18TH ANNUAL

SOUTHEAST SOUTH DAKOTA

EXPERIMENT FARM

PROGRESS REPORT 1978

AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE UNIVERSITY
BROOKINGS

This eighteenth annual report of the research program at the Southeast South Dakota Experiment Farm has special significance for those engaged in agriculture and the agriculturally related businesses in the nine county area of southeast South Dakota. The results shown are not necessarily complete or conclusive. Interpretations given are tentative because additional data resulting from continuation of these experiments may result in conclusions different from those based on any one year. Trade names are used in this publication merely to provide specific information. A trade name quoted here does not constitute a guarantee or warranty and does not signify that the product is approved to the exclusion of other comparable products.

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EIGHTEENTH ANNUAL PROGRESS REPORT
SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

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Introduction . . . . . Fred E. Shubeck. Research Manager

One of the most striking events of the 1978 growing season was the devastating hailstorm that occurred July 5. None of the soybeans survived. Some of the corn plants lived, but they were severely injured. Young trees in the orchard took a severe beating and their branches are full of scars from the wind-driven hail. Small grains were completely destroyed.

Perhaps we should look upon this event not so much as a disaster but as an opportunity -- an opportunity to study late planted emergency crops so if this type of disaster reoccurrs, more information will be available to help make management decisions.

On July 6 a quick decision was made to embark upon an extensive program of replanting. Rainfall was above average in July and August and results were gratifying.

Tables 1 and 2 summarize temperatures and precipitation data for 1978. Daily readings were taken and data summarized by Experiment Farm personnel.

A total of 54 meetings were held in the office-laboratory building by Extension Clubs, 4-H Clubs, Adult Education Meetings, Judging Schools and other local groups. In addition a college level Animal Nutrition Course was taught during the winter by Dr. Gerry Kuhl.

A total of three different crop tours or field days were conducted at the Experiment Farm in 1978.

Work was started on remodeling the hog house to utilize a scraper system under the slats to move manure to a large covered cement tank. The old lagoon was filled with dirt hauled from Harmon's gravel pit.

Table 1. Temperatures at the Southeast Experiment Farm

Month	1978 Av. Temperature (F)[1] Maximum	Minimum	26 Year Average Maximum	Minimum	Departure from 26 Year Average Maximum	Minimum
January	11.2	-9.7	25.5	4.4	-14.3	-14.1
February	17.7	-2.5	32.8	11.1	-15.1	-13.6
March	39.7	19.3	43.6	22.3	- 3.9	- 3.0
April	56.0	36.6	61.4	35.6	- 5.4	+ 1.0
May	71.0	46.1	73.7	47.6	- 2.7	- 1.5
June	81.0	54.1	83.0	57.4	- 2.0	- 3.3
July	83.6	59.3	87.9	62.3	- 4.3	- 3.0
August	83.0	58.2	86.3	59.8	- 3.3	- 1.6
September	80.1	52.6	75.9	49.2	+ 4.2	+ 3.4
October	62.9	32.7	65.8	41.0	- 2.9	- 8.3
November	43.7	20.4	46.3	24.2	- 2.6	- 3.8
December	25.2	3.4	31.3	11.1	- 6.1	- 7.7

[1]Computed from daily observation.

Table 2. Precipitation at the Southeast Experiment Farm

Month	Precipitation 1978 (inches)	26-Year Average (inches)	Departure from 26-yr. Ave. (inches)
January	.40	.48	-0.08
February	.46	1.14	-0.68
March	.43	1.35	-0.92
April	3.39	2.44	+0.95
May	3.08	3.23	-0.15
June	1.94	4.04	-2.10
July	10.61	3.33	+7.28
August	2.96	2.79	+0.17
September	1.59	2.73	-1.14
October	.37	1.53	-1.16
November	.46	1.01	-0.55
December	.52	.70	-0.18
Total	26.21	24.77	+1.44

REPLANTED SOYBEANS

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Is it worth the risk to try for a cash crop of soybeans when planting in July?
2. What variety maturity should be selected?

Methods and Procedures

Preceding crop destroyed by hail - beans
Weedicide on first crop - Lasso, 2 1/2 quarts per acre broadcast pre-emergence
Seedbed preparation for 2nd crop - disk, drag
Planting date 2nd crop - July 11, 1978
Weedicide - Lasso II banded at planting
Emergence - July 17, 1978
First Killing frost - October 7, 1978 (24°F)
Harvest date - October 19, 1978

Table 3. Replanted Soybean Varieties

Variety	Maturity * (Approximate)	% Moisture at harvest	Bu/Acre at 13% Moisture
Corsoy	Medium	9.1	31
Hodgson	7 days earlier than Corsoy	9.0	29
Swift	12 days earlier than Corsoy	8.3	24
Evans	14 days earlier than Corsoy	8.8	30
Clay	18 days earlier than Corsoy	8.3	27

*From South Dakota 1978-79 Certified Seed Directory.

Discussion and Interpretation of Table 3.

Two outstanding results occurred: (1) Yields were rather spectacular considering the late planting date, and (2) Beans from all varieties dried down to 9.1% moisture or less in the field by harvest time. First killing frost occurred October 7 which was about normal.

Growing conditions after the hailstorm were unusually favorable. Growing conditions at the Experiment Farm after the 1969 hailstorm were also favorable. These facts should be considered carefully when making the decision whether or not to replant after hailstorms that may occur in the future.

Very little information was available on yield and plant characteristics when date of planting occurred so late in the season. Some soybean varieties are influenced by day length which is a reflection of planting date. It was somewhat of a surprise to see a variety like Corsoy reach 30 inches in height. A very early variety, Clay, was much shorter in height but the clusters of pods were closer together and the yield was comparable to the taller growing varieties.

It was also a surprise to see beans from all varieties so well matured at harvest with moisture content low. If the frost had occurred 2 to 3 weeks earlier, Corsoy would have been in trouble, while Clay was fairly well matured. The management decision in selecting a variety will be "Can I afford to take 2,3,4, or 5 bushel per acre yield reduction by planting earlier varieties in order to reduce the risk of getting a non-marketable immature crop?" Even though yields from all varieties were excellent in delayed plantings, results may be different with less than optimum growing conditions.

Evans beans were planted in a very high fertility area formerly used for hog pasture in addition to the area used for variety trials. Evans beans in the high fertility area were taller with more leaves and vegetative growth than those in the variety trial but the yield was about the same.

REPLANTED CORN

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. What can we expect from a 72 day maturity rated corn replanted on July 13, 1978?
2. Is it possible to develop mature marketable corn grain or is it best to plan on using it for silage?

Methods and Procedures

Original corn destroyed July 5 by hail
Remaining stalks and stubble were tandem disked & dragged
Replanted in 30 inch rows July 13
Plant population - 16,638 plants per acre
Emergence - July 18
Herbicide - First planting; Lasso II banded
Second planting; none
Insecticide - First planting - Furadan 10G
Second planting - none
Fertilizer - First planting - 80-40-20 (oxide) disked in
Second planting - none
Variety - Pioneer 3992 (A 72 day corn, S. Dak. rating)
Sampled for yield - October 5
First killing frost - October 7

Table 4. Replanted Corn

Variety	Bu/Acre calculated at 15.5% moisture	Tons of silage per acre calculated at 65% moisture
Pioneer 3993 (a 72 day corn)	51.0	4.1

Discussion and Interpretation of Table 4.

Corn was sampled for yield on October 5 - two days before the first killing frost. Total plant moisture was down to 74% so silage cutting was started on that date. Kernels were in the early dent stage and ears contained 51% moisture.

Conditions for maturing corn in the early fall of 1978 were excellent. The average high temperature for the period September 3 to September 12 was 91.2° Fahrenheit. If it was impossible to mature a 72 day corn in 1978, the chances of maturing similar corn in other years would be remote if it was planted as late as July 13. However, with good growing conditions, large amounts of good quality silage were obtained.

REPLANTED SUNFLOWERS FOR SILAGE

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. What silage yields can be expected with late planting and what quality of silage can be obtained?
2. Will late planting reduce insect problem?

Methods and Procedures

First crop - Wheat
Fertilizer on wheat - 40 lbs. N/acre
Wheat destroyed by hail - July 5
Seedbed preparation - Moldboard plowed, tandem disked, spike tooth harrowed
Sunflowers planted - July 14
Emerged - July 23
Type - Three way cross, oil type
Fertilizer - none applied on sunflowers

Table 6. Replanted Sunflowers for Silage

Variety	Plant Population	Tons of Silage per Acre
Sigco 8903	18,000	5.04

Discussion and Interpretation of Table 6.

A total of 35.4 tons of sunflowers were cut for silage from 7.03 acres giving a yield of 5.04 tons per acre. Forage was placed in an upright silo. Sunflower silage will be fed to beef heifers with rate of gain, palatability, and total digestible nutrients determined.

A disk and a chisel plow were tried for preparing a seedbed after the hailstorm, but both implements were ineffective. Large amounts of chopped small grain straw from the hail formed a dense mulch and had to be moldboard plowed. Soil was wet when plowed and the resulting seedbed was not the best. A fairly uniform stand of sunflowers was obtained however.

Yield of sunflower forage was encouraging. Late planted sunflowers can be cut for silage or left to mature a seed crop. After all three of our silos were filled with emergency crops, 10 acres of sunflowers were left in an attempt to mature a cash seed crop. These flowers had 14% moisture by the end of November. No damage by the headmoth was observed.

REPLANTED SUNFLOWERS FOR A CASH SEED CROP

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. What yields of sunflower seed can be expected when replanted July 11?
2. Will late planting control or reduce the insect problem?

Methods and Procedures

First crop sunflowers - broadcast Treflan at 1.5 pints per acre and incorporated
Destroyed by hail - July 5
Stubble tandem disked and spiked tooth harrowed
Replanted - July 11
Emergence - July 16
Herbicide for second planting - Lasso II banded in row
Harvested - October 31 - November 3

Table 5. Replanted Sunflowers for a Cash Crop

Variety	Plant Populations	Lbs. Seed/Acre	% Oil*
Cougar	17,500	2223	38.93
Duke	20,300	2492	38.45
Gold Rush	14,500	2543	38.34
Gold II	12,300	1958	35.97
Mr. Gold	15,850	2485	36.61
Cargill 205	14,000	2550	41.07
Sigco Ex 90	23,500	2256	35.65
Sigco 8903	23,050	2260	38.29

*Oil % determination by Sigco, Brekenridge, Minnesota.

Discussion and Interpretation of Table 5.

Yield of sunflowers was very satisfactory for such a late planting date, July 11. Insect damage was not a problem. At present prices (10 cents/lb.), sunflowers were a highly successful crop. Oil content may have been affected by late planting date.

Insect problems have been severe in previous years at the S.E. Experiment Farm when sunflowers were planted at normal dates. The question of paramount importance now is, can very early or very late plantings avoid the insect problem? How early or late must they be planted? It will probably vary from year to year but if we can get results three to five years, planting decisions involving this aspect would be more dependable than at present.

For those farmers who are irrigating, the possibilities of double cropping look more promising.

LATE PLANTED FORAGE SORGHUM

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Is forage sorghum the best crop to plant after a late season hailstorm?

Methods and Procedures

Previous crop destroyed by hail - corn
Corn had Lasso applied in the row for weed control
Fertilizer on corn - 80-40-20 (oxide)
Corn ground was disked and dragged after hailstorm
Forage sorghum planted July 13
Emerged - July 18
No weedicide or fertilizer on forage sorghum

Table 7. Late Planted Forage Sorghum

Variety	Maturity	Plants per acre	Tons silage per acre at 65% moisture
Pioneer 956	100 day	77,000	9.2

Discussion and Interpretation of Table 7.

At the time of our September crop tour, it looked like the forage yields would be more than 9 tons. The thick stand, narrow rows (30 inch), high plant population and 9 foot tall stalks at harvest suggested a high yield potential. Forage yield was greater than for any of the other crops that were replanted. Pioneer 956 is a seed bearing forage sorghum but frost occurred before seed could develop.

About 280 tons of forage were put in silos. This will be fed to determine its relative value as a feed crop.

LATE PLANTED MILO

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Will an early maturing grain sorghum be successful when planted in the middle of July or later?
2. How effective are narrow row spacings and high plant populations for late planting of a small sized early maturing milo?

Methods and Procedures

In Block 14 - Previous crop destroyed by hail - soybeans
Lasso in row for soybeans
Tandem disked and dragged for milo after hailstorm
No fertilizer added

In Block 16 - Previous crop destroyed by hail - corn
Fertilizer on corn - 80-40-20 (oxide)
Tandem disked and dragged for milo after hailstorm
All milo plots were sprayed with 2-4D ester at 1/4 to 1/2 pint per acre
Harvested - October 7

Table 8. Replanted Crop - N.K. Mini-Milo

Seeding dates	Method of Seeding	Row Spacing	Plant Pop.	% Water at Harvest	Lbs. Grain/ Acre	T. of Silage Per/A
July 13 Block 14	JD Press Drill	14"	300,000	22%	4897	3.6
July 19 Block 16	JD Press Drill	14"	225,000	21%	4285	5.4
August 4 Block 14	Noble Press Drill	9"	500,000	Immature	None	6.9

Discussion and Interpretation of Table 8.

The July 13 and 19 planting dates gave mature grain at harvest. The August 4 planting date produced no seed that could be combined.

Nine inch rows cannot be compared to 14 inch rows because plant populations were not the same.

The late planting (August 4) with 9 inch rows and high populations produced the most forage.

Northrup-King Mini-Milo is a small, very early maturing grain sorghum. Previous workwith this variety at the S.E. Experiment Farm showed that high populations and narrow rows were very necessary for maximum yields. Consequently, the replanted mini-milo was planted in 14 inch and 9 inch rows with dense plant populations. As a result, yields of grain were very good. With excellent growing conditions, yields of late planted mini-milo were almost as much as obtained in some years with normal planting dates - except for the August 4 planting date which produced no seed. Grain yields appeared to decrease as planting dates were delayed, but forage yields remained high when planting was delayed as late as August 4.

One hundred and twenty five tons of mini-milo were put in silos at the Experiment Farm.

LATE PLANTED BUCKWHEAT

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. What yields can we expect from buckwheat when planted late?
2. Does buckwheat mature quickly enough to be a dependable crop when planted in July?

Methods and Procedures

Previous crop destroyed by hail - soybeans
Soybeans disked and dragged
Buckwheat planted July 18 and August 4
No fertilizer applied for soybeans or buckwheat
Seeding rate - 40 - 50 lbs. per acre
Crop was straight combined without windrowing on October 20.

Table 9. Late Planted Buckwheat

Seeding Dates	Seeding Method	Row Spacing	Plant Pop.	% moisture at Harvest	Lbs. seed per acre
July 18	JD Press Drill	7"	450,000	10.5	786
Aug. 4	Noble Press Drill	9"	600,000	9.2	1013

Discussion and Interpretation of Table 9.

It was a surprise to see buckwheat mature when planted as late as August 4. Test weight was 46 lbs. per bushel.

Yields of different row spacings should not be compared because of dissimilar number of plants per acre for the two spacings.

Buckwheat looks like a very fast growing cash crop that is reasonably sure to mature when planted after a July 5 hailstorm. Marketing may be a problem.

LATE PLANTED PROSO MILLET

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. How will millet compare to other late planted emergency crops for grain and forage production?

Methods and Procedures

Previous crops destroyed by hail - wheat and oats
Fertilizer for small grain - 40-0-0
Small grain plowed, disked and dragged
Proso millet seeded July 19 in 7" rows with JD Press Drill
Emerged - July 25
Seeding rate - 40 lbs. per acre
Variety - Cerise

Table 10. Late Planted Proso Millet

Variety	Lbs. of grain per Acre at 26% water	Tons of silage per Acre at 50% water
Cerise	970	2.27

Discussion and Interpretation of Table 10.

This is a low growing, fast maturing, hairy stemmed crop that produces a lot of grain in proportion to forage. It matured well before frost even though planted July 19.

It looks like a pretty sure crop for emergency or delayed planting.

RATES OF NITROGEN AND DATES OF PLANTING CORN

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Will planting dates influence response to fertilizer?
2. What is the optimum rate of nitrogen fertilizer for a soil with a medium amount of organic matter?
3. Will the optimum rate of nitrogen application be influenced by drought?
4. Will high rates of nitrogen influence disease or insect damage?
5. Will soil temperatures serve as a reliable guide to determine optimum date to plant corn?

Methods and Procedures

May 1 - Moldboard plowed (cornstalks chopped in fall)
May 2 - Tandem disked
May 3 - Broadcast fertilizer by hand for first planting
Planting dates - May 4, May 12, May 22, June 2. Fertilizer was applied shortly before each planting, then tandem disked and spike tooth harrowed
Variety - YW 59
Herbicide - Lasso II banded
Insecticide - Counter 15G
All plots cultivated twice
September 27-28 - Harvested all plots

Table 11. Effect of Fertilizers and Planting Dates on Yield of Corn (high Nitrogen Rates)

Broadcast Treatment N + P_2O_5 + K_2O	Planting Dates May 4	May 12	May 22	June 2	Average
0 + 0 + 0	33	25	16	54	32.0
0 + 25 + 70	29	22	23	43	29.0
80 + 25 + 70	21	14	8	49	23.0
160 + 25 + 70	24	13	10	52	25.0
240 + 25 + 70	31	15	10	46	28.0
Average	28.0	18.0	13.0	49.0	

Discussion and Interpretation of Table 11.

This experiment is located in the southeast corner of the south quarter of the Experiment Farm which appeared to have somewhat less hail damage than the area to the north. It was not replanted after the hailstorm.

With a yield potential well over 100 bu. per acre, these results tell us very little regarding date of planting and response to nitrogen under normal growing conditions, it does indicate the severity of the hailstorm and ability of corn to recover depending on its stage of growth.

The latest planting date (June 2) gave yields about twice as much as most of the earlier plantings. The plants were smaller, less developed when the hail came and were better able to recover.

Fertilizer had no beneficial effect on yield when plants were severely injured by hail.

Table 12. Effect of Fertilizer and Planting Dates on Yield of Corn (Low Nitrogen Rates)

Broadcast Treatment N + P_2O_5 + K_2O	Planting Dates May 4	May 12	May 22	June 2	Average
0 + 0 + 0	33	26	14	57	33
20 + 25 + 70	26	15	14	46	25
40 + 25 + 70	25	8	9	52	26
60 + 25 + 70	22	13	14	43	23
80 + 25 + 70	27	18	11	39	24
Average	27.0	18.0	12.0	47.0	

Discussion and Interpretation of Table 12.

This table indicates the extent that corn is able to recover after a hailstorm if it is younger and less developed when injured.

PROGRESS REPORT - SOLAR DRYING BIN

F. Shubeck and B. Lawrensen

The solar drying bin was used for the third year in the fall of 1978. Loading of the bin began October 25 and ended October 27. By October 27th, 3,190 bushels of shelled corn were elevated in for drying (calculated from scale weights and moisture content).

The aeration fan was started October 26 and ran part or all of each day until November 9. It was turned on as air temperatures rose above 50°F and was turned off at 5 P.M. in the evening. The average high air temperature for this period was 61.4°F.

The stirrator was turned on when the fan was operating until three revolutions around the bin were completed. Corn samples were taken from the top to the bottom at 2 foot intervals on November 6 and November 15 for moisture determinations. The average moisture content on November 15 was 14.9%.

With relatively warm sunny days and low original moisture content in the corn, drying was accomplished quickly at a very reasonable cost. The auxillary electric heating unit was never turned on. Kilowatts used for the aeration fan and for the stirrator are listed below:

10 H.P. centrifugal fan	790 KWH
Stirrator (3 revolutions)	40 KWH
	830 KWH

At 2¢ per KWH, the electrical cost for drying 3,190 bushels of corn from 16.3% down to 14.9% moisture was:

830 KWH X 2¢/KWH = $16.60

PERFORMANCE OF HERBICIDES IN CORN AND SOYBEANS

W. E. Arnold and L. J. Wrage

Herbicide demonstration plots are the final steps in the herbicide evaluation program. Treatments include herbicides that are labeled and are available to growers. The side-by-side comparisons show the strengths and weaknesses of the various treatments. Rates and application methods for each treatment are based on results obtained in previous years' screening tests.

Methods

Preplant and preemergence herbicides were applied on the corn and soybean plots on May 19. A plot sprayer using 20 gpa water and 40 psi pressure was used. Preplant treatments were incorporated immediately with two tandem diskings set to cut 5-6 inches deep (except Cobex, Dual and Lasso preplant treatments incorporated 3-4 inches) and harrowed. Plots were planted the same day in 30-inch rows. Rainfall was nearly ideal, .62 inches the first and over 1 3/4 inch the second week after treatment. Post-emergence herbicides were applied when annual weeds were 1-2 inches tall. Post-emergence 2,4-D and dicamba were applied when the corn was 6-8 inches tall.

Weed pressure was light to moderate. Annual grasses include green and yellow foxtail, rough, smooth and prostrate pigweed and lambsquarters. Plots were not cultivated.

Results

The performance of corn and soybean herbicide treatments is presented in the following tables. Evaluations are based on an average of two visual estimates for grasses and broadleaved weeds in each plot. A 3-year (1976,77,78) average is included.

Weed control in 1978 was excellent. Many treatments provided over 90% control of susceptible species. Combination and overlay treatments provided excellent control of both grasses and broadleaves.

Table 13. Corn Herbicide Demonstration Plots

Treatment	lb/A s.i.	Percent Weed Control 6/29/78 Gr	6/29/78 Bdlf	3-Yr Avg Gr	3-Yr Avg Bdlf
PREPLANT INCORPORATED					
Check	--	0	0	0	0
Lasso	3 1/2	96	88	--	--
Dual	3 1/2	95	78	--	--
Eradicane	4	94	86	97	90
Eradicane+atrazine	4+1	94	97	--	--
Eradicane+Bladex	4+1 1/2	97	97	--	--
Sutan+	4	89	77	88	78
Sutan+	6	95	83	--	--
Sutan+atrazine	4+1	90	97	93	97
Sutan++Bladex	4+1 1/2	94	96	95	95
AAtrex/atrazine	2 1/2	75	99	82	99
Check	--	0	0	0	0
PREEMERGENCE					
AAtrex/atrazine	2 1/2	63	97	71	95
Bladex	2 1/2 or 3	86	90	88	89
Ramrod/Bexton/Propachlor	5	93	84	96	87
Lasso	3	95	89	97	92
Dual	3	95	85	97	92
Prowl	2	85	88	88	87
Lasso+atrazine	2+1	90	97	96	98
Lasso+Bladex	2+1 1/2	94	97	97	98
Lasso + Banvel	2+1/2	93	97	96	98
Dual+atrazine	2+1	93	97	--	--
Prowl atrazine	1 1/2+1	84	95	--	--
Prowl+Bladex	1 1/2+1 1/2	87	94	--	--
Prowl+Banvel	1 1/2+3/8	89	96	--	--
Ramrod+atrazine	4+1	96	99	97	99
PREEMERGENCE AND POST					
Atrazine+oil	1 1/2+1 gal	78	97	73	97
Bladex	1 1/2	57	83	69	90
Propachlor &2,4-D amine	3&1/2	92	95	92	72
Propachlor&Banvel	3& 1/4	92	94	95	96
Propachlor&4-D+Banvel	3&1/2+1/4	92	97	--	--
Check	--	0	0	0	0

Gr=grass
Bdlf=broadleaf

Table 14. Soybean Herbicide Demonstration Plots

Treatment	lb/A a.i.	Percent Weed Control 6/29/78 Gr	Bdlf	3-Yr Avg. Gr	Bdlf
PREPLANT INCORPORATED					
Check	--	0	0	0	0
Cobex	1/2	93	92	92	87
Basalin	1	91	90	91	83
Treflan	3/4	94	94	92	88
Tolban	1	95	93	94	86
Prowl	1 1/4	93	93	--	--
Vernam	2 1/2	87	87	88	84
Tolban+Sencor/Lexone	1+3/8	98	98	--	--
Prowl+Sencor/Lexone	1 1/4+3/8	97	97	--	--
Treflan+Sencor/Lexone	3/4+3/8	98	98	94	91
Treflan+Sencor/Lexone	3/4+1/2	97	98	--	--
PREPLANT INCORPORATED&PRE					
Treflan&Sencor/Lexone	3/4&1/2	98	98	98	97
Treflan&Sencor/Lexone	3/4&3/8	97	98	--	--
Treflan&Lorox	3/4&1	95	96	93	91
Treflan&Modown	3/4&2	95	98	95	98
PREPLANT INCORPORATED&POST					
Treflan&Basagran	3/4&1	92	95	92	93
PREEMERGENCE					
Prowl (7 day)	1 1/4	79	80	--	--
Check	--	0	0	0	0
Amiben	3	92	95	94	91
Lasso	3	97	93	97	90
Lasso+Sencor/Lexone	2+1/2	97	98	97	95
Lasso+Lorox	2+1	95	93	95	88
Lasso+Modown	2+2	96	97	96	92
Lasso+Amiben	2+2	96	98	--	--
Lasso+Premerge	2+4 1/2	96	96	94	84
Lasso+CIPC	2+3	95	96	95	92
Modown	2	70	85	48	88
Sencor/Lexone	1/2	90	99	85	94
PREEMERGENCE&POST					
Lasso&Basagran	2&1	95	95	96	96
Lasso&Dyanap	2&3	98	97	96	95
Check	--	0	0	0	0

Gr=Grass
Bdlf=Broadleaf

FORAGE FINISHING EXOTIC CROSSBRED AND BRITISH CATTLE

V. L. Anderson and C. A. Dinkel

Summary

Exotic crossbrad cattle finished on an all-forage ration gained slower and less efficiently than concentrate-fed half sibs. Dressing percentage was lower for forage-finished cattle. Carcass quality and yield grades were similar for both rations. Feed cost per pound of gain was lower for forage-finished cattle. British cattle finished on forage were less efficient than exotic crossbred cattle on the same ration. Carcasses from forage-finished British cattle graded higher with a less desirable yield grade than the exotic crossbred cattle on the same ration.

Introduction

The success of forage-finishing cattle depends on the differences in price and availability of grain and forage. Since there is limited information available on finishing exotic crossbred cattle on all-forage rations, a 2-year project was conducted to study the differences in feedlot performance and carcasses from forage- and concentrate-fed animals.

Procedures

The exotic crossbred cattle used in this experiment were produced at the South Dakota State University Beef Breeding Unit by mating Angus, Charolais, Angus x Charolais and Charolais x Angus dams artificially to one Limousin sire in 1976 and one Simmental sire in 1977. The straightbred British cattle used, primarily Hereford and Angus with a few Shorthorns, were produced at the SDSU Beef Unit. The British cattle were subjected to some selection prior to the start of the trial.

The forage ration consisting of three parts by weight (as fed) corn silage (38% dry matter) and one part alfalfa hay (18.1% protein) was pen fed

ad libitum in sex groups. The concentrate rations were fed individually ad libitim and consisted of the following ingredients by weight as fed:

Growing Ration	Finishing Ration
58% cracked corn	83% cracked corn
20% ground alfalfa	10% ground alfalfa
16% oats	5% soybean meal
4% soybean meal	2% vitamin A premix
2% vitamin A premix	

Steers and heifers were switched from a growing to a finishing ration at 700 pounds and 625 pounds and fed for an additional 140 days and 119 days, respectively, prior to slaughter.

An attempt was made to slaughter the forage-fed exotic crossbred cattle at the same weight as the corresponding concentrate-fed cattle. Target weights for British steers and heifers were 1000 pounds and 825 pounds, respectively. USDA graders evaluated the carcasses.

Results

Treatment groups are compared for feedlot performance and carcass data in tables 15 & 16. Exotic crossbred steers and heifers fed the concentrate rations gained .54 pound and .63 pound more per day, respectively, than forage-fed half sibs. TDN requirements were 2.64 pounds and 1.97 pounds less per pound of gain for concentrate-fed exotic crossbred steers and heifers, respectively, than for similar cattle on the forage ration. Feed costs per pound of gain for concentrate-fed exotic crossbred steers and heifers were $.267 and $.269, respectively (table 15.) Feed costs for forage-fed exotic crosabred steers and heifers were $.248 and $.243, respectively. Dressing percentages were 6.8% and 5.6% better for concentrate-fed steers and heifers, respectively. Carcass quality and yield grades were similar for all exotic crossbred cattle on both rations.

Forage-fed exotic crossbred steers and heifers gained .54 pound and .18 pound more per day, respectively, than British cattle. British steers and heifers required 1.63 pounds and .56 pound more TDN, respectively, per pound of gain than exotic crossbred cattle. Feed costs per pound of gain for forage-fed steers and heifers were $.353 and $.243 for British and $.248 and $.243 for exotic crossbreds, respectively. Dressing percentages were 1.3% and .9% better for exotic crossbred steers and heifers, respectively, than British cattle on the same all-forage ration. Yield grades for exotic crossbred steer and heifer carcasses were .9 and .7, respectively, more desirable than grades for British cattle. Carcass quality grade was one grade higher for British steers and heifers than exotic crossbred cattle.

This trial indicates concentrate rations are advantageous for rate of gain and dressing percentage but forage rations may result in lower feed cost per pound of gain. Forage-fed cattle require a longer time on feed and increased fixed costs may offset the lower feed cost per pound of gain advantage.

Table 15 Feedlot Performance of British and Exotic Crossbred Cattle

	British straightbred Forage	Exotic crossbred Forage	Exotic crossbred Concentrate
	Steers		
No. of animals	18	19	65
Starting wt., lb.	446	546	540
Final wt., lb.	943	1065	1083
Average daily gain, lb.	1.40	1.94	2.48
TDN/gain	9.52	7.89	5.25
Feed cost of gain, $ per lb.	.222[a]	.204[a]	.251[b]
	Heifers		
No. of animals	19	32	66
Starting wt., lb.	423	525	516
Final wt., lb.	779	915	898
Average daily gain, lb.	1.57	1.75	2.38
TDN/gain	8.03	7.47	5.50
Feed cost of gain, $ per lb.	.219[a]	.202[a]	.260[b]

[a] Based on feed prices of $15 per ton for corn silage and $25 per ton for alfalfa hay.

[b] Based on feed prices of $2 per bushel for corn, $30 per ton for alfalfa hay, $1 per bushel for oats, $200 per ton for soybean meal and $7.50 per hundredweight for vitamin A premix.

Table 16 Carcass Data from British and Exotic Crossbred Cattle

	British straightbred Forage	Exotic crossbred Forage	Exotic crossbred Concentrate
	Steers		
Dressing percentage	57.1	57.4	64.2
USDA yield grade[a]	2.2	1.3	1.3
USDA quality grade[b]	C-	G-	G
	Heifers		
Dressing percentage	57.5	58.4	64.0
USDA yield grade	2.0	1.3	1.2
USDA quality grade	C-	G-	G-

[a] Yield grade 1 = 52.4 - 54.6% cutability. Yield grade 2 = 50.1 - 52.3% cutability.

[b] C- = low choice, G = average good, G- = low good.

COMPARATIVE PERFORMANCE OF CROSSBRED HEIFER CALVES FED MGA OR IMPLANTED WITH SYNOVEX-H

G. Kuhl, C. Carlson, L. Embry and F. Shubeck

Numerous studies have demonstrated the substantial economic benefit of using hormonal growth stimulants with feedlot heifers. The feed additive, melengestrol acetate (MGA) and ear implants such as Synovex-H, are commonly used for this purpose. Consistent improvements in both rate of gain and feed efficiency have been shown with these growth promotants. However, relatively few trials have directly compared MGA and Synovex-H under controlled conditions. Thus, the major objective of this study was to determine the relative merit of these two growth stimulants.

In addition, this study presented an opportunity to compare the feedlot performance and carcass characteristics of two different groups of crossbred cattle.

Experimental Procedures

Forty-two heifer calves were available from a SDSU crossbreeding project conducted at the Ft. Meade Station by Dr. Gene Deutscher. Twenty-two of the heifers were out of Simmental-Angus cows, while 20 head were from Hereford-Angus dams. All calves were sired by one Charolais bull by artificial insemination. Thus, the two breed groups consisted of either one-half or three-fourths (SAXC) exotic breeding.

The calves had been implanted with Ralgro during the suckling phase at Ft. Meade, but were not creep fed prior to shipment to the S.E. Expt. Station, the heifers were poured for grubs and received a 3-way and IBR vaccination. A few weeks after weaning, the calves were shipped to the S.E. Farm and backgrounded on alfalfa hay and corn silage until the start of the trial.

The experiment was initiated on January 13, 1978. Each breed group was uniformly divided into 2 pens on the basis of shrunk body weight obtained after an 18 hour stand without feed or water. One pen of heifers from each breed group was implanted with Synovex-H, while the other lot received MGA at 0.35 mg/head/day from a pelleted commercial 32% protein supplement fed at a constant 1.5 lb. per heifer daily. The Synovex-H implanted heifers received a comparable commercial 32% supplement at the same level, but without MGA.

All 4 lots of cattle received the same basal ration, consisting of shelled corn and corn silage, plus the appropriate protein supplement. During the first 105 days of the trial, the calves were fed corn silage (44.6% dry matter) at 16 lbs. per head daily, with cracked corn fed to appetite. The heifers were gradually switched to this ration during the first 5 day period. During the last 45 days of the study, the corn silage was reduced to 6 lbs. per head per day and whole shelled corn full-fed. This ration transition was done over a 5 day period.

The heifers were fed in open, sloped concrete lots without access to enclosed shelter. Daily feed records were kept on each pen. The cattle were weighed at monthly intervals throughout the trial.

The experiment was terminated after 150 days on feed at which time the average full body weights of the one-half and three-fourths blood cattle exceeded 1000 and 1050 lbs., respectively. The cattle were sold on a grade and yield basis so that detailed carcass data could be obtained.

Results

The comparative feedlot performance of the two crossbred groups which received either MGA or Synovex-H is shown in Table 17. The Simmental-Angus x Charolais heifers averaged about 50 lbs. heavier than the Hereford-Angus

x Charolais calves at the start of the trial. However, the average daily gain of the three-fourth's blood heifers during the feedlot trial was only about 2.3% faster than the half blood-cattle. The Synovex-H implanted cattle gained more rapidly than the MGA fed heifers across both breed groups, with Synovex-H resulting in about 5.6% greater gains than MGA.

Average daily feed consumption was not significantly affected by type of growth stimulant. However, feed conversion was 3.4% better with Synovex-H in the half bloods and 7% higher in the Simmental cross heifers.

The carcass measurements shown in the table reveal only modest differences between MGA and Synovex-H treated heifers. The Synovex-H implanted heifers had larger rib-eye areas, a result principally attributable to the heavier carcasses produced by the implanted cattle. The half blood heifers were significantly fatter than the three-fourths exotic cattle as evidenced by fat thickness over the 12th rib and yield grade. No differences in quality grade were detected across breed groups, however. Overall, the 4 lots of heifers graded 67% choice and 76% yield grade 1 and 2.

Summary

Two groups of crossbred heifer calves consisting of 22 Simmental-Angus x Charolais and 20 Hereford-Angus x Charolais were used in this study. One-half of each breed group was fed MGA, while the other half was implanted once with Synovex-H, in order to determine the relative value of these two growth stimulants in feedlot heifers. Comparative feedlot and carcass performance of the two breed combinations were also evaluated.

All 4 lots of cattle received the same ration during the 150 day trial. A commercial 32% protein supplement, with or without MGA, as appropriate, was fed at a constant 1.5 lb./head/day. Corn silage was limited to 16 lbs. per head daily during the first 105 days, and decreased to 6 lbs./head/day

for the last 45 day feeding period. The balance of the ration consisted of shelled corn fed to appetite.

Synovex-H resulted in 5.6% faster gains and 5.3% greater feed efficiency than MGA across breed groups. The Simmental cross calves gained only 2.3% faster than the half blood exotics, with no consistent differences in feed conversion.

In regard to carcass characteristics, the Synovex-H implanted heifers had heavier carcasses and correspondingly larger rib eye areas. No significant differences in other carcass parameters, including quality and yield grades, were noted between the Synovex-H and MGA treatments. The three-fourths blood exotics had heavier carcass weights with larger rib eyes, less fat cover and higher yielding carcasses than the half bloods.

Because of the limited number of calves available for this study, the 1978 heifer calf crop from the same set of brood cows will be used in the coming year to validate the growth stimulant and breed group responses reported in the present study.

Table 17. Comparative Performance of Crossbred Heifer Calves Fed MGA or Implanted with Synovex-H.

	Simmental-Angus x Charolais		Hereford-Angus x Charolais	
	MGA	Synovex-H	MGA	Synovex-H
No. Heifers	11	11	10	10
Days on Trial	150	150	150	150
Initial Shrunk Wt., lb.	668	671	621	620
Final Shrunk Wt., lb.	1028	1058	979	991
Avg. Daily Gain, lb.	2.40	2.58	2.39	2.47
Avg. Daily Ration, lb. (As Fed Basis):				
Corn Silage	13.4	13.4	13.4	13.4
Shelled Corn	18.1	18.0	17.0	17.1
Supplement	1.5	1.5	1.5	1.5
Feed/100 lb. Gain, lb. (As Fed Basis):				
Corn Silage	558	520	561	541
Shelled Corn	756	701	714	690
Supplement	62	58	62	60
Total	1376	1279	1337	1291
Carcass Wt., lb.	654	682	620	642
Fat Thickness, in.[a]	0.26	0.24	0.36	0.38
Rib Eye Area, sq. in.	13.55	14.65	12.31	13.00
Quality Grade[b]	18.9	18.9	18.4	18.4
Yield Grade	1.7	1.8	2.1	2.5

[a] Fat thickness measured over rib eye between 12th and 13th rib.
[b] 18 = High Good; 19 = Low Choice

FEEDLOT PERFORMANCE OF YEARLING HEIFERS FED PRO-SIL TREATED OR UREA SUPPLEMENTED CORN SILAGE

G. Kuhl, C. Carlson, L. Embry and F. Shubeck

Whole plant corn silage is highly regarded as an excellent and economical source of energy for growing and finishing beef cattle. However, corn silage is particularly deficient in protein for feedlot cattle, containing only about 8% crude protein on a dry matter basis. Numerous methods of protein supplementation have been evaluated over the years, but the increasing costs of supplemental protein has spurred increased interest in utilizing non-protein nitrogen sources for this purpose. Recent studies at several midwest universities have shown that an ammonia-molasses-mineral suspension product (Pro-Sil) is a very effective supplementation source when added at ensiling time.

The objective of this study was to evaluate the performance of cattle fed Pro-Sil treated corn silage or untreated (control) corn silage supplemented with a urea-based protein supplement at the time of feeding. In addition, two plastic horizontal Silopress silage bags were used to store the Pro-Sil treated and control corn silages in order to gain experience with this silage storage method.

Experimental Procedure

The corn silage was harvested in early October, 1977 and ensiled in 8 mil thick plastic "sausage" bags, 8 feet in diameter and 100 feet long, using the Eberhardt Silopress ensiling system. One bag was filled with untreated (control) silage, while the other had Pro-Sil applied via a broadcast pipe positioned across the intake of the Silopress machine at approximately 50 pounds per ton of silage. The analysis of the Pro-Sil product was 85% calcium and 4.0% salt with trace minerals.

The bags were sealed and left unopened until the beginning of the feeding trial on June 30, 1978.

Eighty croasbred yearling heifers averaging 700 lbs. were purchased from a reputation backgrounder in central South Dakota. The heifers were presented as three-eights Limousin out of the Hereford-Angus dams. The cattle were allotted into 8 pens of 10 head each on the basis of shrunk body weight obtained after an 18 hour stand without feed and water. Four pens were assigned to the Pro-Sil treatment and 4 pens to the control treatment. All heifers were implanted with Ralgro and dewormed at the start of the trial.

The control corn silage averaged 43.3% dry matter and 8.4% crude protein, while the Pro-Sil treated silage contained 42.5% dry matter and 13.8% crude protein. Since some volatile nitrogen compounds may be lost through drying procedures prior to conventional crude protein analysis, fresh samples of silage were also analyzed for crude protein. No differences in crude protein content was noted between the dry and wet analytical methods with the control silage; however, the Pro-Sil treated silage analyzed 15-20% higher in crude protein when fresh (non-oven dried) samples were used. The Pro-Sil treated silage was considerably darker in color than the control silage--a characteristic of the product addition.

For the first 27 days of the trial, all cattle received 4 lb. per head per day of high quality alfalfa hay (18-19% crude protein, dry basis) plus a full-feed of the appropriate corn silage. Thereafter, the heifers on the control silage treatment received a custom mixed supplement containing 17% urea, 69.6% ground corn, 8.7% dicalcium phosphate, 0.63% limestone, 2.3% trace mineral salt and a source of vitamin A and Rumensin. The Pro-Sil silage fed heifers received a supplement consisting only of ground corn, vitamin A and Rumensin.

The supplements were fed at 10% of the ration dry matter. Rumensin was offered at the equivalent of 30 grams per ton of air dried feed.

The experiment was terminated after 61 days on trial when the supply of silages was exhausted.

Results

The experimental results are presented in Table[18]. After 61 days on trial, the Pro-Sil silage fed heifers had gained 11 lbs. more per head than the control heifers. Average daily gain was 1.81 lb. for the control heifers and 2.00 lb. for the Pro-Sil silage fed cattle, or a 10.5% difference between the silage treatments.

The average daily feed consumption results are separated into 2 phases in the table. For the first 27 days, alfalfa hay was fed at 4 lb./head/day, while the last 34 days only supplement and silage were fed.

The lbs. of feed required per lb. of gain are also shown in the table. On a dry matter basis, the Pro-Sil treated corn silage fed cattle were 10.4% more efficient (9.58 vs. 8.58 lbs.) than the control animals.

Summary and Conclusions

Corn silage was treated with Pro-Sil, an ammonia-molasses-mineral suspension, at ensiling time and compared with untreated (control) silage which was supplemented with a custom urea-based protein-mineral supplement at feeding time. An equivalent amount of supplement consisting only of ground corn was fed with the Pro-Sil treated silage to equalize supplemental energy levels. The silages were stored in plastic Silopress bags to investigate this ensiling structure.

Eighty crossbred yearling heifers were divided into 8 pens, with 4 pens receiving each of the two silages. The cattle fed the Pro-Sil treated silage gained 10.5% faster and required 10.4% less feed per lb. of gain.

These results are consistent with previous studies at other experiment stations and demonstrate effectiveness of this nutritive silage additive.

The Silopress "sausage" bag was found to be a useful efficient silage making system when managed properly. The bags must be located on a hard surfaced, well drained site in order to assure year-round access with mechanized equipment. Silage was stored in the horizontal plastic bags for 9 months without evidence of deterioration.

Table 18 Feedlot Performance of Yearling Heifers Fed Pro-Sil Treated or Control Corn Silage.

Item	CONTROL	PRO-SIL
No. Cattle	40	40
Days on Feed	61	61
Initial Shrunk Wt., Lb.	653.3	654.8
Final Shrunk Wt., Lb.	764.0	776.6
Avg. Daily Gain, Lb.	1.81	2.00
Avg. Daily Ration,	First 27 Days, Lb.:	
Corn Silage	32.7	32.7
Alfalfa Hay	4.0	4.0
Avg. Daily Ration,	Last 34 Days, Lb.:	
Corn Silage	35.8	35.8
Supplement	1.9	1.9
Lb. Feed/Lb. Gain,	As-Fed:	
Corn Silage	18.96	17.25
Alfalfa Hay	0.98	0.89
Supplement	0.57	0.52
Lb. Feed Dry Matter/Lb. Gain	9.58	8.58

CARCASS COMPARISON OF FORAGE AND CONCENTRATE FINISHED EXOTIC CROSSBRED CATTLE

V. L. Anderson and C. A. Dinkel

Summary

Least squares analysis was used to evaluate carcass data for forage and concentrate finished exotic crossbred cattle. Forage finished cattle had smaller rib eye area, less fat thickness over the rib eye and less kidney fat. Quality grade, marbling, color and firmness were less desirable in forage finished carcasses. Percentage of fat was lower and percentage of bone higher in forage finished carcassea. No differences were detected between rations in taste panel evaluation.

Introduction

Increased demand for hamburger type beef has caused increased interest in producing lean beef at less cost. Exotic crossbred cattle and high forage rations have potential to reduce production costs. This study was conducted to evaluate carcasses from half sib exotic crossbred cattle on all forage and high concentrate finishing rations.

Procedures

Exotic crossbred cattle used in this experiment were born in 1976 and 1977 at the South Dakota State University Beef Breeding Unit. Dam breeds were Angus, Charolais and reciprocal crosses. One Limousin bull sired the 1976 calf crop and one Simmental bull sired the 1977 calf crop. Sex, breed of dam and year effects were removed in the analyeis.

The forage ration consisted of 75% corn silage (38% dry matter) and 25% alfalfa hay (18.1% protein). Concentrate finishing ration was 83% cracked corn, 10% ground alfalfa, 5% soybean meal and 2% vitamin A premix.

An attempt was made to slaughter animals of the same sex at the same average weight. USDA graders evaluated the carcasses in the packing plant, and cut out and taste panel evaluation was completed at the Animal Science Department, SDSU.

Results

Forage finished steers weighed 1065 lb. at slaughter and dressed 57.4%. Concentrate fed steers weighed 1083 lb. and dressed 64.2%. Forage finished heifers weighed 915 lb. at slaughter and dressed 56.4%. Concentrate fed heifers weighed 898 lb. and dressed 64.0%.

Forage fed cattle had 1.62 sq. in. smaller rib eye, .08 in. less fat thickness and .5% less kidney fat. Quality grade was lower in forage finished carcasses with no difference detected in yield grade. Carcasses from forage fed cattle had .9% more bone and 1.8% less fat. No differences were detected in taste panel evaluation of the two ration treatments. Results are given in tables 19 & 20.

Table 19 Least Squares Means for Carcass Evaluation of Exotic Crossbred Cattle

Source	Carcass Trait: Rib Eye Area sq. in.	Fat Thickness in.	Kidney Fat %	Maturity[a]	Marbling[b]	Color[c]	Firmness[d]	Quality Grade[e]	Yield Grade[f]
Ration									
Concentrate	13.78^{x}	.23^{x}	2.3^{x}	23.6	4.0^{x}	5.0^{x}	5.6^{x}	16.8^{x}	1.5
Forage	12.16^{y}	.15^{y}	1.8^{y}	23.6	3.6^{y}	4.7^{y}	4.8^{y}	16.1^{y}	1.5
Sex									
Heifers	12.78	.18	2.2^{x}	23.6	3.8	5.1	5.3^{x}	16.4	1.4
Steers	13.15	.20	1.9^{y}	23.6	3.8	4.6	5.0^{y}	16.5	1.6
Breed of Dam									
AA	12.27^{x}	.31^{x}	2.3^{x}	23.7	4.5^{x}	5.0	5.4^{x}	18.0^{x}	2.1^{x}
AC	13.33^{y}	.16^{y}	2.0^{x}	23.6	3.6^{y}	4.8	5.2^{xy}	16.0^{y}	1.4^{y}
CA	13.09^{y}	.18^{y}	2.0^{x}	23.6	3.8^{y}	4.7	5.3^{x}	16.4^{x}	1.4^{y}
CC	13.19^{y}	.11^{y}	1.8^{y}	23.6	3.2^{y}	4.8	4.9^{y}	15.3^{y}	1.2^{y}

^{x,y} Means with different superscripts are significantly different ($P < .05$)

[a] Maturity; 24 = A-, 23 = A, 22 = A+

[b] Marbling; 3 = Traces, 4 = Slight, 5 = Small

[c] Color; 4 = Cherry red, 5 = Light cherry red

[d] Firmness; 4 = slightly soft, 5 = moderately firm, 6 = firm

[e] USDA Quality Grade; 15 = High Standard, 16 = Low Good, 17 = Good, 18 = High Good

[f] USDA Yield Grade; 1 = 52.6% to 54.6%, 2 = 50.3% to 52.3% yield retail cuts

Table 20 Least Square Means for Cutability and Taste Panel Evaluation of Exotic Crossbred Cattle

Source	Edible[a] Portion %	Fat[b] %	Bone[b] %	Semiboneless[c] Cuts %	Shear[d] Test PSI	Taste[e] Panel Tenderness	Taste[e] Panel Flavor	Taste[e] Panel Juiciness
Ration								
Concentrate	66.6	20.3^{x}	13.1^{x}	52.7	14.0	3.4	3.0	4.1
Forage	67.3	18.5^{y}	14.2^{y}	53.3	14.0	3.6	3.1	3.9
Sex								
Heifers	66.5	20.0	13.5	52.6	14.5	3.6	3.1	4.1
Steers	67.4	18.8	13.8	53.4	13.5	3.4	3.0	3.9
Breed of Dam								
AA	62.9^{x}	23.9^{x}	12.9^{x}	50.1^{x}	13.5	3.2^{x}	3.0^{x}	3.8^{x}
AC	67.0^{y}	19.4^{y}	13.8^{y}	53.0^{y}	13.8	3.4^{x}	3.1^{x}	3.9^{xy}
CA	67.8^{y}	18.5^{y}	13.8^{y}	53.4^{y}	14.4	3.4^{x}	2.9^{x}	4.0^{xy}
CC	70.1^{y}	15.8^{z}	14.1^{y}	55.6^{z}	14.3	4.0^{y}	3.3^{y}	4.2^{y}

x,y,z Means with different superscripts are significantly different ($P < .05$)

a Weight of roasts plus all lean trim/carcass weight x 100

b Weight/carcass weight x 100

c Weight of roasts plus lean trim from chuck, rib, round and loin/carcass weight x 100

d Mechanical tenderness test measured in pounds per square inch

e Evaluation of rib eye with 1 being most desirable and 7 least desirable

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