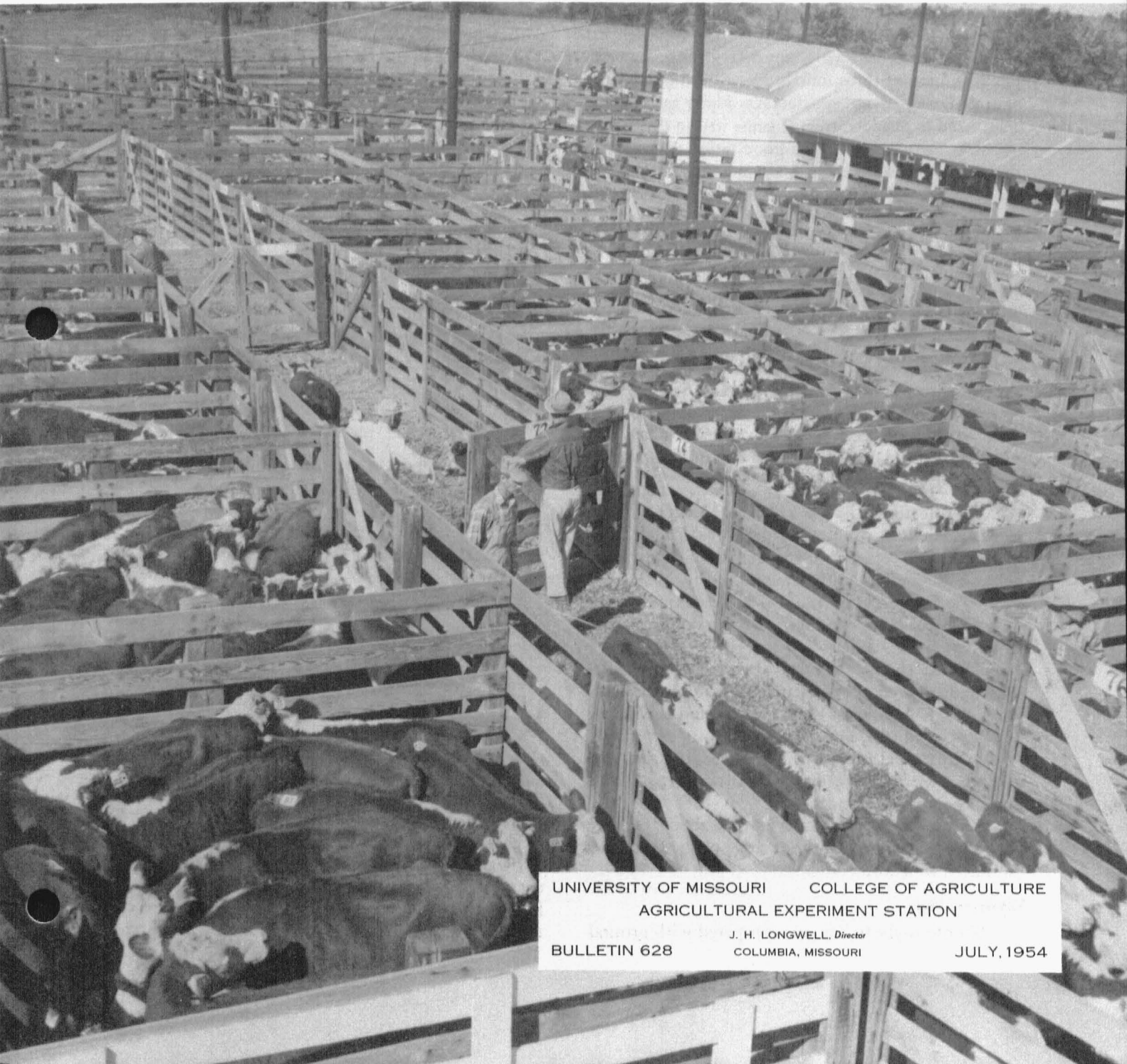


# WINTER RATIONS

for

# FEEDER CALVES



UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE  
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# Winter Rations

## for

### FEEDER CALVES

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The method used in wintering calves has a great effect on their performance on pasture or in the feedlot. Feeder calves should be wintered to produce a level of gain that is aligned with the method of handling after the wintering period. If pasture is to be used extensively the following summer, a range in average daily gain of three-fourths to one and one-fourth pounds is considered satisfactory. Many rations can be utilized to produce average gains within this range.

Most calves have had a good ration of milk and pasture and, in some cases, grain in creeps until wean-

ed. After their purchase, however, they are managed in many different ways. Some are fattened for quick sale, but the majority are wintered and fattened later. Thus, large amounts of roughage may be utilized in wintering, with only small amounts or no grain required for the desired winter gain. The purpose of this bulletin is to report the results of feeding various winter rations in processed and non-processed form to steer calves of Good to Choice grade. All the work that deals with one problem has been grouped together, irrespective of when the work was done.

#### Part I

#### PROCESSING ROUGHAGE

Roughage processing has been simplified in recent years through the use of improved machinery. Processing continues to be an expensive operation, however, and poses the question, "Does it pay?" This problem was studied in feeding tests conducted by the Missouri Agricultural Experiment Station over several years. Comparisons were based solely on the value of a unit of feed; no effort was made to evaluate processing as related to storing and handling.

##### *Alfalfa Hay*

Whole alfalfa hay was compared with ground alfalfa hay in tests conducted during 1930-31 and 1931-32. The two types of hay were fed with the same amount of corn silage. The amount of hay was limited to insure the consumption of a large quantity of silage. Table 1 gives the results based on the average of two years' tests.

During the first test the calves fed whole alfalfa hay made an average daily gain of 0.70 pound compared to 0.57 pound for the lot fed ground alfalfa hay. In the second test, however, the results were in reverse order—calves fed whole alfalfa hay made an average daily gain of 0.70 pound and those fed ground alfalfa hay, 0.84 pound.

Ground and whole alfalfa hay had about the same feeding value, based on the average of the two trials tabulated in Table 1.

##### *Soybean Hay*

Whole soybean hay was compared with ground

TABLE 1 -- WHOLE VS. GROUND ALFALFA HAY  
(Average of data for two winter feeding periods,  
December 4, 1930 - April 11, 1931; December 3,  
1931 - May 5, 1932.)  
141 Days

Lot	I		II	
	Whole Alfalfa Hay Corn Silage (lbs.)	Ground Alfalfa Hay Corn Silage (lbs.)		
Ration				
Average Initial Weight	391	388		
Average Final Weight	490	489		
Total Gain	99	101		
Average Daily Gain	.70	.71		
Total Feed:				
Whole Alfalfa Hay	460	none		
Ground Alfalfa Hay	none	457		
Corn Silage	2042	2035		
Average Daily Ration:				
Whole Alfalfa Hay	3.23	none		
Ground Alfalfa Hay	none	3.61		
Corn Silage	14.39	14.34		
Feed Per 100# Gain:				
Whole Alfalfa Hay	468	none		
Ground Alfalfa Hay	none	464		
Corn Silage	2056	2077		

soybean hay, both fed with corn fodder. The two lots of calves were fed by identical methods with the allowance of hay being limited to force the calves to eat relatively large amounts of corn fodder. After the fodder allowance was weighed, the ears of corn were removed from the stalks and broken into the feed

TABLE 2 -- WHOLE VS. GROUND SOYBEAN HAY  
(December 1, 1932 - March 30, 1933)  
119 Days

Lot	I	II
	Whole Soybean Hay Whole Corn Fodder (lbs.)	Ground Soybean Hay Whole Corn Fodder (lbs.)
<b>Ration</b>		
Average Initial Weight	404	407
Average Final Weight	521	525
Total Gain	117	118
Average Daily Gain	.97	.98
<b>Total Feed:</b>		
Whole soybean hay	478	none
Ground soybean hay	none	478
Corn fodder*	1964	1973
<b>Average Daily Ration:</b>		
Whole soybean hay	3.98	none
Ground soybean	none	3.98
Corn fodder*	16.37	16.44
<b>Feed Per 100# Gain:</b>		
Whole soybean hay	409	
Ground soybean hay		406
Corn fodder*	1680	1676

\*The ears of corn were shucked out and broken into the feed trough.

TABLE 3 -- COMPARISON OF CORN SILAGE, WHOLE CORN FODDER, AND GROUND CORN FODDER WHEN FED TO PRODUCE THE SAME APPROXIMATE GAINS  
(December 4, 1930-April 11, 1931; December 3, 1931-May 5, 1932; December 1, 1932-March 30, 1933)  
134 Days Average

Lot	I	II	III
	Corn Silage Whole Alfalfa (lbs.)	Whole Corn Fodder Whole Alfalfa (lbs.)	Ground Corn Fodder Whole Alfalfa (lbs.)
<b>Ration</b>			
Average Initial Weight	396	394	395
Average Final Weight	494	502	497
Total Gain	98	108	102
Average Daily Gain	.73	.82	.79
<b>Total Feed Fed:</b>			
Corn Silage	2282		
Whole Corn Fodder		1611.7	
Ground Corn Fodder			1616.2
Whole Alfalfa Hay	466	463	463.5
<b>Average Daily Ration:</b>			
Corn Silage	17.27		
Whole Corn Fodder		12.12	
Ground Corn Fodder			12.2
Whole Alfalfa Hay	3.5	3.5	3.5
<b>Feed Per 100# Gain:</b>			
Corn Silage	2328		
Whole Corn Fodder		1478	
Ground Corn Fodder			1497
Whole Alfalfa Hay	474	438	436

bunk. The corn stover remaining was then fed with the broken ear corn.

Calves that were fed the ground soybean hay gained 0.98 pound compared to 0.97 pound for the calves fed whole soybean hay. Results of this test indicate that grinding was not profitable. Complete data are given in Table 2.

### Feeding Entire Corn Plant

Corn is valued for both the grain and the roughage that it produces. The two common forms of roughage are silage and fodder. Whole and ground corn fodder and silage were compared in three trials. Each form of roughage was fed with a limited amount of whole alfalfa hay.

In these tests, all lots of cattle were fed to make approximately the same gain. Two of the rations, the one containing corn silage and the one containing whole corn fodder, were more palatable than the ration containing ground fodder. For that reason these two rations had to be limited in amount for all to produce about the same gain. The following Table 3 contains the data.

Whole and ground corn fodder were about equal

TABLE 4 -- \*GROUND VS. CHOPPED CORN STOVER  
(December 4, 1930-April 11, 1931; December 3, 1931-May 5, 1932)  
141 Days Average

Lot	I	II
	Ground Corn Stover Whole Alfalfa Hay (lbs.)	Chopped Corn Stover Whole Alfalfa Hay (lbs.)
<b>Ration</b>		
Average Initial Weight	390	393
Average Final Weight	493	489
Total Gain	103	97.6
Average Daily Gain	.73	.69
<b>Total Feed:</b>		
Ground corn stover + *Broken ear corn	1440	
Cut corn stover + *Broken ear corn		1439
Whole alfalfa hay	456	456
<b>Average Daily Ration:</b>		
Ground corn stover + *Broken ear corn	10.0	
Cut corn stover		10.02
Whole alfalfa hay	3.2	3.60
<b>Feed Per 100# Gain:</b>		
Ground corn stover + Broken ear corn therefrom	1367	
Cut corn stover + Broken ear corn therefrom		1453
Whole alfalfa hay	440	469

\*The ears of corn from the stover were fed to the calves as broken ear corn.

to one another when fed in the same amounts. Thus, grinding the corn plant did not increase its feeding value. The dry matter in silage has much higher nutritive value than the dry matter in fodder (30 pounds dry matter in silage was worth 72 pounds of dry matter in fodder). Stated another way, 1.1 ton of corn silage equalled 0.8 ton of corn fodder when both were fed with alfalfa hay to produce an average daily gain of 0.8 pound. If the silage and the whole fodder had been full fed, the daily gains from them would have been larger.

### *Ground vs. Chopped Corn Stover*

Ground corn stover was compared with chopped corn stover, both being fed with the same, limited amount of alfalfa hay. The ears of corn were removed from the fodder and fed as broken ear corn. The remaining stover was fed in a ground form to one lot and in a chopped form to the other. Ground stover in this test produced slightly larger gains than cut stover, 0.73 pound per day compared to 0.69 pound, but the difference was not significant (6 pounds total).

The detailed data are given in Table 4.

## Part II COMPARING DIFFERENT HAYS FED WITH AND WITHOUT SILAGE

Dry roughages are used to a greater extent than corn silage to winter stock cattle in spite of the established fact that corn silage produces more economical gains. Many cattlemen have excellent reasons, of course, for relying either completely or partially on dry roughage. Actually, more cattle are wintered on hay than any other roughage and many kinds of hay are used.

### *Oat, Alfalfa and Soybean Hays Compared with Corn Silage—Alfalfa Hay Ration*

During the winter of 1933-34, oat, soybean and alfalfa hays were compared with each other and with a ration of corn silage and alfalfa hay. The silage was of good quality and made from a corn crop that would have yielded 30 to 40 bushels of corn; the alfalfa hay was U. S. No. 2 grade; the oat hay was poor in quality and contained very little grain; and the soybean hay was of medium quality.

All lots of cattle were fed to make an average daily gain of approximately 1 pound per head. To accomplish this, it was necessary to supplement the oat hay with a concentrate mixture of 10 parts shelled corn to 1 part cottonseed cake, by weight. The essential data are reported in Table 5.

The oat hay ration was supplemented with 237 pounds (total) of the corn-cottonseed cake mixture to approximate the gains of the other lots of cattle. This lot gained 0.87 pound per day compared to 0.81 pound and 0.98 pound gain, respectively, for the lots fed alfalfa hay alone and corn silage and alfalfa hay. The calves wintered on the soybean hay gained 0.77 pound, the lowest average daily gain, but they had no supplementation.

In this test the quality of the feeds, as always, affected the results. The quality of any kind of hay often has a greater influence upon its value than the

TABLE 5 -- OAT, ALFALFA AND SOYBEAN HAY COMPARED WITH CORN SILAGE AND ALFALFA HAY  
(December 22, 1933-May 11, 1934)

Lot	I	II	III	IV
	Corn Silage Alfalfa Hay	Oat Hay	Alfalfa Hay	Soybean Hay
	lb.	lb.	lb.	lb.
Avg. Initial Weight	398.4	401.1	401.7	401.7
Avg. Final Weight	535.2	522.9	515.5	509.1
Total gain	136.8	121.8	113.8	107.4
Avg. Daily Gain	.98	.87	.81	.77
<b>Total Feed Fed:</b>				
Corn Silage	2117.48			
Hay	735.71	1441.7	1588.5	1734.4
Corn + C.S.C.*		237.1		
<b>Avg. Daily Ration:</b>				
Corn silage	15.12			
Hay	5.26	10.29	11.35	12.39
Corn + C.S.C.*		4.23		
<b>Feed Consumed Per Cwt. Gain</b>				
Corn Silage	1547.87			
Hay	537.80	1184.27	1396.69	1614.90
Corn + C.S.C.*		194.77		

\*Fed last 56 days only



particular *species* from which it is made. The data show that it was necessary to supplement low quality roughage with what it lacked nutritionally to secure satisfactory gains; for example—supply either some high quality roughage or some concentrate as was done in the case of the low quality oat hay.

### Red Clover and Alfalfa Hay

In a test during the winter of 1946-47, red clover was compared with alfalfa hay. No other roughage was fed, but enough shelled corn-soybean oil mixture was fed to produce the rate of gain that was made concurrently by calves fed corn silage and alfalfa hay.

The clover hay was of high quality. The alfalfa was U. S. No. 1 and U. S. No. 2 grade, but, nevertheless, had more than the average amounts of crude fiber for these grades. The shelled yellow corn (No. 2) and the soybean meal (41 percent protein) were mixed together, 10 parts to 1 part by weight, respectively. Complete data are given in Table 6.

In this test, clover hay was superior to alfalfa; 1.3 bushels of shelled corn and 7.5 pounds of soybean meal were required during the winter by cattle fed clover hay while 5.4 bushels of shelled corn and 30.4 pounds of soybean meal were required by cattle fed alfalfa hay to produce approximately the same gain as cattle fed corn silage and alfalfa hay (see Lot 1, Table

TABLE 6 -- RED CLOVER AND ALFALFA HAY COMPARED  
(December 27, 1946-May 3, 1947)

	Lot 3 Clover *Sh. Corn 10 S.B.O.M. 1	Lot 4 Alfalfa Hay *Sh. Corn 10 S.B.O.M. 1
Avg. Initial Weight (lb.)	436.00	439.00
Avg. Final Weight (lb.)	601.00	621.00
Avg. Total Gain (lb.)	165.00	182.00
Avg. Daily Gain (lb.)	1.30	1.43
<u>Avg. Total Feed Consumed (per head)</u>		
Legume Hay (lb.)	2000	1826
Shelled Corn (bu.)	1.3	5.4
Soybean Oil Meal (lb.)	7.45	30.4
<u>Avg. Daily Ration</u>		
Legume Hay (lb.)	15.75	14.38
Shelled Corn (lb.)	.59	2.39
Soybean Oil Meal (lb.)	.06	.24
<u>Feed Consumed Per Cwt. Gain</u>		
Legume Hay (lb.)	1212.12	1003.30
Shelled Corn (lb.)	.79	2.97
Soybean Oil Meal (lb.)	4.52	16.70

\*Fed as needed to produce approximately the same gain as cattle receiving a ration of corn silage and alfalfa hay.

12, for complete data) without supplementation. This superiority of clover hay should not be expected every time—it depends upon the relative quality of each hay.

### Part III EFFECTS OF MATURITY ON FEEDING VALUE OF TIMOTHY HAY

The composition of a growing plant is not constant—its nutritive content changes rapidly during growth. In the early stages of growth, most of the grasses are highly nutritious, but as they get older and approach maturity their nutritive value decreases. There is an optimum stage of maturity at which the various hays should be cut for maximum feeding value. In this test, early-cut timothy was harvested June 17 (bloom stage) and the late cut timothy, July 17 (mature condition) and compared in a winter feeding test. In addition to the timothy hay, 1.5 pounds of soybean meal was fed per head per day. Table 7 gives the data for this test.

Calves fed the *early* cut timothy gained almost twice as fast as those fed the *late* cut timothy, 0.90 pound compared to 0.49 pound. Thus, less early cut hay was required to produce 100 pounds gain. Steers fed the early cut hay needed 593 fewer pounds of hay, and, in addition, 144 pounds less soybean oil meal per hundredweight gain. The early-cut hay must have been more palatable because the calves ate 21 percent more of it. The average daily gain of nearly 1 pound derived from early-cut hay is a more desirable rate

TABLE 7 -- COMPARISON OF EARLY AND LATE-CUT TIMOTHY HAY IN WINTER RATION (12/30/44-4/20/45)  
111 Days

	Lot 1 Early Cut Timothy and S.B.O.M.	Lot 2 Late Cut Timothy and S.B.O.M.
Avg. Initial Weight (lb.)	414.25	415.50
Avg. Final Weight (lb.)	513.75	470.17
Avg. Total Gain (lb.)	99.5	54.67
Avg. Daily Gain (lb.)	.90	.49
<u>Avg. Total Feed Consumed</u>		
Hay (lb.)	1188.00	976.75
S.B.O.M. (lb.)	159.50	166.50
<u>Avg. Daily Ration</u>		
Hay (lb.)	10.70	8.80
S.B.O.M. (lb.)	1.44	1.50
<u>Avg. Feed Per Cwt. Gain</u>		
Hay (lb.)	1193.97	1786.75
S.B.O.M. (lb.)	160.30	304.58

than the lower gain from mature timothy from the standpoint of putting cattle in the best condition for summer grazing. Actually, in this test, 1 ton of early-cut timothy was worth 2 tons of mature timothy hay.

The chemical analysis shows that the early-cut timothy had 54 percent more protein, 15 percent less crude fiber, 7 percent more nitrogen free extract, 33

percent more fat, 73 percent more phosphorus and 34 percent more calcium. The superiority of early-cut timothy hay is clear.

TABLE 8 -- ANALYSIS OF EARLY AND LATE CUT TIMOTHY HAY  
(All figures are in percent - air dry basis)

	Moisture	Protein	Ether extract	Crude fiber	Nitrogen free ex.	Phosphorus	Calcium
Early cut timothy	5.16	7.94	1.98	30.52	48.07	0.194	0.332
Late cut timothy	5.54	5.13	1.49	36.66	45.20	0.114	0.246

## Part IV SILAGE

Many species of plants can be made into silage. Tests indicate that more of the nutrients are retained when a crop is harvested as silage than when harvested by any other method. There are differences in the feeding value of different kinds of silage. In this test, corn, alfalfa, Atlas sargo and barley silages were fed with alfalfa hay and compared. The composition of each silage is listed in Table 9.

### *Description of the Feeds*

**CORN SILAGE:** The silage was made from corn that had an estimated yield of 35 to 40 bushels per acre. It was ensiled when the shucks had dried and the kernels had begun to dent. Approximately 5.5 to 6 tons of silage were obtained per acre.

**ALFALFA SILAGE:** The alfalfa silage was made from the first cutting of alfalfa on May 23, 24, and 25 when it showed one-fourth bloom and averaged 26 inches in height. All of the alfalfa was ensiled immediately after cutting except for two loads ensiled about 24 hours after being cut. A total of 71.64 tons of green alfalfa were produced on 9.2 acres. Blackstrap molasses was added as a preservative at the rate of 68 pounds per ton of green alfalfa as the alfalfa was ensiled. The silage was low in nitrogen free extract or energy, as indicated in Table 9.

**ATLAS SORGO SILAGE:** The Atlas Sorgo silage was ensiled when some of the seed had begun to turn white. It yielded approximately 11.5 tons per acre and was not as good as the average of sorgo silage obtained for analyses from all parts of the state by the Agricultural Chemistry Department.

**BARLEY SILAGE:** The barley silage was made from Missouri Early Beardless barley cut when

the grain was in the milk stage. The plants ranged from two and one-half feet in height. About 3.5 tons of green barley silage were obtained per acre. Most of the barley (18 of the 20.5 acres) had been grazed by 36 two-year-old steers from April 22 to April 30 and then for one week by 34 cows and heifers. The barley was cut with a binder on June 3 and 4 and ensiled immediately, blackstrap molasses being added at the rate of 48 pounds per ton of green barley as the barley was blown into the silo. A good quality product was obtained. Data are given in Table 10.

The nutritional value of a given feed may range from excellent to bad depending upon its quality. There was considerable variation in the quality of the feeds that were used; thus, quality was an important factor in the results obtained.

The standard ration of corn silage and alfalfa hay produced the fastest and most efficient gains. The rate was 1.14 pounds for this ration — while the rate for the others ranged from 0.58 to 0.85 pound. This rate of gain (1.14 pounds) is better than lower rates for cattle that are to be grazed, fattened and sold prior to December. Prices paid usually break after that date.

Barley silage and alfalfa hay was second best but still inferior to the standard ration. The rate of gain was only 60.5 percent as fast as that from the standard ration (0.69 pound compared with 1.14 pounds).

Sorgo silage rated third, gave slightly less desirable results than barley silage (0.58 pound average daily gain compared with .69 pound from barley silage). In this test, one ton of corn silage produced as much gain as 2 tons of sorgo silage and the cattle gained twice as fast.

TABLE 9 -- ANALYSES OF SILAGES USED FROM DECEMBER 12, 1940-APRIL 25, 1941

	Protein	Fat	Crude Fiber	Nitrogen Free Extract
	%	%	%	%
Corn silage	7.38	2.67	21.52	54.56
Barley silage	11.19	3.27	27.59	40.34
Alfalfa silage	11.00	2.31	29.84	18.74
Atlas Sorgo silage	6.13	2.08	28.10	48.35

TABLE 10 -- COMPARISON OF SILAGES FOR WINTERING CALVES  
(December 20, 1940-April 25, 1941)  
126 Days

	Lot 1	Lot 2	Lot 3	Lot 4
	Corn Silage Alfalfa Hay	Alfalfa Silage Alfalfa Hay Shelled Corn	Atlas Sorgo Alfalfa Hay	Barley Silage Alfalfa Hay
No. Head in Lot	16	16	16	16
Avg. Initial Weight (lb.)	371.64	373.69	371.42	374.08
Avg. Final Weight (lb.)	515.08	480.89	444.35	460.75
Avg. Total Gain (lb.)	143.44	107.20	72.93	86.67
Avg. Daily Gain (lb.)	1.14	.85	.58	.69
<u>Avg. Total Feed Consumed</u>				
Silage (lb.)	2216.37	1497.69	2293.12	2414.56
Alfalfa Hay (lb.)	558.81	845.75	561.50	612.37
Shelled Corn (lb.)		279.00		
<u>Avg. Daily Ration</u>				
Silage (lb.)	17.59	11.89	18.20	19.16
Alfalfa Hay (lb.)	4.67	6.71	4.45	4.86
Shelled Corn (lb.)		2.21		
<u>Feed Consumed Per Cwt. Gain</u>				
Silage (lb.)	1545.18	1396.99	3143.96	2786.03
Alfalfa Hay (lb.)	410.50	788.88	769.84	706.59
Shelled Corn (lb.)		260.24		

In this test, alfalfa silage was the least satisfactory of those compared. The unsatisfactory results can be attributed partially, at least, to a poor quality product. The silage had a foul odor, was unpalatable and during the first month the cattle lost weight. Gain, not loss, was the object of feeding; consequently, shelled

corn was added to the ration. This reduced the amount of silage consumed but increased the daily rate of gain to an 0.85-pound average for the winter. An average of five bushels of corn per head was fed and the cattle consumed about 50 percent more hay than the other comparable lots of cattle.

#### Part V

### COMPARISON OF SILAGES WHEN SHELLED CORN IS ADDED TO PRODUCE A GIVEN AMOUNT OF GAIN

The preceding test indicated clearly that alfalfa, Atlas sorgo and barley silage produced less gain than corn silage when each was fed with legume hay. To make gains equal to those obtained from corn silage, each would need to be improved through supplementation.

In a feeding test from December 30, 1944, to April 20, 1945, rations of sorgo, soybean and barley silages and alfalfa hay were fed and to each was added enough shelled corn to produce as much gain as was obtained from a lot receiving a ration of corn silage and alfalfa hay. The amounts of shelled corn added indicated how close each approached the value of corn silage. In this test, 2.4 pounds of shelled corn were required daily for the sorgo silage ration, 3.4 for the soybean silage and 3.9 for the barley silage. The daily allowance of hay was practically the same for all lots, except Lot 3 (fed soybean silage) which received about 0.75 pound more hay daily than the other lots. The following quantities of corn were required with the various silages used during the winter: 4.7 bushels

with sorgo, 6.7 with soybean and 7.7 with barley silage. In this test, sorgo was superior to soybean and barley silage; the latter two were nearly equal, everything considered. The standard ration of corn silage and legume hay was clearly superior to all. Complete data are given in Table 11.

In 1946-47, corn silage was compared with Atlas sorgo silage, when both were fed with legume hay. One objective was to obtain the same rate of gain in both lots. To do this, the ration of sorgo silage was supplemented with a concentrate mixture of 10 parts shelled corn to 1 part soybean oil meal by weight. The results are given in Table 12.

The data reported in Table 12 show that Lot 1, fed corn silage and legume hay, made an average daily gain of 1.29 pounds. To make nearly the same gain (1.19 pound) with sorgo silage, another lot was fed 2.5 pounds of the concentrate mixture daily. This amounted to an average of 5.2 bushels of shelled corn and 29 pounds of soybean meal per head for the winter. With concentrates added, cattle ate less silage.

TABLE 11 -- COMPARISON OF SILAGES TO WHICH SHELLED CORN WAS ADDED TO PRODUCE A GIVEN AMOUNT OF GAIN DURING WINTER  
(December 30, 1944-April 20, 1945)  
111 Days

	Lot 2	Lot 3	Lot 4	Lot 5
	Corn Silage Alfalfa Hay	Soybean Silage Alfalfa Hay and Shelled Corn	Atlas Sorgo Silage Alfalfa Hay and Shelled Corn	Barley Silage Alfalfa Hay and Shelled Corn
Avg. Initial Weight (lb.)	415.13	418.71	415.13	415.63
Avg. Final Weight (lb.)	555.29	569.48	561.67	557.46
Avg. Total Gain (lb.)	140.16	150.76	146.54	141.83
Avg. Daily Gain (lb.)	1.26	1.36	1.32	1.28
<u>Avg. Total Feed Consumed</u>				
Silage (lb.)	1923.75	2200.00	2141.63	2147.75
Hay, Alfalfa (lb.)	678.75	755.14	675.00	675.00
Shelled Corn (lb.)		374.50(6.7 bu.)	267.50(4.7 bu.)	432.50(7.7 bu.)
<u>Avg. Daily Ration</u>				
Silage (lb.)	17.33	19.82	19.29	19.35
Hay, Alfalfa (lb.)	6.11	6.80	6.08	6.08
Shelled Corn (lb.)		3.37	2.41	3.90
<u>Feed Per Cwt. Gain</u>				
Silage (lb.)	1372.48	1459.26	1461.45	1514.27
Hay, Alfalfa (lb.)	484.25	500.89	460.62	475.91
Shelled Corn (lb.)	none	248.41(4.4 bu.)	182.54(3.3 bu.)	304.93(5.5 bu.)

TABLE 12 -- COMPARISON OF CORN SILAGE AND ATLAS SORGO SILAGE  
(December 27, 1946-May 3, 1947)

	Lot 1	Lot 2
	Corn Silage Legume Hay	Atlas Sorgo Silage Legume Hay *Shelled Corn 10 Soybean Oil Meal 1
Avg. Initial Weight (lb.)	451.00	440.00
Avg. Final Weight (lb.)	615.00	591.00
Avg. Total Gain (lb.)	164.00	151.00
Avg. Daily Gain (lb.)	1.29	1.19
<u>Avg. Total Feed Consumed (per head)</u>		
Legume Hay (lb.)	842	794
Corn Silage (lb.)	2642	none
Atlas Sorgo Silage (lb.)	none	2282
Shelled Corn (bu.)	none	5.2
Soybean Oil Meal (lb.)	none	29
<u>Avg. Daily Ration</u>		
Legume Hay (lb.)	6.63	6.25
Corn Silage (lb.)	20.80	none
Atlas Sorgo Silage (lb.)	none	17.97
Shelled Corn (lb.)	none	2.29
Soybean Oil Meal (lb.)	none	.22
<u>Feed Consumed Per Cwt. Gain</u>		
Legume Hay (lb.)	513.41	525.83
Corn Silage (lb.)	1610.98	none
Atlas Sorgo Silage (lb.)	none	1511.26
Shelled Corn (bu.)	none	3.44
Soybean Oil Meal (lb.)	none	19.21

\*Fed as needed to produce approximately the same rate of gain as secured with corn silage.



**Part VI**  
**VALUE OF ADDING PROTEIN CONCENTRATE**  
**TO A CORN SILAGE RATION**

The value of adding protein concentrate to a ration of corn silage and legume hay was studied in three trials. In the first test, cottonseed cake was added to a corn silage-alfalfa hay ration; in the second, soybean oil meal was added to a corn silage-lespedeza hay ration; in the third, soybean oil meal was added to a ration of corn silage and alfalfa hay.

The addition of protein concentrate resulted in

a marked gain in every case. The amount ranged from 0.25 pound to 0.50 pound increase for adding the pound of protein concentrate daily. It reduced the amount of feed required per 100 pounds of gain by as much as 40 percent in one case. Supplying the needed protein and improving the digestion of the feeds are two main reasons for the response. The complete data are found in Table 13.

**TABLE 13 -- VALUE OF ADDING PROTEIN CONCENTRATE TO A RATION OF CORN SILAGE AND LEGUME HAY**  
(All figures represent pounds)

Ration	1940-41		1942-43		1944-45	
	Corn Silage Alfalfa Hay Cottonseed Cake	Corn Silage Alfalfa Hay	Corn Silage Lespedeza Hay Soybean Meal	Corn Silage Lespedeza Hay	Corn Silage Alfalfa Hay Soybean Oil Meal	Corn Silage Alfalfa Hay
Avg. Initial Weight	371.67	371.64	361.31	361.42	414.63	415.13
Avg. Final Weight	573.00	515.08	504.08	459.81	574.75	555.29
Avg. Total Gain	201.33	143.44	142.77	98.39	160.2	140.11
Avg. Daily Gain	1.60	1.14	1.44	.99	1.44	1.26
<b>Avg. Total Feed Consumed:</b>						
Silage	2241.75	2216.37	1639.00	1639.00	1925.88	1923.75
Alfalfa hay	577.00	558.81			680.38	678.75
Lespedeza hay			453.63	453.63		
Cottonseed Cake	118.06					
Soybean Oil Meal			90.13		110.31	
<b>Avg. Daily Ration:</b>						
Silage	17.79	17.59	16.56	16.56	17.35	17.33
Alfalfa hay	4.58	4.67			6.13	6.11
Lespedeza hay			4.58	4.58		
Cottonseed cake	.94					
Soybean Oil Meal			.91		.99	
<b>Feed Consumed per cwt. Gain:</b>						
Silage	1113.45	1545.18	1147.99	1665.72	1202.73	1372.48
Alfalfa hay	286.59	410.50			424.90	484.25
Lespedeza hay			317.75	461.02		
Cottonseed cake	58.64					
Soybean Oil Meal			63.13		68.89	

**Part VII**  
**VALUE OF FEEDS GROWN DURING DROUGHT**

*Corn Silage and Corn Fodder Compared*

When severe drought occurs, every bit of available feed is needed. The corn may be utilized in many different ways, but is harvested primarily as fodder or ensilage. What is the feeding value of these drought-produced feeds? In 1934, severe drought made corn "fire" badly and practically filled it about tasseling time. Both fodder and silage were made from the crop and fed in a test during the winter of 1934. The amount fed was determined by what cattle would consume readily in addition to alfalfa hay (U. S. No. 3 leafy) fed at the rate of 4 pounds per head daily. The complete data appear in Table 14.

The outstanding results in this test are:

(1) Both "drought" corn silage and corn fodder produced good gains when full fed with a limited amount of top quality alfalfa hay.

(2) Much larger amounts of drought feed were required to winter a steer than are usually required of feed produced in a normal season. For example, in the preceding year, calves that were 45 pounds heavier at the outset and fed for 27 days less time ate 15.1 pounds silage and 5.26 pounds of alfalfa hay daily (average) compared with 25.5 pounds of silage and 4.1 pounds of alfalfa hay daily of drought-produced feed.

TABLE 14 -- WINTERING STOCK CALVES ON FEEDS  
GROWN DURING THE DROUGHT  
(December 18, 1934-April 9, 1935)

Lot	I	III
	Corn Silage Alfalfa Hay	Corn Fodder Alfalfa Hay
Initial Weight (lb.)	353.58	353.21
Final Weight (lb.)	486.19	435.19
Total Gain (lb.)	132.61	81.98
Average Daily Gain (lb.)	1.17	.73
<b>Total Feed Fed</b>		
Corn silage (lb.)	2880	
Corn fodder (lb.)		1611.25
Alfalfa hay (lb.)	463	463
Cottonseed meal (lb.)		
Pasture (days)		
<b>Average Daily Ration</b>		
Corn silage (lb.)	25.50	
Corn fodder (lb.)		14.3
Alfalfa hay (lb.)	4.10	4.10
Cottonseed meal (lb.)		
<b>Feed Consumed per Cwt. Gain</b>		
Corn silage (lb.)	2172	
Corn fodder (lb.)		1965
Alfalfa hay (lb.)	349	564
Cottonseed meal (lb.)		

(3) In each case, silage and alfalfa hay produced about 0.5 pound more daily gain than fodder and alfalfa hay, or 1.17 pounds compared to 0.73 pound. A comparison of the same rations made up of feeds produced in a normal season gave 1.2 and 0.98 pound daily gains, respectively.

This seems to indicate that feed produced during an extremely dry season has good feeding value but greater amounts of it are required to produce a unit of gain. The exact amount cannot be specified because drought conditions, between years, will vary a great deal, giving varied effects on crops.

*Cotton Cake (43 percent Protein) and Alfalfa Hay as Supplements to Silage and Fodder Made from Drought Corn*

When additional protein is needed for stocker cattle, it is often secured by using a protein concentrate such as cottonseed, linseed, or soybean meal or by using a limited amount of legume hay. Hay of any kind is usually scarce and expensive following a drought. Protein concentrate, cottonseed cake for example, may be available. This was the case in 1934. In this test, approximately 4 pounds of alfalfa hay were compared with 1 pound of cottonseed cake in supplementing drought silage and fodder. Detailed results are in Table 15.

In this study, 4 pounds of U. S. No. 2 alfalfa hay were superior to 1 pound of 43 percent protein cottonseed meal when added daily to rations of either corn silage or corn fodder made from "drought corn."

Calves fed silage and alfalfa hay gained 1.17 pounds per day (Table 15) compared to 0.72 pounds per day for those fed silage and cottonseed meal. The lot fed alfalfa hay consumed 2,172 pounds of silage per hundredweight gain in addition to the hay, while

TABLE 15 -- WINTERING STOCK CALVES ON FEEDS GROWN DURING THE DROUGHT  
A COMPARISON OF ALFALFA HAY AND COTTONSEED MEAL  
(December 18, 1934-April 9, 1935)

Lot	I	II	III	IV
	Corn Silage Alfalfa Hay	Corn Silage Cottonseed Meal	Corn Fodder Alfalfa Hay	Corn Fodder Cottonseed Meal
Initial Weight (lb.)	353.58	354.67	353.21	352.79
Final Weight (lb.)	486.19	435.56	435.19	427.63
Total Gain (lb.)	132.61	80.89	81.98	74.84
Average Daily Gain (lb.)	1.17	.72	.73	.66
<b>Total Feed Fed</b>				
Corn silage (lb.)	2880	3268.75		
Corn fodder (lb.)			1611.25	1844.38
Alfalfa hay (lb.)	462.6		462.63	
Cottonseed meal (lb.)		107.19		107.19
Pasture (days)				
<b>Average Daily Ration</b>				
Corn silage (lb.)	25.50	28.93		
Corn fodder (lb.)			14.26	16.32
Alfalfa hay (lb.)	4.10		4.09	
Cottonseed meal (lb.)		.95		.95
<b>Feed Consumed Per cwt. Gain</b>				
Corn silage (lb.)	2171.88	4040.69		
Corn fodder (lb.)			1965.44	2464.64
Alfalfa hay (lb.)	348.88		564.32	
Cottonseed meal (lb.)		132.50		143.23

the lot fed cottonseed meal instead of alfalfa hay required 4,041 pounds of silage per hundredweight gain.

Four pounds of No. 2 alfalfa hay were also superior to 1 pound of 43 percent protein cottonseed cake when added to corn fodder, Lots 3 and 4 respectively. The average daily rates of gain were 0.73 and 0.66 pounds, an 11 percent advantage in favor of the hay. The amounts of fodder and hay required to make 100 pounds gain were 1965 and 564 pounds, respectively compared to 2,465 pounds of corn fodder and 143 pounds cottonseed meal.

#### *Drought Corn Fodder Fed on Small Grain Pasture*

Early fall seedings of small grains are usually made in drought years to increase the feed supply, if the ground can be prepared. This was done in 1934 and the small grain proved invaluable to livestock men that year.

The use of fall-sown barley for wintering feeder calves was studied in the fall and winter, 1934. Two lots of feeder calves were utilized. Both lots grazed barley and were fed drought fodder; one of these lots was fed cottonseed meal. Table 16 gives the results.

In this case, the addition of protein concentrate increased the rate of gain by 37 percent, or from 0.69 pound daily gain to 0.95 pound. For each pound of cottonseed meal fed, approximately 0.27 pound of additional gain was secured. In this test, as in others

**TABLE 16 -- WINTERING STOCK CALVES ON DROUGHT FODDER AND BARLEY PASTURE WITH AND WITHOUT PROTEIN CONCENTRATE**

Lot	V	VI
	Corn Fodder Barley Pasture	Corn Fodder Barley Pasture Cottonseed Meal
Initial Weight (lb.)	353.21	352.92
Final Weight (lb.)	430.63	459.75
Total Gain (lb.)	77.42	106.83
Average Daily Gain (lb.)	.69	.95
Total Feed Fed		
Corn fodder (lb.)	2265.5	2265.5
Cottonseed meal (lb.)		103.13
Pasture (days)	113	113
Average Daily Ration		
Corn fodder (lb.)	20.22	20.22
Cottonseed meal (lb.)		.92
Feed Consumed per Cwt. Gain		
Corn fodder (lb.)	2926.39	2120.58
Cottonseed meal (lb.)		96.53

reported previously, there was good response from addition of protein concentrate to the ration.

The calves ate large amounts of fodder and, consequently, small amounts of barley pasture. The cattle feeder, of course, could limit the fodder allowance if pasture should be used more extensively.

## SUMMARY

Many roughages were fed alone and in various combinations, with and without supplementation, to good and choice feeder calves and compared. The effects of processing were studied in some instances.

1. Grinding roughage did not pay, based on the following results:

a. Ground and long alfalfa hay had about the same feeding value, when both were fed in approximately the same limited amounts with corn silage.

b. Ground and long soybean hay produced almost identical results when both were fed in the same limited amounts with corn fodder.

c. Grinding corn fodder did not add to its value. Whole and ground fodder, fed in the same amounts with alfalfa hay, gave practically the same results.

2. Chopped and ground corn stover produced equal results, when fed with broken ear corn and whole alfalfa hay.

3. One and one-tenth ton of corn silage was worth 0.8 ton of either ground or whole corn fodder when both were fed with alfalfa hay in amounts that produced an average daily gain of 0.8 pound. Calves

would have consumed greater amounts of corn silage and whole fodder and made faster gains if given free choice.

4. Alfalfa hay was superior to both oat and soybean hay—these latter hays, however, were of lower quality than the alfalfa.

5. Clover was slightly superior to alfalfa hay.

6. Quality of feed in 4 and 5, above, affected results materially.

7. One ton of early-cut timothy was worth two tons of late-cut, mature timothy when each was fed with 1.5 pounds soybean meal per head per day.

8. Corn silage was superior to alfalfa, Atlas sorgo and barley silages. All were fed with alfalfa hay and, in the case of alfalfa silage, shelled corn was needed to produce satisfactory gains.

a. One ton of corn silage produced as much gain as two tons of sorgo silage and the cattle gained twice as fast.

b. Barley silage produced faster gains than sorgo, attaining 61 percent of the rate on corn silage.

c. Alfalfa silage was of poor quality and the results were unsatisfactory.

9. In a later test, designed to obtain the same

average daily gain in all lots, the following average total amounts of corn were added to barley, soybean and Atlas sorgo silages, respectively, to equal the gain produced with corn silage: 7.7, 6.7 and 4.7 bushels. Alfalfa hay was fed in addition, to all lots and the average daily rate of gain was approximately 1.25 pounds.

10. To equal the average daily gain made with corn silage, other silages must be supplemented properly.

11. Adding protein concentrate to a ration of corn silage and legume hay increased the gain. This increase ranged from 0.25 to 0.50 pound with the addition of 1 pound protein concentrate daily per head.

Greatest benefit was derived when the quality of feed was poorest.

12. Good results were obtained with silage and fodder produced during droughts but more total feed was required than normally per unit gain; the amounts required were no greater, however, than in other tests wherein low quality feeds were utilized.

13. Four pounds of alfalfa hay were slightly superior to 1 pound of 43 percent protein cottonseed meal when added to rations of either silage or corn fodder made from drought corn.

14. Each pound of cottonseed meal added to a ration of corn fodder and barley pasture increased the gain 0.27 pound.

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