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Feeding experiments with farm work mules, Delta Experiment Station, Stoneville, Mississippi

Roy G. Kuykendall

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FEEDING EXPERIMENTS

WITH

FARM WORK MULES

Delta Experiment Station

Stoneville, Mississippi

By

Roy Kuykendall

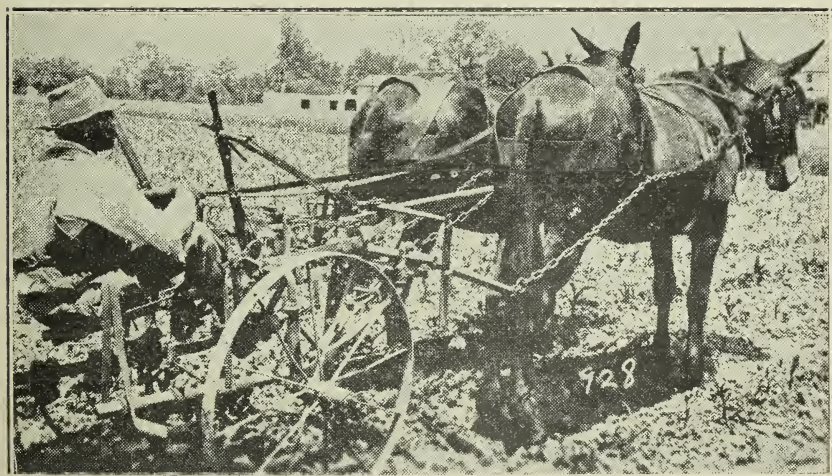


Figure 1. Left, Tom in self-feeder lot. Right, Jerry in hand-fed lot.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATIONS

State College, Mississippi

J. R. RICKS, Director

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Feeding Experiments with Farm Work Mules

By

Roy Kuykendall*

INTRODUCTION

Feed for, and feeding Delta farm mules are two very important problems of the Delta Planter.

This bulletin covers the data on Delta Station mule feeding work over a period of eight years. This work has consisted of several different types of feeding experiments. The practical and economical side of feeding, as well as balanced rations, have been considered in planning these investigations.

METHODS AND FEEDS

The mules used in these experiments represented the average mules on a well balanced plantation. They were worked in pairs, one from each comparative lot, most of the time. The lots compared were averaged in weight, quality, speed, physical condition, etc., as nearly as possible. All lots were fed twice a day, and all mules in each lot were fed together in one manger. The total daily feed for each lot was weighed daily except in self feeding. The roughage in all tests consisted of alfalfa hay or slightly mixed alfalfa except where otherwise stated. The grain usually consisted of shelled corn, but oats were substituted for corn for a few short periods. When feeding cottonseed cake or meal in the self feeder, 25-lbs of oyster shell flour per 1000-lbs of cake or meal and sufficient salt was mixed in the feeder. Except in one or two of the first tests, the mules were weighed individually on three consecutive mornings at the beginning and at the end of the tests and the three weights averaged for initial and final weights, respectively. They were weighed individually every Monday morning during the tests. The work consisted of general plantation labor. The daily consumption of feed per 1000-lbs. live weight was calculated by using the average mule weight over the entire test period.

Mule feeding work at this Station was begun in 1927 and has consisted of the following experiments:

1. Thrashed sagrain compared with shelled corn.
2. Chopped and unchopped sagrain stover compared.
3. Chopped and unchopped soybean hay compared.
4. Green sagrain heads and stalks compared with corn and hay.
5. Self feeding grain compared with hand feeding.
6. Heavy and very heavy cottonseed meal feeding.
7. Corn alone compared with corn and cottonseed cake as concentrates.
8. Corn alone compared with corn, cottonseed cake, and blackstrap molasses.
9. Cottonseed hulls compared with alfalfa hay.

* Acknowledgements: The Author wishes to express his appreciation to Mr. W. E. Ayres, Assistant Director in charge of the Delta Station, for his constructive criticisms and helpful suggestions while these investigations were in progress; to Mr. W. C. McGee who kept the work records, for his cooperation; to Mr. J. B. Turner who conducted the 1927 tests; and to Director J. R. Ricks and members of his Central Station staff for their suggestions.

EXPERIMENTAL RESULTS

CORN AND THRASHED SAGRAIN

The purpose of this test was to determine the comparative value of thrashed sagrain and shelled corn. Each lot consisted of one mule from each of nine pairs. The two lots were fed alike except Lot 2 received thrashed sagrain rather than shelled corn. The results are presented in Table I.

TABLE I.—Thrashed Sagrain Compared with Shelled Corn
March 1—April 21, 1927

Lot No.	Grain Fed	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.				Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Shelled Corn	Thrashed Sagrain	C. S. Meal	Rough-age	Begin Test	During Test	End Test		
1	Corn -----	12.05	.	.9	9.81	1230	1230	1231	1	20.8
2	Sagrain -----		12.05	.9	9.81	1221	1230	1220	—1	19.3

It has been generally accepted that grain sorghum has about 90% of the feeding value of corn, but the results in Table I. indicate that thrashed sagrain is equal, pound for pound, to shelled corn as mule feed; but due to its being so limited, the work should be repeated to be conclusive.

SAGRAIN STOVER

In 1928 work was begun comparing sagrain stover (cured and bundled sagrain from which the heads were removed) chopped with a feed mill, about as silage is chopped, and unchopped stover as roughage for mules. The purpose of chopping the stover was to increase palatability and decrease waste. An effort was made to feed the lots equal amounts of concentrates per unit weight and to so feed stover to the two lots as to maintain them in similar condition.

There were four feeding periods in this test. The first began May 19 and continued through July 15, 1928; the next extended from March 4 to June 30, 1929; the third began December 2, 1929 and continued through April 2, 1930; and the final period began January 19, 1931 and ended July 28, 1931. The lots consisted of one mule from each of eight teams in the first period, one mule from each of seven teams in the second period, one mule from each of eight teams in the third period, and one mule from each of seven teams in the final period. In the first period Lot 2 was fed the chopped stover; in the second, Lot 1; in the third, Lot 2 was fed the chopped stover again; and in the final period the lots were reversed again.

Results of these four periods with the average are presented in Table II.

TABLE II.—Chopped and Unchopped Sagrain Stover Compared
1928-1931

Lot No.	Condition of Roughage	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Other Grains	C. S. Meal	Roughage	Begin Test	During Test	End Test		
May 19—July 15, 1928									
2	Chopped -----	12.31	.91	8.8	1217	1218	1238	21	31.7
1	Unchopped -----	12.06	.89	8.9	1242	1244	1242	0	32.4
March 4—June 30, 1929									
1	Chopped -----	12.77	.86	6.8	1265	1251	1273	8	No
2	Unchopped -----	13.06	.87	9.4	1260	1237	1258	—2	records
December 2, 1929—April 2, 1930									
2	Chopped -----	8.81	.79	8.0	1265	1265	1238	—27	57.4
1	Unchopped -----	8.43	.76	9.0	1317	1323	1309	—8	56.4
January 19—July 28, 1931									
1	Chopped -----	9.89	1.16	9.9	1323	1388	1275	—58	52.3*
2	Unchopped -----	10.06	1.18	12.3	1321	1266	1241	—80	54.2*
Average 4 periods									
	Chopped -----	10.58	.96	8.5	1268	1265	1256	—12	47.1
	Unchopped -----	10.58	.96	10.3	1285	1270	1263	—22	47.7

*Work days recorded April 27—July 18 only.

The average work mule days cover only three periods, because the work records for the period of March 4—June 30, 1929 were lost.

The average results in Table II. indicate that about 18% of the unchopped roughage was wasted. No attempt was made to calculate the cost of chopping. If the value of the 18% roughage saved by chopping is more than sufficient to pay the cost of chopping, it is economical to chop cured sagrain stover as roughage for mules.

SOYBEAN HAY

After concluding the work on chopped and unchopped sagrain stover, similar work was begun with soybean hay. Each lot consisted of one mule from each of seven pairs. Both lots were fed the same except Lot 2 was fed chopped hay. The results of this test are shown in Table III.

TABLE III.—Chopped and Unchopped Soybean Hay Compared
April 3—September 3, 1930

Lot No.	Condition of Roughage	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Other Grain	C. S. Meal	Rough-age	Begin Test	During Test	End Test		
1	Chopped -----	10.10	1.17	8.98	1265	1272	1280	15	88.1
2	Unchopped -----	10.04	1.17	9.41	1288	1280	1286	—2	83.0

Only about 4.5% of unchopped soybean hay was wasted when fed to mules. This was insufficient to pay the cost of chopping. Chopping coarse soybean hay may be justified when roughage is extremely scarce and high priced and the work very hard.

GREEN SAGRAIN

From August 15 through November 14, 1929, a test was carried on to determine the value of green sagrain alone for work mules compared to shelled corn and hay with small amounts of cottonseed meal fed to both lots. The sagrain was cut and bundled with a corn binder and fed green. Each lot consisted of one mule from each of six teams. From August 15—November 14, 1932, this test was duplicated, feeding Lot 1 sagrain and larger amounts of cottonseed meal, and Lot 2 corn and hay omitting the meal. Each lot consisted of one mule from each of five teams. The results of this test are shown in Table IV.

TABLE IV.—Green Sagrain Heads and Stalks Compared with
Corn and Hay

Lot No.	Kinds of Feed Used	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Shelled Corn	C. S. Meal	Rough-age	Begin Test	During Test	End Test		
August 15—November 14, 1929									
1	Corn & hay -----	12.18	.99	11.19	1309	1343	1305	—4	39.6
2	Sagrain -----		1.02	2.7*	1320	1298	1239	—81	44.5
August 15—November 14, 1932									
1	Sagrain -----		2.85	2.79*	1431	1377	1363	—68	52.5
2	Corn & hay -----	10.52		10.52	1428	1426	1430	2	55.4

*Bundles and not pounds of green sagrain. The bundles averaged approximately 20 pounds each when green and 8 pounds each when dried.

These results indicate that green sagrain heads and stalks should be supplemented with more than three pounds of cottonseed meal, or its equivalent of some other grain, to maintain the weight of work mules. These mules only

EXPERIMENTAL MULE FEEDING

7

consumed an average of 2.7 bundles of sragrain and 1.02-lbs. cottonseed meal daily per 1000-lbs. live weight in the first period, and 2.79 bundles sragrain and 2.85-lbs. cottonseed meal in the last period, which did not contain sufficient grain for mules doing farm work.

HAND AND SELF FEEDING

In 1930 hand and self feeding concentrates were compared. A self feeder was built according to Figure 2, and used for this test. The self-fed mules had free access to a mixture of grain and cottonseed meal, whereas the hand-fed ones were limited. The cottonseed meal and grain was given in the same proportion to both lots.

This work consisted of three periods. The first began April 4 and ended October 22, 1930. Each lot was composed of one mule from each of seven teams. The second period began March 4 and ended August 30, 1931; and the mules changed lots from the first period. Six mules, one from each of six pairs, were used in each lot. In the third period, April 4 to August 3, 1932, one mule from each of the seven teams was used for each lot. The mules consisted of a few of the mules used previously and some new ones in this last period. An attempt was made to feed the same amount of roughage (which consisted mostly of alfalfa hay) per unit weight. The cottonseed meal was poured in with the corn to the handfed lot. The self-fed mules never had colic nor any other digestive trouble from over eating. Results of these three periods with the average are shown in Table V.

**TABLE V.—Hand Feeding and Self Feeding Compared
1930-1932**

Lot No.	Feeding Method	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Other Grain	C. S. Meal	Roughage	Begin Test	During Test	End Test		
April 4—October 22, 1930									
3	Hand fed -----	9.43	.76	10.18	1331	1363	1358	27	121.3
4	Self fed -----	10.95	.89	10.15	1358	1407	1438	80	113.7
March 4—August 30, 1931									
4	Hand fed -----	9.90	.67	10.80	1394	1388	1408	14	94.7
3	Self fed -----	11.44	.70	9.53	1436	1465	1451	15	91.2
April 4—August 3, 1932									
3	Hand fed -----	10.25	.58	9.89	1459	1463	1472	13	64.5
4	Self fed -----	11.77	.79	8.60	1422	1453	1418	—4	61.7
Average 3 periods									
3	Hand fed -----	9.80	.71	10.44	1395	1395	1406	11	93.7
4	Self fed -----	11.34	.80	9.54	1404	1438	1435	31	88.9

These tests indicate that mules are good judges of the amount of feed required for the work being performed. For MAXIMUM EFFICIENCY work mules must be in good condition. Self feeding will keep them so at an additional daily cost of only a few cents.

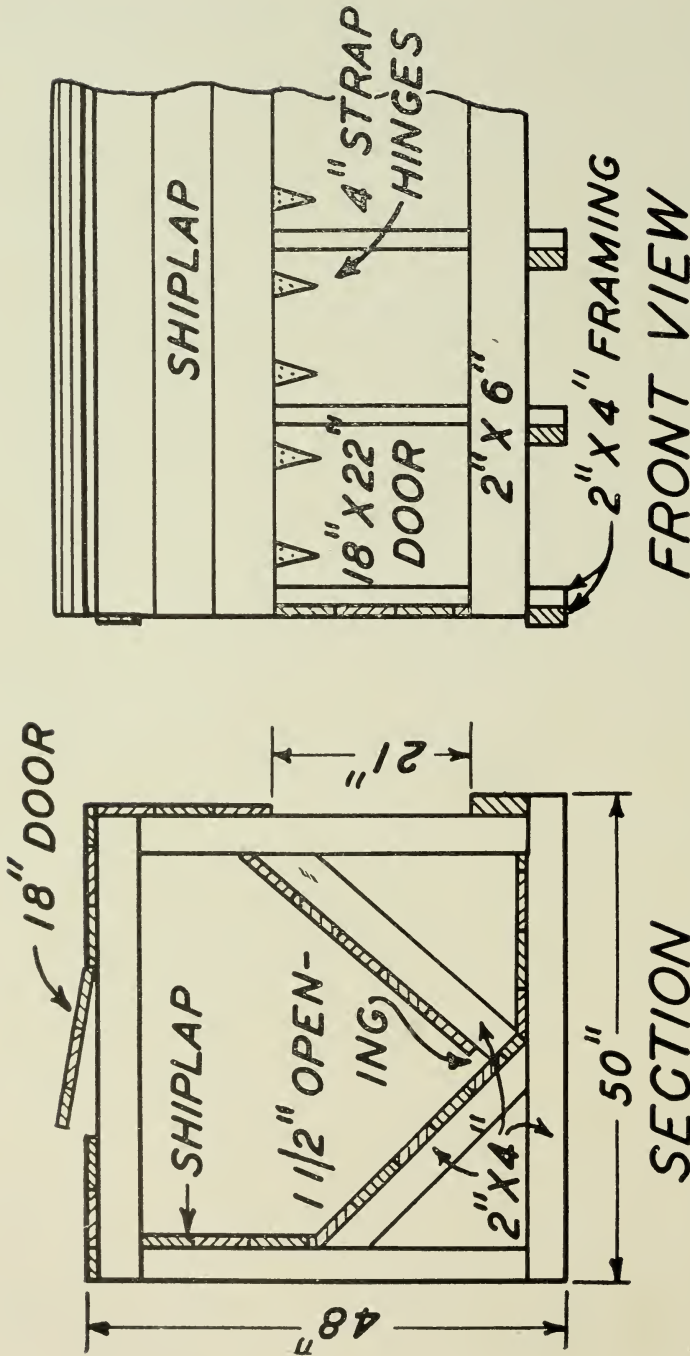


Figure 2. Since cottonseed cake is the delta's cheapest mule feed, keeping it before the mules is a very economical practice. This is most easily and satisfactorily done with self-feeders. They insure a constant supply of clean cake and minimize waste. Details of a satisfactory self-feeder are given above. The feeder should be as long in feet as there are mules to be fed. One door for 3 mules is sufficient. The capacity is most easily increased by increasing the height. The framing for the front slope must be cut to fit between the floor of the back slope and the front studs to permit the doors to work. The doors are 1 inch longer than the opening so they swing against the 2x6 across the front. The hinges are right-side out on the door and wrong-side out on the front of the feeder, to which the doors are hung.



Figure 3. Left, Jerry in hand-fed lot. Right, Tom in self-feeder lot.

COTTONSEED MEAL

Cottonseed meal is the second major crop in the Yazoo-Mississippi Delta and is only out-ranked in value in Mississippi by corn and lint cotton. Until recently, majority opinion indicated that 1 to 1.5-lbs. of cottonseed meal daily was as much as a mule could safely consume.

In 1932, after feeding a limited amount of cottonseed meal to work mules for several years, the Delta Station undertook to determine how much cottonseed meal mules would safely and satisfactorily consume if other grain was limited. The plan was to feed three and four pounds of cottonseed meal daily per 1000 pounds live weight to Lots 2 and 1 respectively. These lots consisted of one mule from each of six teams. Previous data indicated that mules doing average farm work required about 12.3 pounds of concentrates per 1000-lbs live weight. This same data indicated cottonseed meal was worth twice as much as an equal weight of corn. It was planned, therefore, to feed daily six and four pounds of corn per 1000-lbs. live weight to Lots 2 and 1 respectively, in addition to three and four pounds of cottonseed meal. The plan was to feed each lot 11.5-lbs of hay daily per 1000-lbs. live weight. The amount of corn had to be reduced before the mules would eat the planned amounts of cottonseed meal.

TABLE VI.—Heavy and Very Heavy Feeding of Cottonseed Meal
April 2—August 1, 1932

Lot No.	C. S. Meal Rates	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Other Grain	S. Meal	Rough age	Begin Test	During Test	End Test		
1	Very Heavy -----	3.09	3.59	11.98	1285	1252	1213	-72	58.6
2	Heavy -----	5.36	2.58	11.57	1317	1297	1268	-49	57.8

There was no digestive or other physical trouble in either lot caused by feeding excessive amounts of cottonseed meal. The results indicate that both lots in Table VI. failed to maintain their weights, but they did consume excessive amounts of cottonseed meal with no visible physical troubles.



Figure 4. Lot One consumed an average of 3.59 pounds of cottonseed meal and 3.09 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.

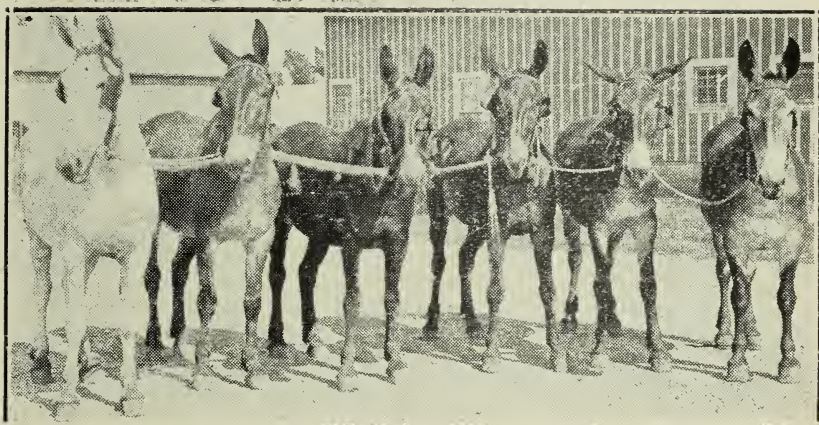


Figure 5. Lot Two consumed an average of 2.58 pounds of cottonseed meal and 5.36 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.

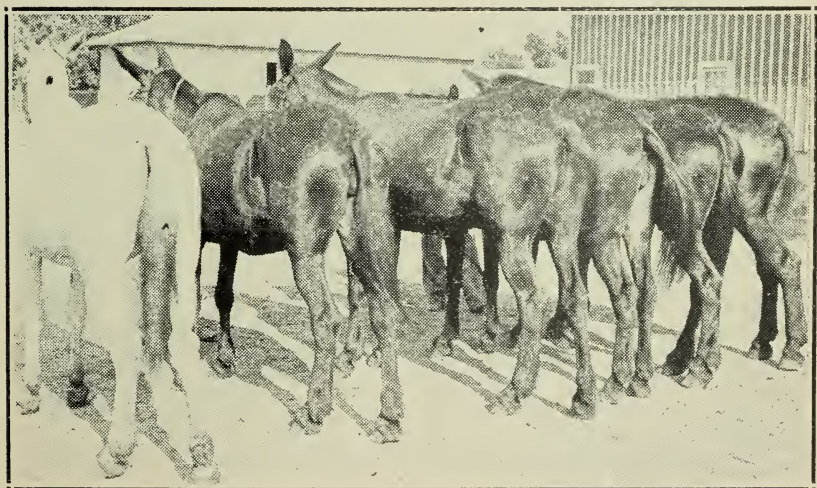
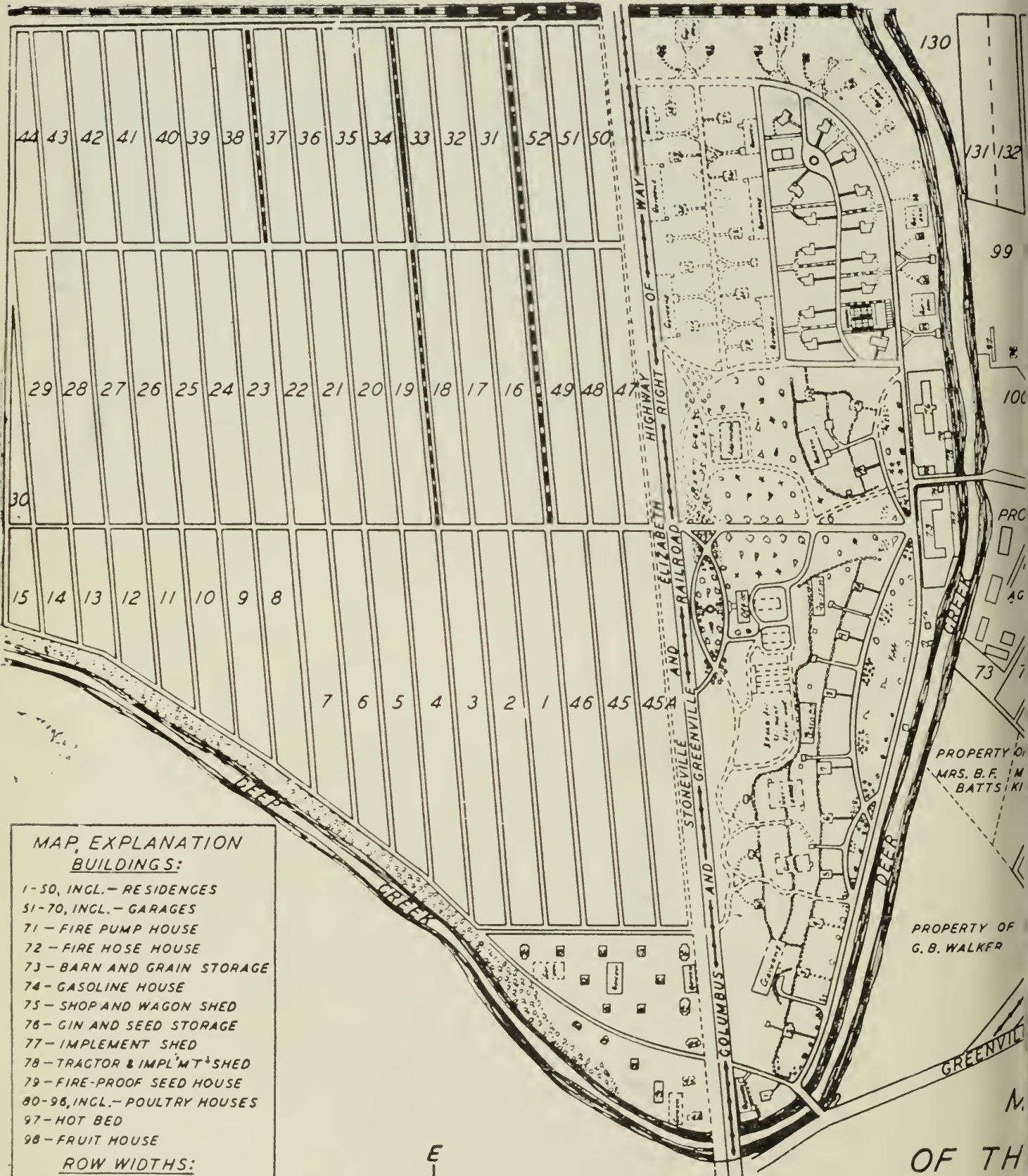
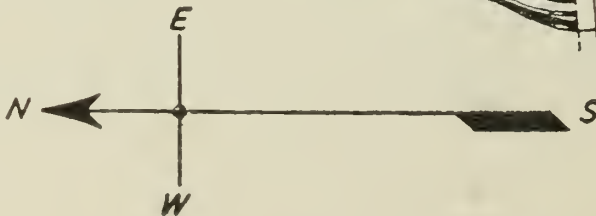


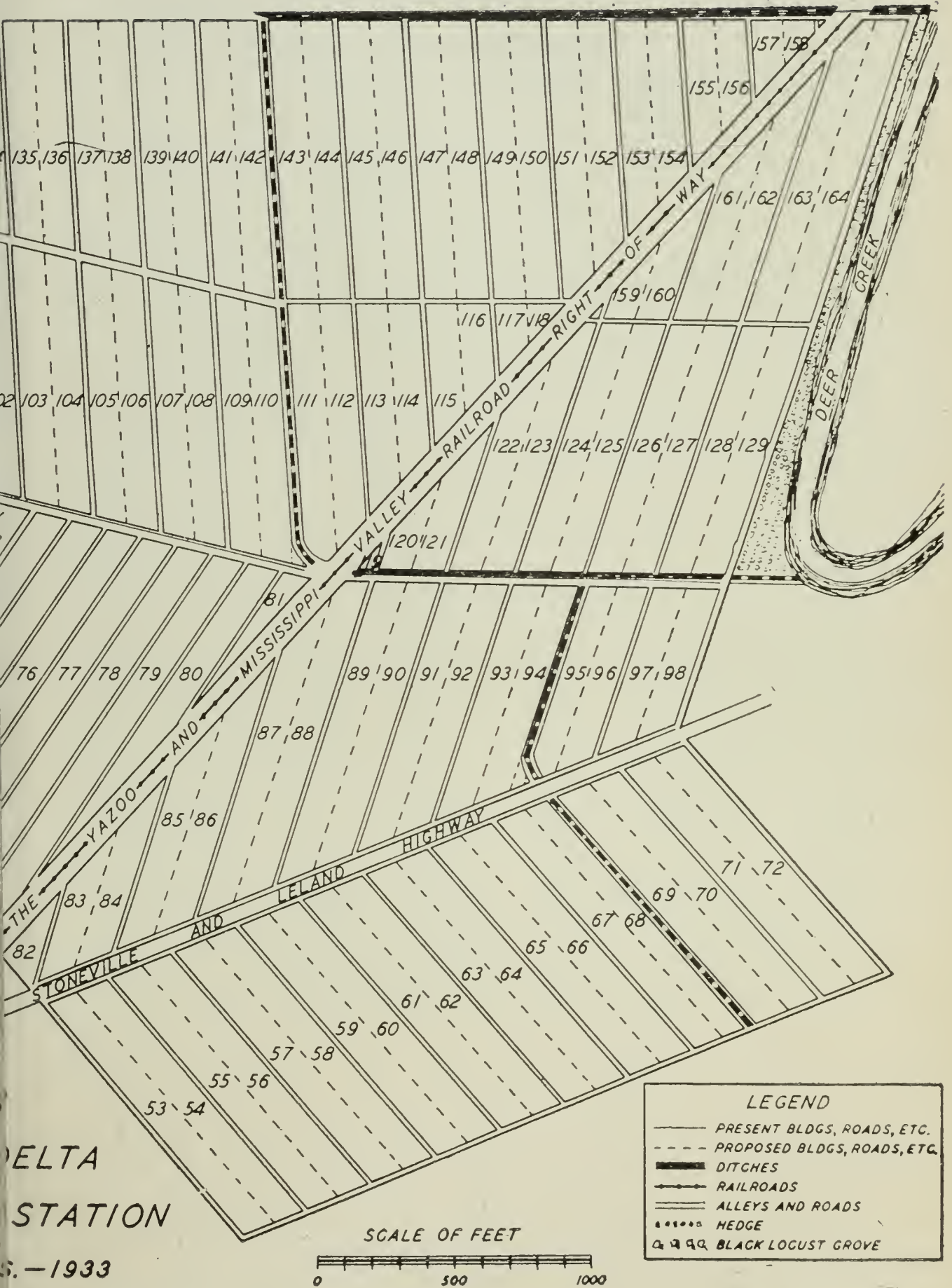
Figure 6. Lot One consumed an average of 3.59 pounds of cottonseed meal and 3.09 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.



MAP, EXPLANATION
BUILDINGS:
 1-50, INCL.— RESIDENCES
 51-70, INCL.— GARAGES
 71 — FIRE PUMP HOUSE
 72 — FIRE HOSE HOUSE
 73 — BARN AND GRAIN STORAGE
 74 — GASOLINE HOUSE
 75 — SHOP AND WAGON SHED
 76 — GIN AND SEED STORAGE
 77 — IMPLEMENT SHED
 78 — TRACTOR & IMPL'MT'S SHED
 79 — FIRE-PROOF SEED HOUSE
 80-96, INCL.— POULTRY HOUSES
 97 — HOT BED
 98 — FRUIT HOUSE
ROW WIDTHS:
 SECTIONS 1-52, 111-118, & 143-158, INCL.—USE CHAIN NO. 1
 ALL OTHERS—USE CHAIN NO. 2



OF THE
 EXPERIMENT
 STONEVILLE,



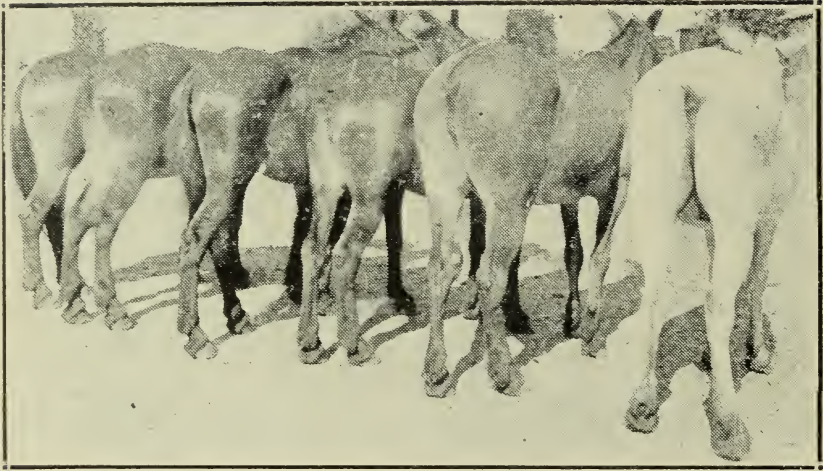


Figure 7. Lot Two consumed an average of 2.58 pounds of cottonseed meal and 5.36 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.

COTTONSEED CAKE

In 1933 the studies with cottonseed products were continued, but cracked cake was used instead of meal. Lots 1 and 2 each consisted of one mule from each of six pairs. The plan was to feed six pounds of corn per 1000-lbs. live weight daily to Lot 2 and give the mules access to cottonseed cake in a self feeder. Lot 1 was to be given 11.5-lbs. of corn per 1000-lbs. live weight to be compared with Lot 2. An attempt was made to feed both lots approximately 11-lbs. of hay per 1000-lbs. live weight. The mules in Lot 3 and 4 were fed the same as 1 and 2 respectively except Lot 4 was fed 4-lbs. of corn per 1000-lbs. live weight instead of six pounds. Results of these tests are shown in Table VII.

TABLE VII.—Corn Alone Compared with Corn and Heavy and Very Heavy Rations of Cottonseed Cake—March 13—July 13, 1933.

Lot No.	Concen- trate Fed	Av. Lbs. Consum- ed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Pounds			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Shelled Corn	C. S. Cake	Rough age	Begin Test	During Test	End Test		
1	Corn -----	11.58		11.31	1327	1323	1307	—20	83.2
2	Corn & Cake ----	6.25	2.33	11.72	1319	1280	1250	—69	76.6
3	Corn -----	11.40		11.40	1442	1461	1449	7	79.0
4	Corn & Cake ----	4.16	3.47	11.98	1434	1391	1352	—82	80.7

According to Table VII, farm work mules will not consume a sufficient amount of cottonseed cake to maintain their weight when limited to six pounds or less of shelled corn per 1000-lbs. live weight.

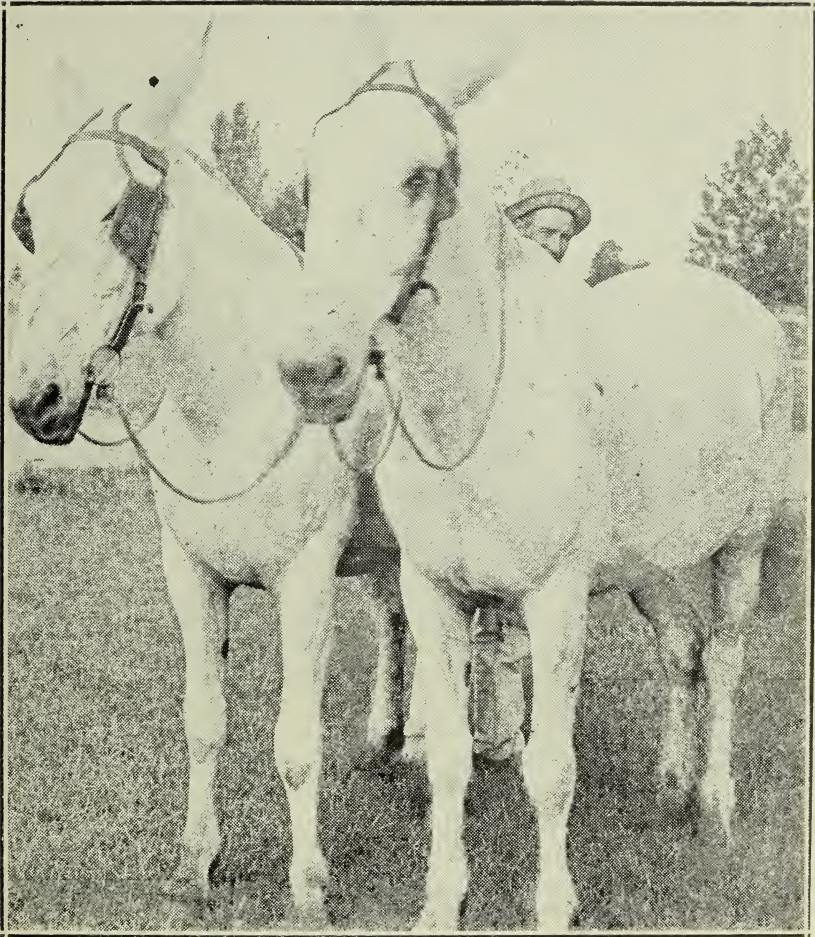


Figure 8. Left, Ike consumed an average of 2.58 pounds of cottonseed meal and 5.36 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.

Right, Mike consumed an average of 3.59 pounds of cottonseed meal and 3.09 pounds of shelled corn daily per 1000 pounds of live weight during the same period.

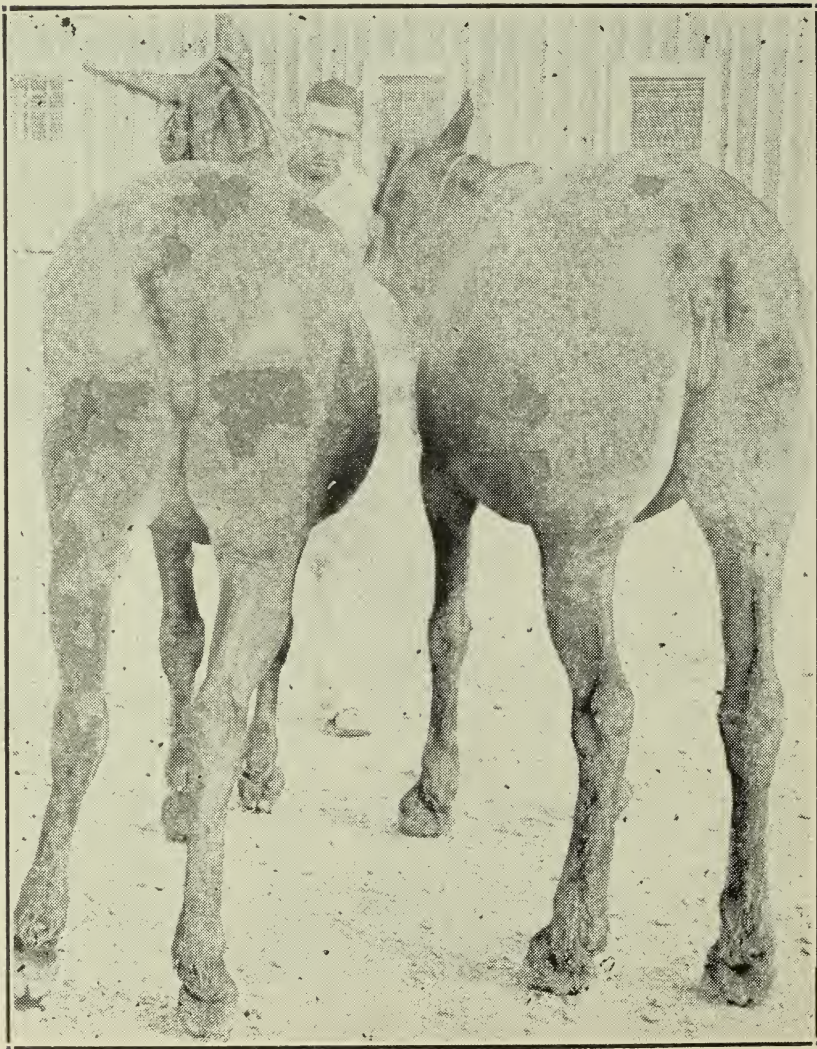


Figure 9. Left, Dolly consumed an average of 3.59 pounds of cottonseed meal and 3.09 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.

Right, Ollie consumed an average of 2.58 pounds of cottonseed meal and 5.36 pounds of shelled corn during the same period. They are not really bob-tailed. Their tails are OFF after flies.



Figure 10. Left, Jerry consumed an average of 11.4 pounds of shelled corn daily per 1000 pounds of live weight during the period March 13-July 13, 1933.

Right, Tom consumed an average of 4.16 pounds of shelled corn and 3.47 pounds of cottonseed meal daily per 1000 pounds of live weight during the same period.



Figure 11. Left Jerry consumed an average of 11.4 pounds of shelled corn daily per 1000 pounds of live weight during the period March 13-July 13, 1933.

Right, Tom consumed an average of 4.16 pounds of shelled corn and 3.47 pounds of cottonseed meal daily per 1000 pounds of live weight during the same period.

COTTONSEED CAKE AND MOLASSES

In May 1934, Lots 3 and 4 were placed back on test the same as the year before except the mules changed lots and 1 pint of black strap molasses per 100-lbs. of cake was mixed with the cake to make it more palatable. Previous preliminary observations indicated that the addition of black-strap molasses made the cake much more palatable. The results of 1933-34 and the average of both periods are shown in Table VIII, the molasses being omitted in the average. The mules in Lot 3 refused to consume the initial amount of hay.

TABLE VIII.—Corn Alone Compared with Corn and Cottonseed Cake with Black Strap Molasses Mixed In.

Lot No.	Concentrate Fed	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.				Av. Weight per Mule in Pounds			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Shelled Corn	C. S. Cake	Roughage	Molasses	Begin Test	During Test	End Test		
March 13—July 13, 1933										
3	Corn alone --	11.40		11.40		1442	1461	1449	7	79.0
4	Corn & Cake	4.16	3.47	11.98		1434	1391	1352	-82	80.7
May 5—August 5, 1934										
3	Corn alone --	11.50		9.92		1413	1425	1442	29	55.1
4	Corn & Cake	4.02	2.37	11.81	.033	1431	1412	1380	-51	52.5
Av. 1933-1934 periods										
3	Corn alone --	11.46		10.67		1426	1443	1445	19	67.1
4	Corn & Cake	4.09	2.92	11.90		1432	1400	1366	-66	66.6

Table VIII. shows that the mules failed to consume as much cotton seed cake when the black strap molasses was mixed in and did not lose as much weight as in the case of cotton seed cake alone.

COTTON SEED HULLS AND HAY

In 1934 cottonseed hulls were compared with hay as a roughage for farm mules. Lots 1 and 2 each of which consisted of one mule from each of six teams were placed on test May 5 to August 5. The results are shown in Table IX.

TABLE IX.—Cottonseed Hulls Compared with Alfalfa Hay
May 5—August 5, 1934

Lot No.	Roughage Fed	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.				Av. Weight per Mule in Pounds			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Shelled Corn	C. S. Cake	Roughage	Molasses	Begin Test	During Test	End Test		
1	Alfalfa hay -	5.10	3.30	11.20	.044	1265	1258	1248	—17	52.5
2	Cottonseed hulls -----	5.48	3.08	5.54	.044	1274	1224	1213	—61	52.5

The results of Table IX indicate that farm mules would not consume a sufficient amount of cotton seed hulls to maintain their weight when cotton seed cake was substituted for approximately half of the grain ration.

SUMMARY

The results of ^{eight} ~~seven~~ years of experimental feeding of work mules at the Delta Experiment Station consisting of nine comparisons of feed combinations are presented as follows:

1. When thrashed sagrain and shelled corn were fed to mules at the rate of 12 pounds daily per 1000 pounds of live weight, they were equal in feed value in the combination herein used.

2. Chopping sagrain stover and soybean hay reduced the daily feed requirement per 1000 pounds of live weight from 10.3 to 8.5 and 9.4 to 8.9 pounds respectively. This was probably due to the reduction in waste. Green mature sagrain, heads and stalks, fed at maximum consumption supplemented with 1 and 2.85 pounds of cotton seed meal daily per 1000 pounds of live weight did not maintain the initial weight of the animals, whereas alfalfa hay and shelled corn, with or without cottonseed meal did maintain the initial weight of the comparative animals.

3. In self feeding shelled corn and cotton seed meal, the mules consumed slightly more of these feeds than hand fed mules but slightly less hay. The increased feed consumption in the self fed group was reflected in a 20 pound increase in mule weight in the average of 3 feeding periods.

4. In a ration composed of cotton seed meal or cake, self fed, shelled corn hand fed, and alfalfa hay kept constant at approximately 12 pounds daily per 1000 pounds of live weight, the amount of cotton seed meal or cake consumed varied inversely with the amount of corn fed. In no case however, was the consumption of cotton seed meal or cake great enough to maintain the mules at their initial live weight, but for the quantity consumed one pound of cotton seed meal or cake was equivalent in feeding value to approximately two pounds of shelled corn.

5. When a cotton seed cake-molasses mixture was self fed and the corn ration reduced from 11.5 to 4 pounds daily per 1000 pounds of live weight with the hay unchanged, the mules refused to consume more than 2.37 pounds of the cake-molasses mixture which was contrary to the preliminary result and resulted in an average loss of 80 pounds each compared to the final weight of the corn and hay fed group.

6. When comparing the palatability and feeding value of cotton seed hulls and alfalfa hay in a ration in which corn was kept constant and a cottonseed cake-molasses mixture self fed the animals consumed only half as much hulls as hay with no increase in the consumption of the cake-molasses mixture which resulted in a corresponding loss in weight.

CONCLUSIONS

1. Thrashed sagrain was equal, pound for pound, to shelled corn as a mule feed.
2. When using sagrain stover (the whole plant less the heads) as a roughage for mules, about 18% was saved by chopping.
3. As a roughage, for mules, only about 4.5% of soybean hay was saved by chopping.
4. To maintain mules doing medium work in good condition, green sagrain stalks and heads should be supplemented by other grain.
5. Self-feeding grain kept mules in good condition for maximum efficiency at an additional daily cost of only a few cents.
6. Mules consumed approximately 3 pounds of cotton seed meal or cake daily per 1000-lbs live weight when limited to a half ration of other grain.
7. Mules did not consume more than one pound of cotton seed meal or cake daily per 1000-lbs live weight unless other grain was limited.
8. The addition of blackstrap molasses to cotton seed cake usually makes the cake much more palatable. Sufficient salt to give 1000 pound mules $\frac{1}{2}$ -oz. daily further adds palatability if mixed with the molasses or otherwise added to the cake or meal.
9. To self feed cotton seed cake or meal and hand feed a limited amount of costlier grain is a good practice.
10. One pound of cotton seed cake or meal was equal, in feed value, to approximately two pounds of shelled corn.
11. Farm work mules consumed only half as much cotton seed hulls as alfalfa hay.
12. Ordinarily, it is very economical to use cotton seed cake or meal as half the grain ration for farm work mules.

APPENDIX

COTTON A FOOD AND FEED CROP: Nature made cotton a food and feed rather than a fiber (clothing) plant. Wild cotton has little fiber on its seed. "Enlightened" man in his scramble to cover his nakedness changed cotton to a fiber plant and forgot, for centuries, its food and feed value. Great piles of cottonseed once wasted around gins, and much was dumped into streams where water power was used. Only recently has the real food and feed value of cottonseed products been suspected, and "the half" is not now known. The 84,000,000 pounds of cottonseed cake produced in one Delta county is worth a fourth as much for feed as all corn produced in IOWA'S PREMIER CORN COUNTY. The same Delta county's 33,000,000 pounds of cottonseed oil is WORTH MORE as human food THAN all the PORK AND BUTTER produced in IOWA'S BEST PORK COUNTY.

PRACTICAL, ECONOMICAL MULE FEEDING SUGGESTIONS: The Delta grows more feed in its cottonseed than it has ever dreamed; but it needs, desperately, to learn to economically use its cottonseed products.

According to old standards, with present crop management methods and today's knowledge of and local (lack of) success in carbonaceous grain production, Delta work-mule feeding is very expensive. Unsafe and/or unprofi-

table Delta cotton lands, in their present state of cultivation and improvement, produce abundant leguminous or non-leguminous forage and some grain (as sargrain and/or oats); but sufficient carbonaceous grain to meet ordinarily accepted feeding standards is not now economically produced in the Delta area of the cotton belt.

POOR FEEDING LOSSES: Many Delta MULES are WEAK and HALF STARVED FOR the LACK OF PROPER HAY and ANY GRAIN. Delta workstock are not more than 60% as efficient, on the average, as they would be if properly fed and otherwise cared for. Said another way, proper feeding would mean as much as adding 50,000 mules to the Delta's present supply. Proper feeding is cheap compared to losses from working mules unable to "make a day" or do good work, not to mention losses due to "trading in" mules which, had they been properly fed, should still give years of efficient service.

For years the Delta Station has used available facilities to determine, through experiment and observation, economical and safe Delta mule feeding practices. The suggestions given are based on these experiments and observations.

ECONOMY and PROPER FEEDING DEMAND the USE of CAKE (or meal) IN FEEDING ALL Delta MULES and the use of some HULLS IN FEEDING THOSE for which ABUNDANT HAY is NOT GROWN.

DOLLARS AND CENTS ECONOMY: The DELTA (and other Southern areas having insufficient other grain) should WINTER AND FATTEN its MULES ON COTTONSEED CAKE (or meal) AND HAY for four reasons: 1. A POUND OF CAKE (or meal) is WORTH as much as mule feed as 2 pounds of CORN or oats. 2. A DOLLAR spent for cake (or meal) usually BUYS as MUCH FEEDING value as \$1.50 to \$3.00 SPENT FOR CORN or oats. 3. Using cake consistently from year to year will help maintain fair prices for cottonseed. 4. Available CORN, oats, etc., can and should be SAVED FOR the four to five months of VERY HARD spring and summer WORK when a half ration of other grain than cake seems necessary.

GENERAL SUGGESTIONS: Fresh, pure water should be available at all times. All troughs should have underground drains to carry off excess water. Outside troughs should be on high ground protected by cinders, brickbats, gravel, or other mud-preventing surface. Knee-deep mudholes around watering troughs are very expensive even if they do not distribute infectious diseases.

Mules should have shelter and should be confined under same at night and in bad weather. Much feed is required to offset lack of protection from rain and cold. Trudging over a muddy lot requires much feed-energy.

Grain-tight mangers (double bottoms help) are essential to economical feeding. Wide (3 ft. or more) mangers are less wasteful than narrow ones. Hay racks should be behind and a part of grain mangers where practical, so that dropped hay will fall in the manger and be eaten instead of being wasted. Mangers in which shelled or ground grain is fed should have 2x2 inch timbers nailed two inches apart in their bottoms to prevent bolting and colic.

Many planters hesitate to feed cottonseed hulls to mules. Cattle feeding tests show hulls to be worth as much or more than Prairie and other low-grade non-legume hays. If roughage must be bought, Delta mules can safely and economically consume reasonable amounts of properly supplemented hulls.

Grinding corn or chopping roughage are doubtfully economical unless equipment is already installed. Waste is minimized, and mixing with cottonseed meal or other feeds is facilitated, however.

Blackstrap molasses makes rough feeds and cottonseed cake more palatable but is usually expensive per unit of digestible nutrients.

Buying shelled corn is more economical than the common practice of buying snapped or husked corn. Definite grades are possible, and freight is much less.

ALL MULES IN BAD CONDITION should be treated for internal (and external if necessary) parasites. (See your county agent and/or local veterinarian for treatment details) Their teeth should be inspected and given necessary attention. Special feed such as a mixture of equal parts of ground corn, cottonseed meal, and shorts, with good chopped alfalfa or alfalfa hay may be necessary; but fall or winter is the time to fatten and prepare all mules for work.

Suggested Delta Rations

FOR IDLE MULES: 1. If plenty of home-grown hay is available for a year, feed 1-1/4 lbs. of hay daily per 1000-lbs. live weight (figured when mules are in good condition) and cottonseed cake, ad libitum—(all the mules will eat). 2. If any hay must be bought, use 1/2 lb. hay per 1000-lbs live weight and a mixture of 200 lbs. cottonseed hulls and 100 lbs. cottonseed meal, ad libitum. 3. If all feed must be bought, 1/4 lb. to 1/3 lb. good hay per 1000-lb live weight daily and a mixture of 300 lbs. cottonseed hulls and 100 lbs. cottonseed meal ad libitum. If mules do not fatten, add 1/2 to 2 gallons (depending upon relative prices) of blackstrap to 400 lbs. of the hulls-meal mixture. When mules must do occasional winter work, feed 3 to 6 lbs. (depending upon the class of work) of other grain per head daily in addition to the idle ration.

FOR WORK MULES: 4. With plenty of hay available: 1-1/4 lbs. of hay and 1/2-lb. of corn or oats daily per 1000-lb. live weight—cottonseed cake ad libitum. 5. If any hay must be bought: 3/4 lb. of good hay and 1/2 lb. of corn or oats daily per 100 lb live weight—a mixture of 500 lbs. cottonseed hulls to 400 lbs. cottonseed meal, ad libitum. One quart of black strap per 100 lbs. of the hulls-meal mixture will make it more palatable. Cracked cake (quail-egg size) is more satisfactory except for mixing with hulls or other feed than cottonseed meal. It is ideal for use in self-feeders. The addition of a pint to a quart of blackstrap per 100-lbs. of cake adds palatability.

All feeding should be done under shelter. Rotten feed kills quickly. One good mule saved will build considerable shelter. Where self-feeders are not used, feed only as much cake or other feed as the mules will clean up daily. Spoiled feed is dangerous.

The average 1000-pound Delta work mule can be kept in efficient work condition for 12 months on 20 bushels of corn (or an equal weight of thrashed sragrain, oats, or soybeans); 2-1/4 tons of good alfalfa, soybean, or other legume hay; and 1200 lbs. of cottonseed cake or meal. The hay and cake or meal requirements can be reduced materially by proper use of pastures.

PASTURES FOR MULES

Delta stalk fields, small grain, winter legume, and alfalfa fields should be pastured when not too wet. Nothing is so satisfactory, considering economy, for fattening and "carrying" mules through the summer and fall idle period (July 15 to December 20) as 1-1/2 acres of sragrain and Mamredo (for plantings previous to May 1) and Mamloxi (for later plantings) soybeans pasture

per head. If this pasture is planted on good land or well fertilized, the acreage may be reduced 25 to 50%. If fencing is not too expensive, small areas (1/4 acre per mule) should be pastured clean before "turning in" on other areas. One-fourth acre of good and well fertilized land per mule near the barn for sagrain and soybeans in summer and fall, and wheat or rye and vetch in winter and spring will pay well. This area may be utilized for mules which must be kept at the barn the year 'round.

For each four mules kept, an acre of permanent pasture on good or well-fertilized land adjacent to the barn lot will pay any plantation. The following per-acre seedings on well prepared land are suggested. The last 10 days of March, Bermuda sod 4x4 ft., 2 lbs. white clover, 6 lbs. lespedeza, 6 lbs. carpet grass, 6 lbs. Dallis grass (imported seed preferred), and 25 lbs. Sudan grass to make pasture the first year. Apply barnyard or stable manure or 300 lbs. of commercial nitrogenous fertilizer per acre before planting. About August 15 sow on the pasture 2 lbs. hop clover, 5 lbs. black medic, and 10 to 20 lbs. unhulled burr clover per acre and follow with a section harrow. In future years fertilize sufficiently to give grasses a rich green color in seasonable weather.

The adoption of the above feed and pasture program will make the Delta feed-independent.

Monthly saving in dollars from feeding each of ten 1000 lb. mules 5 lbs. of corn (or threshed sagrain or oats) and 3 1/2 lbs. of cottonseed cake (or meal) and 12 lbs. of hay instead of 12 lbs. each of corn (or threshed sagrain or oats) and hay daily.

Cts. per bu. for corn	Dollars per Ton for Cottonseed Cake (or Meal)									
	12.00	14.00	16.00	20.00	25.00	30.00	35.00	40.00	50.00	60.00
25	3.07	2.02	0.97	-1.13	-3.76	-7.13	-9.88	-11.63	-16.88	-22.13
30	4.95	3.90	2.85	0.39	-1.88	-5.25	-8.00	-9.75	-15.00	-20.25
35	6.82	5.77	4.72	2.62	-0.01	-3.38	-6.13	-7.88	-13.13	-18.38
40	8.70	7.65	6.60	4.50	1.87	-1.50	-4.25	-6.00	-11.25	-16.50
45	10.58	9.53	8.48	6.38	3.75	0.38	-2.37	-4.12	-9.37	-14.62
50	12.45	11.40	10.35	8.25	5.62	2.25	-0.50	-2.25	-7.50	-12.75
55	14.33	13.28	12.23	10.13	7.50	4.13	1.38	-0.37	-5.62	-10.87
60	16.20	15.15	14.10	12.00	9.37	6.00	3.25	1.50	-3.75	-9.00
70	19.95	18.90	17.85	15.75	13.12	9.75	7.00	5.25	0.00	-5.25
80	23.70	22.65	21.60	19.50	16.87	13.50	10.75	9.00	3.75	-1.50
90	27.45	26.40	25.35	23.25	20.62	17.25	14.50	12.75	7.50	2.25
100	31.20	30.15	29.10	27.00	24.37	21.00	18.25	16.50	11.25	6.00
115	36.83	35.78	34.73	32.63	30.00	26.63	23.88	22.13	16.88	11.63
130	42.45	41.40	40.35	38.25	35.62	32.25	29.50	27.75	22.50	17.25
145	48.07	47.02	45.97	43.87	41.24	37.87	35.12	33.37	28.12	22.87
160	53.70	52.65	51.60	49.50	46.87	43.50	40.75	39.00	33.75	28.50
180	61.20	60.15	59.10	57.00	54.37	51.00	48.25	46.50	41.25	36.00
200	68.70	67.65	66.60	64.50	61.87	58.50	55.75	54.00	48.75	43.50
225	78.07	77.02	75.97	73.87	71.24	67.87	65.12	63.37	58.12	52.87
250	87.45	86.40	85.35	83.25	80.62	77.25	74.50	72.75	67.50	62.25

The above table is based on 1500 lbs. of corn and 1050 lbs. cottonseed cake replacing 3600 lbs. of corn in feeding work mules.

AN ALLUVIAL EMPIRE

THE YAZOO-MISSISSIPPI DELTA

THE GARDEN SPOT OF AMERICA

SEE ROAD MAPS FOR

CONCRETE AND IMPROVED HIGHWAYS

SCALE OF MILES
0 5 10 20 30

MAP 55

