

# Factors Affecting the Feeding Value of Sorghum Silage, 1962-63 (Project 623).

F. W. Boren, E. F. Smith, D. Richardson and G. E. Fairbanks

This is the third year of an experiment designed to investigate factors that affect the feeding value of sorghum silage. Data reported in Circular 383, 1960-61, indicated that almost without exception, average daily gain, silage dry matter consumption, and silage dry matter percent were positively correlated. Pounds of silage dry matter required to produce a pound of gain were negatively correlated with average daily gain, silage dry matter and daily dry matter consumption. Winter gains also ranked in the same order as the percentage of grain in the silage, i.e., the higher the grain content, the greater the gain. However, digestion coefficients, using steer calves, were lower with the high-grain silage, suggesting the possibility of appreciable nutrient loss in undigested grain.

In Bulletin 447, 1961-62, data were reported on the effects of silage dry matter, stage of maturity, grain versus no grain, and ground-heads silage on winter gains. Gains were directly related to silage dry matter and daily silage dry matter consumption and also to the grain content of the silage. Grain on the silage crop increased gain approximately 32%. Forage sorghum cut at 10 days past full bloom and having only 20% dry matter produced unsatisfactory gains. It appears that silage with less than 25% dry matter will not produce satisfactory gains in the type beef calves used in these tests. Grinding the heads did not improve gains; however, it appeared that silage dry matter and silage consumption affected average daily gain.

## Experimental Procedure

The 1962-63 experiment was designed to study further the value of grinding heads of forage sorghum for silage. It appeared from previous experiments that this practice might be beneficial. Two forage sorghum varieties, DeKalb FSIA and White Sourless, were used. DeKalb FSIA is described as nonjuicy, nonsweet, heavily grained, and mid-season maturity. White Sourless is very sweet, very juicy, lightly to moderately grained, and mid-season maturity.

This experimental design was used.

Lot no.	Variety	Silage treatment
1	DeKalb FSIA	Heads removed at medium to hard-dough stage of maturity, ground in a hammermill and combined with chopped forage at a uniform rate and ensiled.
2	DeKalb FSIA	Conventional silage made at same maturity as Lot 1.
3	White Sourless	Same as Lot 1.
4	White Sourless	Same as Lot 2.

Upright, 50-ton concrete stave silos were used to ensile the forage sorghum. They were provided through the courtesy of Salina Concrete Products, Inc., Salina, Kansas.

Forty head of choice-quality Hereford heifer calves, weighing about 350 pounds each, were randomly allotted, 10 head to a lot, and randomly assigned to each of the four types of silage. Silage was fed free choice and 1.25 pounds of soybean oil meal were fed per head daily. Dicalcium phosphate was fed daily in the soybean oil meal. Salt was kept before the calves at all times.

## Observations

The performance of the calves is shown in Table 13. Average daily gains made by the heifers were not significantly different. As in previous experiments, gains increased as dry matter consumption increased. Grinding the heads of DeKalb FSIA increased gain about 10%, whereas there was no benefit from grinding the heads of White Sourless sorghum.

Table 13  
Factors affecting the feeding value of sorghum silage (progress report).  
November 20, 1962, to March 14, 1963—114-day wintering period.

Lot no.	3	4	5	6
No. heifers per lot	10	10	10	10
Silage variety	DeKalb FSIA		White Sourless	
	Ground heads	Control	Ground heads	Control
Silage treatment				
Silage dry matter content, %	32.8	32.4	28.1	29.6
Initial wt. per heifer, lbs.	350	351	354	348
Av. gain per heifer, lbs.	140	134	131	152
Final wt. per heifer, lbs.	490	485	485	500
Av. daily gain per heifer, lbs.	1.23	1.18	1.15	1.33
Av. daily ration, lbs., as-fed basis:				
Silage	27.44	27.38	30.10	30.37
Soybean oil meal	1.25	1.25	1.25	1.25
Av. daily ration, lbs., dry-matter basis:				
Silage	9.00	8.87	8.46	8.99
Soybean oil meal, 90% dry matter	1.13	1.13	1.13	1.13
Total dry matter consumed daily, lbs.	10.13	10.00	9.59	10.12
Lbs. dry matter per cwt. gain	823.6	847.5	842.6	760.9
Feed cost per cwt. gain, as-fed basis:				
Silage	\$ 7.81	\$ 8.12	\$ 9.16	\$ 7.99
Soybean oil meal	\$ 3.88	\$ 4.02	\$ 4.14	\$ 3.57
Total feed cost per cwt. gain	\$11.69	\$12.14	\$13.30	\$11.56

t. Feed prices: Silage, \$7 per ton; soybean oil meal, \$3.80 per cwt.

# The Effects of Adding Protein to Dry-rolled Sorghum Grain Fattening Rations, 1961 (Project 370).

F. W. Boren, E. F. Smith, D. Richardson, R. P. Cox

Previous work (Bulletin 447) indicated that sorghum grain fattening rations supplemented with 0.5 pound per head per day of soybean oil meal produced gains minimal in efficiency and carcasses equal to those from heifers fed 1 pound of protein per head daily. With each increase of 0.5 pound of protein (0, 0.5, 1.0) came a 0.20-pound increase in average daily gain, an increase in feed efficiency, and an increase in profit over feed cost.

This experiment repeated a portion of the previous experiment with modifications, as shown below, for a 140-day fattening period:

- Lot 13. One half pound of soybean oil meal per head daily.
- Lot 14. One pound of soybean meal per head daily.
- Lot 15. One and one half pounds of soybean meal per head daily.
- Lot 16. One half pound of soybean meal per head daily for the first 28 days, then increasing one half pound each 28 days for the 140 days.
- Lot 17. Two and one half pounds of soybean meal per head daily for the first 28 days, then decreasing one half pound each 28 days for 140 days.

Table 14

The effects of adding protein to dry-rolled sorghum grain fattening rations.

March 9, 1962, to July 27, 1962—140 days.

Lot no.	13	14	15	16	17
Protein feeding:					
Lbs. per head daily ..	0.5	1.0	1.5	0.5 plus 0.5 lb. each 28 days	2.5 minus 0.5 lb. each 28 days
Method of feeding ..	Constant	Constant	Constant	0.5 lb. each 28 days	0.5 lb. each 28 days
No. heifers per lot .....	10	10	10	10	10
Av. initial wt., lbs. ....	541	545	546	547	547
Total gain, lbs. ....	266	231	251	227	229
Av. final wt., lbs. ....	747	776	796	774	776
Av. daily gain per head, lbs. ....	1.47	1.65	1.79	1.62	1.64
Av. daily ration, lbs.: <sup>1</sup>					
Sorghum grain .....	14.72	14.63	14.12	13.21	13.05
Soybean oil meal .....	0.5	1.0	1.50	1.50	1.50
Prairie hay .....	4.78	4.65	4.99	4.56	4.54
Feed required per cwt. gain, lbs.: <sup>2</sup>					
Sorghum grain .....	1001	887	794	815	796
Soybean oil meal .....	33	61	84	93	91
Prairie hay .....	325	282	279	281	277
Total .....	1359	1230	1157	1189	1164
Feed cost per cwt. gain: <sup>3</sup>					
Sorghum grain .....	\$18.02	\$15.97	\$14.29	\$14.67	\$14.33
Soybean oil meal .....	1.25	2.32	3.19	3.53	3.46
Prairie hay .....	2.60	2.26	2.23	2.25	2.22
Total .....	21.87	20.55	19.71	20.45	20.01
Initial cost per head <sup>4</sup> ....	\$129.84	\$130.80	\$131.04	\$131.28	\$131.28
Cost of feed <sup>4</sup> .....	45.05	47.47	49.47	46.42	45.82
Total cost, animal + feed .....	174.89	178.27	180.51	177.70	177.10
Av. carcass value per head <sup>5</sup> .....	183.30	199.66	198.88	200.02	196.48
Profit over feed cost per head .....	8.41	21.39	18.37	22.32	19.38
Carcass data					
Av. area ribeye, sq. in.	8.96	8.79	8.88	8.80	8.87
Av. fat thickness at 12th rib .....	0.59	0.51	0.75	0.75	0.72
Av. carcass grade: <sup>1</sup>	18.3	18.9	19.0	19.1	18.8
Choice + = 21 .....				1	1
Choice = 20 .....		1	4	2	1
Choice - = 19 .....	4	7	2	4	3
Good + = 18 .....	5	2	4	3	4
Good = 17 .....	1				1
Good - = 16 .....					

1. Each lot supplemented with 10,000 I.U. vitamin A and 30 gms. calcium carbonate per head daily; salt fed free choice; none of these included in cost of feed.

2. Feed costs used are on page 72.

3. Initial live wt. x \$24 per cwt.

4. Feed cost per cwt. gain x total gain.

5. Carcass weight x carcass grade price; Choice, \$12.25; good, \$39.50.

## Observations.

Data collected from this experiment appear in Table 14. Average daily gain increased 0.18 and 0.14 pound, respectively, as daily soybean meal intake increased from 0.5 to 1.5 pounds. However, a daily intake of 1.5 pounds of protein fed in a decreasing or increasing manner seemed to depress gain.

Feed efficiency increased markedly as the protein intake increased from 0.5 to 1.5 pounds daily. Feed efficiency was essentially the same for Lots 15, 16, and 17 which received 1.5 pounds of protein per head daily.

Table 15 shows data collected from another feeding trial with the same objectives. Feeding methods were the same except sorghum silage instead of prairie hay was used as a roughage.

Average daily gain was materially increased when daily protein intake was increased from 0.5 to 1.0 pound but no increase occurred with 1.5 pounds of protein. Decreasing or increasing the protein during the fattening period did not affect average daily gain.

In both experiments the heifers from the lots receiving 1.5 pounds of protein constantly throughout the fattening period had larger rib eyes and higher carcass grades.

Table 15

Effects of adding protein to dry-rolled sorghum grain fattening rations. May 10, 1962, to September 27, 1962—140-day fattening period.

Lot no.	7	8	9	10	11
Protein:					
Lbs. per head daily ..	0.50	1.0	1.5	0.5 plus 0.5 lb. each 28 days	2.5 minus 0.5 lb. each 28 days
No. heifers per lot .....	10	10	10	10	10
Av. initial wt., lbs. ....	626	620	625	618	624
Total gain, lbs. ....	231	279	278	272	276
Av. final wt., lbs. ....	857	899	903	890	891
Av. daily gain per head, lbs. ....	1.65	1.99	1.99	1.94	1.97
Av. daily ration, lbs.: <sup>1</sup>					
Sorghum grain .....	14.0	14.1	14.0	14.0	14.0
Soybean oil meal .....	0.5	1.0	1.5	1.5	1.5
Sorghum silage .....	18.7	18.8	18.8	18.4	18.7
Feed required per cwt. gain, lbs.: <sup>2</sup>					
Sorghum grain .....	848	709	704	722	711
Soybean oil meal .....	30	50	75	77	76
Sorghum silage .....	1133	945	945	948	949
Total .....	2011	1704	1724	1747	1736
Feed cost per cwt. gain: <sup>3</sup>					
Sorghum grain .....	\$15.26	\$12.76	\$12.67	\$13.00	\$12.80
Soybean oil meal .....	1.14	1.90	2.85	2.93	2.89
Sorghum silage .....	3.97	3.31	3.31	3.32	3.32
Total .....	20.37	17.97	18.83	19.25	19.01
Initial cost per head <sup>4</sup> ....	\$150.24	\$148.80	\$150.00	\$148.32	\$149.76
Cost of feed <sup>4</sup> .....	47.05	50.14	52.35	52.36	52.49
Total cost, animal + feed .....	197.29	198.94	202.35	200.68	202.25
Av. carcass value per head <sup>5</sup> .....	212.49	220.37	233.90	230.52	228.04
Profit over feed cost per head .....	15.20	21.43	31.55	29.84	25.81

Table 15 (Continued)

	Carcass data				
	9.01	9.65	9.70	9.83	9.51
Av. area ribeye, sq. in. . . . .	0.88	0.83	0.90	0.83	0.93
Av. fat thickness at 12th rib, in. . . . .	18.4	17.8	19.2	18.5	18.4
Av. carcass grade: . . . . .	1	2	2	2	2
Choice + = 21 . . . . .	2	1	2	4	1
Choice = 20 . . . . .	6	4	4	1	6
Choice - = 19 . . . . .	1	3	3	3	1
Good + = 18 . . . . .	1	1			
Good = 17 . . . . .					
Good - = 16 . . . . .					

1. Each lot supplemented with 10,000 I.U. vitamin A and 30 gms. calcium carbonate per head daily. Salt fed free choice; none of these included in feed cost.

2. Feed costs are on page 72.

3. Initial wt. x \$24 per cwt.

4. Feed cost per cwt. gain x total gain.

5. Carcass wt. x carcass grade price: Choice, \$43.25; good, \$40.50.

#### Effects of Field-conditioned Alfalfa Hay on the Winter Performance of Weaned Heifer Calves, 1962-63 (Project 370).

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This feeding trial was to determine the effects of various field-conditioned alfalfa hays on the winter performance of heifer calves.

Second-cutting alfalfa was field-conditioned or processed as follows:

1. Control—mowed, raked, baled.
2. Crushed—mowed, crushed with one smooth steel roll and a spiral-grooved rubber roll, raked and baled.

Table 16

#### Winter performance of weaned heifer calves fed alfalfa hay field-cured by various methods.

December 12, 1962, to March 8, 1963—93-day wintering period.

Lot no. . . . .	13	14	15	16	17
No. heifers per lot . . . . .	10	10	10	10	10
Hay-conditioning method	Control	Crushed	Rotary cut	Swathed, crimped	Wafered
Initial wt. per heifer, lbs. . . . .	438	441	442	443	442
Av. gain per heifer, lbs. . . . .	102	110	98	121	119
Final wt. per heifer, lbs. . . . .	540	551	540	564	561
Av. daily gain per heifer, lbs. . . . .	1.10	1.18	1.05	1.30	1.28
Av. daily ration, lbs.: . . . . .					
Alfalfa hay . . . . .	11.8	13.1	11.3	11.9	13.0
Ground sorghum grain, lbs. . . . .	3.5	3.5	3.5	3.5	3.5
Lbs. feed per cwt. gain: . . . . .					
Alfalfa hay . . . . .	1072.7	1110.2	1076.2	915.4	1015.6
Ground sorghum grain, lbs. . . . .	318.2	296.6	333.3	269.2	273.4
Total lbs. feed required per cwt. gain . . . . .	1390.9	1406.8	1409.5	1184.6	1289.0
Feed cost per cwt. gain <sup>1</sup> . . . . .	\$16.46	\$16.44	\$16.76	\$14.00	\$15.08

1. Feed costs on page 72.

3. Rotary cut—a 12-foot, trail-behind, twin-rotor rotary mower that cut, lacerated, and windrowed the hay in one operation, baled.

4. Swathed, crimped—a 12-foot, self-propelled windrower with a crusher-crimper attachment, baled.

5. Wafered—Alfalfa cut with a flail-type cutter, field dried to about 15% moisture in windrows, wafered with a Massey-Ferguson wafering machine.

Fifty head of choice Hereford heifer calves were used in this study, allotted 10 head per lot, and fed alfalfa free choice, plus 3.5 pounds of rolled sorghum grain per head per day. Salt was available at all times.

#### Observations

Data are given in Table 16. There was no apparent reason for the difference in average daily gain of heifers in the various lots. Calves fed wafers rapidly adjusted to that type of hay-package and were apparently satisfied with wafers as a source of roughage.

#### Vitamin A and Dehydrated Alfalfa Fed Individually and in Combination with and without Aureomycin in a Steer Fattening Ration (Project 567).

D. Richardson, E. F. Smith, F. W. Boren and Keith Kingsley

Hereford yearling steers in this test were used in a previous bluestem pasture grazing test. After the grazing test was completed, they were assigned to six lots of 10 animals each on the basis of weight and uniformity to compare the value of dehydrated alfalfa as a source of vitamin A with preformed vitamin A, both individually and in combination with and without Aureomycin. The supplements supplied the same amount of protein, calcium and phosphorus in each lot. Vitamin A value of carotene was figured on the dehydrated alfalfa at 400 I.U. per milligram of carotene; 10,000 I.U. of vitamin A per head was fed daily for the first 84 days and 15,000 I.U. units for the remainder of the test; 70 milligrams of Aureomycin was fed per head daily. After the steers were on feed, silage was limited to 20 pounds per head daily; however, grain was fed *ad lib*.

#### Results and Observations

The results of this test are presented in Table 17.

- (1) Dehydrated alfalfa produced greater gains than preformed vitamin A (compare Lots 7 and 9).
- (2) A combination of dehydrated alfalfa and vitamin A was no better than either alone (compare Lot 11 with 7 and 9).
- (3) Aureomycin apparently was beneficial with a combination of dehydrated alfalfa and vitamin A but not when used with each individually (compare Lot 12 with 8 and 10). We have no satisfactory explanation for these results.
- (4) Liver storage of vitamin A was greatest with animals fed preformed vitamin A; however, there was no relationship between liver storage of vitamin A and gains of individual animals.
- (5) No deficiency symptoms or differences in appearance attributed to vitamin A were observed.
- (6) Feed cost and efficiency favored lots making the greatest rate of gain.
- (7) There were no significant differences in dressing percentage, carcass grade or carcass characteristics.

The following is a 114-day progress report on a repeat of this test, except 15,000 I.U. of vitamin A per head daily has been used throughout the test.

Lot no. . . . .	7	8	9	10	11	12
Av. starting wt., lbs. . . . .	862	860	860	856	862	857
Av. daily gain, lbs. . . . .	2.86	2.96	3.00	3.02	2.88	3.19