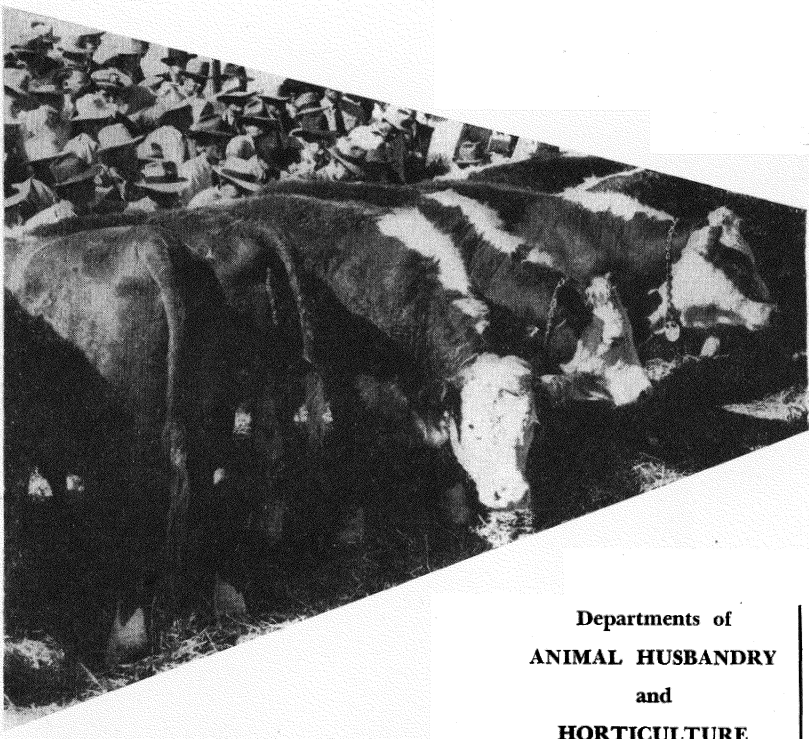


DRIED SWEET POTATOES

as a replacement for corn

In Fattening Beef Cattle



Departments of
ANIMAL HUSBANDRY
and
HORTICULTURE

OKLAHOMA AGRICULTURAL EXPERIMENT STATION

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THE COVER: A close-up view of cattle fattened on dried sweet potatoes. The picture was taken during a Feeders' day tour at Oklahoma A. & M. College.

THE ANSWER IN BRIEF

The South, and particularly the Southwest, has need for additional concentrate feed to use in finishing cattle produced on grass. This bulletin reports results of feeding trials made at the Oklahoma Agricultural Experiment Station to determine the value of dehydrated sweet potatoes in a fattening ration for beef calves.

In general, these tests showed that dried sweet potatoes are a palatable feed under most circumstances, and that they may be used as at least a part of the concentrate in a steer fattening ration. Whether their use is to be recommended depends, of course, upon the cost of sweet potatoes as compared to the cost of corn or other carbonaceous concentrates. Further summary observations will be found on page 13.

In swine feeding, sweet potatoes have been unsatisfactory as a replacement for corn, in whole or in part.

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DRIED SWEET POTATOES

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In Fattening Beef Cattle

By A. E. DARLOW, O. B. ROSS, D. F. STEPHENS, R. W. MacVICAR,
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BEEF PRODUCTION in the southwestern part of the United States is based chiefly on a system of management which makes excellent use of grass but, in general, necessitates grain feeding of the cattle in the Corn Belt before they are finally ready for market. Grain feeding is particularly necessary for cattle that leave the ranges before they are three years of age.

The production of finished beef in the South and Southwest is handicapped by lack of concentrates for finishing the cattle. Many Southwestern cattlemen would prefer to finish cattle in the area where they are produced if grain were available in sufficient quantities. Southwestern dairymen, also, must often import concentrates for their cattle. Therefore the possibility of using sweet potatoes as a livestock feed has received attention during the past few years.

Sandy, infertile soils, of which there are vast areas in Oklahoma and the South, are ideal for sweet potatoes but produce very poor yields of corn. Sweet potatoes on such soil may produce more carbohydrate material than the best soils of the State when planted to corn. Such a crop, if found suitable for livestock feeding, would be of great value to producers of meat animals and dairy products in the South and Southwest.

Cull sweet potatoes are already being dehydrated for use as feed. The feasibility of growing sweet potatoes solely for livestock feed will depend on cost compared with corn, and cost of sweet potatoes will depend on yield, cost of harvesting, and cost of processing. The Oklahoma Station, as well as one or two other Southern experiment stations, has developed high-yielding strains suitable for livestock feed, and these could be made available if there were a demand for them.

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This bulletin summarizes results of feeding tests in which dehydrated sweet potatoes were compared to corn as a concentrate for fattening beef calves.*

Results of these tests showed, in general, that dried sweet potatoes, are a palatable feed under most circumstances, and that they may be used as at least part of the concentrate in a steer fattening ration whenever they have an economic advantage over corn.

RESULTS OF EARLIER RESEARCH

Several stations in the South have reported enough work with dried or dehydrated sweet potatoes to indicate the possibility of using them in livestock rations. Grimes (1914)** used sweet potatoes to replace corn for fattening steers, and they proved to be 91 percent as efficient as corn. The two concentrates were fed with cottonseed meal and peanut hay. In another trial (1942) he found sweet potatoes to be worth 90 percent as much as corn when each of the concentrates was fed with cottonseed meal, hay, and silage. Cullison (1944) fed four steers sweet potatoes, cottonseed meal and Dallis grass hay. The steers gained 1.84 pounds per head per day as compared to 1.8 pounds per head daily for ten heifers that were fed a similar ration where corn replaced sweet potatoes. A previous report from Mississippi (1942) showed that sweet potatoes were very nearly as efficient as corn in producing gain on steer calves. Similar results were reported by the Tennessee station (1940), where sweet potatoes replaced corn in the feeding of steer calves. Copeland (1941) found sweet potatoes to be 90 percent as efficient as corn in a dairy cow ration.

Grimes (1941) reported that mules did not eat straight sweet potatoes readily and that they used them to best advantage when they constituted not over 50 percent of the ration. He reported further that sweet potatoes proved to be unsatisfactory for pigs weighing fifty pounds. The pigs fed sweet potatoes ate only about half as much

* These feeding trials are reported more fully in the following publications:

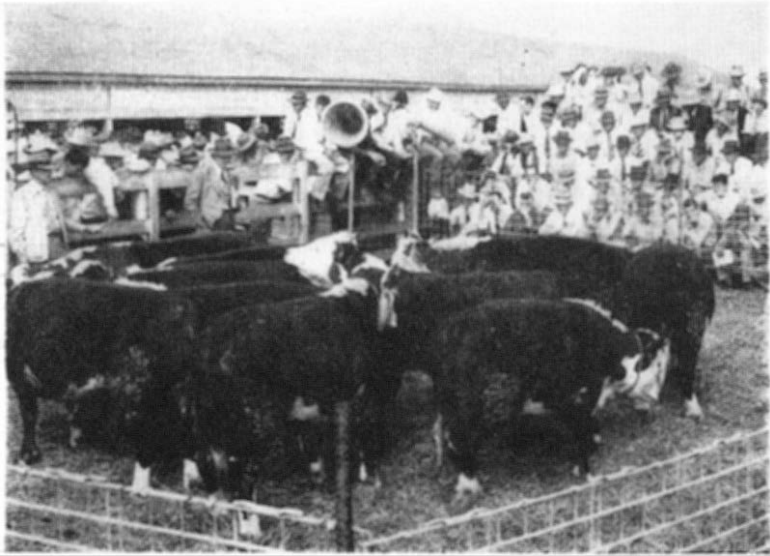
Darlow, A. E., et al., "Dried sweet potatoes and ground wheat as a substitute for fattening steer calves." Okla. Agri. Exp. Sta. Mimco Cir. 136. pp. 19-21 (April, 1945.)

----- "A comparison of dried sweet potatoes, wheat and corn for fattening steer calves." Okla. Agri. Exp. Sta. Bul. 296 pp. 39-42 (April, 1946.)

Ross, O. B., et al., "A comparison of dried sweet potatoes, mungbeans and corn, and a comparison of urea pellets, ground mungbeans and cottonseed meal for fattening steer calves." Okla. Agri. Exp. Sta. Misc. Pub. MP-11, pp. 39-44 (May, 1947.)

----- "A comparison of dried sweet potatoes, ground mungbeans and corn, and a comparison of urea pellets, ground mungbeans and cottonseed meal for fattening steer calves." Okla. Agri. Exp. Sta. Misc. Pub. MP-13, pp. 48-52, (April, 1948.)

** Dates in parentheses refer to articles listed in "Literature Cited," page 15



These Steers Were Fattened on Dried Sweet Potatoes.

Fattening ration for these animals, seen during Feeders' day at Oklahoma A. & M. College, was dried sweet potatoes. They are a palatable feed under most circumstances, and may be used as a part of the concentrate in a steer fattening ration. Recommendation of their use depends upon the cost of sweet potatoes as compared to other carbonaceous concentrates such as corn.

feed as did pigs fed corn. There was also considerable scouring among the sweet potato pigs. Larger pigs made more satisfactory use of sweet potatoes, but in no instance were they as valuable as corn, and in no case did they do well when the sweet potatoes constituted more than 50 percent of the ration. Godbey (1942), working with fattening hogs in dry lots, found the pigs ate insufficient amounts of sweet potato meal to make satisfactory gains. This trial was discontinued after 42 days due to the refusal of the pigs to consume the sweet potato meal.

Unpublished data on one feeding trial at the Oklahoma Station indicate that dried sweet potatoes should not be used in a swine fattening ration. Rate of gain was decreased and feed required per hundredweight gain was increased in all lots where sweet potatoes replaced any portion of corn in the ration.

Southwell and Black (1948) state "Dehydrated sweet potatoes are not equal to corn in fattening feed for steers if they furnish all of the carbohydrate portion of the feed, but are equal to corn if they re-

place up to fifty percent of the corn in the ration." Their data show that the straight sweet potato fed steers required less total feed per hundredweight gain than did steers on either of the other two rations; but they ate less feed, gained more slowly, and sold at a lower price than either of the other lots.

Digestion trials to determine the digestibility of sweet potatoes in combination with other ration ingredients by lambs and steers were made at this station by Briggs *et al.* In the test with steers, the digestibility of the nitrogen-free extract of sweet potatoes was greater than that of corn. The reverse was true for lambs. The apparent digestibility of the protein in sweet potatoes was lower than that of corn for both lambs and steers, and markedly lower for lambs. The weighted average of the information gathered from both lambs and steers on the basis of total digestible nutrient content showed that the dried sweet potatoes had 92.3 percent of the value of No. 3 corn.

HOW THE OKLAHOMA TESTS WERE MADE

The cattle tests were begun in 1944 and continued for four years. All of the experiments were conducted with weanling steer calves which weighed approximately 500 pounds when placed on feed. During the first two years there were two lots, one of which was fed corn as the carbonaceous concentrate, and the other fed sweet potatoes. A third lot was added during the last two years, and this lot received a concentrate ration composed of one-half corn and one-half sweet potatoes. There were ten steers per lot in all tests. The corn steers were fed $1\frac{1}{2}$ pounds of cottonseed meal daily in all tests. The protein content of sweet potatoes was lower than that of corn (Table I), therefore the cottonseed meal fed to the sweet potato steers was adjusted so that all rations contained approximately equal amounts of protein. The average length of the feeding period for the four tests was 166 days.

RESULTS OF THE OKLAHOMA TEST, BY YEARS

1944-45

The sweet potatoes fed in 1944 were culls furnished by the Department of Horticulture of the Oklahoma Agricultural Experiment Station. They were prepared by slicing and spreading on concrete pavement to dry in the sun. The cattle fed these sweet potatoes gained about as rapidly as those fed corn. Both lots were valued at the same price when they went to market, but the sweet potato lot required more pounds of concentrate (potatoes and cottonseed meal)

TABLE I.—Chemical Composition of Corn and Dried Sweet Potatoes Used in Feeding Trials.

(Percent: dry matter basis)

	Dry matter	Ash	Crude protein	Fat*	Fiber	Carbohydrate**	Calcium	Phosphorus
1945								
Corn	83.23	1.73	12.03	2.29	2.55	81.40	.02	.336
Potatoes	90.66	6.30	6.24	1.44	4.02	82.00	.30	.221
1946								
Corn	87.26	1.97	9.55	3.20	2.44	82.84	.06	.332
Potatoes	88.38	6.80	7.38	1.43	3.58	80.81	.29	.204
1947								
Gr. Corn	87.63	1.39	9.46	3.67	2.43	83.05	.04	.288
Potatoes	91.73	6.06	5.41	1.17	3.59	87.77	.21	.174
1948								
Gr. Corn	86.29	1.69	9.69	5.27†	2.50	80.85	.069	.276
Potatoes	90.98	4.41	5.30	4.47†	4.85	80.97	.014	.190

* Ether extract.

** Nitrogen-free extract.

† The ether extract of both corn and sweet potatoes in 1948 was considerably higher than for other years.

per 100 pounds gain than did the corn lot. The value of sweet potatoes, based on prices paid for the other ingredients of the ration, proved to be approximately 82 percent that of corn.

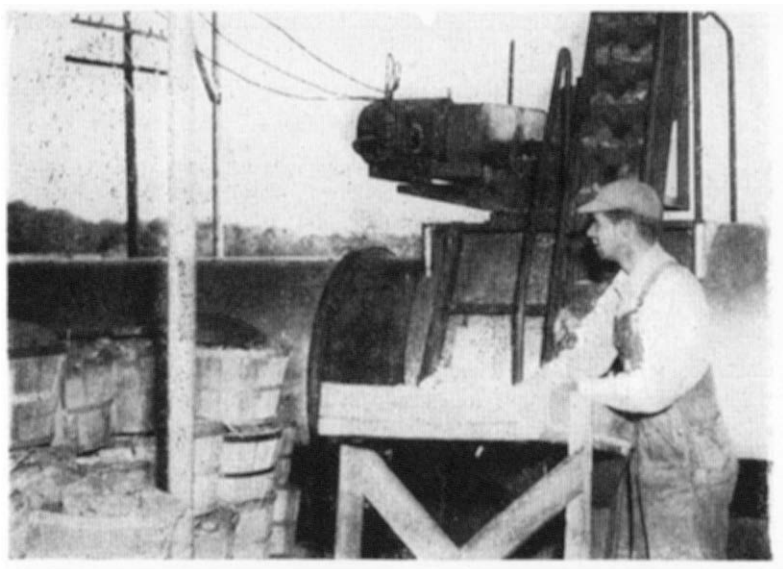
1945-46

The sweet potatoes fed in 1945-46 and the following years were secured in part from a commercial dehydrating plant and in part from the Department of Horticulture. Those furnished by the Department of Horticulture were dried in a commercial-type dehydrating plant located at the Station's Perkins Farm nine miles south of Stillwater.

The average daily gain of the two lots of steers was approximately equal in the 1945-46 test. That year it required a little less sweet potatoes but more cottonseed meal to make 100 pounds of gain for the sweet potato steers than was required in the corn lot. The cattle sold at the same price, although the corn steers made a yield (dressing percentage) of 62 percent and the sweet potato steers yielded 61 percent. On the basis of prices paid for ingredients other than sweet potatoes, the sweet potatoes were 90 percent as valuable as corn.

1946-47

In 1946-47 there were three lots of steers. One was fed corn, one was fed half corn and half dried sweet potatoes, and the third lot was fed dried sweet potatoes. The sweet potatoes fed this year appeared to be quite unpalatable, for some reason, and the steers fed only sweet potatoes ate only 8 pounds per head daily. The corn steers ate approximately 11 pounds of corn per head daily, and the steers fed a mixture of potatoes and corn ate about 11½ pounds per head daily. As would be expected, the average daily gain of the sweet potato steers was quite low. The corn steers gained 2.13 pounds per head daily, the mixed corn and potato lot 2.17 pounds, and the straight sweet potato lot 1.72 pounds per head per day. In this year's test the steers receiving one-half sweet potato and one-half corn gained as fast and were valued at 25 cents per hundred more than the corn steers. The steers fed straight dried sweet potatoes lacked thrift and their appearance would ordinarily result in a price differential greater than that shown in this particular year. They sold at \$1.00 per hundred less than the corn steers and \$1.25 under the mixed corn and sweet potato steers.



Sweet Potatoes Are Dehydrated Here.

The picture shows a portion of the sweet potato dehydrating plant at the Station's experimental farm near Perkins. Sweet potatoes furnished by the Department of Horticulture for the tests reported in this bulletin were dried in this commercial-type plant.

1947-48

In 1947-48 three lots of steers were fed rations comparable to those fed in 1946. The steers fed the mixture of sweet potatoes and corn made the most rapid gain. The straight sweet potato fed steers and the corn steers were practically equal in daily gain, although the total consumption of feed was greater in the corn lot.

Four-year Summary

Table II shows the data for four years where straight corn and straight sweet potatoes were compared. Sweet potatoes proved to be 95 percent as valuable as corn in this comparison.

TABLE II.—Comparison of Corn and Dried Sweet Potatoes, Average of Four Years, 1944-45 to 1947-48, Inclusive.

(Average number of days fed, 169)

	Ground Corn*	Dried Sweet Potatoes*
Number of Steers	40	40
Average weight per steer (lbs.)		
Initial	490	490
Final	859	838
Average daily gain	2.18	2.05
Average daily ration (lbs.)		
Ground corn	11.43	---
Cottonseed meal	1.50	2.08
Dried sweet potatoes	---	10.44
Alfalfa	1.00	1.00
Silage	7.84	7.76
Salt	.02	.01
1-1-1 mineral mixture**	.03	.02
Feed per cwt. gain (lbs.)		
Ground corn	525	---
Cottonseed meal	69	102
Dried sweet potatoes	---	506
Alfalfa	46	50
Silage	362	390
Salt	1	.8
1-1-1 mineral mixture**	1	1

* Both lots received cottonseed meal, alfalfa hay and silage, as shown under "average daily ration" in the table.

** Equal parts salt, bonemeal, and ground limestone.

AVERAGE FEED PRICES

Corn	\$3.00 per cwt.	Silage	\$5.20 per ton
Cottonseed meal	\$74.80 per ton	Salt	.80 per cwt
Alfalfa Hay	\$21.80 per ton	1-1-1 Mineral Mixture	\$1.91 per cwt

The data for 1946 and 1947 are summarized in Table III. The steers fed sweet potatoes to replace all of the corn made a lower average daily gain than did the corn-fed steers. However, on the basis of the feed required per hundred pounds gain, the dried sweet potatoes were found to be 102 percent as valuable as corn when sweet potatoes replaced all the corn.

Where half of the corn was replaced by sweet potatoes, the average daily gain was greater than for the corn lot, but the total feed required per hundred pounds gain was greater, which made the sweet potatoes 86 percent as valuable as corn. Observation of the steers in the 1946-47 test, when the straight sweet potato steers gained only 1.7

TABLE III.—Comparison of Corn With Dried Sweet Potatoes, and with a 50-50 Mixture of Corn and Dried Sweet Potatoes. Average of Two Years, 1946-47 and 1947-48.

(Average Number of Days Fed, 166)

	Corn*	Dried Sweet Potatoes*	50-50 Mixture*
Number of steers	20	20	20
Average weight per steer (lbs.)			
Initial	506	505	876
Final	862	825	507
Average daily gain	2.13	1.91	2.21
Average daily ration (lbs.)			
Ground corn	11.26	---	6.17
Cottonseed meal	1.50	1.90	1.74
Dried sweet potatoes		9.18	6.17
Alfalfa hay	1.00	1.00	1.00
Silage	9.49	8.82	9.47
Salt	.02	.02	.02
1-1-1 mineral mixture**	.02	.02	.02
Feed per cwt. gain (lbs.)			
Ground corn	527	---	278
Cottonseed meal	70	100	79
Dried sweet potatoes	---	478	278
Alfalfa hay	47	53	45
Silage	445	477	429
Salt	1.0	.9	.8
1-1-1 mineral mixture**	.9	1.3	.8

* All three lots received cottonseed meal, alfalfa hay and silage, as shown under "average daily ration" in the table.

**Equal parts salt, bonemeal, and ground limestone.

AVERAGE FEED PRICES

Corn	\$ 3.76 per cwt.	Silage	\$5.60 per ton
Cottonseed meal	\$92.40 per ton	Salt	.88 per cwt.
Alfalfa hay	\$23.00 per ton	1-1-1 Mineral Mixture	\$2.20 per cwt.

pounds per head daily, would cause doubt as to the advisability of trying to fatten steers on this sort of ration.

SUMMARY OBSERVATIONS

In the two years in which corn and sweet potatoes were fed half and half, sweet potatoes proved to be a valuable part of the ration. The concentrate was palatable, the steers made good gains and sold at a good price, and the dressing percentage was equal to that of the corn-fed steers. However, on the basis of pounds of feed required per hundred pounds gain, dried sweet potatoes proved to be 86 percent as valuable as corn. This means that dried sweet potatoes offered on the open market would have to be bought at a price equal to 86 percent that of corn on a pound basis, in order to be equally profitable.

In the four tests when corn was compared to a ration where all of the corn was replaced by dried sweet potatoes, the sweet potatoes proved to be 95 percent as valuable as corn. (Attention should be called to the fact that during one of these tests—1946-47—the sweet



Beef Cuts from Animals Fed Different Rations.

A member of the animal husbandry staff inspects cuts from steers fed dried sweet potatoes, left, corn, and wheat during fattening. The sweet potatoes, due to higher carotene content, might create a yellow fat problem; otherwise, variation of the effect of the three feeds on meat quality appears to be slight.

potatoes appeared to be quite unpalatable. The steers failed to consume them in quantities equal to the feed consumed in the other lots, and were decidedly underfinished at the close of the test.) Although the feed requirement per hundred pounds gain was lower than for the corn lot, the steers fed straight sweet potatoes gained more slowly and failed to reach market finish. Therefore complete replacement of corn by dried sweet potatoes cannot be recommended on the basis of the results of these tests.

In general, it may be said that dried sweet potatoes are a palatable feed under most circumstances and that they may be used as a part, at least, of the concentrate in a steer fattening ration. Their use would be determined by the relative cost of sweet potatoes and corn or other carbonaceous concentrates.

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