

55.
TEXAS AGRICULTURAL EXPERIMENT STATIONS.

BULLETIN NO. 76.

Animal Husbandry Section.—NOVEMBER, 1904.

EXPERIMENTS IN STEER FEEDING

- I. RICE BY-PRODUCTS FOR STEER FEEDING.
- II. FODDERS FOR FEEDING STEERS WITH COTTONSEED MEAL.
- III. MOLASSES FOR STEER FEEDING.
- IV. COMPARISON OF YEARLINGS WITH TWO-YEAR-OLDS FOR FATTENING.
- V. CORN VS. CORN AND COTTONSEED MEAL FOR STEERS ON PASTURE.



Yearling Shorthorn and Hereford Grade Steers Used in Experiments.

POSTOFFICE:

COLLEGE STATION, BRAZOS COUNTY, TEXAS.

TEXAS AGRICULTURAL EXPERIMENT STATIONS.

OFFICERS.

GOVERNING BOARD.

(BOARD OF DIRECTORS A. AND M. COLLEGE.)

M. SANSOM, President.....	Alvarado.
F. A. REICHARDT.....	Houston.
K. K. LEGGETT.....	Abilene.
GEO. T. JESTER.....	Corsicana.
W. J. CLAY.....	Austin.
A. HAIDUSEK.....	La Grange.
L. D. AMSLER.....	Hempstead.
A. J. BROWN.....	Dallas.

STATION OFFICERS.

DAVID F. HOUSTON, LL. D., President of the College.

JOHN A. CRAIG.....	Dean and Director.
H. H. HARRINGTON, M. S.....	Chemist.
M. FRANCES, D. V. M.....	Veterinarian.
F. S. JOHNSTON.....	Agriculturist.
E. J. KYLE, M. S.....	Horticulturist.
F. R. MARSHALL.....	Animal Husbandry.
EDWARD C. GREEN, B. S.....	Assistant Horticulturist.
G. S. FRAPS.....	Assistant Chemist.
R. L. BENNETT.....	Cotton Specialist.
O. M. BALL.....	Botanist.
J. G. HARRISON.....	Bookkeeper.

STATE SUB-STATIONS.

J. K. ROBERTSON, Superintendent.....	Beeville, Bee county.
W. S. HOTCHKISS, Superintendent.....	Troupe, Smith county.

NOTE.—*The main station is located on the grounds of the Agricultural and Mechanical College, in Brazos County. The Post-office address is College Station, Texas. Reports and bulletins are sent free upon application to the Director.*

EXPERIMENTS IN STEER FEEDING.

BY JOHN A. CRAIG AND F. R. MARSHALL.

The experiments reported in this bulletin were conducted with a view to determining the value in a fattening ration of some cattle foods now engaging the attention of feeders in this State. In some instances these are new materials about which little is known. Others have been reported upon by other stations, but under different conditions.

The State of Texas is peculiarly fortunate in the immensity of her possibilities in developing the cattle industry in all its departments. The ranges of the South and Northwest have the facilities and the conditions for producing as good feeding cattle as any section of the world. The degree of merit of these feeders when finished has been aptly demonstrated in international competitions where feeders taken off Texas ranges have proven to be of equal merit with those bred and finished under any other conditions. This desirable outcome has been brought about by the ranchmen giving more than usual attention to the selection of the sires that have been used on their herds. It is hoped that the conditions in the market will enable them to keep up the improvement, which they have brought about in the early maturing qualities of their stock by the use of well-bred sires. It has been one of the objects of our cattle feeding work to demonstrate the merit of Texas feeders, and also in a degree to indicate how it will be possible for the ranchman to carry his stock up to the time of sale without check. In this way the ranchman is more or less interested in the question of growing greater quantities of forage and perhaps using some mill feeds each season, not only for his feeders, but, perhaps, also as an insurance against loss of breeding stock.

It is a leading aim, also, of our work to endeavor to indicate to the feeder how the farm and mill products of Texas may be utilized to the best advantage when fed to Texas raised steers. The climatic conditions of the wide belt of territory on the eastern boundary of Texas are such as to admit of the growing of a great variety of fodders. The ravages of the boll weevil through these districts have directed attention towards the possibility of feeding such crops to steers from the range belt. To secure the greatest possible profit from growing alfalfa, corn, cow peas, peanuts, rape, and sorghum, it would seem necessary to market them as beef, pork, or mutton. Through demonstrating the values of fodders for this purpose, we hope to assist both the ranchman and the farmer in these districts.

Within recent years Texas has been producing an immense quantity of by-products, particularly by-products from the cotton crop and also those from the rice and sugar industries. In arranging for experimental work we have tried to keep in mind the desirability of determining the real value of these by-products for steer

feeding. Between the feed dealer, who thinks that the feeder wants to get something for nothing, and the feeder, who believes that the dealer is trying to sell him nothing for something, we are endeavoring to stand in the position whereby we can indicate a fair value of these by-products to each, and thus assist the ranchman, the millman, and the feeder in building up an economical cattle industry.

OUTLINE OF EXPERIMENTS CONDUCTED.

The experiments which are the basis of this bulletin extend over two years, 1903 and 1904. In January, 1903, Professor Gibbs, then Director of the Station, and Mr. Carson started an experiment, the results of which are herewith reported for the first time. Forty steers, all white faces, with a predominance of Hereford blood were used. Ten of them were two-year-olds and thirty of them yearlings. The two-year-olds and ten of the yearlings were from West Texas, and the other twenty yearlings were from South Texas ranches. This work was planned and conducted principally to test the feeding value of different concentrates, although a test of rice hulls in comparison with cottonseed hulls for roughage was also included. These steers were divided into eight lots of five each, and were fed from January 14th to April 24th, a period of 100 days, as follows:

EXPERIMENT, 1903—RICE BY-PRODUCTS AND MOLASSES.

- Lot 1—(two-year-old steers). Cottonseed meal and cottonseed hulls.
- Lot 2—(two-year-old steers). Cottonseed meal, cottonseed hulls, and molasses.
- Lot 3—(yearlings). Cottonseed meal and cottonseed hulls.
- Lot 4—(yearlings). Cottonseed meal, cottonseed hulls, and rice bran.
- Lot 5—(yearlings). Cottonseed meal, rice hulls, rice bran and cottonseed hulls.
- Lot 6—(yearlings). Cottonseed meal, rice polish and cottonseed hulls.
- Lot 7—(yearlings). Cottonseed meal, rice hulls, rice bran, and molasses.
- Lot 8—(yearlings). Corn and cob meal and alfalfa hay.

In January of 1904, thirty head of yearlings were procured and put under experiment by the present writers. It was intended to duplicate some of the previous year's work with rice products and also to test some of the forms of roughage commonly grown in East Texas. Of these yearlings ten were from the Laureles ranch, Corpus Christi, Texas, being cross-bred Shorthorn-Herefords, and twenty head were from the King ranch, Alice, Texas, these being high-grade Herefords. We wish to state that these cattle were obtained through the liberality of the managers of these ranches, Captain Tod, of Laureles ranch, and R. J. Kleberg, of the Santa Gertrudes, on such conditions as to enable us to use all our funds available for such experimental work for the purchase of feeds.

Having so much to investigate in live stock lines, our funds must necessarily be limited for any line of investigation, but these gentlemen very liberally let us have such steers, allowing us to feed them in any way that we wished, they to be reimbursed as soon as the experiments were completed and the cattle sold, by the original price of the stock. These cattle were divided into six lots as nearly as possible equal in appearance, feeding capacity, and weight. They were fed as follows:

EXPERIMENT, 1904—FODDERS WITH COTTONSEED MEAL.

- Lot 1. Cottonseed meal, rice bran, and sorghum hay.
- Lot 2. Cottonseed meal, rice bran, and cow pea hay.
- Lot 3. Cottonseed meal, rice bran, and peanut hay.
- Lot 4. Cottonseed meal, rice bran, and alfalfa hay.
- Lot 5. Cottonseed meal, rice bran, and cottonseed hulls.
- Lot 6. Cottonseed meal and cottonseed hulls.

The experiment with these cattle commenced on February 16th, and continued for a period of seventy days. The feeding was done by Messrs. J. C. Burns and C. O. Moser, senior students in the Animal Husbandry Department, and the results obtained form the basis of their graduating thesis on "The Comparative Value of Various Forms of Roughage for Beef Production."

In addition to the experiments mentioned above and the cattle included in them, two other lots of cattle were fed at the same time on the same foods as mentioned for lots 5 and 6, giving us during the work of the last two years three distinct trials of rice bran. These extra cattle were Northern bred and reared grade Shorthorns and Red Polls purchased in Chicago market, December, 1903. They were brought to the College by the Veterinary Department, to afford opportunity for experimentation as to the best possible treatment for animals being carried through the inoculation fever. These ten were selected from those making a full and complete recovery, and the experiment begun on March 25th, at which time no effect of their previous sickness could be observed. They were fed for sixty days with the results reported under "Rice By-Products for Steer Feeding" in the discussion of rice bran. They composed lots 1 and 2 in the sixty-day trial. Their rations were:

- Lot 1. Cottonseed meal, rice bran, and cottonseed hulls.
- Lot 2. Cottonseed meal and cottonseed hulls.

EXPERIMENT, 1904—CORN VS. CORN AND COTTONSEED MEAL WITH PASTURE.

During the summer of 1904, from April 21st to November 2d, a period of 196 days, thirty-eight yearling Shorthorn and Hereford grade steers were used to conduct an experiment to determine if it would be an advantage to add cottonseed meal to a ration of corn to such steers on pasture. The pasture was very poor, but, as all the steers had the same character of pasture, the experiment is a

fair trial of such feed, though it can hardly be said to represent what might be expected from such a class of steers on fair pasture. The thirty-eight head of steers were obtained through Mr. R. J. Kleberg, manager of the Santa Gertrudes ranch. They were well bred Herefords and Shorthorns and quite uniform in type. An equal number of Herefords and Shorthorns were put in each lot, making altogether two lots of nineteen head in each. The following indicates the difference in the rations of the two lots:

Lot 1—(yearlings). Corn and pasture.

Lot 2—(yearlings). Corn, cottonseed meal, and pasture.

The result of this experiment is reported under the head of "Corn vs. Corn and Cottonseed Meal for Steers on Pasture" in the latter part of this bulletin.

PRICES OF FEEDS.

In the experiments conducted in 1903, the following prices were paid for feeds at the Station, and they have been so charged in determining feed cost of one pound of gain:

Cottonseed meal	\$20.00 per ton.
Cottonseed hulls	4.00 per ton.
Rice bran	12.50 per ton.
Rice hulls	2.00 per ton.
Rice polish	20.00 per ton.
Corn and cob meal	11.42 per ton.
Alfalfa hay	14.00 per ton.

In 1904 the prices for feeds were charged as follows:

Cottonseed meal	\$21.00 per ton.
Cottonseed hulls	5.00 per ton.
Rice bran	10.00 per ton.
Alfalfa hay	15.00 per ton.
Sorghum hay	10.00 per ton.
Cow pea hay	8.00 per ton.
Peanut hay	9.00 per ton.
Prairie hay	11.00 per ton.
Corn	60 cents per bushel.
Molasses	10 cents per gallon.

These prices are those demanded on the market here and should be modified to suit local conditions in determining relative profit of different rations.

DISCUSSION OF RESULTS.

To enable us to present the results of the two years' work, it will be best to discuss the results by bringing together only those lots which should be directly compared. The five lines of experiment included in the two years' work with 118 head of steers in all were:

- I. Rice By-Products for Steer Feeding.
- II. Fodders for Feeding Steers with Cottonseed Meal.
- III. Molasses for Steer Feeding.
- IV. Comparison of Yearlings with Two-Year-Olds for Fattening.
- V. Corn vs. Corn and Cottonseed Meal for Steers on Pasture.

I. RICE BY-PRODUCTS FOR STEER FEEDING.

In Bulletin No. 73, entitled "The Composition of Rice By-Products," the Chemical Section presents very clearly the manner in which these by-products result from rice milling, and also indicates the possible nutritive value for feeding purposes. As further light upon this matter, we take the following extract from a letter from the Houston Rice Milling Company, explaining the means by which rice bran and rice polish are produced: "After the rice has passed through several machines which remove the sticks, weeds, burrs, and other foreign matter usually gathered up in the fields, and getting it as clean as possible, it goes to the hulling stones, two very large French or English burr stones, the bottom stone stationary, the top one revolving, very much like the old style grist mill, except that the stones are set very much wider apart to avoid breaking the rice. From these the rice is passed to the hulling machines, horizontal, semi-conical cylinders having metallic cores on shaft revolving at a high rate of speed. These cores have corrugations running from end to end in slightly screw form, which, while the grains are confined closely to the sides of the cylinder, thus forces the rice by the tendency of these corrugations from the hopper end of the machine to the discharge gate. One side of this cylinder is solid metal, the other perforated, and so the grain being carried over and over with each revolution is rubbed against the perforations a considerable quantity of the inside cuticle being thus removed and becoming bran. Such as comes through these perforations is finished bran and is carried away and sacked. When the rice is discharged from this machine it is a mixture of whole grains, broken grains, and such of the bran or cuticle as has been removed in passing through the machine but not forced through the perforations. In this condition it is passed to a large reel or sifter, which removes the balance of the bran and leaves the rice ready for the polishing machine, or brush, as it is usually called. The brush is sheathed in wire cloth and the rice passes down between the two and is polished by the abrasion, very much the same as the bran process, the polish or flour thus taken off being shed through the meshes of the wire cloth. The average yield per hundred pounds of rice is about seven pounds of bran and $1\frac{1}{2}$ pounds of polish, varying according to the character of the rice."

Rice Bran.—Rice bran has been selling quite freely the past season at prices approaching those asked for wheat bran. It resembles wheat bran but slightly, being finer, lighter in color, and

having a sweeter taste. Its composition has been determined by our Chemical Department. Its total composition compared with wheat bran is given in press Bulletin No. 2, Vol. 4, as follows:

Feed.	Water.	Ash.	Protein.	C. Fibre.	Nitrogen Free Extract.	Oils.
Rice Bran.....	11.5	8.5	10.1	13.3	46	10.3
Wheat Bran.....	11.9	5.8	15.4	9	54	4

As stated by the Chemical Department, much caution should be exercised in buying rice bran. Rice millers admit that more or less ground hulls are mixed with most brans. There is apparently no uniformity in the proportion of hulls in bran sold from various mills, and the output of a single mill varies considerably. For this reason, until some uniform standard is adopted, it is advisable to buy rice bran by sample only. Attention should be called to the high oil content of rice bran. Probably it is the character of this oil that causes laxativeness when liberal amounts of this feed are used. We have data on three separate experiments to show the effect of using rice bran as an addition to cottonseed meal and hull ration. In the experiment of 1903 it will be seen that, if we compare Lot 4, that received rice bran with Lot 3, that did not have any bran in their ration of cottonseed meal and hulls, we can study results from the addition of the rice bran. Bran used in this test was secured from a Houston milling firm at a cost of \$12.50 per ton. Lot 3 received hulls and meal in the proportion of one of the latter to four of the former. Two pounds of the cottonseed meal was replaced by three pounds bran for Lot 4. At no time did this lot receive more than four pounds daily of the rice bran. Their records as compared with those in the straight meal and hulls ration will give us the data for determining the value of the addition of rice bran. The results of the tests in 1903 are as follows:

RICE BRAN—100-DAY TRIAL (1903).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost of pound of gain.
Lot 3.....	659	2,862 lbs. cottonseed meal..... 11,196 lbs. cottonseed hulls.	1,105 lbs.	2.21	4.61
Lot 4.....	677	1,865 lbs. cottonseed meal..... 1,510 lbs. rice bran. 10,944 lbs. cottonseed hulls.	1,085 lbs.	2.17	4.6

RICE BRAN—70-DAY TRIAL (1904).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost per pound of gain.
Lot 6.....	562	1,822 lbs. cottonseed meal..... 5,545 lbs. cottonseed hulls.	1,010 lbs.	2.88	3.23
Lot 5.....	519	917.5 lbs. rice bran. 1,344.5 lbs. meal. 5,635 lbs. cottonseed hulls.	1,043 lbs.	2.98	3.14

RICE BRAN—60-DAY TRIAL (1904).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost per pound of gain.
Lot 1.....	730	1,646 lbs. cottonseed meal..... 7,014 lbs. cottonseed hulls.	859 lbs.	2.6	4.1
Lot 2.....	732	1,645 lbs. cottonseed meal..... 7,122 lbs. cottonseed hulls. 927 lbs. rice bran.	1,002 lbs.	3	3.9

In the first trial, by substituting 1510 pounds rice bran for 1000 pounds cottonseed meal, the daily gain was lessened $\frac{4}{100}$ of a pound.

In the second trial, where 917 pounds rice bran replaced 478 pounds cottonseed meal, the gains were $\frac{1}{10}$ of a pound per day greater.

In the third trial, 927 pounds of rice bran added to the ration caused an increased gain of 143 pounds.

The substitution of double the weight of rice bran for a part of the meal ration seems more profitable than an addition of rice bran to a full meal ration. The average of the first two trials shows that ten pounds of rice bran would be equal to six pounds cottonseed meal when fed to the extent of two-fifths of the grain ration.

Rice Polish.—Rice polish is much like wheat shorts in appearance though of a lighter color. These two materials are very similar in comparison, the main difference being a slightly higher protein content in the wheat shorts as well as a considerably higher proportion of crude fiber. The nitrogen free extract and oil are contained in greater quantities in the rice polish. The effect of using rice polish as a fattening ration is shown by the records of Lot 3 on a straight ration of cottonseed meal and hulls in comparison with Lot 6, which had rice polish in addition in the experiment of 1903. At the outset a part of the regular cottonseed meal

ration was withdrawn from Lot 6 and substituted by an equal amount of the rice polish. The most of the rice polish eaten at any one time by this lot was $2\frac{1}{2}$ pounds each per day. No disturbing influences are noted as attributable to the use of this feed. The rice polish was procured at a cost of \$20 per ton, which was exactly the same price as that being paid for the cottonseed meal at the same time, and the advisability of substituting rice polish in a straight meal and hulls ration can be judged from the records of the two lots as shown below:

RICE POLISH—100-DAY TRIAL (1903).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost of pound of gain.
Lot 3.....	659	2,862 lbs. cottonseed meal..... 11,196 lbs. cottonseed hulls.	1,105 lbs.	2.21	4.6
Lot 6.....	683	,729 lbs. cottonseed meal..... 1,177 lbs. rice polish. 1,407 lbs. cottonseed hulls.	1,145 lbs.	2.29	4.5

It will be seen that the use of rice polish in this ration at \$20 per ton made a slightly greater and cheaper gain when it replaced some of the cottonseed meal at \$20 per ton.

Rice Hulls.—The data for determining the value of rice hulls is derived from the experiments conducted during 1903. It was designed in the commencement of this experiment to feed Lot 5, exactly the same as Lot 4, except that rice hulls would be substituted for cottonseed hulls. They were started on a ration of cottonseed meal, 3 pounds, rice bran, 3 pounds, and rice hulls, 12 pounds. The hulls were apparently eaten quite readily for a time, but it was only a few days before they refused to eat up clean the 12 pounds given them, although Lot 4 was eating with a relish 20 pounds of the cottonseed hulls. When it was found they could not be induced to consume anything like a fair amount of that form of roughage, it was decided to use rice hulls mixed with cottonseed hulls. During the balance of the experiment they were fed rice hulls and cottonseed hulls in equal parts, but of this mixture they did not consume as much as Lot 4 did of the cottonseed hulls. The record of Lot 4, which had cottonseed hulls in comparison with Lot 5, having rice hulls in addition, is given as follows:

RICE HULLS—100-DAY TRIAL (1903).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost of pound of gain.
Lot 4.....	677	1,865 lbs. cottonseed meal..... 1,510 lbs. rice bran.	1,085 lbs.	2.17	4.6
Lot 5.....	662	10,944 lbs. cottonseed hulls. 1,867 lbs. cottonseed meal..... 1,455 lbs. rice bran. 4,222 lbs. rice hulls. 3,346 lbs. cottonseed hulls.	890 lbs.	1.86	4.35

These results show that rice hulls are practically of no value for steer feeding.

II. FODDER FOR FEEDING STEERS WITH COTTON-SEED MEAL.

The steers used in this experiment were all yearlings, and are described more fully in the forepart of the bulletin outlining the work conducted in 1904. The experiment, beginning February 16th, extended over seventy days. The aim of the experiment was to try and determine if any improvement could be made on the common ration of cottonseed meal and cottonseed hulls used by the majority of feeders in this State. The several fodders enumerated below were each tried with a ration consisting of cottonseed meal and rice bran, and, as another lot was fed on cottonseed meal and cottonseed hulls alone, it is possible to indicate whether it was of any advantage whatever to add these fodders to such a ration.

Sorghum Hay.—One trial. The gains of five steers (Lot 1) receiving sorghum hay, rice bran, and cottonseed meal are compared with gains made by five other steers receiving cottonseed hulls with rice bran and cottonseed meal mixed through them. The aim was, in each case, to allow the cattle all the roughage they could clean up. Lot 1 was started on $2\frac{1}{2}$ pounds rice bran, $1\frac{3}{4}$ pounds cottonseed meal, and 8 pounds sorghum hay per head per day. At the end of forty days they were eating daily $2\frac{3}{4}$ pounds rice bran, 6 pounds cottonseed meal, and 13 pounds sorghum hay. No further increase was made in bran, and they would clean up no more of the hay; the meal was increased to 6 pounds per day by the fiftieth day, and no further change was made.

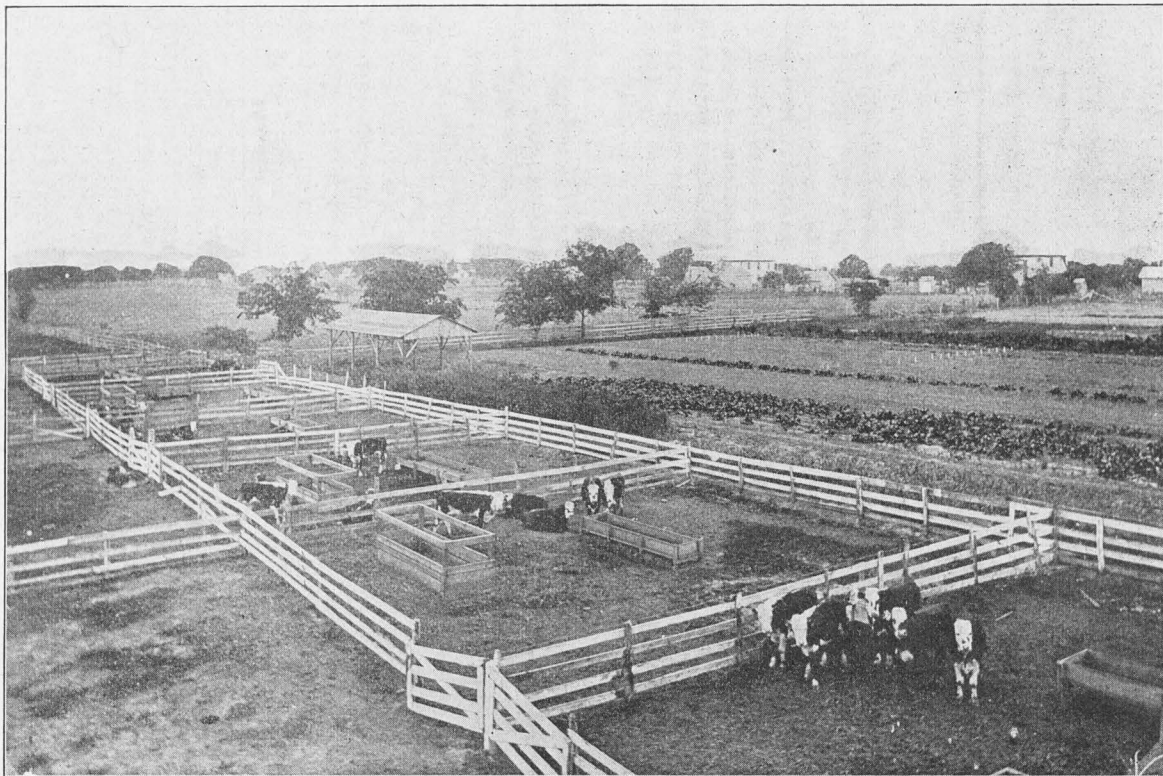
SORGHUM—70-DAY TRIAL (1904).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost of pound of gain.
Lot 1.....	541	917.5 lbs. rice bran..... 1,344.5 lbs. cottonseed meal. 3,929 lbs. sorghum hay.	824 lbs.	2.35	4.6
Lot 5.....	519	917.5 lbs. rice bran..... 1,344.5 lbs. cottonseed meal. 5,635 lbs. cottonseed hulls.	1,043 lbs.	2.98	3.1

Since the grain ration is the same for these two lots, it would appear that 5635 pounds hulls produced 219 pounds more gain than did 3929 pounds sorghum hay. In all probability some of the gain may be attributed to a better digestion of the meal and bran owing to being mixed with the hulls, as it is not possible to do with sorghum hay. With cottonseed meal and rice bran as concentrates, then, sorghum has the value indicated above, which expressed in other terms is: that 1 pound sorghum hay is equal to 1.02 pounds cottonseed hulls. Another point worthy of observation is that it is not possible to induce cattle to consume as much of the sorghum hay as they will eat of the hulls fed with meal mixed through. The most we could get these 600-pound steers to eat of the hay was 13 pounds each per day.

Cow Pea Hay.—One trial. The gains of Lot 2, fed cow pea hay, cottonseed meal, and rice bran are compared with those of Lot 5, that received cottonseed hulls, cottonseed meal, and rice bran. While the cow pea hay contained a great many pods, it had evidently been rather ripe when cut, as most of the leaves were fallen and the stalks were quite woody. It is important to note in this case that a nitrogenous roughage, having a nutritive ratio in itself of nearly 1 to 4, was fed with cottonseed meal, the nutritive ratio of which is 1 to 1.2. Economical gains should not be expected from feeding so wastefully of protein, but, inasmuch as cottonseed meal is the concentrate in general use over the State, it was thought best to first study the value of this hay in combination with that feed. At the outset this lot received $2\frac{1}{2}$ pounds rice bran, $1\frac{3}{4}$ pounds cottonseed meal, and 8 pounds cow pea hay. At the close of seventy days they were eating $2\frac{3}{4}$ pounds rice bran, 6 pounds cottonseed meal, and 15 pounds cow pea hay. The changes in the ration of Lot 5 have been noted previously.

The records of the two lots is shown in the following table:



Yearling Hereford-Shorthorn steers in the feed lots when used in the experiment—Fodders with Cottonseed Meal.

COW PEA HAY—70-DAY TRIAL (1904).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost of pound of gain.
Lot 2.....	561	917.5 lbs. rice bran..... 1,344.5 lbs. cottonseed meal. 4,491 lbs. cow pea hay.	812 lbs.	2.3	4.5
Lot 5.....	519	917.5 lbs. rice bran..... 1,344 lbs. cottonseed meal. 5,635 lbs. cottonseed hulls.	1,043 lbs.	2.98	3.1

With similar amounts of grain fed, a difference of 231 pounds gain is attributable to feeding 5635 pounds of hulls instead of 4491 pounds of cow pea hay. On this basis 1 pound of cow pea hay is equivalent to .94 pounds of hulls, provided animals would consume as much of one as of the other, which they might do if cow pea hay were of the best quality. This valuable feed will undoubtedly yield a larger profit fed along with a carbonaceous grain ration.

Peanut Hay.—One trial. The case of Lot 3 is similar to Lot 2. The peanut hay contained a great many peanuts and had evidently been well cured, most of the leaves being present. The animals ate it quite readily, and at the outset received 10 pounds per day, their other feed being the same as for Lots 1, 2, and 5. At the first monthly weighing it was apparent that, though all steers in Lot 3 were eating well, they were not putting on the weight that most of the other cattle were. However, no serious symptoms other than an undesirably loose condition of the bowels were observed until the sixth week. At this time, although they were still eating well, the droppings were too soft, there was redness about the eyes, and some swelling about the sheath. Feeding was continued several days after these symptoms were observed, and, though no serious illness developed, the gains ceased. At this time they were eating $2\frac{3}{4}$ pounds rice bran, 5 pounds cottonseed meal, and 15 pounds peanut hay daily per head. The peanut hay was discontinued and prairie hay substituted. This record as compared with Lot 5 for the same time, namely, for first 42 days of the 70-day trial is shown:

PEANUT HAY—42-DAY TRIAL (1904).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost of pound of gain.
Lot 3.....	516	546 lbs. rice bran..... 606 lbs. cottonseed meal. 2,899 lbs. peanut hay.	390 lbs.	1.86	4.5
Lot 5.....	519	546 lbs. rice bran..... 606 lbs. cottonseed meal. 2,985 lbs. cottonseed hulls.	590 lbs.	2.81	3.1

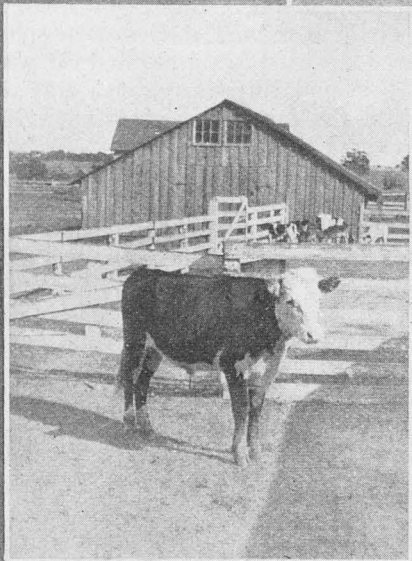
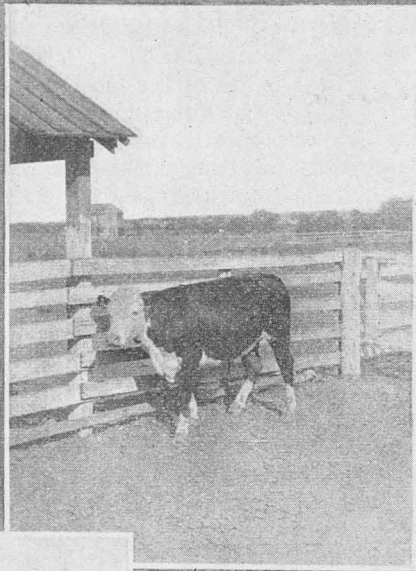
It is useless to compare peanut hay with cottonseed hulls as an adjunct to cottonseed meal; not only is it unsafe when so fed, but it is a wasteful use of protein which could be much better utilized if fed with corn or molasses or to younger or breeding stock in limited quantities. Peanuts are a valuable forage crops for hogs, and the hay is relished well by both cattle and sheep, and judiciously utilized is one of the most valuable crops in this district.

Prairie Hay.—Lot 3 having been taken off of peanut hay, Texas prairie hay was substituted. No further unfavorable symptoms were apparent, and the gains improved. For the four remaining weeks they made an average daily gain of 3.44 pounds per head. Compared with cottonseed hulls, prairie hay would seem to have a value three-tenths greater than the former. Four weeks was too short a time, however, to do more than observe the general effects upon the animals.

Alfalfa Hay.—One trial. The alfalfa hay fed to Lot 4 was purchased, baled, from a local dealer, and was of an excellent color. Ten pounds daily per head were fed at first, and at the end of the sixth week they were eating 13 pounds. The effects here were similar to those noted for Lots 2 and 3 except that the scouring was much more serious, due not only to the narrowness of the ration but to the laxative qualities of the alfalfa itself. The scouring being too pronounced to permit of satisfactory gains, a change was made at the end of the sixth week, and shelled corn substituted for a part of the cottonseed meal. During the first six weeks Lot 4, having consumed 2259 pounds alfalfa, gained only 245 pounds. Lot 5, having received the same amounts of meal and bran and 2985 pounds hulls, gained 590 pounds.

After the introduction of the corn, the steers did much better, very few grains passing through undigested after the first four or five days. The gains for the closing month were 2.7 pounds per head daily. It is not possible to compare the feeding value of alfalfa and hulls in this instance, but where considerable amounts of corn are used alfalfa is well known to be a very valuable feeding stuff. With cottonseed meal as the main concentrate, alfalfa can not be used satisfactorily.

To make a comparison so that the two standard rations of cottonseed meal and hulls as against corn cob meal and alfalfa, two lots were fed on these different rations from among the yearlings in the experiment of 1903. If we compare Lot 3 and Lot 8, it is impossible to arrive at some conclusion as to the relative value of these two very characteristic rations for steer feeding. Cottonseed meal and hulls is the ration that is most generally used throughout the cotton belt, while corn and alfalfa will likely be conceded to be the ration which is most generally followed in the corn belt where alfalfa is obtainable.



The steer best in type shown in the upper illustration, and the poorest steer shown in the lower illustration, in the group of thirty head of yearlings used in the experiment—Fodders with Cottonseed Meal.

ALFALFA HAY—100-DAY TRIAL (1903).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost of pound of gain.
Lot 3	659	2,862 lbs. cottonseed meal..... 11,196 lbs. cottonseed hulls.	1,105 lbs.	2.21	4.6
Lot 8.....	684	5,570 lbs. corn and cob meal... 8,460 lbs. alfalfa hay.	1,265 lbs.	2.53	7

It will be seen from this table that alfalfa and corn cob meal produce slightly more satisfactory gains, but, under conditions existing in the greater part of Texas, it will hardly be possible to make a pound of gain as cheaply as on a ration consisting of cottonseed meal and hulls. The alfalfa hay in this instance was very high priced, and, of course, the returns may be greatly modified by the difference in prices prevailing in different districts. If we charge the alfalfa at \$5 per ton and the corn at 40 cents per bushel the feed cost of one pound of gain would be 4.1 cents. These are near the prices paid in the most favored districts. On this basis the comparison with the cottonseed meal and hull ration shows that these rations give very similar results. As these steers were very similar in every particular and conditions very uniform, this experiment supplies material for an interesting comparison, which the reader is asked to carry out according to the prices prevailing in different districts.

III. MOLASSES FOR STEER FEEDING.

It will be seen that, if we compare Lot 1 and Lot 2, in the experiment of 1903, it will afford us the data for determining whether it would be advisable to add molasses to the ration of cottonseed meal and hulls for steer feeding. These steers were the same age, being two-year-olds from the same ranch, and were very evenly divided as to weight. The experiment, like the others conducted, extended over 100 days. The molasses was purchased at 10 cents per gallon, and they received one-fifth gallon per head per day throughout the trial. The following table presents the results in a way that admits of direct comparison:

MOLASSES—100-DAY TRIAL (1903).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost of pound of gain.
Lot 1.....	879	3,380 lbs. cottonseed meal..... 13,325 lbs. cottonseed hulls.	1,295 lbs.	2.59	4.66
Lot 2.....	877	3,380 lbs. cottonseed meal..... 13,213 lbs. cottonseed hulls. 100 gals. molasses.	1,550 lbs.	3.1	4.52

It will be seen from this that the lot receiving molasses as an addition to their ration not only made a greater gain per head daily, but it was also made cheaper. The gain made by the steers that were fed molasses is exceptionally high, and the cost was reasonable, all of which indicates that molasses is an addition to such a ration which should be exceedingly satisfactory. It is possible that even better results than these might be obtained by feeding a larger quantity of the molasses, but the determination of this point we reserve for further experiment.

IV. COMPARISON OF YEARLINGS WITH TWO-YEAR-OLDS FOR FATTENING.

If we refer back to the conduct of Lot 1, as compared with the progress of Lot 3, in the experiment of 1903, we will find that it is possible to make a comparison between the feeding capacity of yearlings as compared with two-year-olds. Lot 1 included five two-year-old steers that were fed for a period of 100 days on cottonseed meal and hulls, and Lot 3 comprised five head of yearlings fed for the same length of time under exactly the same conditions and on an exactly similar ration. The following table shows the chief points determined in the feeding of these two-year-olds:

YEARLINGS VS. TWO-YEAR-OLDS—100-DAY TRIAL (1903).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost of pound of gain.
Lot 1.....	879	3,380 lbs. cottonseed meal..... 13,325 lbs. cottonseed hulls.	1,295 lbs.	2.59	4.66
Lot 3.....	659	2,862 lbs. cottonseed meal..... 11,196 lbs. cottonseed hulls.	1,105 lbs.	2.21	4.6

It will be seen that the yearlings were slightly better weight for their ages than the two-year-olds, but in this instance they did not

do quite as well on a meal and hull ration as more mature cattle. There was no more tendency, however, to refuse the feed in this lot than there was with the older cattle; both relished their rations. It will be seen that at the close of the experiment the gains were nearly equal. With good farm-grown feeds containing a more nutritious roughage, the gain made by yearlings and two-year-olds has been known to be very much in favor of the younger stock, but with such a ration as cottonseed hulls and meal the difference between the progress of the yearlings as compared with the two-year-olds was practically of no value.

V. CORN VS. CORN AND COTTONSEED MEAL FOR STEERS ON PASTURE.

Thirty-eight yearlings of Shorthorn and Hereford breeding were divided into two lots, and from April 21st to November 2d, a period of 196 days, they were on pasture and fed two different rations. Lot 1, nineteen head, received corn shelled and in the ear with the addition of cotton seed meal. The following table permits of a direct comparison of the progress of these two lots fed in these different on pasture:

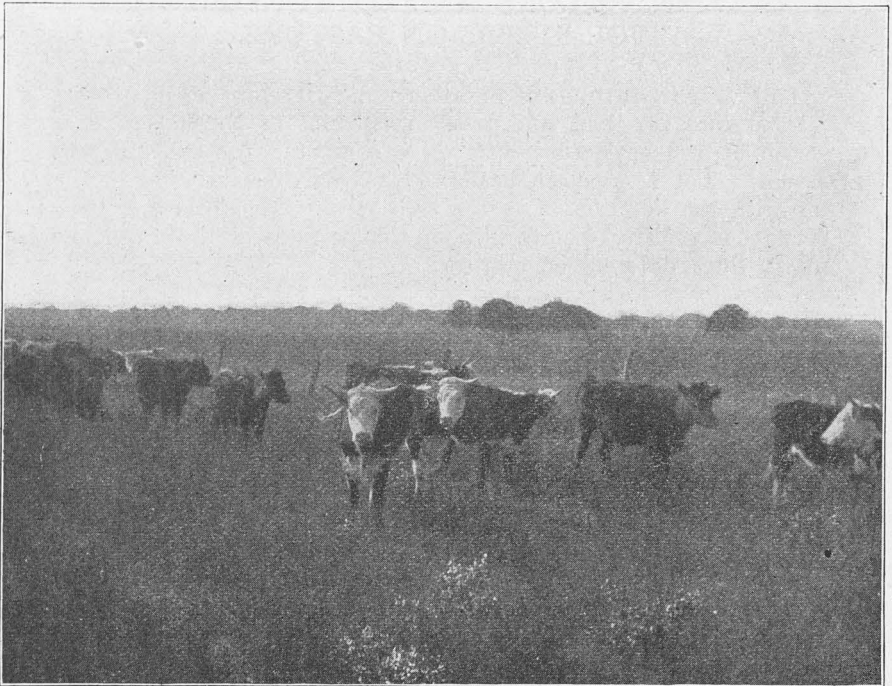
YEARLINGS—196-DAY TRIAL (1904).

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed cost of pound of gain.
Lot 1..... (Corn)	457	5,614 lbs. shelled corn.....	3,244 lbs.	.87	4.6
Lot 2..... (Corn and cottonseed meal)	472	10,345 lbs. ear corn. 4,012 lbs. shelled corn..... 8,050 lbs. ear corn. 3,267 lbs. cottonseed meal.	4,075 lbs.	1.1	3.6

It will be noted from the above results that, by substituting 3267 pounds of cottonseed meal for 3438 pounds corn, gives an increase in gain of 831 pounds. This indicates that cottonseed meal with some corn would make a better ration for feeding such steers on pasture.

At the Nebraska Experiment Station, in Bulletin No. 85, a somewhat similar experiment was conducted entitled "Corn vs. Corn and Oil Meal on Grass for Fattening Two-Year-Old Steers." It will be noted in this case that oil meal was used instead of cottonseed meal, and that the steers were two-year-olds, but the result of the experiment also indicates that the addition of oil meal to corn for steers on grass gives better results than corn alone:

	Average weight at beginning.	Feed eaten.	Total gain.	Average daily gain per head.	Feed and pasture cost of pound of gain.
Lot 1..... (Corn)	1100	3,813 lbs. corn.....	1,740 lbs.	1.6	7.4
Lot 2..... (Corn and oil meal)	1080	3,432 lbs. corn..... 381 lbs. oil meal.	2,165 lbs.	2.	6.5



The yearling Hereford and Shorthorn grades used in the experiment with Corn and Cottonseed-Meal on Grass.

When they charged the corn at 33 cents per bushel, oil meal at \$25 per ton, and grass at \$3 per acre, it was estimated that 100 pounds of gain would cost \$7.41 on corn alone with pasture, while each 100 pounds of corn and oil meal with pasture cost \$6.55. It is further estimated that with corn alone 23 per cent more grain was required for a given increase in weight than with corn and oil meal, and that the cost of gains with corn alone was 13 per cent greater than with corn and oil meal. These results are similar in their teaching to those which we obtained in this experiment. Oil meal and cottonseed meal are not unlike in composition, and, consequently, they might be expected to effect the corn ration in a very similar manner.

SUMMARY OF EXPERIMENTS.

YEAR 1903.—RICE BY-PRODUCTS AND MOLASSES.

	No. of days.	Average weight.	Feed Eaten.											Total gain.	Average daily gain per head.	Feed cost per pound of gain.			
			Cottonseed meal.	Rice polish.	Rice bran.	Corn and cob meal.	Molasses.	Cottonseed hulls.	Sorghum hay.	Rice hulls.	Cow pea hay.	Peanut hay.	Prairie hay.				Corn.	Alfalfa hay.	
Lot No. 1.....	100	879 lbs.	3380. lbs.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1295 lbs.	2.59 lbs.	4.66
Lot No. 2.....	100	877 lbs.	3380. lbs.	.....	.....	.....	100 gal.	13213 lbs.	.....	.....	.....	.....	.....	.....	.....	.....	1550 lbs.	3.1 lbs.	4.52
Lot No. 3.....	100	659 lbs.	2862. lbs.	.....	.....	.....	.....	11196 lbs.	.....	.....	.....	.....	.....	.....	.....	.....	1105 lbs.	2.21 lbs.	4.61
Lot No. 4.....	100	677 lbs.	1865. lbs.	.....	1510. lbs.	.....	.....	10944 lbs.	.....	.....	.....	.....	.....	.....	.....	.....	1085 lbs.	2.17 lbs.	4.6
Lot No. 5.....	100	662 lbs.	1867. lbs.	.....	1455. lbs.	.....	.....	3346 lbs.	.....	4222	.....	.....	.....	.....	.....	.....	890 lbs.	1.86 lbs.	4.35
Lot No. 6.....	100	683 lbs.	1729. lbs.	1177	.....	.....	.....	11407 lbs.	.....	.....	.....	.....	.....	.....	.....	.....	1145 lbs.	2.29 lbs.	4.53
Lot No. 7.....	100	649 lbs.	1930. lbs.	.....	1538. lbs.	.....	96 gal.	3734 lbs.	.....	4380	.....	.....	.....	.....	.....	.....	1105 lbs.	2.21 lbs.	4.55
Lot No. 8.....	100	684 lbs.	.....	.....	.....	.....	5570	.....	.....	.....	.....	.....	.....	.....	.....	.....	1265 lbs.	2.53 lbs.	7.

YEAR 1904.—FODDER WITH COTTONSEED MEAL.

Lot No. 1.....	70	541 lbs.	1344.5 lbs.	.....	917.5 lbs.	.....	.....	.....	3929	.....	.....	.....	.....	.....	.....	.....	824 lbs.	2.35 lbs.	4.63
Lot No. 2.....	70	561 lbs.	1344.5 lbs.	.....	917.5 lbs.	.....	.....	.....	.....	4491	.....	.....	.....	.....	.....	.....	812 lbs.	2.3 lbs.	4.51
Lot No. 3.....	70	516 lbs.	1344.5 lbs.	.....	917.5 lbs.	.....	.....	.....	.....	.....	2899	1470	.....	.....	.....	.....	872 lbs.	2.49 lbs.	4.57
Lot No. 4.....	70	546 lbs.	783.5 lbs.	.....	917.5 lbs.	.....	.....	.....	.....	.....	.....	.....	688	3949	.....	.....	627 lbs.	1.8 lbs.	9.94
Lot No. 5.....	70	519 lbs.	1344.5 lbs.	.....	917.5 lbs.	.....	.....	5635 lbs.	.....	.....	.....	.....	.....	.....	.....	.....	1043 lbs.	2.98 lbs.	3.14
Lot No. 6.....	70	562 lbs.	1822. lbs.	.....	.....	.....	.....	.....	5545	.....	.....	.....	.....	.....	.....	.....	1010 lbs.	2.88 lbs.	3.23

CORN VS. CORN AND COTTONSEED MEAL ON PASTURE

Lot No. 1.....	196	457 lbs.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3244 lbs.	.87 lbs.	4.6
Lot No. 2.....	196	472 lbs.	3267. lbs.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4075 lbs.	1.1 lbs.	3.6

Ear corn.

CONCLUSIONS.

1. Rice bran added to a ration of cottonseed meal and hulls in two out of three trials gave an increased rate of gain at a lower cost.

2. Rice polish added to a ration of cottonseed meal and hulls slightly increased the rate of gain at the same cost.

3. Rice hulls were not satisfactory as a substitute for cottonseed hulls, as the steers did not relish them.

4. Rice hulls fed with cottonseed meal, rice bran and molasses were unsatisfactory, as the steers could not be induced to eat a fair ration.

5. Sorghum hay in a ration of cottonseed meal and rice bran gave about equal results to cottonseed hulls, as 1 in the former results equal to 1.02 pounds of cottonseed hulls. The daily rate of gain per head was slightly in favor of the hulls, being 2.98 pounds as against 2.35 pounds in the instance of the sorghum.

6. Cow pea hay was not found as satisfactory as cottonseed hulls in a ration of rice bran and cottonseed meal, as the daily rate of gain per head was 2.98 pounds in the instance of the lot receiving hulls and 2.3 pounds in the trial with cow pea hay. A pound of cow pea hay was equaled by .94 of a pounds of hulls.

7. Peanut hay was very unsatisfactory fed with rice bran and cottonseed meal, owing to the fact that it was a very nutritive food, being too similar to cottonseed meal in composition to mix well with it.

8. Alfalfa hay was a very unsatisfactory addition to rice bran and cottonseed meal ration, for the reason that it was also rich in those constituents which are abundant in cottonseed meal, making the ration too nitrogenous.

Cottonseed meal and hulls make the most generally used ration in the cotton belt, while corn and alfalfa hay are most highly thought of as a ration in the corn belt. A comparison of these rations becomes interesting from these facts.

The steers receiving the ration of cottonseed meal and hulls ate daily per head 5.7 pounds of cottonseed meal and 22.4 pounds of hulls, and gained 2.21 pounds. With the cottonseed meal at \$20 per ton and the hulls at \$4 per ton, the cost of 1 pound of gain was 4 cents.

9. The steers receiving the alfalfa and corn and cob meal ate daily per head 11 pounds of corn and cob meal and 16.9 pounds of alfalfa, and gained 2.53 pounds. With the corn and cob meal at 40 cents per bushel, and the alfalfa at \$5 per ton, the cost of 1 pound of gain was 4.1 cents. It will be seen from this that the cost of fattening steers under the very best circumstances for securing the most economical rations is very similar.

10. Molasses added to a ration consisting of cottonseed meal and hulls resulted in a greater and cheaper gain from those receiving it, as they gained 3.11 pounds per head daily, while those not receiving it gained 2.59 pounds.

11. Yearling steers in comparison with two-year-old steers on rations of cotton seed meal and hulls made about the same gain at a little cheaper cost. The two-year-old steers gained 2.59 pounds per head daily and the yearlings 2.21 pounds.

12. In feeding steers on pasture it was found that a corn and cottonseed meal ration gave better returns than corn alone. The substitution of 3267 pounds of cottonseed meal for 3438 pounds of corn gave an increased gain of 831 pounds on the total lot of nineteen head.