	.....	9.632	281.43	40.44	3.422
	B	2673.4	4.010	.....	.....	525.04	4.012	532.94	2.217	.....	.....	10.164	265.50	38.57	3.828
III	A	2671.0	4.006	.....	.....	628.26	4.711	157.57	.655	157.79	1.143	10.515	271.14	38.44	3.875
	B	2573.2	3.859	.....	.....	312.30	2.332	312.37	1.290	311.49	2.255	9.723	255.84	39.06	3.800

TABLE NO. 4b.

Cost of Feeds at Varying Prices—140 Days.

(Stated per Pen and Steer.)

Groups.	Pens.	(1) Medium Prices (per 100 lbs.).						(2) High Prices (per 100 lbs.).						(3) Very High Hulls and Low Grain (per 100 lbs.).								
		Hulls at 15c.	Hay at 30c.	C. S. M. at 75c.	Chops at 41.6c.	Oats at 72.4c.	Cost of Feed.	Cost per pound Grain.	Hulls at 20c.	Hay at 40c.	C. S. M. at 100c.	Chops at 55.5c.	Oats at 89.9c.	Cost of Feed.	Cost per pound Gain.	Hulls at 25c.	Hay at 50c.	C. S. M. at 75c.	Chops at 41.6c.	Oats 72.4c.	Cost of Feed.	Cost per pound Gain.
I	A	4.326	.....	4.321	1.077	.....	9.754	4	5.768	.....	5.761	1.437	.....	12.966	5.317	7.210	.....	4.320	1.077	.....	12.607	5.169
	B	2.823	3.112	4.598	1.065	.....	11.598	4.263	3.764	4.149	6.131	1.421	.....	15.465	5.680	4.705	5.187	4.598	1.065	.....	15.555	5.717
II	A	4.150	.....	4.328	1.154	.....	9.632	3.422	5.533	.....	5.771	1.540	.....	12.844	4.563	6.916	.....	4.328	1.154	.....	12.398	4.403
	B	4.010	.....	4.012	2.217	.....	10.239	3.856	5.346	.....	5.250	2.957	.....	13.553	5.104	6.683	.....	3.937	2.217	.....	12.837	4.803
III	A	4.006	.....	4.711	.655	1.143	10.515	3.877	5.342	.....	6.282	.874	1.481	13.979	5.155	6.677	.....	4.711	.655	1.142	13.169	4.856
	B	3.879	.....	2.342	1.299	2.255	9.743	3.808	5.146	.....	3.123	1.733	2.924	12.926	5.052	6.432	.....	2.343	1.299	2.555	12.299	4.807
Groups.	Pens.	(4) Low Hulls and Hay—High Grains (per 100 lbs.).						(5) Very Low Prices (per 100 lbs.).														
		Hulls at 10c.	Hay at 20c.	C. S. M. at 125c.	Chops at 69.4.	Oats at 117c.	Cost of Feed.	Cost per pound Grain.	Hulls at 10c.	Hay 20c.	C. S. M. at 66.6c.	Chops at 27.7c.	Oats at 46.9c.	Cost of Feed.	Cost per pound Gain.							
I	A	2.844	.....	7.202	1.797	.....	11.883	4.872	2.884	.....	3.837	.717	.....	7.427	3.045							
	B	1.882	2.074	7.663	1.777	.....	13.396	4.923	1.882	2.074	4.083	.709	.....	8.748	3.215							
II	A	2.766	.....	7.214	1.925	.....	11.905	4.230	2.766	.....	3.843	.768	.....	7.377	2.621							
	B	2.673	.....	6.563	3.698	.....	12.934	4.871	2.673	.....	3.476	1.476	.....	7.648	2.880							
III	A	2.671	.....	7.853	1.093	1.846	13.463	4.961	2.671	.....	4.184	.436	.740	8.016	2.956							
	B	2.573	.....	3.903	2.167	3.644	12.287	4.802	2.573	.....	2.079	.865	1.460	6.949	2.716							

RESULTS OF THE SLAUGHTER TEST.

ST. LOUIS DRESSED WEIGHTS OF TEXAS EXPERIMENT CATTLE.

Much of the steer feeding carried on in Texas and in other Southern States is limited to 80 or 100 days, while the fattening period in the West and North is prolonged for 120 to 150 days, and in some instances the cattle are not considered "ripe" until they have been fed 180 days. During the early stages of fattening, a very large proportion of the gain in weight consists of additions to the blood and to the paunch, and when such half-fat cattle are shipped long distances the shrinkage is startling. Thousands of such cattle are bought up on our central markets, after shipment, and are again used as feeders for times varying in lengths from 60 to 100 days, when they are sold for immediate slaughter.

Shrinkage in shipment will vary with such conditions as distance, with water and feed enroute, with weather, with the degree of fatness, with the system of feeding and the nature of the feed given just prior to shipment.

By securing the average of three weighings for each steer just before shipment and then taking the live and the dressed weights of the steers in St. Louis, some interesting facts have been developed with reference (1) to the per cent. of dressed weight when fed various rations; (2) shrinkage in transit when so fed; and (3) waste fat produced when fed these rations.

NET WEIGHTS.

The best net weights were secured from the steers fed *hulls, meal and corn chops*, regularly, and according to the records of the live cattle, this ration also produced the greatest amount of fat per head. The breed of cattle is a recognized factor in determining dressing qualities, and great care has been exercised to secure equal advantages in this respect to all of the pens. The ration given consisted of *19.8 pounds of hulls, 4.1 pounds cotton seed meal, and 2 pounds of corn chops per day*, resulting in a carcass weighing 57.43 per cent. of the live weight of steer in St. Louis. When meal and hulls were used during the first 100 days, and corn chops was added for forty days, the steers dressed 57.19 per cent. of their St. Louis live weight. When oats was fed, it had a tendency to reduce the per cent. of dressed weight. When sorghum hay was used as a partial substitute for hulls, the result was marked in a tendency to improve the "standing up" qualities of the cattle during shipment. Judged from the standpoint of Station shipping weights the least shrinkage was noticed in the pen fed a ration of *sorghum hay, hulls, and meal*, topped out with *corn chops*.

WASTE FAT.

The steers receiving the largest amount of hulls yielded the largest amount of waste fat, except in the case of the pen fed hulls and sorghum hay. These rations produced 37 and 37.5 pounds waste fat, respectively,

per head. When grain took the place of some of the hulls fed, the waste fat per steer fell to 33.3 pounds.

The importance of selecting proper feeds and rightly combining them can be better appreciated by applying the results of this experiment to a bunch of 100 head of stock; weighing 1000 pounds—gaining 404.5 pounds per head during the feeding season. The gain in flesh when fed continuously upon hulls, meal and chops costs .57 cents less per pound than when hulls and meal alone are used for the first 100 days. This makes a difference of \$2.26 per head, or \$226 in feeding 100 head, to say nothing of the higher butchers' value of beef so fed and carrying a smaller amount of waste fat.

TABLE NO. 5.

Dressed Weights and Summary of Results—140 Days.

Groups.	Pens.	Live Weight Gains.	Cost per Pound Gains. Ct.	Per Cent. Gains.	Daily Gains per 1000 lbs.	Shipping Weight at Station.	Live Weight [□] at St. Louis.	Dressed Market Weights.	Shrinkage in Shipment—per cent.	Dressed Carcass—per cent.	Waste Fat per Steer—lbs.
I	A	243.86	4.000	35.67	2.512	927.50	867.1	497.1	6.5	57.19	37.0
	B	272.08	4.263	37.71	2.690	996.16	938.3	528.6	5.7	56.20	37.5
II	A	281.43	3.422	40.45	2.888	977.21	905.5	521.5	7.3	57.55	34.3
	B	265.50	3.856	38.57	2.750	953.78	891.4	512.3	6.6	57.31	32.3
III	A	271.14	3.875	38.45	2.743	965.21	858.3	477.8	6.8	55.63	33.3
	B	255.84	3.800	39.06	2.790	921.25	904.3	525.1	6.5	57.88	34.3

THE "DRY MATTER" AND NUTRIENTS SUPPLIED IN RATIONS.

It will be remembered that all of the steers in all of the pens gained at nearly the same rate during the first 100 days, and it is interesting to note that the amounts of "dry matter" consumed by the several pens were not widely different. The smallest "dry matter" eaten was by Pen "B," of Group III—2197 pounds, while the largest amount of dried matter consumed was by Pen "B," of Group II. By referring to the last column of the table, it will be seen that these cattle did not make any better progress than did the steers of Pen "A," Group I, and it is suggested that the reason for this failure is that the amount of protein fed these cattle was too small. The nutritive ratios are as 1:7 and 1:9, respectively, while the nutritive ratio of Pen "A" was 1:6.

All of the rations fed for 140 days supplied fairly uniform amounts of dry matter to the steers, and the nutritive ratios of the feed were not widely different, ranging from 1:5.61 to 1:8.95.

The most rapid gains was secured from the steers in the pens receiving

a moderate amount of dry matter having a medium nutritive ratio of 1:6.29.

THE NUTRIENTS SUPPLIED BY DIFFERENT FEEDS.

The digestible nutrients contained in the cotton seed hulls fed are shown in the first part of the table, and then the nutrients found in the cottonseed meal and other feed stuffs are supplied in Table 6. It will be noticed that though the hulls supplied a much larger amount of carbohydrates than did any of the other materials used, a smaller proportion of protein was also furnished by this material. The carbohydrates were supplied in the form of crude fibre, which is not considered easily digestible, but when fed in combination with finely ground grains or oils (fats) has great value because of its tendency to clog the digestive track and prevent the laxative conditions caused by such grains that we recognize by scouring. The digestibility of the hulls is increased by feeding them with cotton seed meal or other feeds rich in protein.

The cottonseed meal furnished a larger amount of protein than of carbohydrates, and also supplied a larger amount of oil (ether extract). Since the cottonseed meal is rich in protein and the hulls are rich in carbohydrates—the two combining well, if properly proportioned, in making an ideal beef ration.

It will be noticed that the corn meal supplied furnished a large amount of carbohydrates and a correspondingly small amount of protein whenever it was used in the rations. And in this respect it resembled sorghum hay, hence corn meal and sorghum hay do not combine well together, because of their similar and one-sided composition. They are not desirable companion foods, because they both lack protein. Although a rather small amount of oats was fed throughout this experiment, it will be noted that fair amounts of protein, carbohydrates, and ether extract were supplied from this feed. This indicates the well-balanced nature of the oat.

DIGESTIBLE NUTRIENTS EATEN.

In compounding the rations for this experiment, three matters were carefully provided for: (1) the rations were arranged in such manner as to render them palatable; (2) the feeds were so proportioned that a fair amount of each nutrient would be supplied the steers of each group; and (3) the physical conditions of the feeds were carefully noted, in order that scouring might be prevented.

The appetites of the steers seemed generally good throughout the feeding period in all of the pens, and in no case did any of the rations prove too laxative. The nutritive elements were supplied the pens in the following proportions in the rations for 100 days and for 140 days:

TABLE NO. 7.

Showing Daily Rations, Dry Matter and Nutritive Ratios.

(Stated by Pens and per Steer.)

Group.	Pen.	Days Fed.	Hulls.	C. S. Meal.	Chops.	S. Hay.	Oats.	Gain per Steer.	Gain per 1000 lbs.	Dry Matter.	Nutritive Ratios.	
I	A	100	22.25	4.06	.....	.....	.....	213.80	271.01	23.518	1:6.43	
		140	20.60	4.11	1.84	.....	.....	243.86	356.70	23.662	1:6.45	
	B	100	13.49	4.19	.....	.....	3.96	.....	198.23	273.79	21.560	1:6.16
		140	13.44	4.37	1.82	7.41	.....	.....	272.08	371.14	23.566	1:6.30
II	A	100	19.62	4.85	1.97	.....	.....	.....	213.90	307.46	23.511	1:5.44
		140	19.76	4.10	1.98	.....	.....	.....	281.43	404.48	23.106	1:6.29
	B	100	19.10	3.72	3.80	.....	.....	.....	206.84	300.49	24.648	1:7.05
		140	19.09	3.75	3.80	.....	.....	.....	265.50	385.74	23.650	1:7.02
III	A	100	17.88	4.44	1.13	.....	.....	1.13	201.72	283.25	22.756	1:5.56
		140	19.07	4.48	1.12	.....	.....	.....	271.14	384.48	23.039	1:5.61
	B	100	18.20	2.21	2.21	.....	.....	.....	197.08	306.55	21.974	1:9.00
		140	18.38	2.23	2.23	.....	.....	.....	255.84	390.65	22.262	1:8.95

The students of the graduating class, 1899, fed the steers and attended to all details of the work, under the direction of the Foreman and the Director.

OUR GENERAL FEED SUPPLY.

The available supply of feeding materials in Texas consists principally of cotton seed and its by-products (hulls and meal), together with corn, oats, wheat bran, rice bran, rice polish, Kaffir corn, and the fodders common to the State, such as sorghum hay, alfalfa, the several forms of prairie hay, Colorado or Concho hay, corn fodder, and Kaffir corn fodder. To this list might be added the root crops and a number of forage plants that are commonly used for pasturage purposes, but are not to be considered in connection with the stall feeding system. Ensilage made of corn, sorghum, or alfalfa has been found very profitable by those who have used this system in feeding growing cattle, and also when used to a limited extent for fattening stock.

Former publications by this Station give the results of experiments in feeding nearly all of the foregoing materials for fattening cattle, and the results are included in the appendix matter embraced in this bulletin. These experiments have been conducted with a view of answering those questions which seemed most to press upon the attention of feeders at the time the experiment was instituted. Results of great practical value have been secured, but few of the experiments have been conducted upon such a scale as to render the investigation exhaustive or the conclusions based thereon final. It will be noted that cotton seed in its several forms, and that its meal and hulls have appeared in nearly all of such investigations.

The Value of Cotton Seed.—Our cotton seed crop is remarkable for the amount of flesh-forming material that we may secure from it annually. With cotton seed materials in hand, our fed cattle gain more rapidly than do the stock of other portions of the United States, as determined by actual experiment. In this connection, Prof. Henry, in his valuable book upon "Feeds and Feeding," after presenting a table showing the results of feeding cottonseed and its products, says, "*This table shows the high value of cotton seed, whether raw, roasted, or boiled, and also of its by-products, cottonseed meal, for beef production. No grain raised at the North equals it, pound for pound, for beef production. When we reflect that for every pound of cotton fibre grown there are two pounds of seed no argument is needed to convince us that the South is capable of producing the beef required for home consumption.*"

If the 1,500,000 tons of cotton seed produced by the State annually be estimated at one-half the value (per bushel) of corn valued at 40¢, it is worth, for feeding purposes alone, \$18,000,000, and for fertilizing purposes the feed can be utilized to the extent of \$6,000,000, so that in the seed of the cotton crop alone the citizens of the State should receive \$24,000,000 per annum, if fully utilized. (See page 175.)

Investigations by the Texas Station show that if properly combined with hay and corn, a pound of raw seed is worth more for beef production than

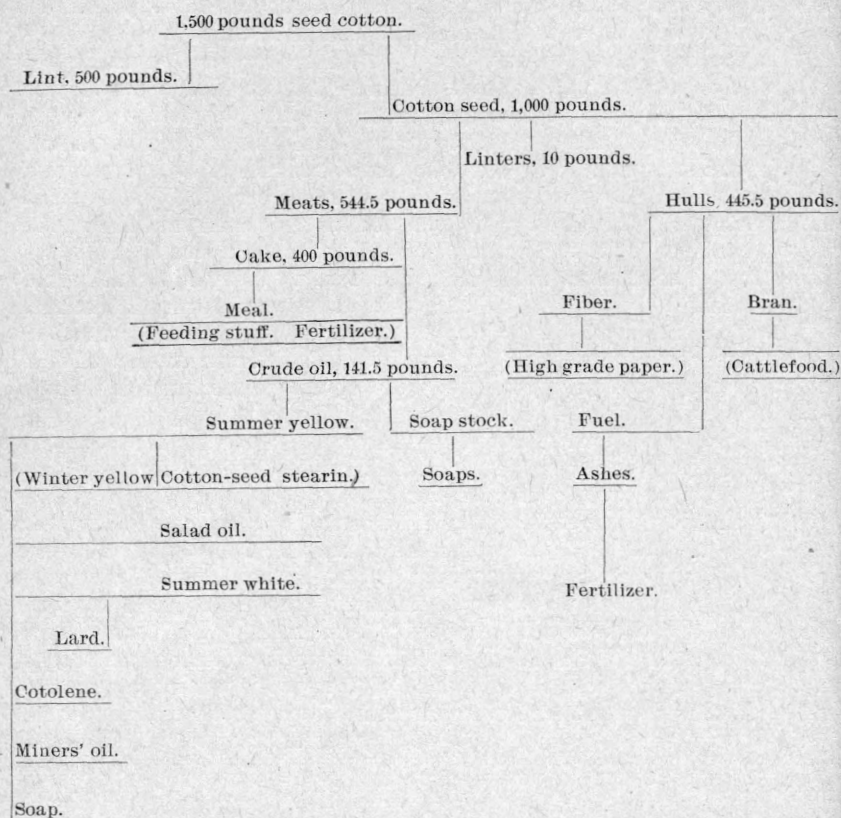
a pound of corn and cob meal (chops). Experiments (conducted by Prof. Gully) with steers fed hay and 5.07 pounds of chops, and 5.50 pounds raw seed, gained more in the same length of time than did similar steers fed hay and 13.02 pounds of chops. In this case 5.50 pounds of cotton seed proved more than equal to 7.52 pounds of chops for steer feeding. In this case, steers were fed for eighty-three days a daily ration of corn and hay (weighing 18.4 pounds), causing a gain of 1.89 pounds per day, while the ration of cottonseed, corn, and hay weighed only 14.8 pounds, and caused a gain of 2.07 pounds. When fed corn and hay alone, an 800-pound steer may be expected to gain at the rate of two pounds per day under favorable conditions for a short fattening period. When cotton seed is judiciously combined with corn and hay, or corn and hulls, the gains run as high as 2.5 or 3 pounds every day for such steers. It is important to note that these fast gains are secured from rations that in the Southwest cost less than a ration composed of hay and corn. Therefore, the presumption that 33½ pounds of seed is equal to about 28 pounds of corn appears entirely safe and conservative. The demonstration of this fact has forced a recognition of the value of cotton seed and it is now worth *commercially* one-half as much per bushel as corn.

Comparing the amount of available seed in the State for feeding purposes with the number of cattle to be fed a winter ration, annually (allowing 20,000,000 bushels of seed for planting seven million acres of cotton, estimating the number of cattle upon winter and partial winter rations, at 3,000,000 head, which is more than half of the 5,200,000 head of cattle in Texas), we see that 23 bushels of seed are produced for every animal thus estimated upon, or a sufficient amount of seed to feed 2,000,000 head of 750-pound steers a full seed ration (12.5 pounds per day) for ninety days, when fed in combination with ordinary hay. It is a fact worthy of note that feeding value of the seed is not largely diminished by cooking the meats and extracting the oil when sent to the oil mills.

The Variety of Cotton Products.—To better appreciate the rich food supply furnished by our cotton crop, the reader's attention is called to the following estimates, which show the approximate values of the cotton seed crop in Texas alone, basing the calculation upon a 3,000,000 bale crop annually: In producing 3,000,000 bales of lint, there is also available for use 3,000,000,000 pounds of cotton seed, which can be better appreciated if stated as 150,000 carloads of seed. Each bale of "seed cotton" is capable of producing many valuable commercial articles.

Products from a Bale of Seed Cotton.

(Adapted from Grimshaw.)



Not all of the cotton seed crop is fed upon the farm, sold to the mills, or used as seed for planting. Much of it is applied to the land as a manure in those sections of the State where the soil has become worn and thin, but the amount of seed sent to our oil mills yields enough cottonseed meal to more than supply our domestic demand for meal to feed cattle. Large quantities of cottonseed meal are exported through Galveston and New Orleans ports, while many train loads are shipped to Northern and Western markets, to be fed for beef and milk production. Curiously enough, we also export from the State grass-fed and half-fat cattle in large numbers that should be brought into contact with this but little utilized and rich supply of Texas feed. This exported cottonseed meal represents soil fertility as well as waste stock food, and it must be replaced within the

next few years if we longer continue the wasteful practice of shipping out the two forms of raw material here referred to, and that should be sent to the market as well as fatted Texas cattle.

FERTILIZING VALUE OF SEED.—The seed from each bale of cotton contain fertilizing elements valued in the Eastern markets at \$6.08 per ton merely for the plant food contained in such seed.

1000 Pounds of Cotton Seed Contain

31.3 lbs. nitrogen, valued at 15c. per pound.....	\$4.69
11.7 lbs. potash, valued at 07c. per pound .....	.82
12.7 lbs. phosphoric acid, valued at 04.5c per pound. ....	.57

Total pounds—55.7

Total value—\$6.08

This statement shows us that ordinarily seed sell for less than their fertilizing value. Nitrogen is the most valuable fertilizing element in the seed, and carefully conducted experiments have shown that *when feeding fattening stock all but four per cent. of the nitrogen in the feed is recovered in the dung.* Much other manurial matter in the urine is also retained upon the farm where feeds are fed, but under ordinary conditions not all of the manure can be saved and applied to the cultivated lands. Estimating the recovered manure at one-third of its total volume (this can be secured during the winter season) the manurial value of an average ton of seed used in feeding is \$4.00, or one-third of its full theoretical value (\$12.16). Equal to \$6,000,000 worth of fertilizing elements found in the annual 15,000 ton seed crop of this State, and that may be retained if seed are fed and manure applied to land.

Sorghum Hay in Texas.—In addition to our very large supply of cottonseed feeding materials, our State annually produces a large amount of hay that is fed upon our farms and ranches, but this is barely sufficient in amount to supply our domestic demands. Sorghum is probably the most popular and most extensively cultivated hay in the State, since this crop thrives upon nearly all soils and our people are thoroughly familiar with its production. The yield per acre, in many instances, is four and five tons per annum. Because of its popularity and wide distribution, it was agreed to use some sorghum hay in these experiments as a partial substitute for the cottonseed hulls fed, to note its effect and determine the comparative value of these two materials. *The results of the trial were favorable to the use of sorghum hay,* and its consumption should be largely increased by those who live upon farms and have annually a few head of cattle that may be fattened and sold at better prices than straight cattle can be expected to bring.

The sorghum hay was grown upon the Station farm from seed sown broadcast at the rate of $2\frac{1}{2}$ bushels per acre, cut when the heads were just appearing throughout the crop. The hay was a well cured, bright grade of sorghum. The actual yield per acre over the field was 3.195 tons.

A statement showing the very low cost of sorghum hay is presented from our accounts for 1898, with this crop on 46 acres.

Cost of Sorghum Hay—46 Acres, 1898.

Sorghum hay, 46 acres.			
To preparation and seeding—	20½ days, man and team.....	@ \$2.00	\$ 41.00
	2½ days, man and team.....	@ 2.50	6.25
	2 days, one man sowing.....	@ 1.00	2.00
	3½ days, man and team.....	@ 2.50	8.75
	1 day, two men and team.....	@ 3.00	3.00
	½ day, man and team.....	@ 2.50	1.25
	75 bushels sorghum seed, @ \$1.00 per bu.....		75.00
To cultivation—	4 days, man and team.....	@ 2.00	8.00
To harvesting—	2½ days, man and team.....	@ 2.50	6.25
	8 days, man and team.....	@ 2.00	16.00
	15 days, 6 men and team.....		135.00
Total cost.....			\$302.50

Yield, 147 tons.

Cost per ton (excluding rent), \$2.05.

The Value of Kaffir Corn: Many inquiries are received at the Station concerning the value of Kaffir corn for steer feeding, and, by reference to carefully conducted experiments of the Kansas Station, we find that for feeding steers, crushed Kaffir corn is nearly equal in value to corn meal, and that the red and white varieties have nearly the same feeding value, as shown by the following statement:

FEEDING KAFFIR CORN MEAL AGAINST CORN MEAL TO STEERS.—175 DAYS.

(Kansas Station.)

Feed.	Average weight at beginning.	Feed Eaten.		Average gain per steer.	Feed for 100 pounds gain.	
		Grain.	Roughage.		Grain.	Roughage.
Lot I, corn meal.....	lbs. 1,036	lbs. 16,271	lbs. 9,297	lbs. 326	lbs. 997	lbs. 569
Lot II, red Kaffir corn meal.....	1,021	16,271	10,300	299	1,086	688
Lot III, white Kaffir corn meal.....	1,025	16,271	10,828	313	1,041	692

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The Feed Value of Cotton Seed and Its Products.

Many doubts exist in the minds of Southern feeders and farmers as to the exact value of cotton seed and cotton seed products for our several classes of live stock. Out of a vast deal of matter published upon the right use of these materials much of it is now out of print, and cannot be had at any price. In this report we summarize a large part of the work done upon this subject.

In the preamble to the Act of Congress, under which the experiment stations in the several states were established, the reasons for creating these stations are briefly indicated in the following: "*That in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and application of agricultural science, there shall be established * * * a department to be known and designated as an 'Agricultural Experiment Station.'*" During December of 1898 we made a statement through agricultural papers of the State requesting that the practical feeders of Texas contribute in a brief form the substance of their experience, as feeders of cotton seed, etc., with the promise that such experiences would be printed in substantial form and distributed throughout the State, free of cost.

EXPERIENCE OF FEEDERS AND FARMERS: The suggestions presented in the form of letters, appearing in the following pages, bear the names of some of our well-known stockmen and feeders, as well as others who are small farmers, and who raise stock incidentally for the purpose of consuming the hay and cotton seed raised upon their farms. The facts and suggestions presented are not only interesting, but many of them are intensely practical, and will, we hope, prove of lasting value. In view of the fact that many of the feed stuffs available in the State are comparatively new to our feeders, we feel justified in sending out this rather informal statement of information and experiences of practical stockmen, and we hope that prejudice existing against the use of SOUND COTTON SEED or SOUND MEAL derived from sound seed for feeding CATTLE, HORSES, SHEEP AND POULTRY may be set aside by the testimony of those who have fed these feeds safely.

We are under obligation to those who have exhibited a spirit of liberality and a disposition to extend the present bounds of our information upon feeding subjects and who have willingly contributed the subjoined matter. Much liberty has been taken with these letters to "boil them down," and to reduce the cost of publication. Some valuable statements appearing in the agricultural press are also presented; because of their clearness.

In attempting to present this matter in popular form, we appreciate its difficulties, as facts must be stated in a discursive rather than in an exhaustive form. It is hoped that the subject will soon be developed beyond its present stage, and that the few conflicting statements here presented may result in agitation and a general study of the feeding problems of our State through the agricultural papers, and otherwise, until the clouds surrounding the economic use of cotton seed and its products for various forms of live stock will be removed.

STATION EXPERIMENTS: The experiment stations in the United States and those of foreign countries have tested carefully the value of cotton seed meal in many respects. The stations of the Southern States have also fed experimentally both the seed and the cotton seed hulls in numerous instances under carefully controlled conditions that have been faithfully reported. Other important work yet remains to be done, and these matters should receive early attention. We summarize the results of a large number of these "station investigations" for the benefit of our readers. We are better enabled to do this through the carefully compiled statements of Kilgore appearing in "The Cotton Plant," published by the U. S. Department of Agriculture in 1896. Recent investigations by the Texas and other stations we have specially prepared for this report. We have taken the liberty to use only those results that appeared most applicable to Southwestern conditions.

The experience of feeders and investigations by the stations are presented under the several forms (1) beef feeding, (2) hog feeding, (3) feeding sheep, (4) feeding milk cattle and young stock, (5) horses, (6) poultry, (7) how cotton seed may affect the health of stock.

In order to receive complete and full information concerning the experience of some of the parties whose names appear in these letters, it may be necessary to write to them, asking specific questions upon points that do not seem clear.

1.—SEED AND MEAL FOR BEEF CATTLE.

No. 1. FEEDING RAW SEED, HAY, AND BRAN: My own experience has been in feeding raw seed to cattle and goats. I have fed in self-feeding troughs, but have discarded them, and only feed what seed the stock will eat up clean. I also feed hay at same time. I had some trouble last winter in having Aberdeen Angus bulls, purchased in Kansas, to eat seed. Had to mix with bran. This winter they eat clear seed freely, and are improving every day. Where I am located, cotton seed is cheaper than meal and hulls on account of freight, hauling, etc. My seed costs from \$6 to \$7 per ton at gin. My experience in feeding seed is that it is a valuable feed for cattle and goats, and stock roughed through the winter on seed gain very rapidly when turned to pasture in the spring."

Columbia.

F. N. BULLOCK,

Breeder Aberdeen Angus Cattle.

No. 2. COTTON SEED AND HAY, FOLLOWED WITH COTTON SEED MEAL: "I have fed cattle in Texas every year for the last twenty odd years. This is now my method: Beginning the first of December, I put out cotton seed in troughs in prairie pastures the cattle are running in, and keep the cotton seed in the troughs during the month of December. First of January I put the cattle in pen and feed prairie hay and cotton seed until first of April. The latter part of March mix a little cotton seed meal with the seed to learn the cattle to eat it. First of April turn the cattle on prairie pasture and give them half feed of meal—feeding once a day for two months, when they are always full fat."

Wharton County.

G. C. DUNCAN.

No. 2. PROFITABLE FEEDING: An interesting record of feeding a lot of high grade dehorned steers bought by A. B. Armour recently appeared in the "Drovers' Telegram." The cattle were fed 98 days near Kansas City, the feeding directed by Mr. William Cummings, "who feed twice a day at the same time each day to the minute." The "Drovers' Telegram" gives the report as follows:

"PURCHASE AND SALE.

Bought 118 head, averaging 1,232½ lb @ \$4.60; total, \$6,687.94.

Sold 118 head, averaging 1,531½ lb @ \$5.49; total, \$9,921.40.

The gain in price per 100 pounds was \$9c.

The cash gain in all was \$3,233.46, out of which all expenses had to be paid.

The average gain per head per day was 3 lb.

EXPENSE ACCOUNT, SHOWING RATIONS.

Hay, average 2½ lb each per day.....	\$ 98 86
Chop, averaging 22½ lb each per day.....	1,536 72
Oil meal, averaging 2 1-25 lb each per day.....	254 08
Wages, average cost 1c. each per day.....	109 00
Sundries	4 85
Total cost.....	\$2,001 51

The total average amount of feed per head per day was 26 $\frac{3}{4}$ lb.

The total average cost of feed per head per day was 16 $\frac{3}{4}$ c.

Total average cost per head per day, including all expenses, was 17 $\frac{3}{4}$ c.

The total net gain and profit for the 118 head fed 98 days was \$1,231.95.

The net gain during the period of feeding was \$10.44 per head.

Points to consider: Feeders were high-class and cost high average price. Cattle were sold on a good market. Gain per day was unusually good. Cost of feed would be different, and probably less, in other localities."

Dallas.

Texas Stock and Farm Journal.

No. 4. FIRST PRIZE STEERS: "When Mr. Marion Sansom, of Alvarado, Johnson county, sold his steers on the Chicago market for 6c., all the people interested in feeding cattle opened their eyes. It was proof of what can be done in Texas, and what has been urged on the Texas farmer all along. All the agricultural and stock journals have referred to this sale, and Mr. Sansom has had requests for an explanation of his methods of feeding, but up to this time he has not given it to the public. To a representative of the "Farm and Ranch," Mr. Sansom stated that: 'Some of the cattle I raised and some I bought. They were all from this and adjoining counties. They were all high-grade Durhams, and aged three years when marketed. Their average weight was 1,543 lb, and they sold for \$6 per 100 lb, and dressed 63.84%. The cattle were put on feed September 1st, 1898. The first ration was *cotton seed hulls and shelled oats*, and this was kept up for 40 days, at the end of which time *the oats were left off and 2 pounds of cotton seed meal given*. This meal ration was gradually increased until it reached 5 pounds by January 1st, 1899, at which date I began giving 2 pounds corn meal, which was increased to 5 pounds, *making 10 pounds daily, half of which was cotton seed meal and the other half corn meal*. This last ration was kept up until cattle went out, March 13th. The meal was mixed with cotton seed hulls from the beginning, giving them all of the hulls they would eat, generally ranging from 30 pounds to 38 pounds. Prairie hay was also fed during the last two months'.

"Mr. Sansom said that the report that the price paid for these steers was a record-breaker was a mistake. The price was 25% better than was paid for any native cattle that day. As a matter of fact, old cattlemen remember that between 1881 and 1884 prices for Texas cattle at Chicago were higher than 6c. The sale was remarkable, however, because it demonstrated that blood and care in handling and raising cattle for market are two things necessary to success.

"Mr. Sansom took first prize at the Fort Worth fat stock show with this same lot which was sold in Chicago, and while at Fort Worth the animals were universally admired."

Dallas.

Texas Farm and Ranch.

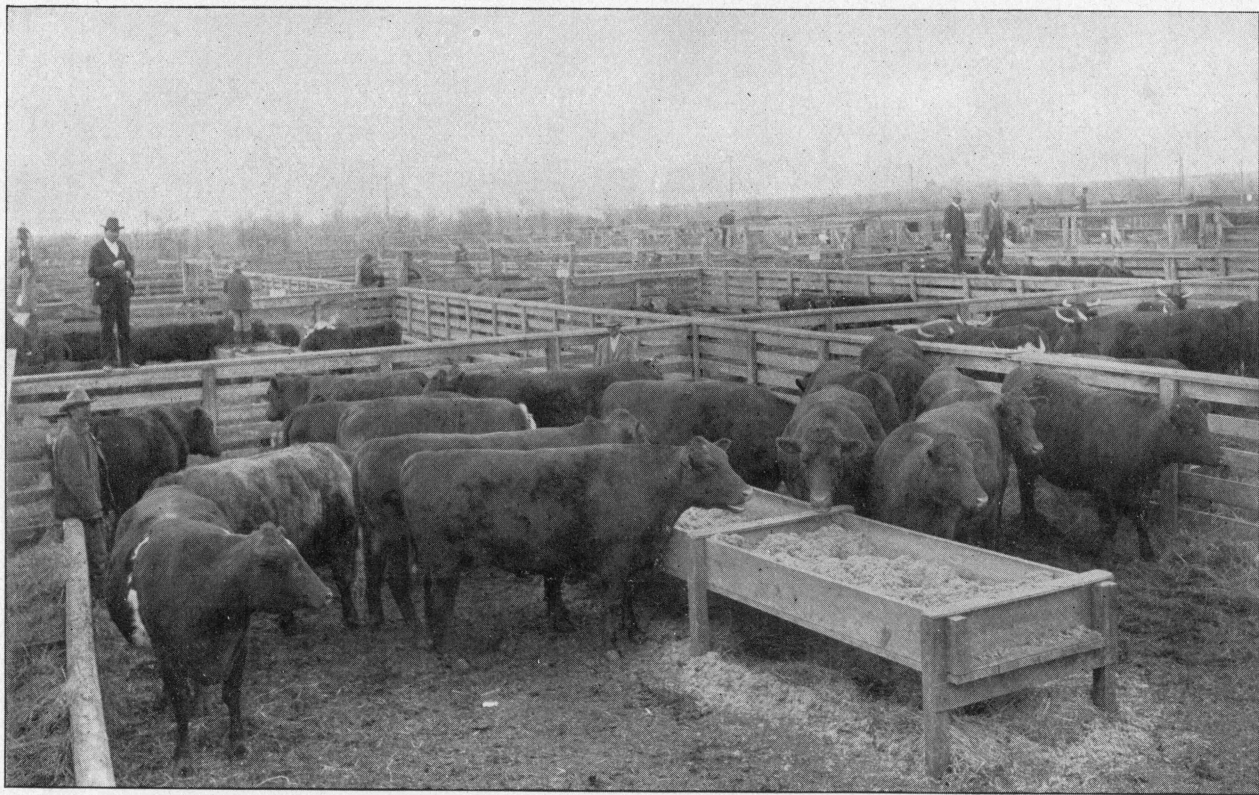
No. 5. CRUSHED SEED AND CORN MEAL: "I have had but little experience in feeding cotton seed in any shape except raw, though I have used some ground and fed them to cattle, mixed with cotton meal, which is better than the raw seed. Have never fed them to hogs or horses."

Centralia.

R. A. WALTON.

No. 6. COTTON SEED MEAL AND WHEAT BRAN IN WEST TEXAS: "Our people of this section know nothing of cotton seed meal and hulls, more than learned at the different mills where they have at times taken cattle to fatten. There are no oil mills in this section, and hence the people have no chance to experiment.

"But we have gins, and ours is one of the best hay producing countries in the State, and we have our mills also. And our people are perfectly satisfied with the results they get from the whole cotton seed, with wheat bran mixed among them, and then plenty of hay or sorghum. Our seed we get for 10c. per bushel, and our bran for 65c. to 80c. per 100. Hay generally six to eight dollars per ton.



A Pen of Prize Winning Texas Steers.—Property of M. Sausom, Alvarado, Texas.

"Parties who have taken cattle to oil mills to feed are now feeding as above, and prefer it to meal and hulls. Cotton seed has not been tried here in any form for horses, hogs nor poultry. But for feeding cattle, we are perfectly satisfied with the above ration, and will never complain of anything so long as we get three cents for our cattle, after paying railroad freight and commission, even with feeders at present prices."

Burnet.

GUS GROVE.

No. 7. COTTON SEED MEAL: My experience is not very great in feeding meal to any kind of stock (it being a new feed comparatively), but I do know that if the meal is fed in too large a quantity to any kind of stock it is injurious. The meal should in all cases be well mixed with the hulls in proportion of about a pint of the meal to a heaping half a bushel of hulls. Too much meal will cause any kind of stock to scour, and frequently leave a cough, as if choked. Cattle and horses, both, generally refuse to eat meal and hulls at first unless they are very hungry, but will soon prefer it to other feed."

Near *Bryan.*

WM. B. ROYALL.

No. 8. AN OIL MILL RATION OF HULLS AND MEAL: "Our experience in feeding cotton seed meal and hulls to cattle is that it should be fed in the proportion of four pounds of hulls to one pound of meal as a maximum. When cattle first go on feed, we usually feed about six pounds of hulls to one pound of meal, and gradually increase the amount until the maximum is reached. We have never fed meal to horses, mules, sheep, or poultry.

Corsicana.

H. L. SCALES,

Sec'y and Gen. Mg'r Corsicana Cotton Oil Co.

No. 9. HULLS, MEAL AND ENSILAGE: "We have fed beef cattle, cows, and yearlings here for three years on ensilage and cotton seed hulls, and think our best results were from cotton seed hulls and meal."

Sulphur Springs.

ROGERS & FURNEY.

No. 10. A RATION FOR GROWING CATTLE WANTED: "In all of your experiments, you have fed, I believe, aged steers. I am feeding some well bred steers, Hereford grades, yearlings past (calved in '97). I have been feeding about 5 lb hulls to 1 lb meal, but they do not seem to fatten as rapidly as they should—appear to be growing. In this case, do you not think a large proportion of meal would be better, and more expensive, of course, but causing more rapid fattening?"

Wolfe City.

GEORGE WOLF HOLSTEIN,

Pres. and Treas. Hunt Co. Oil Mill.

REPLY: *Doubtless a larger proportion of cotton seed meal, fed in combination with hulls, will prove beneficial to young cattle, because they require more bone making and muscle making material. Cotton seed meal supplies these, while they are largely lacking in the hulls.*

Wheat bran can be profitably and safely employed in nearly all such cases, because the bran is more safely digested by the calf, or yearling, than is the full grain ration consisting of cotton seed meal alone. However, if bran is not available, cotton seed meal might be fed with hulls, combined as one to three.

J. H. C.

No. 11. MEAL AND HULLS FOR WORK OXEN: "We are not feeding any cotton seed meal now, and have not done so for several years. We used to feed our

work oxen on it, but it seemed to make them too fat and unfit for the hot weather as work steers."

Olive.

OLIVE, STERNBERG & Co.,
M'f'rs Long Leaf Yellow Pine.

No. 12. RATIO OF HULLS TO MEAL: "My experience is confirmed by your paper (bulletin), namely, the proper proportion to feed hulls and meal is as 5 to 1, though I begin at 7 or 8 to 1 and wind up at 4 to 1, so that my average is as stated."

Cleburne.

M. M. PITTMAN,
M'f'g'r Cotton Seed Oil, Meal, Hulls and Lint.

No. 13. HULLS, MEAL AND CORN MEAL: "In regard to feeding cotton seed meal and hulls, feeders differ as to the amount of meal to feed, but all agree that steers should be given all of the hulls they will eat. I have secured best results by feeding 3 lb cotton seed meal the first 15 days, then for the next 15 days 4 lb; for the next 30 days, 5 lb meal per day, and for the balance of the time give 6 lb. Hay, corn shucks, or straw (after they have been on feed 50 or 60 days) is a benefit to them. To carry them on long feed, should add two or three pounds corn meal after they have been on feed 60 days."

Fort Worth.

E. B. HARROLD.

No. 14. CORN, OATS, AND COTTON SEED RATIOS: "I send you a brief statement of my experience with a small bunch of graded short horns, but I am anxious to secure information as to the value of corn and oats as feed.

"I have watched the feed pens at this place where two to three thousand cattle are fed each year on cotton seed hulls and meal, and believe that this makes more fat for the same cost than anything else for feed, but I have wintered calves that were well fed on this ration and when they were ready to turn out on grass they were seal fat—but one died during the summer, though the grass was good. Another, fed at the same time, died the next summer, and the other two did not thrive, and are dwarfs in the herd now. The two that died ran in feed lots with the steers some 100 to 110 days; the other two had pretty fair feed, and had the hay they wanted. The two that died, however, had nothing but meal and hulls as their ration. *If the fact could be established that corn meal or oats are desirable feeds, we could then hope to decrease the cotton acreage, as this would be at least one step in that direction.*

Corsicana.

JOHN S. GIBSON.

No. 15. HULLS AND MEAL TOPPED WITH CORN MEAL: The following very clear financial statement has been received from Mr. G. E. King, of Taylor, Texas, with reference to 2,082 head of the Lucas and King cattle fed at the oil mill near Bryan, Texas, between November 10th, 1898, and April 23rd, 1899. The cattle were not all placed on feed at once, nor were all shipped at the same time, but the average time for which the steers were on feed was 126 days:

"Total weight and cost of feed consumed per steer:

C. S. Meal, 606 lb @ \$15.....	\$ 4.545
Cotton seed hulls, 3,190 lb @ \$3.....	4.785
Corn meal, 140 lb @ \$15.....	1.05

Total cost of feed per steer.....\$10.38

Length of feeding period, 126 days.

Average daily ration per steer:

Cotton seed meal.....	4.80 lb
Cotton seed hulls.....	24.50 lb
Corn meal.....	1.10 lb

N. B.—The corn meal was fed during the last 40 days only at rate of $3\frac{1}{2}$ lb per day.

Gains and cost, 126 days:

Average of original weights.....	725 lb per steer.
Net gain during 126 days.....	245 lb per steer.
Market weight of steers.....	970 lb per steer.

Gain per day per steer, 1.94 lb.

Cost per pound to fatten, 4.24c.

The estimated cost for feeding expenses, including such items as labor and camp provisions, are \$1 per head for the feeding season.*

Taylor.

GEO E. KING.

COTTON SEED MEAL USED BY KANSAS FEEDERS.

The following interesting statements bearing upon the use made of COTTON SEED MEAL and of SORGHUM HAY in the State of Kansas is taken from "The Beef Steer and His Sister" (Kansas Agricultural Department, F. D. Coburn, Topeka, Secretary), and will prove of value to some feeders. Not only is COTTON SEED MEAL, now shipped to Western and Northern markets and fed freely, but vast quantities are exported, as shown in the statement appearing at the bottom of this page.* In addition to these facts the hulls are now meeting with a ready sale in many Northern localities. In cities they are largely used as a substitute for hay in feeding milk cows, while through the important distilling districts the hulls are mixed freely with distillery slops (rich in protein), and form a valuable ration for thousands of well bred steers.

No. 1. SOAKED CORN, WHEAT MEAL AND C. S. MEAL: "My best gain was made on a daily ration of 12 pounds of soaked corn, 4 pounds wheat meal, and 4 pounds cotton seed meal, with timothy and prairie grass pasture. The cattle—180 head of mixed grades, three and four years old—averaged 1,300 pounds at the beginning, May 1, and gained $3\frac{1}{2}$ pounds per day for the next two months."

El Dorado, Kansas.

J. W. ROBINSON.

*The bulk of the cotton seed products exported from Texas are sent through the port of Galveston, about 15 per cent going through New Orleans. Over 50 per cent of the cake and meal and about one-sixth of the cotton seed oil exported from the United States is sent via Galveston. Following is a statement of the exports of cotton seed products exported through Galveston during the fiscal year ending June 30, 1899, which covers the crushing season of 1898-99 (compared with previous years):

Cotton seed meal and cake—	Pounds.	Value.
Germany.....	341,185,411	\$ 2,905,647
Netherlands.....	80,638,251	682,402
Belgium.....	3,858,600	31,569
France.....	9,203,720	75,762
England.....	38,194,722	311,868
Denmark.....	75,577,242	627,001
Cuba.....	16,000	145
Italy.....	1,336,100	12,537
Ireland.....	455,438	4,060
Total, 1898-99.....	550,465,484	\$ 4,650,591
Total, 1897-98.....	496,467,998	4,284,039
Total, 1896-97.....	310,492,948	2,824,948
Total, 1895-96.....	207,790,667	2,086,721
Total, 1894-95.....	246,940,443	2,281,973

—Galveston News.

No. 2. WHEAT STRAW AND C. S. MEAL: "I prefer to grind the husk, cob, corn and all for starting, and for finishing add one-half shelled corn. I also find from 1 to 4 pounds of linseed oil-cake meal very beneficial. Cotton seed meal is an excellent adjunct to other feed, used with care. I have good results from feeding it and wheat straw alone, allowing about 8 pounds of meal to the steer. I do not keep grain constantly accessible, but give twice a day just what they will clean up."

Wellsville, Kansas.

CAREY MCLAIN.

No. 3. BRAN WORTH ONE-THIRD THE VALUE OF C. S. MEAL: "When wheat bran and corn sell for the same price per pound, it is profitable to use 4 or 5 pounds of bran per day for fattening. When corn is 25c., the feeder is justified in using 3 or 4 pounds a day of bran at \$6 a ton, or cotton seed or old-process linseed oil-cake meal at \$18 a ton. The 'rough' feed given to fattening cattle on grain should be rich, and of good. Well-made timothy and clover hay, preferable with a large proportion of clover, should be given in abundance with corn."

Newman, Kansas.

J. F. TRUE.

No. 4. CORN MEAL AND C. S. MEAL RATION: "On a car-load or more of cattle, my gain has been about 3 pounds a day in March, April and May, with 1,200 pound four-years-olds, of range grades crossed up from Texas. These were fed in open lots sheltered by bluff and timber, and given 28 pounds of corn meal and 4 pounds of cotton seed meal night and morning. When ready for market, I keep the cattle from water on the day of shipment, bed the cars with sand, straw or old hay (not cinders), and put as many in a car as can comfortably stand side by side."

Peabody, Kansas.

THOS. H. POTTER.

No. 5. GROUND WHEAT AND CORN MEAL COMBINED WITH C. S. MEAL: "If corn is ground it should be with the cob; that makes it more bulky than clear meal, and cattle do not scour on it so badly. Have fed snapped corn with equal success when I had plenty of hogs to follow the steers. I used wheat bran with corn, but it cost me more per hundred than the corn, and I did not think it paid. I also tried cotton seed meal with ground wheat, mixing them half and half, but the results were not satisfactory. I feed, however, 3 to 5 pounds a day, with corn, with good results. Linseed oil-cake did better, however; the cattle seemed to eat more regularly when I mixed this with their corn meal, and gave larger gains and profits than on any other feed. Have given as much as 14 pounds daily, but found that too expensive; 1 to 5 pounds of oil meal per steer is about right when it is \$20 per ton and corn is 25c. per bushel."

Bucyrus, Kansas.

D. H. HEFLEBOWER.

No. 6. EQUAL PARTS LINSEED MEAL AND C. S. MEAL: "I fed a bunch of cattle on pasture 6 pounds of cotton seed meal and 6 pounds of linseed oil-cake meal daily with excellent results. The last month I added 14 pounds of ground corn to the above, and made ripe, finished cattle. I did this when corn was worth 40c. per bushel, cotton seed meal \$16, and linseed oil-cake \$18 per ton."

Baileyville, Kansas.

H. W. BAILEY.

No. 7. FEEDING 15,000 STEERS: "Our figures of gain have always been made on the entire number of cattle from the average time received at the farm to the average time sold in Chicago. These cattle, as stated, have been principally

westerns and Texans, and have included a very considerable portion of cows of all ages, as we have made a practice of taking our thinnest and poorest old cows from the range. The following is a table of gains made on our cattle, showing a very small net gain as compared with the gains made by feeders with select bunches of steers:

TABLE SHOWING THE COST OF KEEPING CATTLE, FOR FOOD AND LABOR.

Seasons of 1894-95, 1895-96 and 1896-97.

Items.	1894-'95.		1895-'96.		1896-'97.	
	Quantity per head	Cost	Quantity per head	Cost	Quantity per head	Cost
Corn and corn chop.....	28.3 bus.	\$ 12.13	40.7 bus.	\$ 7.19	69.1 bus.	\$ 8.55
Corn and oat chop.....	.3 "	.09	8.6 "	2.17	.2 "	.03
Bran.....	6.1 "	2.44	5.2 "	1.59	2.3 "	.46
Oil-cake.....	7.6 "	4.27	3.7 "	1.67	.7 "	.37
Hay.....	.6 ton	3.61	.4 ton	.63	.7 ton	.78
Stover.....					1.1 "	1.55
Forage beets.....		.12		1.24		.71
Ensilage.....		.03		.07		.10
Salt.....		.03		.02		.04
Wheat.....	4.1 bus	2.13				
Peas.....						.04
Barley.....					7 bus.	.17
Total food.....	46.4 bus.	\$ 24.85	58.2 bus.	\$ 12.48	73.0 bus.	\$ 12.80
Total hay and stover.....	.6 ton		.4 ton		1.8 tons	
Labor.....		1.71		2.55		1.67
Coal and gasoline.....		.24		.16		.35
Oil.....						.02
Insurance.....		.21				
Horse forage.....		.33		.45		.23
Total labor.....		\$ 2.49		\$ 3.16		\$ 2.27
Total food and labor.....		\$ 27.34		\$ 17.74		\$ 15.07
Average number of days fed	152		171		215	

Year.	Number of cattle marketed.	Number of days fed.	Average weight of cattle when received.	Average weight of cattle at market.	Average gain, lbs.
1894-'95.....	5,897	152	1,073	1,290	217
1895-'96.....	3,775	171	1,154	1,392	238
1896-'97.....	5,454	215	1,066	1,304	238

TABLE SHOWING THE COST OF FOOD AND LABOR PER HEAD, AND COST OF GRAIN PER HUNDRED, AND CORN PER BUSHEL, FOR ESTIMATING PROBABLE COST.

Year.	Number of cattle.	No. of days fed.	Cost of food.	Cost of labor.	Total cost.	Cost of corn per bushel.	Cost of corn per hundred.	Cost of oats per hundred.	Cost of oil cake per hundred.	Cost of bran per bushel.	Wheat and Barley per hundred.	Cost of all grain per hundred.	Per cent. of corn to all grain.
1886-'87.....	5,417	151	\$14.09	\$3.49	\$17.58	\$0.28	\$9.50	\$0.60	\$0.92	\$0.41	.....	\$9.51	75
1887-'88.....	5,586	202	25.28	3.01	28.29	.35	.62	.48	.96	.61	.....	.63	89
1888-'89.....	4,296	180	15.34	3.02	18.36	.35	.44	.54	.83	.46	.....	.47	87
1889-'90.....	6,033	197	15.40	2.17	17.57	.18	.32	.41	.88	.41	.....	.35	83
1890-'91.....	7,298	222	32.29	2.33	34.72	.46	.82	.94	1.12	.71	.....	.89	79
1891-'92.....	2,176	252	25.87	3.27	29.14	.22	.50	.69	1.05	.75	.....	.50	95
1892-'93.....	1,222	126	12.94	2.63	15.56	.25	.44	.....	1.12	.51	.....	.49	93
1893-'94.....	2,579	182	14.46	2.11	16.57	.23	.41	.....	1.11	.80	(wh't)	.46	90
1894-'95.....	5,925	152	25.14	2.49	27.63	.44	.78	.87	1.06	.71	\$0.87	.82	60
1895-'96.....	3,827	171	14.58	3.16	17.74	.18	.32	.44	.80	.54	(Bar)	.39	69
1896-'97.....	5,495	215	12.80	2.27	15.07	.12	.22	.47	.89	.43	\$0.48	.23	95

Ames, Nebraska.

R. M. ALLEN,
Mg'r Standard Cattle Co.

No. 8. SORGHUM HAY FOR STEERS: "Sorghum is, my most profitable crop in quantity and quality of cattle food produced. I give cattle on corn all they will eat of it, with prairie hay and millet for a change, and use it with millet for wintering. Judging from what I hear and see, alfalfa is a very good crop. Rating prairie hay as worth \$2 per ton for feeding to fattening cattle with grain, alfalfa and red clover are worth \$4; alfalfa straw, \$2; millet, sorghum or Kaffir corn hay, and sorghum or Kaffir corn with seed on, are each worth about \$3 per ton; oat straw, \$2, and wheat straw, \$1."

Augusta, Kansas.

I. HAMMOND.

No. 9. SORGHUM FOR WINTERING CATTLE: "Sorghum produces for me the best and largest quantity of cattle food per acre, and cattle (westerners) wintered on it exclusively increased in weight. I consider it an excellent 'rough' feed. The sweet sorghums are best for early winter use, but, later heavy freezing seems to rob the stalks of a great deal of their nutriment."

Black Wolf, Kansas.

E. S. ROOT.

No. 10. BEST VARIETY OF SORGHUM: "The experience of farmers in this section this year shows the great value and necessity of putting out each year at least a few acres of sorghum or Kaffir corn, and in the event of a dry season, such as the past has been, they will both do well, and they can be fed to advantage to all kinds of stock. We farmers do not feel the loss of a corn crop nearly so much if we have a crop of either sorghum or Kaffir corn. I sowed the 'Collier,' to be mowed and put up for hay, and 'Folger' and 'Colman,' put in with a drill, cultivated, and put in shock like corn. My field corn is light, but my sorghums all are very heavy and as fine as I ever saw; also my Kaffir corn."

Thrall, Kansas.

F. G. THRALL.

STATION RESULTS OF FEEDING STEERS ON COTTON SEED, HULLS AND MEAL—continued.

Daily Rations Used.	Days fed.	No. fed.	Average Weights.	Daily gains.
2. NORTH CAROLINA STATION EXPERIMENTS.				
<i>(a.) 3-Year Old Native Steers.</i>				
1. 18.98 lbs. hulls, 4.4 lbs. C. S. meal.....	100	4	942	1.72
<i>(b.) 2-Year Old Steers.</i>				
1. 17.34 lbs. hulls, 3.97 lbs. C. S. meal.....	100	4	855	1.91
2. 17.92 lbs. " 4.66 lbs. " "	84	4	934	1.77
<i>(c.) Mature Steers.</i>				
1. 16.44 lbs. hulls, 8.71 lbs. C. S. meal.....	97	2	1065	1.75
<i>(d.) 2 1-2 to 3 1-2-Year Old Steers.</i>				
1. 13.45 lbs. hulls, 9.08 lbs. C. S. meal	136	2	1009	1.71
3. ALABAMA STATION EXPERIMENTS.				
<i>(a.) 18-Year Old Work Oxen.</i>				
1. 20.78 lbs. hulls, 4.95 lbs. C. S. meal	84	2	1150	1.20
<i>(b.) 2 1-2-Year Old Grade Hol. Steers.</i>				
1. 18.47 lbs. hulls, 4.50 lbs. C. S. meal.....	84	2	751	2.82
4. ARKANSAS STATION EXPERIMENTS.				
<i>(a.) 2 and 2 1-2-Year Old Steers.</i>				
1. 19.24 lbs. hulls, 5.75 lbs. C. S. meal.....	90	2	712	2.74
<i>(b.) Fed to Steers (age not given).</i>				
1. 6.44 lbs. hulls, 4.86 lbs. C. S. meal, 13.9 lbs. cow pea hay.....	90	5	760	2.
5. MISSISSIPPI STATION EXPERIMENTS.				
<i>(a.) Wintering 23 Cows and 1 Bull (Beef).</i>				
1. 9.75 lbs. hulls, 3.75 lbs. C. S. meal.....	135	24	687.9	.0005

RESULTS OF FEEDING COTTON SEED MEAL WITH FEEDS OTHER THAN HULLS.

Daily Rations Used.		Daily fed.	No. fed.	Weight.	Daily gains.
1. TEXAS STATION EXPERIMENTS.					
<i>(a.) 3 and 4-Year Old Texas Steers.</i>					
1.	5.97 lbs. C. S. meal, 22.70 lbs. corn silage, 3.07 lbs. hay.....	83	6	781	2.05
2.	4.39 lbs. " " 20.76 lbs. " " 1.89 lbs. " 8.63 lbs. corn cob meal.....	83	6	906	2.37
3.	5.85 lbs. C. S. meal, 12.95 lbs. corn silage.....	80	6	810	2.30
4.	16.39 lbs. ear corn, 8.09 lbs. hay (<i>check ration</i>).....	83	11	834	2.
<i>(b.) 2 and 3-Year Old Short Horn and Hereford Grades.</i>					
1.	3.59 lbs. C. S. meal, 23.99 lbs. corn silage, 4.22 lbs. corn and cob meal.....	90	4	774	1.82
2.	5.64 lbs. C. S. meal, 37.79 lbs. corn silage, 0.32 pts. molasses....	90	4	831	2.22
<i>(c.) 2-Year Old Steers.</i>					
1.	3 lbs. C. S. meal, 7 lbs. corn meal, 4.36 lbs. hay, 1.20 corn fodder.....	77	2	771	2.11
2.	12 lbs. corn meal, 4.36 lbs. hay, 1.12 lbs. corn fodder.....	77	2	782	1.85
<i>(d.) 3-Year Old Steers.</i>					
1.	4.50 lbs. C. S. meal, 10.50 lbs. corn meal, 6.48 lbs. hay, 1.52 lbs. corn fodder.....	77	2	1256	1.88
2.	17 lbs. corn meal, 6.48 lbs. hay, 1.58 lbs. corn fodder.....	77	2	1270	1.85
<i>(e.) 4-Year Old Steers.</i>					
1.	18 lbs. corn meal, 7.27 hay, 1.65 corn fodder.....	77	2	1384	2.10
2.	4.8 lbs. C.S. meal, 11.19 lbs. corn meal, 7.27 lbs. hay, 1.72 lbs. corn fodder.....	77	2	1335	1.14
<i>(f.) 2 and 3-Year Old Grade Short Horn Steers (first period).</i>					
1.	2.90 lbs. C. S. meal, 6.09 corn meal, 6.60 corn fodder.....	19½	4	925	.96
2.	11.73 lbs. corn meal, 5.11 lbs. corn fodder.....	19½	4	883	1.06
<i>(Second period.)</i>					
3.	2.63 lbs. C. S. meal, 5.27 lbs. corn meal, 8.68 lbs. hay.....	31¼	4	979	1.23
4.	10.46 lbs. corn meal, 7.97 lbs. hay.....	29¼	4	932	1.24
2. PENN. STATION EXPERIMENTS.					
<i>(a.) Western Steers.</i>					
1.	3.95 lbs. C. S. meal, 9.85 lbs. corn meal, 6.27 lbs. corn fodder..	97	2	1214	1.94
2.	15 lbs. corn meal, 6.15 lbs. corn fodder (<i>check ration</i>).....	97	2	1214	1.85
3.	4.12 lbs. C. S. meal, 10.37 lbs. corn meal, 3.50 lbs. corn fodder	49	2	1225	1.43
4.	4.12 lbs. C. S. meal, 10.37 lbs. corn fodder, 8 lbs. hay.....	42	2	1327	2.26
<i>(b.) Pennsylvania Steers.</i>					
1.	4 lbs. C. S. meal, 8 lbs. corn meal, 8.5 corn fodder.....	84	2	1055	1.55
2.	15.65 lbs. corn meal, 5 lbs. corn fodder (<i>check ration</i>).....	84	2	961	1.04
3.	3 lbs. C. S. meal, 6 lbs. corn meal, 3.88 lbs. corn fodder.....	28	4	955	1.74
4.	3 lbs. " " 6 lbs. " " 10 lbs. hay.....	28	4	1020	2.05
5.	12 lbs. corn meal, 9.77 lbs. hay (<i>check ration</i>).....	28	4	1055	1.47
3. MAINE STATION EXPERIMENTS.					
<i>(a.) 5 to 8-Month Short Horn and Hol. Steers.</i>					
<i>(One of each in each experiment.)</i>					
1.	1.16 lbs. C. S. meal, 1.16 lbs. wheat bran, 1.16 lbs. ground oats 9.56 lbs. hay, 8.02 lbs. silage.....	233	3	585	1.65
2.	1.16 lbs. corn meal, 1.16 lbs. wheat bran, 1.16 lbs. ground oats, 9.63 lbs. hay, 7.85 lbs. silage.....	233	3	583	1.64

RESULTS OF FEEDING COTTON SEED MEAL WITH FEEDS OTHER THAN HULLS—continued.

Daily Rations Used.		Days fed.	No. fed.	Weights.	Daily Gains.
<i>(b.) 18-Month Old Steers.</i>					
1.	3.50 lbs. corn meal, 12 lbs. hay.....	69	1000000	742	.61
2.	1.55 lbs. C. S. meal, 2 lbs. corn meal, 12 lbs. hay.....	69	1000000	802	1.15
3.	3.50 lbs. corn meal, 12 lbs. hay.....	69	1000000	908	.11
4.	2 lbs. C. S. meal, 5 lbs. corn meal, 10 lbs. hay.....	69	1000000	839	1.80
5.	2 lbs. " " 3 lbs. " " 12 lbs. oat straw.....	69	1000000	781	1.08
4. WOBURN (ENGLAND) STATION EXPERIMENTS.					
<i>(a.) Feeding Bullocks.</i>					
1887-8. (Coarse fodder, straw, chaff, and roots) alike to all.					
1.	3 lbs. decorticated cotton seed cake, 3 lbs. linseed cake, 3 lbs. corn meal.....				2.65
2.	3 lbs. bean meal, 3 lbs. oats, 3 lbs. barley.....				2.35
1889-'90.					
1.	4.33 lbs. decorticated C. S. cake, 4.34 lbs. linseed cake, 13.73 lbs. hay chaff, 4.18 lbs. roots.....				3.12
2.	2.12 lbs. decorticated C. S. cake, 2.17 lbs. linseed cake, 15.49 lbs. hay chaff, 44.27 lbs. roots.....				2.54
1888-'89.					
1.	2.3 lbs. decorticated S. C. cake, 2.88 lbs. linseed cake, 4 lbs. barley.....				2.21
2.	3.3 lbs. undecorticated C. S. cake, 2.88 lbs. linseed cake, 4 lbs. barley.....				1.97
1890-'91. (Coarse fodder, hay, chaff, and roots) alike to all.					
1.	5.03 lbs. decorticated C. S. cake, 3 lbs. linseed cake, 1 lb. barley.....				2.38
2.	5.07 lbs. undecorticated C. S. cake, 3 lbs. linseed cake, 1 lb. barley.....				1.84
1878-9. (Coarse fodder, roots and wheat chaff, alike to all.)					
1.	7.69 lbs. decorticated C. S. cake, 7.88 lbs. corn meal.....				2.32
2.	13.92 lbs. linseed meal (check).....				2.29
1880. (Corn fodder, hay, chaff, wheat chaff, roots), alike to all.					
1.	7.7 lbs. decorticated C. S. cake, 7.7 lbs. corn meal.....				2.60
2.	15.4 lbs. linseed cake (check).....				2.12
1880-1. (Corn fodder, hay chaff, and mangle-worzels) alike to all.					
1.	9.48 lbs. decorticated C. S. cake, 9.48 lbs. corn meal.....				2.63
2.	17.18 lbs. linseed cake.....				1.64
5. MARYLAND STATION EXPERIMENTS.					
<i>(a.) 3-Year Old Grade Short Horns.</i>					
1.	2.50 lbs. C. S. meal, 12.20 lbs. corn fodder, 9.36 lbs. corn and cob meal, 0.50 pts. molasses, 1.25 lbs. corn meal, 9.33 lbs. roots.....	90	4	1113	2.78
2.	11.50 lbs. corn fodder, 10.90 lbs. corn and cob meal, 0.27 pts. molasses, 9.33 lbs. roots.....	90	4	1062	1.70
6. MISSOURI STATION EXPERIMENTS.					
<i>(a.) 2-Year Old Short Horns.</i>					
1.	1.36 lbs. C. S. meal, 2.66 lbs. wheat bran, 2.32 lbs. hay, 53.2 lbs. silage, 0.09 lbs. straw.....	49	3	991	1.49
2.	1.36 lbs. C. S. meal, 2.66 lbs. wheat bran, 4 lbs. hay, 2 lbs. straw, 12.68 corn fodder.....	49	3	985	1.34
7. VIRGINIA STATION EXPERIMENTS.					
<i>(a.) 3 1-2-Year Old Steers.</i>					
1.	6 lbs. C. S. meal, 6 lbs. wheat bran, 9.07 lbs. hay.....	35	12	1273	.86
2.	6 lbs. " " 6 lbs. " " 7.43 lbs. " 10 lbs. silage.....	28	12	1327	.86
3.	4 lbs. " " 6 lbs. " " 15. lbs. roots.....	35	12	1277	.90
4.	6 lbs. corn meal, 6 lbs. " " 9. lbs. hay.....	35	12	1253	.80

STATION RESULTS OF FEEDING STEERS ON COTTON SEED WITH OTHER FEEDS.

Daily Ration Used.	Days fed.	No. fed.	Average Weights.	Daily Gains.
1. TEXAS STATION EXPERIMENTS.				
<i>(a.) Old Cows.</i>				
1. 4.74 lbs. boiled cotton seed, 4.02 lbs. C. S. meal, 11.93 lbs. silage, 6 lbs. corn fodder.....	48	8	788	2.67
<i>(b.) 3 and 4-Year Old Texas Steers.</i>				
1. 9.19 lbs. boiled cotton seed, 20.19 lbs. silage, 2.30 lbs. hay.....	83	6	863	2.08
2. 7.15 lbs. raw cotton seed, 18.80 corn silage, 2.36 lbs. hay.....	83	6	901	1.80
3. 16.39 lbs. ear corn, 8.09 lbs. hay.....	83	11	834	2
<i>(c.) 4 and 6-Year Old Texas Steers.</i>				
1. 5.45 lbs. raw cotton seed, 11.68 lbs. corn silage, 16.15 lbs. corn and cob meal.....	79	9	747	2.87
2. 4.33 lbs. boiled cotton seed, 15.33 lbs. corn and cob meal, 7.49 lbs. hay.....	79	3	773	2.95
<i>(d.) 2 and 3-Year Old Texas Steers.</i>				
1. 6.68 lbs. roasted cotton seed, 4.06 lbs. corn and cob meal, 3.71 lbs. hay.....	83	12	619	2.26
2. 7.89 lbs. boiled cotton seed, 5.10 lbs. corn and cob meal, 3.38 lbs. hay.....	83	12	633	2.28
3. 5.50 lbs. raw cotton seed, 5.07 lbs. corn and cob meal, 4.26 lbs. hay.....	83	12	586	2.07
4. 13.02 lbs. corn and cob meal, 5.39 lbs. hay (<i>check ration</i>).....	83	12	604	1.89
<i>(e.) 2 and 3-Year Old Short Horn and Hereford Grades.</i>				
1. 3.59 lbs. C. S. meal, 23.99 lbs. corn silage, 4.22 lbs. corn and cob meal (<i>check ration</i>).....	90	4	774	1.82
2. 5.64 lbs. C. S. meal, 37.79 lbs. corn silage, 32 pints molasses.....	90	4	831	2.22
2. ARKANSAS STATION EXPERIMENTS.				
<i>(a.) 2 1-2-Year Old Steers.</i>				
1. 3.40 lbs. raw cotton seed, 14.48 lbs. cow pea vine hay.....	90	2	718	1.92
2. 3.44 lbs. raw C. S., 11.35 lbs. C. S. hulls, 8.07 lbs. cow pea vine hay.....	90	2	798	1.95
<i>(b.) 3-Year Old Grade Steers.</i>				
1. 11.2 lbs. raw cotton seed, 16.8 lbs. pea vine hay.....	90	2	1183	3.02
<i>(c.) Fed to Grade Steers. Age not Given.</i>				
1. 10.2 lbs. raw cotton seed, 1.46 lbs. cow pea vine hay.....	90	5	761	1.9
2. 10.3 lbs. ground cotton seed, 14.5 lbs. cow pea vine hay.....	90	5	765	1.9
3. MISSISSIPPI STATION EXPERIMENTS.				
<i>(a.) Feeding Calves.</i>				
1. 1.61 lbs. C. S. meal, 13.9 lbs. skim milk.....	56	3	265	1.20
2. 4.35 lbs. crushed cotton seed.....	56	3	209	.85
3. 5.23 lbs. boiled cotton seed.....	56	3	234	.67
4. 25.04 lbs. skim milk (<i>check ration</i>).....	56	3	215	1.57

2.—FEEDING HOGS COTTON SEED AND ITS PRODUCTS.

Many conflicting reports have reached the Experiment Station with reference to the profits and the losses in feeding *cotton seed* (raw, boiled, crushed, and rotted) to hogs, and also on feeding the cotton seed meal. The Texas Experiment Station was the first to conduct carefully planned experiments to test the effect of cotton seed and its products upon the health of the hog. Other stations have verified the results obtained, which indicate that *after the end of the fortieth day, some deaths may be expected in all of the pens where cotton seed or its products are used.*

These experiments, conducted in 1891, did not, however, include a trial of rotted or fermented seed and, according to recent trials by this Station, it has been found possible to feed this material with fairly good results, but it must be borne in mind that a few successful attempts made in feeding partially rotted seed do not prove that under all conditions this method of treatment renders the seed entirely safe.

The composition of the seed, when rotted, undergo a peculiar change, due to partial decomposition, and is noted especially in the increase of the percentage of crude protein, which changed from 23.48% in the sound seed to 30% in the rotted seed, and this change is made regardless of the fact that the water content of the partly rotted seed has materially increased. The following analysis, made under the direction of Prof. Harrington, in the Chemical Section of the Station, is presented:

	<i>Rotted Seed.</i>	<i>Sound Seed.</i>
Water	30.00	7.64%
Ash	4.16	5.06
Ether extract	12.74	18.29
Crude fibre	19.47	30.11
Crude protein	30.00	23.48
Nitrogen free extract	3.63	15.42

In answer to inquiries upon the subject of using cotton seed, the following reply has been sent from this station: "Wet seed are not safe unless they are allowed to stay wet until they are partly rotted. Experiments have shown us that hogs would freely eat soaked seed (which had been in this condition two weeks), but would not eat a sufficient amount alone to cause them to fatten, but if corn meal be supplied in addition to the cotton seed, hogs will fatten fairly well and there is little danger in feeding such rations.

"The question of roasted seed for hogs is out of date. Experiments conducted by this Station some years since proved that there was no money to be made in roasting seed for hogs and that roasted seed were not any better than boiled seed, either as cow or hog feed, and it is therefore unnecessary to expend money to buy roasters when seed can as well be treated in a cheaper way."

The letters here presented from practical feeders are divided (a) into those who have used cotton seed successfully with hogs, and (b) with those who have met with more or less failure.

A.—SUCCESSFUL FEEDERS.

No. 1. FEEDING COTTON SEED TO HOGS IN THE '60S: "I have had much experience in cotton seed feeding. In the '60 I ran a horse gin. No seed was hauled home by the farmers except for seed. My gin was in a pasture. I would have them hauled out to them to eat at leisure (grass was of the best). Evening and night, cattle would be all round eating them. I would have at the creek (close by the pasture) wagon after wagon loads hauled and thrown in the pools of water. The hogs kept fat and I could kill when the house needed fresh meat. The hogs were fat all the time. I heard nothing of cotton seed killing hogs, but when they ate the seed thrown out sound and kept dry (except for the little rain that fell upon them) it would kill during the first warm days that came, espe-

ially before vegetation put forth. I have fed to calves and milk cows, always with best results, except the butter will be white. I have plowed oxen a life time and always fed on cotton seed, shucks, fodder, or hay mixed, when I could get them."

Nockenut.

H. S. HASTINGS.

No. 2. COTTON SEED COMBINED WITH VARIOUS CROPS: "My limited experience in feeding cotton seed is all with the hull on, with turnip tops, cabbage, potatoes, pumpkins, kershaw, or melons—with bran, corn, or corn meal (mixed and cooked). This made a very good feed for fattening hogs with no bad results; the seed composing from 1/3 to 1/4 of the feed."

Sanco.

J. L. DURHAM.

No. 3. MUST BE COMBINED WITH OTHER FEEDS: "I enclose Mr. M.'s letter to *Farm and Ranch*, as a sample of many letters from different sections of this and several other States which I have received of late in regard to the matter therein mentioned, and shall endeavor to give him and others what information I have gathered on this subject from actual experience and close observation. While I am but 38 years of age, I can remember when cotton seed were thrown out on the gin yards by the ginners, and except a small quantity for seed, they were never hauled away by the farmers who grew them. They were looked upon as being, as Mr. M. says, 'certain death to hogs,' worth nothing as a ration for cattle, and, to put on land, certain destruction to any crop, because of the disposition 'to fire' any plant under which they might be put. But men commenced to experiment, and this once useless and dangerous appendage of the fleecy staple is now considered the most valuable product of the plant.

"It is fact that hogs that remain around a gin house and eat nothing except cotton seed for any considerable length of time usually become diseased, and many die. But I am of the opinion, nor am I alone in this conclusion, that dust, vermin, lack of pure water, no change of diet, and filthy quarters and other evils attending those unwholesome surroundings and conditions cause the swine to become diseased and die, and not cotton seed.

"Around the old-fashioned horse-gins, where there was no water, and dust and filth was knee deep, a dead hog was a common sight, but around our more modern gins, where plenty of good water is always accessible, and there is comparatively little chance or space for the accumulation of filth, a dead hog is the exception and not the rule * * *.

"The first time I ever saw raw cotton seed fed to hogs, with no other ration, was by Mr. J. C. Boon, of Navarro county, in 1896. He had six large hogs, which he put in a close pen and fed on cotton seed alone till they were ready for the block, and I have never seen finer hogs, considering age, time of feeding and single diet, than these were. With the exception of the slops which came from the kitchen, and fed to them each day, with an ample allowance of water, their sole diet was cotton seed.

"Mr. Boon dug a hole in the ground near his pen, and filled it with the amount of seed he allowed his hogs, and then put in sufficient water to thoroughly wet the entire mass. Then he took a common weeding hoe and worked the seed and water together till all the dust was absorbed by the water, and the loose lint usually left on seed was well moistened and clinging close to the hull. When thus manipulated, he transferred them to a trough in the pen, and the meal was prepared, and greedily eaten by the hungry swine. Like Mr. M., I was somewhat surprised, and expected to see the hogs become diseased and begin to lose flesh in a short time, but to my surprise just the opposite was true.

"When killed, the only objection he mentioned to his cotton seed pork was the decided flavor of the seed imparted by the feeding of seed alone, unmixed with any other feed. Mr. Boone informed me that he could fatten hogs cheaper on cotton seed than on corn, when the latter is most abundant and the former is selling at 10 cents per bushel.

"I saw other farmers on the prairies of Texas feeding rations of raw seed and bran, cooked seed and bran, seed and turnips, cotton seed, oats and corn, and in every instance the cotton seed were thoroughly soaked in water before feeding, and I have yet to see a hog die from feeding this now common diet for hogs among the farmers of Texas.

"Mr. M. mentions the feeding of cotton seed meal to hogs, and asks for my opinion thereon. Inasmuch as I have never seen the meal fed to hogs, I can not speak from experience, and therefore prefer to remain silent, as my unsupported opinion might lead to disastrous results. But if I lived where I could obtain the meal in sufficient quantity, and cheap enough, I should sacrifice a pig or two in trying to learn something about feeding the meal. I can assure any readers of *Farm and Ranch* that cotton seed thoroughly moistened can be safely and with profit fed to hogs, alone or with other food, and during the present scarcity of corn, none should fail to take advantage of this useful bit of knowledge and make preparation to put it into practice, rather than sell the seed to oil mills and pay exorbitant prices for lard and bacon.

"If seed are fed raw and dry to hogs, I am informed that the air passages of the lungs become clogged with dust and lint, circulation is obstructed, and the animal becomes diseased, and finally pines away and dies, not from any poisonous element obtained from the seed, but from the very causes that would produce disease and death if obtained through the agency of any other food. Almost every disease that hogs are heir to results from lack of water, exposure to inclement weather, and filthy surroundings, and while their conditions may be varied without serious loss, their natures cannot be changed to suit all conditions and surroundings.

"Mr. M., and no other farmer who attempts to feed cotton seed to hogs, should fail to use plenty of water, whether fed with bran, turnips, corn, or alone, and when this is done, good and not evil results will follow."

Caledonia.

H. P. WEBB.

(In *Farm and Ranch*, Dallas.)

Mr. H. P. Webb, Caledonia, Texas:

I was much interested in your communication in *Farm and Ranch* of Sept. 2, on the feeding value of turnips, and have nothing but approval for all you say in that regard. But your incidental mention of feeding cotton seed to hogs, without intimating any danger in so doing, is somewhat curious in view of the fact that cotton seed is considered almost certain death when fed to hogs. I have myself killed a good many hogs in trying to solve the problem of converting cotton seed and cotton seed meal into pork and lard, without success. I have not altogether lost hope in that regard, and would like very much to learn all about your method of feeding hogs on cotton seed, if you have seen and know of the same being done for some time without bad results.

Yours very truly,

S. J. MATHEWS.

No. 4. A MIXED EXPERIENCE: In regard to cotton seed meal as feed for hogs, how fed, etc., I herewith send you statement of experience with said feed. I fed about twenty head of pigs, shoats, and hogs cotton seed meal made into slop, with about ten per cent. corn chops added to same; fed about three gallons per day to bunch. All came through the winter in fine condition. Not having any mast in my hog pasture, a neighbor kindly tendered me the use of his mast grounds. I took ten head of fine shoats and placed them upon pecan and acorn mast. In less than a week had lost nine. I believe that had the shoats remained in the pasture they would have been all right, as those kept at home did well.

My belief from experience is that it will not do to change at once from this feed to another. If any change is made to another, it should lessen the one as the other increases, until the system is thoroughly cleansed of above feed. I have fed the meal in all stages, sweet and sour mash, and hogs sis well until above change.

I think the above per cent. of corn chops, or other mixed feed with this, should be greater—say 20 per cent.

Gunsight.

T. G. COLEMAN.

No. 5. COTTON SEED, CORN, AND TURPENTINE: "I have fed cotton seed to my hogs for four seasons. The first I ever fed to any extent was the winter of '94. I had two large sows that I wished to fatten and kill. Being short of corn, I put the two sows in a pen, separated from my killing hogs, and gave them a small feed of corn at night and put in fresh cotton seed every morning. Seed was kept before them all of the time, and they got big and fat. Since then, I have given my fattening hogs, after putting them up to fatten, as much as they would eat once a day, at twelve o'clock. Ever since, I have been feeding the seed to my hogs. I give each of them a few drops of turpentine two or three times a week. I think the turpentine is an antidote for cotton seed. But I have never made up my mind to risk feeding seed to hogs or pigs that I expect to keep over for another year. I would rather my pigs would eat cotton seed than sleep in dust; dust is sure death, in my experience, if they sleep in it long enough, and I have found no remedy for it—the dust cough—though I have used turpentine for it. I think turpentine and copperas are good hog medicines; no worm can stay where they are used."

Millican.

C. B. MCGREGOR.

No. 6. USE OF COOKED SEED: "My experience in feeding cotton seed is not extensive, but I have learned something by my experience with cotton seed as a hog feed. Last spring, for want of corn, I was forced to try cotton seed, but before doing so, I allowed my hogs (in dry lot) to become quite thin—trying to keep them alive till 'sorghum time' with a very limited amount of damaged sheaf oats. I began cooking cotton seed and added it, at first, in small quantities, to the oat ration, gradually increasing the amount of cooked seed until I had found the amount the hogs would eat up clean. To my surprise, my hogs began to fatten and squeal for their ration of cooked seed. As soon as my early sorghum began to ripen, I discontinued the oats and began feeding sorghum—all that my hogs would clean up, but they continued to eat heartily of the cooked cotton seed, and I continued feeding the cooked seed until my new corn came in, at which time my hogs were fat enough to butcher, and had made a splendid growth. Shortly after beginning the cotton seed ration, I told my neighbors about it, and how well my hogs were doing. Many of them said my hogs would die when the hot weather came, but not one of them died until I butchered them this winter, and nicer, sweeter, tenderer pork I never saw. I sold one hog that weighed 389 pounds, and the purchaser told me that the meat was as tender as chicken. Now as to what I have learned: (1) Cotton seed (cooked) will not kill hogs, but when mixed with other rations is a most excellent, healthy and cheap feed. (2) One bushel of cotton seed is equal to about two bushels of corn as a hog feed, when cotton seed is selling at 10c. per bushel and corn at 40c. (the price last summer) it stands as 10:8, in favor of cotton seed (trouble of cooking not counted). Have also learned that I can grow hogs and make good pork out of cotton seed and sorghum. Have also learned that I had better keep my cotton seed (or buy them) at \$7 per ton and sell my corn at 23c. per bushel (present price of each). Then one-half bushel of cotton seed at about 5½c. and corn at 23c. is a saving of about 17½c. per bushel on the corn."

Near Alvarado.

J. JAMES.

No. 7. COOKED SEED AND ALFALFA PASTURE: "Having no oil mill in this locality, of course we can only use the whole seed. During the winter of '97-'98, other feed being very costly, I bought some 2½ tons of cotton seed. These were boiled, very thoroughly (a most important matter in feeding hogs) until they would mash very easily between one's thumb and finger. So far as possible, they were fed warm, and were used into daily feeds to winter 66 stock hogs, which, besides, had the run of some 30 acres of alfalfa pasture—of course very short at that time of the year. Most of the bunch went through the winter very well; had a loss of about 10%—mostly the smaller pigs. The spring crop of pigs from these

sows was unusually thrifty and good. Where fuel is cheap, it is obvious that, at the price I paid for the seed (\$5 to \$6 per ton) that this is a very cheap feed. I do not consider cotton seed alone a good ration for a hog, but to help out short pasture, or to save more costly food, they will serve a good purpose."

Pecos City.

WILLARD H. DENIS.

B.—UNFAVORABLE RESULTS.

No. 8. UNFAVORABLE EXPERIENCE WITH COOKED SEED. "I have had no experience in feeding cotton seed, other than in the raw state to cattle. I have cooked them for hogs, and fed them, but derived very little benefit."

Franklin.

G. F. LEWIS.

No. 9. AVOIDS FEEDING SEED TO HOGS: "My experience and observation with seed and hogs convince me that if the hogs survive, they are injured more than benefited by eating seed, consequently I try to keep them from seed at all times. Have never tried to make horses or mules eat seed. We find seed necessary at all seasons of the year for milk cows, and especially in warm weather, to give firmness to the butter. Seed have averaged \$6.00 per ton at Station, five miles from gin; hulls at mill about \$3.50; and meal, I think, \$17 or \$18 and 13 miles to haul them."

Independence.

W. L. BAILEY.

No. 10. FEEDING ON SOAKED SEED AND CORN: "Situated as we are, 30 miles from market, confines us to the use of whole seed. So far as my individual experience in feeding cotton seed is concerned, I have not found it profitable, except to cattle. I partially fattened my pork on them last year, but as I lost one fine hog, eleven months old, after getting him fat, and had another to sicken, droop, and pine away (but finally recovered), I have not fed any more to hogs. This was out of a pen of 7; the other 5 thrived and fattened nicely. I followed the directions of Dr. Neely, of Roger's Prairie, Leon county, who claims to have met with excellent success in feeding seed to hogs. For two months I fed $\frac{3}{4}$ cotton seed and $\frac{1}{4}$ shelled corn, soaked in water two days, or until the seed was thoroughly sprouted. I used two barrels, keeping one in the soak all the while. After two months I decreased the seed to about one-half, and two or three weeks before killing I fed on corn only. I could tell no difference in the flavor or the firmness of the meat, but I thought feeding the seed had something to do with the loss, by death, of the one referred to, and having corn in abundance I have not experimented with seed this winter. So far as my observation goes, raw cotton seed will kill young hogs. I have not thoroughly satisfied myself as to the prime cause, although I have examined some that died from the effects of them. In one I found a wad of lint lodged in the windpipe, which led me to believe that it was the lint that did the work. I feed all my cattle regularly something like a peck per day, and find them wholesome feed. I can see no good reason why the meal could not be fed profitably to almost any and all kinds of stock."

Hollis.

J. O. FORD.

No. 11. DEAD HOGS AROUND GIN: "While I have had no experience in feeding cotton seed to hogs, I think cotton seed will kill them, since I have seen them always dying. I think the seed are highly beneficial to cattle, combined with other food, but, alone, I do not know what kind of beef they would produce."

Quitman.

JOHN H. LONG.

No. 12. FEEDS ONLY LIMITED AMOUNT OF SEED TO STOCK: "I have fed cotton seed some to hogs, but, generally, with bad results. I would not feed to hogs, cooked or raw, with corn meal, or any other way. I would feed a little meal and

hulls to my milk cows, combined with plenty of other feed—such as hay, oats, and corn, and find that these give better results than plain seed—nor will I feed meal and hulls exclusively to fatten stock.”

Milford.

E. C. WILLIAMS.

No. 13. COSTLY EXPERIMENTS: “I have never used cotton seed or its products with anything but milk cattle. I have used the seed and the meal and consider the latter the best feed I have ever used. Several farmers have tried cotton seed for fattening hogs, but have lost more than half of them.”

Shovel Mount.

W. GIESECKE.

No. 14. LOSS OF HOGS: “I have been all my life on a farm; am now past fifty years old. Now, if cotton seed will not kill hogs in any way they are given them—raw, cooked, soaked, or in meal after the oil is pressed out—I would pay a good price to find out how to feed them—provided the other man furnishes the hogs. Mr. Editor, knowing you are an old Texan, and that you were raised in South Texas, and on a farm at that, I believe it would not be out of place to ask you something about hogs and cotton seed and the benefit or loss in feeding them. Cotton seed has killed hogs for me every time.”

McLennan county.

W. J. DUFFEL,
In *Farm and Ranch*, Dallas.

No. 15. FEEDING COTTON SEED TO HOGS: “In 1897 some experiments were made in feeding cotton seed and cotton seed meal, both raw and cooked, to hogs and pigs. The feeding trial with grown hogs extended over a period of twelve weeks. Eight Berkshire hogs were selected and divided into four lots of two hogs each.

“Lot 1 received cooked cotton seed meal and corn meal.

“Lot 2 received raw cotton seed meal and corn meal.

“Lot 3 received cooked cotton seed and corn meal.

“Lot 4 received cooked cotton seed meal and whole corn.”

“All four lots made their largest gain the second week of the trial. Taking the experiment as a whole, the gain made by the lots was neither satisfactory nor profitable. The hogs began to die first in the lot getting raw cotton seed meal. The first hog died at end of the fourth week, and at the end of the eighth week the remaining hogs in same lot died. While the hogs getting the cooked seed and meal did not die, some were very sick and refused to eat, and would get better and begin eating again after being allowed to run in an oat and clover patch for several days. After the fourth week, most of the hogs began to lose flesh, and after sixth or eighth week, none of lots made gains.

“Twenty-three pigs, four months old, were selected and fed a ration of cooked cotton seed, corn meal, shorts, and skim milk. They were fed forty-six days, and for the first two weeks made an average daily gain of one pound, but after the first two weeks the gain was small. The pigs continued to eat with great relish, leaving no waste. At the end of forty days the pigs began to die, and when the experiment closed four pigs had died and several others were sick, but were turned into a clover lot and were apparently well in a week. Some of these pigs were kept until grown, and put on feed to fatten for market. The cotton seed pigs were poor feeders, and were never gotten in good condition.

“We do not publish the result of these experiments in detail, for the reason that, until some method is devised by which the poisonous element in the feed can be cheaply and completely extracted, cotton seed and its products cannot be considered as a feed for hogs.”

(Extracted from Bulletin No. 60, Mississippi Experiment Station.)

3. FEEDING COTTON SEED AND ITS PRODUCTS TO SHEEP.

Few careful experiments have been made by the sheep men of the State in the use of cotton seed, its meal, or hulls, for *fattening mutton*. Very generally, this feed is used only for carrying flocks through the winter season, when, if skillfully fed, a slightly larger amount of feed could be used and fatten the lambs for market. The lambs are now generally shipped to other States and there prepared for market.

No. 1. FEEDING RANGE AND MUTTON SHEEP: "In the *Stockman and Farmer* of December 14th, I gave an account of my experience in feeding cotton seed, and refer you to same. On the range, cotton seed is the best and easiest way to feed, as the sheep get, in addition, what grass they require, but where there is but little or no grass, meal and hulls are the best. I am this winter feeding one flock of ewes and fall lambs and one flock of spring lambs cotton seed, and they are doing well.

"We cannot rely upon grass alone to fatten sheep, and cotton seed and cotton seed meal and hulls will, I think, be extensively used in the future."

Standart.

C. W. STANDART.

(From *Texas Stockman and Farmer* San Antonio.)

"In my opinion, cotton seed is the best and cheapest food grown in Texas for feeding sheep. While cotton seed meal may do as well for a feed, it is not as convenient to handle as cotton seed, for the reason that in wet weather it is difficult to use the feeding troughs unless under cover. My method is to feed the sheep on the range and feed them in the morning as they leave the corral, and when want of grass requires a change of range make a new corral and move the troughs, and do this as often as required. I pack the cotton seed in old wool sacks, being more convenient to handle, and when properly packed wet weather does not injure the seed. I use troughs made out of six-inch boards, 12 feet long. I understand there are a good many sheep in Texas now being fed on cotton seed meal and hulls, and the result will be known in the spring.

C. W. S.

No. 2. HULLS AND MEAL FOR EWES: "In reply to yours of 20th instant will say that 1/3 cotton seed and 2/3 cotton seed meal is the best ration I have ever used for suckling ewes. My experience is not very extensive in fattening sheep."

Burnet.

D. G. SHERARD.

No. 3. SEED PREFERRED TO COTTON SEED MEAL: "I have never fed any but the whole seed, and I believe it to be the most economical, because it does not waste as the meal. Though I have only fed milk cows and on an average of 125 sheep. Whole seed can be bought from near-by gins, but meal has to be bought from the oil mills at long distance or from retail dealers. The experience of sheep men is all in favor of the whole seed, as it can be fed on the ground, whereas the meal must be fed in troughs that have to be cleaned after each feeding because of the droppings from the sheep."

Round Rock.

H. L. RAVEN.

No. 4. FEEDING 6,000 MUTTONS: "Texas being one of the best cotton growing States in the Union, and full of cotton seed mills, I do not think there is any kind of feed that will give better results, nor do I think there is any better feed for sheep than cotton seed meal and hulls. I have 6,000 muttons now in the feed pens; I am well pleased with the results so far. This is my first trial at feeding, and later on I can give fuller details as to feeding sheep. Texas raises good sheep for the feed pen."

Sweetwater.

J. C. KING.

(In *Texas Stockman and Farmer*, San Antonio.)

No. 5. HULLS AND MEAL ENDORSED: "Sheep, like other stock, relish a variety of food. Cotton seed meal and hulls are good; corn, bran, and oats, with good

bright hay, or sheaf oats, is good. Sheep are often neglected as to watering facilities. They should have good clean water and plenty of trough room and dry footing."

Sonora.

KOS BARRY.

(In *Texas Stockman and Farmer*, San Antonio.)

No. 6. A WISCONSIN TEST: The following statement from the Wisconsin Station shows clearly the high value of cotton seed meal for feeding young lambs. The "oil meal" mentioned is linseed meal. The resulting gains were favorable, but not so good as when linseed meal was used:

(FROM THE U. S. EXPERIMENT STATION RECORD.)

* * * * * To compare the effect of feeding linseed meal and cotton seed meal to young lambs, two lots of five lambs each, Shropshire grades of good quality and about three months old, were used. Both lots were pastured in the same pasture and from July 16th to September 24th, ten weeks, received all they would eat of the following grain mixtures: lot 1, 1 part by weight of linseed meal and 2 parts of corn meal; and lot 2, 1 part of cotton seed meal and 2 parts of corn meal. During the experiment, one of the lambs in lot 2 died. The average weekly gain per lamb was 3.3 pounds for the lot receiving linseed meal, and 2.95 pounds for the lot receiving cotton seed meal. The value in corn meal at \$14, linseed meal at \$20 and cotton seed meal at \$25 per ton, the cost of feed per pound of gain in live weight was 2c. for the linseed meal lot and 3½c. for the cotton seed meal lot.

"The result of this trial show:

"(1) For feeding lambs a grain mixture of oil meal and corn meal gave better results than a grain mixture of cotton seed meal and corn meal.

"(2) The lambs fed the oil meal made a greater gain than those receiving the cotton seed mixture. During the ten weeks trial, the lambs fed the oil meal ration each made a weekly gain of 3.3 pounds, while those getting the cotton seed ration each made a weekly gain of 2.95 pounds.

"(3) The oil meal ration was in addition cheaper; for the lambs so fed made 100 pounds gain at a cost of \$2, or 2c. per pound, while those getting the cotton seed ration made 100 pounds gain at a cost of \$3.30, or 3½c. per pound."

(Wisconsin Station Bulletin No. 32.)

SUMMARIZED AMERICAN EXPERIMENTS.*

FEEDING COTTON SEED MEAL IN COMBINATION WITH OTHER FEEDS TO SHEEP.

RATION.	Duration of period. Days.	Number of Animals.	Average live Weight. Pounds.	Average daily gain. Pound.
NEW YORK CORNELL STATION EXPERIMENTS.				
<i>6-months-old Cotswold and Southdown lambs.</i>				
(1) 0.21 pound cotton seed meal, 0.46 pound linseed meal, 0.291 pound wheat bran, 1.205 pounds hay, 0.45 pound roots.....	166	3	61	0.184
(2) 0.684 pound corn or corn meal, 0.992 pound hay, 0.45 pound roots.....	166	3	54	.104
<i>6-months-old Shropshire and Southdown lambs.</i>				
(1) 0.788 pound corn or corn meal, 0.754 pound hay, 0.735 pound roots.....	151	2	60	.161
(2) 0.351 pound cotton seed meal, 0.771 pound wheat bran, 1.033 pounds hay, 0.662 pound roots.....	151	2	67	.256
(3) 0.205 pound cotton seed meal, 0.675 pound corn or corn meal, 0.205 pound wheat bran, 0.844 pound hay, 0.801 pound roots.....	151	2	70	.248
(4) 0.205 pound cotton seed meal, 0.689 pound corn or corn meal, 0.205 pound wheat bran, 0.775 pound hay.....	151	2	69	.191

ENGLISH EXPERIMENTS: "Experiments were made at Woburn, England, with sheep at pasture upon 4 acres divided into four 1-acre lots. The sheep in two of the lots received no additional food, and the average gain made was taken as that due to pasturage alone. The sheep in the other two lots received additional foods, as shown in the table below, and the increase in live weight on each of these over that on pasturage alone is considered as gain due to the additional food. This assumes that the pasturage on the different acres was uniform, which is an element of uncertainty. The results are summarized by years in the following table:

*From "The Cotton Plant." U. S. Department of Agriculture.

Woburn (England) Experiments with Sheep at Pasture with and without Additional Foods

Pasture.	Number fed.	Total additional foods.		Total gain in live weight.	Increased gain attributed to food in addition to pasturage.
		Cotton seed meal.	Corn meal.		
1877.					
Clover and rye grass.....	10	728	.....	303	91.25
“ “ “ “.....	10	.....	728	275	63.25
1879.					
Clover and rye grass.....	10	672	.....	328	46.25
“ “ “ “.....	10	.....	728	435	153.25
1881.					
Dutch clover: (a).....	10	672	.....	433.75	283
“ “ “ “.....	10	.....	728	351.25	200.50
1883.					
Dutch clover.....	10	672	.....	266.25	124.50
“ “ “ “.....	10	.....	728	210.75	69

4. COTTON SEED AND ITS PRODUCTS FOR MILK PRODUCTION AND GROWTH.

The importance and value of cotton seed for production of milk is very generally understood by both farmers and dairymen, but the best possible rations containing either cotton seed or its meal have not yet been established. The suggestions contained in the following letters are therefore important:

No. 1. VALUE OF SEED IN HOT WEATHER: "I have fed about eight hundred bushels a year. It is my chief feed. I give each cow from four to six pounds at a feed twice a day, for my milk cows I add a little bran or corn chops to make them relish it. In the winter I give them hay, in summer I give them pasturage. I have milked seven cows this year, and fed as stated, and have sold 2,051 pounds of butter. It sold for \$354.25 after giving my merchant 15% for selling it. I can make good, firm butter the hottest day in summer without ice. Cotton seed helps to make it so, but makes it harder to churn and hurts the flavor some. I spent fourteen years as a dairyman in England, and have had a small dairy at this place thirteen years, and have fed many things, but I find that cotton seed is the cheapest for me, as I live close to a gin. I find that cotton seed will kill pigs if they are fat, but is not so dangerous to poor ones. I have just lost five out of seven through being too careless.

Trinity.

H. A. MOLDRAM.

No. 2. RATION OF SEED, BRAN AND CORN MEAL: "I have fed both cotton seed and cotton seed meal, and find that the seed is better for cows than the meal. The rations I use are: (1) five pounds of cotton seed meal, four pounds of bran, with cane fodder; (2) five pounds of cotton seed meal, four pounds of corn meal, with cane fodder; (3) ten pounds of cotton seed, three pounds of corn meal, with cane fodder. I find that No. 3 will make one-fifth more milk and butter. I have also tried all three with corn fodder, but falls off one-sixth with this material."

Round Rock.

FRANK L. ATEN.

No. 3. SEED COMBINED WITH FODDER: "I am feeding cotton seed whole, combined with hay, corn fodder, or other roughness, for milk stock, and it has given satisfaction."

Mezia.

M. A. DEPUY.

No. 4. COTTON SEED, OATS AND SORGHUM: "I have used the following feed for years, and find it satisfactory: one gallon of seed per head both morning and night, combined with half bunch of oats and as much sorghum hay as will be eaten through the night. When grass is plentiful I feed little or no hay, but continue cotton seed and oats to a greater or less extent throughout the season. Cows tied in stalls at night the year around. I never sell any seed, and never plant cotton two years in succession on the same piece of land."

Thornton.

A. RAND.

No. 5. SEED, BRAN AND CORN MEAL: "I feed whole seed to nothing but cattle. I do not like the meal and hulls. I use four to six quarts of cotton seed twice per day for each feed, with a little wheat bran or corn meal. I like the bran best."

Ennis.

L. M. RICHMOND.

No. 6. COTTON SEED FOR COWS; COTTON SEED AND HAY FOR MILK PRODUCTION: "According to my experience there is no better feed for milk cows than whole seed combined with a little hay, nor do I have any trouble with feeding seed only because I see there is a full feed of hay or fodder used. It is preposterous in the extreme to feed horses upon cotton seed products. No well fed horse will eat any of it at all."

Alexander.

J. F. BROYLES.

No. 7. PREFER OATS COMBINED WITH SEED: "I do not consider cotton seed in their natural state a good feed to be used alone. I combine it with fresh oats and wheat bran, and obtain better results from the mixture of seed and oats than from seed and bran for milk cows."

Kemp.

W. H. BOWLBY.

No. 8. SEED, CHOPS AND BRAN: "I am feeding on an average twelve head of milk cows, and for a period of four years best results have been secured from a mixture of say four bushels of cotton seed, one bushel of corn and cob meal with one bushel of bran, combined with abundance of hay. My cattle eat this regularly and do moderately well. Care must be taken to not over feed. A cow will eat one-fourth to one-third of a bushel of this mixture daily."

Comanche.

W. T. LEE.

No. 9. FEEDS SMALL RATION OF COTTON SEED MEAL: "I have fed a small ration of cotton seed meal to dairy cattle for the last five years the whole year through, alone and mixed in various proportions with bran, corn, and meal, and crushed wheat, and rye. The amount of cotton seed meal varied from 6 pounds daily to 2 pounds. I found that the larger ration invariably produced disturbances in the udder, though the general health of the cow did not suffer. Since I have reduced the cotton seed meal to 2 pounds daily, all trouble with gargetty udders disappeared.

"Whenever I left the cotton seed out of the ration for only a few days, the cows immediately shrink in milk and butter."

Waring.

DR. W. D. ALBINI.

No. 10. COTTON SEED WHITENS BUTTER: "Have fed some milk cows on cotton seed at the rate of one-half gallon twice per day, mixed with bran and other feed, and it makes butter perceptibly whiter and inferior in quality.

"From 20 to 60 years ago, linseed cake was largely used in England in conjunction with turnips and hay for feeding cattle successfully, and there is no reason why cotton seed might not be similarly used in combination with these materials as well."

Lampasas.

WM. A. ROSS.

No. 11. HULLS AND MEAL FOR MILK STOCK: "I have fed no stock other than cattle with cotton seed or meal. I made an experiment three years ago. During the winter I fed meal and hulls almost exclusively, using three or three and one-half pounds of meal combined with as much hulls as the stock would eat well, and kept up a good flow of milk. I received a little over one pound of butter per day, feeding 30 head of registered Jersey cows. In the spring following I lost nearly half the calves. Two came dead, and others died within one to three weeks. I fed *the same amount* of meal with chopped oats and sorghum hay with good results.

"Am now feeding 6 to 7 pounds of cotton seed twice per day, with as much bailed oats and sorghum hay as eaten clean, and average a fraction over a pound of butter."

Riesel.

H. SCHARLACH.

No. 12. FEEDING RAW FEED: "I only feed seed in the summer, using about 3 gallons per day to each cow, which gives satisfaction in the flow of milk and in flesh. I did not feed any seed in winter, because my pea crop keeps my stock very fat.

"Have let pigs run where they could get cotton seed, and they eat well when fed plenty of corn in addition. In '96 I saw hogs feeding around a gin and seed was their only food; while they remained in thin order they fattened well, when in a pen and fed corn. I use peas because of their fertilizing value in cultivating sandy land."

Comanche.

F. T. EMERT.

No. 13. FEEDING SEED TO CATTLE AND GOATS: "I am feeding raw seed to goats and milk cows as a part of their ration, and they are doing well. The method used is rather slovenly, but I do not consider the seed wasted when tramped under foot, as I carefully save the manure and return to the field."

Curtis.

J. H. BURKETT.

No. 14. COTTON SEED TO CALVES AND YEARLINGS: "I use only cotton seed in winter to feed calves and yearlings, or cows that come early with calves. I use in connection with the seed sorghum hay, corn fodder or shucks. I consider cotton seed, on account of its laxative quality, to be of very great value when fed in connection with such dry feed as we farmers usually have."

Bracken.

ALBERT NICHOLS.

No. 15. CORN AND COB CHOPS FOR YEARLINGS; ALFALFA FOR HOGS: "I am at present feeding two hundred head of yearling cattle upon corn cobs and shuck (crushed) combined with prairie hay, and give each five pounds of the crushed corn to five pounds of hay. They are thriving and growing well. I run hogs with them, and also feed my hogs alfalfa hay, of which they are very fond."

Bonham.

WILL LANIUS.

No. 16. WASTE IN HANDLING SEED: "I will mention a few channels where waste exists in feeding cotton seed and its products. The largest sort of waste is generally at gins, because some gins fail to have good buildings, and this occasions loss. Then seed haulers are very careless in loading and unloading. Farmers, in many instances, have no seed houses to store seed in, and they are put on the ground without shelter and exposed to weather until fed out. Again, many small feeders throw their seed on the ground, and allow their stock to eat some and tramp some in the ground. These small wastes in the seed supply make big losses, and in many cases cause poor cattle.

"Now, as a remedy, I would suggest that ginners furnish receptacles to prevent any waste, and compel their seed haulers to pick up all that may be spilled in loading. The farmers should build good seed houses and feed in roomy troughs. I never saw cotton seed fed to horses and mules, but I have seen some that seem to relish this feed, and believe that it would be of value to horses if eaten."

Jonah.

U. T. KILLGORE.

**Summary of Trials Feeding Milk Cows Cotton Seed and its Products
by Texas Station.**

(From Bulletin 33.)

Daily Ration Used.	Days fed.	No. fed.	Lbs. milk produced.
1. 6 lbs. alfalfa, 7.9 lbs. corn meal, 7.9 C. S. meal...	28	2	1226
2. 8.64 lbs. C. S. hulls, 7.09 lbs. corn meal, 7.09 lbs. C. S. meal.....	28	2	1008
3. 4.03 lbs. hay, 7.14 lbs. silage, 7.99 lbs. corn meal, 7.99 lbs. C. S. meal.....	28	2	1108
4. 7.19 lbs. common hay, 8.17 lbs corn meal, 8.17 lbs. C. S. meal.....	28	2	1150
1. 9.78 lbs. alfalfa, 3.75 lbs. corn meal, 2.25 lbs. C. S. meal.....	28	2	874
2. 13.16 lbs. cotton seed hulls, 3.75 lbs. corn meal, 2.25 lbs. C. S. meal.....	28	2	736
3. 5 lbs. choice prairie hay, 4.57 lbs. silage, 3.75 lbs. corn meal, 2.23 C. S. meal.....	28	2	680
4. 9.6 lbs. choice prairie hay, 3.75 lbs. corn meal, 2.25 lbs. C. S. meal.....	28	2	780
1. 10.9 lbs. cotton seed hulls, 11.57 lbs. C. S. meal...	28	2	1202
2. 11.96 lbs. " " " 20.1 lbs. corn meal...	28	2	1112
3. 5.9 lbs. alfalfa, 15.33 lbs. C. S. meal.....	28	2	1134
4. 12.7 lbs. common hay, 13.33 lbs. C. S. meal.....	28	2	1022
5. 9 lbs. common hay, 16.78 lbs. corn (boiled).....	28	2	1053
1. 9.39 lbs. cotton seed hulls, 8.87 lbs. C. S. meal.....	28	2	842
2. 5.3 lbs. " " " 20 lbs. C. S. meal.....	28	2	783
3. 5.16 lbs. " " " 11.32 lbs. C. S. meal....	28	2	756
4. 8.92 lbs. " " " 9.66 lbs. " "	28	2	760
5. 4.3 lbs. common hay, 9.73 lbs. corn (boiled).....	28	2	643

(From Bulletin 47.)

Daily ration used.	Days fed.	No. fed.	lbs. Milk Produced.	lbs. Butter Produced.
1. 7 lbs. c. s. m.; 16 lbs. c. s. h.; 28 lbs. silage.....	14	18	780.20	32.38
2. 10 lbs. c. s. m.; 20 lbs. c. s. h.....	14	3	760.20	35.65
3. 10 lbs. c. s. m.; 20 lbs. sorghum hay	14	3	814.00	39.06
4. 10 lbs. c. s. m.; 16 lbs. c. s. h.; 33 lbs. silage.....	14	3	986.00	48.14
5. 6 lbs. c. s. m; 4 lbs. B.; 16 lbs. c. s. h.; 33 lbs. silage.	14	3	984.20	46.41
6. 6 lbs. c.s.m.; 4 lbs. c.m.; 16 lbs. c.s.h.; 33 lbs. silage.	14	3	915.35	39.87
7. 6 lbs. c.s.m.; 4 lbs. O.; 16 lbs. c.s.h.; 33 lbs. silage...	14	3	1017.65	49.40
8. 8 lbs. c. s. m.; 25 lbs. c s. h.....	14	3	767.85	35.11
9. 8 lbs. c. s. m.; 30 lbs. sorghum hay.....	14	3	836.50	38.07
10. 8 lbs. c. s. m.; 18 lbs. c. s. h.; 35 lbs. silage.....	14	3	1069.55	47.82
11. 4 lbs. c.s.m.; 6 lbs. B.; 18 lbs. c.s.h.; 35 lbs. silage.	14	3	1051.88	48.03
12. 4 lbs. c.s.m.; 6 lbs. c.m.; 18 lbs. c.s.h.; 35 lbs. silage.	14	3	1039.76	42.47
13. 4 lbs. c.s.m.; 6 lbs. oats; 18 lbs. c.s.h.; 35 lbs. silage.	14	3	1030.46	49.54
14. 6 lbs. c. s. m., 25 lbs. c. s. h.....	14	3	794.00	39.06
15. 6 lbs. c. s. m.; 30 lbs. sorghum hay.....	14	3	816.65	37.39
16. 6 lbs. c. s. m.; 18 lbs. c. s. h.; 35 lbs. silage.....	14	3	1076.85	50.41
17. 2 lbs. c.s.m.; 8 lbs. bran; 18 lbs. c.s.h.; 35 lbs. silage.	14	3	1014.65	47.00
18. 2 lbs. c.s.m.; 8 lbs. c.m.; 18 lbs. c.s.h.; 35 lbs. silage.	14	3	1010.95	41.08
19. 2 lbs. c.s.m.; 8 lbs. oats; 18 lbs. c.s.h.; 35 lbs. silage.	14	3	1035.10	49.41

5. FEEDING COTTON SEED AND ITS MEAL TO HORSES.

The variable results obtained in feeding cotton seed or cotton seed meal to horses or mules are hard to reconcile, unless we assume that the difference in composition in seed (which causes a difference in the composition of meal made therefrom) arises from difference in varieties of cotton, variable climatic conditions and difference in soils upon which seed has been grown—all of which tend to change the flavor and alter the quality, so that where stock will eat and thrive upon feed given by one person, other feeders report that the stock refuse the feed, or when freely eaten some derangement of the digestive organs ensue.

In other States and in some foreign countries cotton seed meal has been used to some extent regularly, without bad results, and it is worthy of especial notice that some high bred stock have been fed continuously on the meal as a part of the grain ration.

The writer has induced work stock to eat the meal by introducing it in very small quantities to mules and horses and so accustom them to its taste and odor. In this way a large per cent. of work stock can be induced to eat it regularly in small amounts, though some refuse it entirely. Have known large amounts to be eaten safely by mules.

No. 1. SUCCESSFUL USE OF MEAL: "I came to Texas twenty-one years ago, and having fed horses on linseed meal in the North concluded I would try cotton seed meal here. We had three fine bred stallions. I found that cotton seed meal was the equal of linseed. During one winter we fed four horses and two mules on sweet potatoes with one quart of cotton seed meal and one quart of bran mixed. We put one quart of the mixture on the potatoes, and worked the mules and horses hard and they were fat and remained in fine condition. The next year we fed corn,

meal, bran and cotton seed in equal proportions, resulting in fat horses, and ever since this we have fed cotton seed meal mixed with other feeds, and find that it is most valuable. As a feed for milk cows it has no superior. I feed one part of bran, one part corn meal and one part cotton seed meal, and as long as I continue to feed horses, mules and milk cows will continue to feed cotton seed meal.

"I have fed cows four quarts of cotton seed meal per day, combined with cotton seed hulls. I know of no feed so good as cotton seed meal."

Alvin.

L. H. ROWAN.

No. 2. SEED FED TO MULES: "I once fed cotton seed mixed with corn to a pair of mules,—one quart of seed to two quarts of corn to each mule twice a day for about three months."

Ft. McKavitt.

C. G. BURBANK.

No. 3. SEED CAN BE USED: "As a feed for horses, where they can be induced to eat it voluntary, a small amount of cotton seed and its products can be used to advantage."

Blackland.

M. & C. ZELLNER.

No. 4. HORSES REFUSE SEED: "I have tried to feed horses on cotton seed, but could not make them eat it."

Phair.

H. J. KLORRES.

No. 5. FINAL RESULTS WERE BAD: "Horses and hogs both do well on cotton seed and its products for a time, but it ultimately has bad effects."

Wharton.

B. W. MARTIN.

The following statements bearing on this subject have been taken from "Feeds and Feeding" by Henry:

No. 6. "Baron E. d'Allinges, agriculturist of the Biltmore estates, Biltmore, N. C., writes that he has fed working horses and mules during 6 days of the week for 3 years on the following ration: 13 to 15 pounds of cut hay and corn fodder, 4 pounds of wheat bran, 2 pounds of cotton seed meal, and six pounds of corn meal. On Sundays he gives whole corn and oats and uncut hay."

No. 7. "At the North Carolina Station 2 old horses were fed for 2 periods of 12 and 18 days on 2 and 2½ pounds of cotton seed meal, respectively, with 4 pounds each of corn meal and ship stuff and clover and timothy hay. The animals ate the rations well and gained weight."

No. 8. "Gebek states that draft horses do well on 2 pounds of cotton seed meal daily in their rations."

6. COTTON SEED AND COTTON SEED MEAL FOR POULTRY, HOGS, SHEEP, BEEF CATTLE, AND HORSES.

A number of letters received from correspondents give in a single letter the results of experience with several classes of stock, and the substance of these is presented below, because they cannot be easily classified.

In addition to the valuable facts brought out in these letters, it is evident that much stock has been lost in experimental feeding by private individuals.

No. 1. COTTON SEED FOR SHEEP, CATTLE, AND TURKEYS: "I consider a bushel of cotton seed fully equal to a bushel of corn as a feed for sheep, and find that such

a small amount as two quarts of cotton seed per day will enable a calf to thrive, or will keep a poor cow alive upon very scanty pasture during winter season.

"I have never known chickens to eat cotton seed, but at one time had turkeys that did eat it, but it made their flesh taste so much like cotton seed that it made it unpalatable. The turkeys thrived upon it, however, as shown by their growth and glossy feathers."

Port McKavitt.

C. G. BURBANK.

No. 2. WINTERING CATTLE AND FEEDING HOGS: "I find that I can keep cattle very well for a few months on seed alone (with light pasture), but by adding one pound of corn meal or chops to four pounds of seed, I find they do much better. I consider cotton seed meal fed in connection with turnips a cheap feed for sheep, and by adding meal or chops, or by allowing corn at lambing time, you have a model feed, provided the sheep have the run of pasture.

As a feed for hogs, cotton seed will not do. My experience has been that they will kill hogs sooner or later in any way you can feed them, although I have fed them a short time with some profit with turnips or chops or corn, fed in the form of slop.

"The best way to feed cotton seed to stock is to feed in troughs, but I do not consider it wasteful to feed on ground, provided the party owns the land upon which the feeding is done and does not feed upon the same ground too long. In following this practice, I place the seed in small piles containing about one pound each."

Hooks.

R. M. HOOKS.

No. 3. FEEDING SEED FOR FATTENING STEERS AND HOGS: "My experience has been confined to feeding raw seed. Have tried to fatten old stock on cotton seed, but the experiment proved a failure. One of my neighbors also tried to fatten a bunch of the same class of stock on cotton seed and cane fodder; the result was unsatisfactory. I have fattened hogs by cooking the seed, and have also fed the raw seed to stock hogs by wetting them and scattering on the ground, but have lost some hogs by their eating dry seed."

Pontotoc.

E. W. MARSHALL.

No. 4. FEEDING SEED ON PASTURE AND TO HOGS: "I feed my own cattle the seed that grow on my own farm, as I think it the best possible way to save labor and seed. I take what raw seed I think necessary in a wagon and drive around the pasture, throwing a shovelful on the ground, and the cattle gather the seed quite clean.

"I once placed equal quantities of seed and corn where hogs could feed on it and eat as much of either or both as they pleased. The result was that all my hogs died."

Valley Mills.

N. E. EIGLEHART.

No. 5. SEED FOR FARM CATTLE AND SHEEP: "My experience in feeding cotton seed and its products has shown that as a hog feed it is dangerous and unprofitable; in fact, we consider that it is worthless.

"For cattle and sheep, seed and its products are recognized as a good feed. The meal and hulls, we all know can be used very profitably in fattening cattle by feeding during the last thirty days equal parts of chopped corn with meal and hulls, and during the last ten days feeding chopped corn fed with hay and hulls. Seed fed on the farm with good care is worth per hundred pounds twice as much as meal and hulls fed carelessly. Raw seed fed on the farm, properly proportioned to each animal, enables the farmer to use his roughness to advantage. In addition to this fact, the droppings are far superior as a fertilizer than where meal and hulls are fed.

"We also find that for milk cows cotton seed mixed with oats is the greatest milk and butter producer in existence."

Blackland.

M. & C. ZELLNER.

No. 6. SEED FOR MILK CATTLE: "Though I have had little experience in stock feeding, I give my milk cows a bucket of cotton seed twice a day during the feeding season. They soon tire of it so that they do not eat it clean."

Phair.

H. J. KLOORER.

No. 7. VALUE OF COTTON SEED ON THE FARM: "I have fed cotton seed to cattle for twenty-five years, and consider them worth half as much as corn.

"I have never fed them to horses, mules or sheep, and think them worth nothing to hogs, as I have never been able to get them to eat enough of the seed to do any good, except when used in a raw state, and then they will kill shotes and pigs.

"I think that all of the seed should be saved and fed on the farm, which will, in part, compensate for the low price of the lint. I would not sell the seed at twenty cents per bushel where I have cattle to consume them."

Boonsville.

D. P. NEWSON.

No. 8. SEED AND MEAL GOOD FOR CATTLE ONLY: "I regard both cotton seed and its products good for cattle, but I do not recommend the meal for horses, hogs or poultry. I have had long experience in feeding it to hogs, horses and poultry, as I operated a mill for two or three years, and I regard it as a failure for all except cattle. Horses and hogs do well on it for a time, but it ultimately has bad effects."

Wharton.

B. W. MARTIN.

No. 9. EXCHANGING SEED FOR MEAL; ROTTED SEED FOR HOGS: "I have been feeding cotton seed to my cattle for a long time, and think it the best of feeds. I have only fed the seed straight. I once tried a plan of exchanging seed for cotton seed meal when cotton seed sold for fifteen dollars per ton. I sold a few tons of seed and took the same money and bought meal at two dollars per hundred pounds, and proved to my satisfaction at that time that it did not pay to make the exchange. The raw seed went the farthest.

"I think hulls a good substitute for cheap hay, but I have had no experience in feeding them. Cotton seed for hogs have always been dangerous, though I have seen as nice pigs that have fed on rotted seed as when fed anything else."

Luling.

J. D. ANDERSON.

No. 10. COTTON SEED MEAL, SHORTS AND WHEAT BRAN FOR CHICKENS: " * * * After a preliminary feeding trial of 25 days, the hens and chickens were each separated in the two lots of five each, and were fed 125 days. Lot 1 of both hens and chickens were fed nitrogenous ration consisting of 1/3 part wheat bran, 1/3 part wheat shorts, 1/3 part cotton seed meal, and 2 parts skim milk. Lot 2 were fed a carbonaceous ration of cracked corn and corn dough. Both lots were given a small amount of green clover as long as it lasted, and afterwards cabbage. The details of the experiment are given in notes and tables.

"The chickens fed on nitrogenous food (cotton seed meal ration) just about doubled in weight, while those fed carbonaceous food only added about 1/3 of their weight.

"At the end of the experiment, little difference could be seen in the hens of the two groups, but the two lots of chickens were in striking contrast. While the chickens fed on nitrogenous food were large, plump, healthy, active, and well feathered, the chickens fed on carbonaceous ration were, in general much smaller, sickly, and, in several cases, almost destitute of feathers. Two of them had per-

fectly bare backs, and so ravenous were they for flesh and blood that they began eating one another.

"The eggs laid by the nitrogenous fed hens were of small size, had a disagreeable flavor, and red, watery albumin, and especially small, dark colored yolk, with a tender vitaline membrane which turned black after being kept several weeks; while the eggs of the carbonaceous fed hens were large, of fine flavor, of natural smell, large normal albumin, and especially large, rich, yellow yolk, with strong vitaline membrane, which was perfectly preserved several weeks in the same brine with the other eggs.

"The flesh of each group was submitted to a number of persons for a cooking test, and the almost unanimous verdict was that the flesh of the fowls fed a nitrogenous ration was darker colored, more succulent, more tender, and better flavored, though of this last there was some difference of opinion."

(I. P. Roberts and J. E. Rice in Cornell [N. Y.] Bulletin.)

No. 11. GOOD FOR SEVERAL CLASSES OF STOCK: "In reference to meal and hulls being fed to stock, I can cite you to several parties who have fed it here with very satisfactory results; and the horses with which hulls are hauled from the hull-house, are just ravenous after it while the wagons are being loaded. I have had some practical experience feeding to some young stock, especially colts, and have had the very best results. Have also seen colts fed small rations, say 1/10 of their food should be meal. It is shown by the Government analysis that this kind of feed will produce the greatest amount of muscle and flesh.

"Henry Exall, of Dallas, who is one of the most famous breeders of the State, feeds one-tenth of all his feed cotton seed meal; and he has produced the finest trotting and running horses in Texas. He has also received the highest price for one year old colts that ever left Texas. Our farmers here at one time, when corn was scarce, fed this meal and hulls to their stock very satisfactorily, and found it a great friend, as it is very much cheaper and has no bad effects.

"Mr. Goodwin, who is cashier of the First National Bank here, tells us that his buggy and saddle animal will quit his corn and oats to eat meal and hulls.

"In many instances I have seen meal and hulls fed to stock horses; to their owner's and every one else's surprise, they came out slick and fat. I do not hesitate to say that this feed can be easily and successfully mixed with other feeds for work stock. I am inclined to think that the work and exercise that these horses get, counteracts any bad effects that might be caused by over-feeding. To illustrate:

"You can feed oxen in the piney woods where they haul lumber, on meal and hulls, and it will have no bad effects to give them this feed the year round. Upon the other hand, feeding cattle in pens where they get no exercise, from 110 to 150 days is as long as they can be fed. I would say feed cotton seed meal to the amount of one-tenth of the rations, and do away with the prejudice that now exists, would be one of the greatest benefits our people could have in the way of horse feed, especially when Texas is short on corn."

Waxahachie.

R. K. ERWIN,

Sec'y and Gen. Manager Waxahachie Cotton Oil Co.

7.—HOW COTTON SEED PRODUCTS MAY AFFECT THE HEALTH OF ANIMALS.

Although cotton seed meal has been used successfully to a limited extent as a human food, and is rich in those elements necessary to the body of man and is not unpalatable, it will never come into current use as a human food stuff until the occasional bad effect upon live stock has been prevented. It is therefore a matter worthy of the widest study and investigation, and one upon which the attention of agriculturists and scientific investigators may be properly centered,

for up to this time we have hesitated to use cotton seed meal for bread making purposes in this country.

The injurious effects of the meal upon the health of domestic animals has been noted in many interesting cases. It sometimes affects cattle by causing partial blindness, lameness, sluggish movements, loss of appetite, inflammation of the vulvus (in heifers) and inflammation of the eye. In hogs, loss of appetite has been noticed, labored breathing, and the absence of blood in the extremities when suffering severely.

The causes of these troubles have been suggested in four forms:

- (1) The possible presence of an active poison in the seed or the meal.
- (2) The development of "ptomaines" during the process of digestion in the body.
- (3) The development of microscopic germs (bacteria) in damaged cotton seed meal and parts of/fermented rations left in troughs and about feeding places.
- (4) The trouble arising from feeding the entire seed, or cotton seed hulls, has been attributed to the indigestibility of the hull, because of its tough and impervious nature, together with the harmful effect of lint lodged in the lungs of the animal.

The following instances are taken from "The Cotton Plant," published by the U. S. Department of Agriculture (Kilgore), pages 420-421: "Nathusius observed for several years that the vulvus of the ewes which had been fed considerable quantities of cotton seed meal immediately after lambing, became highly inflamed, and the sheep soon died. It is stated that only those animals eating American cotton seed meal were affected, and when the use of the meal was stopped the trouble disappeared. Relief was found in the use of carbolic acid wash.

"Gautier reports sickness in calves, and Bongard injuries to calves and sheep from feeding cotton seed meal. Gips reports the death of three out of eight cattle made sick from the eating of moulded cotton seed cake.

"Esser reports the death of about 100 fattening lambs after a few days feeding on 250 grammes cotton seed meal as auxiliary food. The meal seemed of good quality, and was often fed to oxen without injury. Schwanefeldt reports the death of calves from the eating of cotton seed meal, and Peschel of cows dying of fever attributed to the effects of cotton seed cake.

"Klein fed cotton seed cake to 12 rabbits and to carp. All the animals, except one rabbit, died in a short time of inflammation of the bowels. Marcker observed in feeding cotton seed meal to sheep, that while ewes could not be affected, male sheep sickened on a much smaller ration. Post-mortem examination showed magnesium, ammonium, phosphate, calculi in the bladder, which probably caused irritation and could not be expelled so easily from the males as from the females.

"Emery, of the North Carolina Station, stated that three milk cows of different kinds had disturbances of the nervous system from eating cotton seed meal, and one died from eating old cotton seed meal.

"Voeleker mentions the death of 5,006 sheep and lambs and serious injury to many others, alleged to have been caused by eating decorticated cotton seed cake. The cake was of good quality, and the sickness and death are ascribed to over-eating. He also reports injuries to the health of cattle, and one death, from eating cotton seed cake of good quality, in which no poison could be found, and states that the injury which the cake undoubtedly did 'was clearly traced to the coarse condition and consequent indigestibility of the cotton seed husks in them.' The same authority states that 'Instances in which very mouldy feeding cakes have injured or killed cattle are too numerous to leave any room for doubt of the injurious properties of damaged or mouldy linseed or other mouldy feeding cakes.' Instances of death, or injury to health of animals, resulting from eating mouldy cakes, oats, and other foods are numerous, and have been ascribed to a mouldy (*aspergillus* spp.) known to be poisonous to animals. Zopf found in cotton seed meal several organisms, particularly *Bacterium vernicosum*, which exercise poisonous powers."

By the courtesy of Dr. A. C. True, of Washington, D. C., and the assistance of Prof. H. Ness, of this place, a translation of the important portions of the report

(in German) by Zopf, above referred to, has been made and it is evident that throughout the trials with the fission fungi selected and tested, nothing but negative results were obtained, as indicated by the following extracts translated from the original:

"INFORMATION CONCERNING THE ORGANISMS IN THE AMERICAN COTTON SEED MEAL.

* * * * *

"In order to solve the problem with certainty, or even to elucidate it, namely, that in the meal concerned no infectious fission fungi were generally present, it would be necessary to investigate each species of a great number separately, and especially to try its capability for infection: a problem which, each one acquainted with the subject will own, would be impossible to solve for one man even in the decades of years."

"Accordingly, there is nothing left except to make a selection from among these bacteria. In what way should such selection be pursued without being entirely arbitrary? There was, as the nearest, only one clew to the answer of this question, namely, the discovery already made by Mr. von Nathusius. Using this for a basis, I sought among the fission fungi, separated by me, to find a species which showed the greatest similarity in form to the one sent me in colored preparation by the above mentioned gentleman. In fact, there was a species among them (it is in the following designated as *bacterium vernicosum*) which corresponded with the above so completely that the identity of both seemed very probable. This fission fungus was then studied with regard to its morphology and physiology, and at last, from pure culture, inoculated as well as fed to sheep by Professor Puetz. Yet, in spite of the use of large quantities of this organism, the experiments upon the animals turned out completely in the negative."

"We tried next to make the sheep sick by feeding them large quantities of the American cotton seed meal sent me by Mr. von Nathusius-Hundsburg, along with the written information that it had shown itself very harmful to sheep upon his estate. The experiment remained, however, without the results wished for."

"Inoculation of sheep had already been made before this from such other fission fungi from the Kuntze meal, as by their entire physiological behaviour was suspected of capability of infection, yet these experiments gave no positive results."

"In consideration of these things, especially the results of the feeding experiments carried on with the meal, which was reputed to have shown decidedly harmful effects, it seemed to Professor Puetz and myself that a further continuation of the inquiry would be fruitless, and it was in this sense so reported to the minister."

* * * * *

PATHOLOGICAL CHARACTERS OF *Bacterium Vernicosum*.

"The consideration of the facts that *bacterium vernicosum*, in regard to form and size in its vegetable state, correspond completely to one of the bacteria which the counsel of rural economy, Mr. W. von Nathusius, found to be so amply present in fresh blood of sheep that sickened and died after being fed on American cotton seed meal; as well as the consideration of the circumstance that this fungus is able to thrive at body temperature (its optimum being 35 degrees to 52 degrees C.), and furthermore, that it possesses a peptonizing action, leads us to suppose that it would exert diverse pathological effects on the animal body."

"Accordingly, inoculation and feeding experiments on sheep were undertaken by Professor Puetz and myself. I cultivated, for this purpose, thrifty colonies upon nutritive gelatin, and swam them moderately in sterilized water (for injection), or picked the slimy mass up with a sterilized scalpel and put it into pieces of turnip, made hollow for the purpose with a knife heated to red heat (for feeding experiments)."

"In spite of the fact that the masses of fission fungi inoculated as well as fed, the results remained negative."

This subject is of international importance, though it chiefly concerns the farmers, stockmen, and the oil mills of Texas, because this State produces quite one-third of the cotton grown in the United States and feeds more live stock than any other. Much important data have been secured by the Veterinarian and other officials of this Station bearing upon the subject, but further scientific investigation is necessary in physiological, chemical, and bacteriological fields before positive results may be expected.

ANALYSES OF FEED STUFFS.

Numerous inquiries are received by the Station officers asking for information as to the relative values of various feeds, and in the table presented below there will be found the analyses of the most common feed stuffs peculiar to the Southwest.

The data show the water content of each feed stuff together with its indicated feeding and fertilizing values. These are arranged for grains, hays and green feeds.

	Dry Matter in 100 lbs.	Digestible Nutrients in 100 lbs.			Fertilizing Constituents in 1000 lbs.		
		Protein.	Carbohydrates.	Ether Extract.	Nitrogen.	Phosphoric Acid	Potash.
(1.) GRAINS, ETC.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Corn (all analyses)	89.1	7.9	66.7	4.3	18.2	7.0	4.0
Dent Corn.....	89.4	7.8	66.7	4.3	16.5	.....	.....
Flint Corn.....	88.7	8.	66.2	4.3	16.8	.....	.....
Corn and Cob Meal.....	84.9	4.4	60.	2.9	14.1	5.7	4.7
Wheat	89.5	10.2	69.2	1.7	23.6	7.9	5.0
Wheat bran	88.1	12.2	39.2	2.7	26.7	28.9	16.1
Wheat bran (winter wheat).....	87.7	12.3	37.1	2.6	.....	.....	.....
Wheat shorts.....	88.2	12.2	50.0	3.8	28.2	13.5	5.9
Wheat middlings	87.9	12.8	53.0	3.4	26.3	9.5	6.3
Rye.....	88.4	9.9	67.6	1.1	17.6	8.2	5.4
Barley	89.1	8.7	65.6	1.6	15.1	7.9	4.8
Malt Sprouts	89.8	18.6	37.1	1.7	35.5	14.3	16.3
Brewers' grains (wet) ..	24.3	3.9	9.3	1.4	8.9	3.1	0.5
Brewers' grains (dried).....	91.8	15.7	36.3	5.1	36.2	10.3	0.9
Oats	89.0	9.2	47.3	4.2	20.6	8.2	6.2
Rice.....	87.6	4.8	72.2	0.3	10.8	1.8	0.9
Rice hulls.....	91.8	1.6	44.5	0.6	5.8	1.7	1.4
Rice bran	90.3	5.3	45.1	7.3	7.1	2.9	2.4
Rice polish.....	90.0	9.0	56.4	6.5	19.7	26.7	7.1
Sorghum seed	87.2	7.0	52.1	3.1	14.8	8.1	4.2
Broom-corn seed.....	85.9	7.4	48.3	2.9	16.3	.....	.....
Kaffir corn	84.8	7.8	57.1	2.7	.....	.....	.....
Millet	86.0	8.9	45.0	3.2	20.4	8.5	3.6
Linseed meal (old process).....	90.8	29.3	32.7	7.0	54.3	16.6	13.7
Linseed meal (new process).....	89.9	28.2	40.1	2.8	57.8	18.3	13.9
Cotton seed	89.7	12.5	30.0	17.3	31.3	12.7	11.7
Cotton seed meal.....	91.8	37.2	16.9	12.2	67.9	28.8	8.7
Peas	89.5	16.8	51.8	0.7	30.8	8.2	9.9
Soja (soy) bean	89.2	29.6	22.3	14.4	53.0	18.7	19.9
Cow-pea.....	85.2	18.3	54.2	1.1	33.3	.....	.....
Horse bean.....	85.7	22.4	49.3	1.2	40.7	12.0	12.9

	Dry Matter in 100 lbs.	Digestible Nutrients in 100 lbs.			Fertilizing Constituents in 1000 lbs.		
		Protein.	Carbohydrates.	Ether Extract.	Nitrogen.	Phosphoric Acid	Potash.
(2.) HAYS, ETC.	lbs	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Timothy	86.8	2.8	43.4	1.4	12.6	5.3	9.0
Mixed grasses.....	71.01	5.9	40.9	1.2	14.1	2.7	15.5
Sago bean hay.....	88.7	10.8	38.7	1.5	23.2	6.7	10.8
Oat hay.....	91.1	4.3	46.4	1.5			
Cow pea hay.....							
Fodda corn, green.....	20.7	1.0	11.6	.4	4.1	1.5	3.3
Fodda corn (field cured).....	57.8	2.5	34.6	1.2	17.6	5.4	8.9
Fodda corn above ear.....	50.3	3.08	25.99	1.62			
Kaffir corn stover.....	80.82	1.48	43.78				
Kaffir corn fodda.....	90.35	2.15	53.49				
Kaffir corn heads.....	78.37	1.03	21.53				
Sorghum hay.....	82.04	2.4	40.6	1.2			
Cotton seed hulls.....	88.9	.3	33.1	1.7	6.9	2.5	10.2
Wheat straw.....	90.4	.4	36.3	.4	5.9	1.2	5.1
Rye straw.....	92.9	.6	40.6	.4	4.6	2.8	7.9
Oat straw.....	9.8	1.2	38.6	.8	6.2	2.	12.4
Barley straw.....	85.8	.7	41.2	.6	31.1	3.	20.9
Red clover (medium).....	84.7	6.8	35.8	1.7	20.7	3.8	22.
White clover.....	90.3	11.5	42.2	1.5	27.5	5.2	18.1
Crimson clover.....	90.4	10.5	34.9	1.2	20.5	4.	13.1
Alfalfa.....	91.6	11.	39.6	1.2	21.9	5.1	16.8
Cow pea.....	89.3	10.8	38.6	1.1	19.5	5.2	14.7
Peavine straw.....	86.4	4.3	32.3	.8	14.3	3.5	10.2

	Dry Matter in 100 lbs.	Digestible Nutrients in 100 lbs.			Fertilizing Constituents in 1000 lbs.		
		Protein.	Carbohydrates.	Ether Extract.	Nitrogen.	Phosphoric Acid	Potash.
(3.) GREEN FEEDS, ETC.							
Sorghum	82.4	2.4	4.1	1.2	.....	.....	.....
Pasture grasses (mixed)	20.	2.5	10.2	.5	9.1	2.3	7.5
Timothy (different stages).....	38.4	2.2	19.1	.6	4.8	2.6	7.6
Oat fodder	37.8	1.6	18.9	1.	4.9	1.3	3.8
Rye fodder.....	23.4	2.1	14.1	.4	3.3	1.5	7.3
Green barley.....	21.	1.9	10.2	.4	.....	.....	.....
Red clover (different stages)....	29.2	2.9	14.8	.7	5.3	1.3	4.6
Crimson clover.....	19.1	2.4	9.1	.5	4.3	1.3	4.9
Alfalfa.....	28.2	3.9	12.7	.5	7.2	1.3	5.6
Cow peas.....	16.4	1.8	8.7	.2	2.7	1.	3.1
Saja bean.....	24.9	3.2	11.	.5	2.9	1.5	5.3
Corn silage.....	20.9	.9	11.3	.7	2.8	1.1	3.7
Sorghum silage.....	23.9	.6	14.9	.2	.....	.....	.....
Alfalfa silage.....	27.5	3.	8.5	1.9	.....	.....	.....
Cow peavine silage.....	20.7	1.5	8.6	.9	.....	.....	.....
Soja bean silage.....	25.8	2.7	8.7	1.3	.....	.....	.....
Beet, sugar.....	13.5	1.1	10.2	0.1	2.2	1.0	4.8
Flat turnip.....	9.5	1.0	7.2	0.2	1.8	1.0	3.9
Rutabaga.....	11.4	1.0	8.1	0.2	1.9	1.2	4.9
Artichoke.....	20.0	2.0	16.8	0.2	2.6	1.4	4.7
Pumpkin, field.....	9.1	1.0	5.8	0.3	.....	.....	.....
Rape.....	14.0	1.5	8.1	0.2	4.5	1.5	3.6
Acorns, fresh.....	44.7	2.1	3.44	1.7	.....	.....	.....
Cow's milk	12.8	3.6	4.9	3.7	5.3	1.9	1.8
Cow's milk (colostrum)	25.4	17.6	2.7	3.6	28.2	6.6	1.1
Skim milk (gravity).....	9.6	3.1	4.7	0.8	5.6	2.0	1.9
Skim milk (centrifugal).....	9.4	2.9	5.2	0.3	5.6	2.0	1.9
Buttermilk.....	9.9	3.9	4.0	1.1	4.8	1.7	1.6
Whey	6.6	0.8	4.7	0.3	1.5	1.4	1.8