CATTLE FEEDERS DAY 1995

Report of Progress
745

Agricultural Experiment Station
Kansas State University, Manhattan
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KSU Southwest Research-Extension Center

THE EFFECT OF DELAYED CASTRATION IN HIGHLY STRESSED BULL CALVES

by
Kelly K. Kreikemeier and Gerald L. Stokka

SUMMARY

One hundred six bull calves (548 lbs) were purchased in south central Missouri, transported to Garden City, and randomly allotted to eight pens (13 or 14 hd/pen). All cattle were processed on arrival; those in four pens were castrated on arrival, and those in the other four pens were castrated 3 weeks later. Timing of castration had little effect on feed intake, daily gain, or feed efficiency, but cattle health was affected. Cattle castrated off the truck had more sickness (88 vs 75%), more death (11.4 vs 3.6%) and more chronic illness (5.4 vs 3.8%). Delayed castration improved profitability by $40/hd.

INTRODUCTION

About 70% of the feeder cattle imported into Kansas originate from states to the south and east. Of the male calves, 10 to 15% are intact bulls when they arrive. Most of these bulls originate from small farms, commingle with other cattle at sale barns or at order buyer stations, and then get transported a long distance to the feedyard. As a result, these bulls are highly stressed when they arrive at the feedyard. Previous research has demonstrated that growth performance is poorer in cattle purchased as bulls and castrated on arrival at the feedyard compared to cattle purchased as steers. This experiment was conducted to evaluate the effect of delaying castration in highly stressed bull calves, to see if health and growth performance could be improved.

PROCEDURES

One hundred six bull calves were purchased from three sale barns in south central Missouri between September 26 and 29. These calves were mostly crossbreds of Angus, Hereford, and Charolais. They had no Brahman, dairy, or Corriente influence. Bull calves arrived at SWREC late on a Friday afternoon (September 30) and were full-fed prairie hay over the weekend. Bulls were processed on Monday, which was the beginning of the experiment. Processing included a four-way clostridial vaccine, a four-way modified live viral vaccine, and injectable ivermectin.

Bulls were castrated using a surgical blade and an emasculator. Experimental treatments included castration at processing or castration 21 days after processing. Cattle were allotted randomly to each treatment, and then to four pens within treatment, with 13 or 14 cattle per pen. Initial and final weights were based on two consecutive daily weights, and the experiment lasted 49 days.

Cattle were placed in open lot pens with concrete flooring. Pen area was 40 sq ft and bunk length was 16 inches per animal. Pens were cleaned weekly to remove manure.

On a dry matter basis, the diet contained 50% corn silage, 20% chopped alfalfa hay, 23% steam flaked sorghum, 4% soybean meal, and 2% mineral premix. It was balanced to contain 12% crude protein and Bovatec was included at 29 grams per ton of complete diet (dry matter basis). This diet was full-fed, one time daily, in the morning.

Identification of sick cattle was based on unthriftiness and a rectal temperature above 103°F. Sick cattle were treated with Micotil at the recommended dosage. For all sick cattle, body weight and body temperature were monitored daily for 7 days after initial treatment. If at any time between 48 hours after treatment and up to 7 days after treatment, an animal failed to gain weight or if body temperature was not reduced, animals were retreated with Micotil.

Any animal that was treated twice and identified sick at a later date was not treated. Cattle were identified as chronically ill at the end of the study if they had an unthrifty appearance and weighed less than at the start of the experiment.

RESULTS AND DISCUSSION

Calves weighed about 550 lbs at the start of the experiment, which represented a 2.5% shrink from payweight (Table 1). Timing of castration had little effect on daily gain, feed intake, or feed efficiency. Data on feed intake include all feed consumed during the 49-day experiment. That is, the proportion of feed consumed by cattle that died during the study is included in the reported feed intake. Big differences occurred in cattle health. Delayed castration resulted in fewer cattle being treated for sickness (88% vs 75%; P = .07), a tendency for reduced death rates (11.4% vs 3.6%; P = .18), and one less chronically ill animal at the end of the study.

An economic analysis of the data shows that delaying castration improved profitability by almost $40 per head (Table 2). Ninety percent of the advantage was due to fewer dead and

Table 1. Effect of early vs late castration on growth performance and health of stressed bull calves.

	Time of castration			P
Item	Arrival	21 days later	SE[a]	value[b]
# of pens	4	4		
# of cattle	54	52		
Initial weight, lb	550	546	6.9	.69
Final weight, lb	626	624	9.3	.89
Daily gain, lb	1.46	1.50	.17	.86
Feed intake, lb	13.06	12.92	.59	.87
Feed/gain	9.29	8.80	.82	.68
% treated	88.4	75.0	4.3	.07
% dead	11.4	3.6	3.7	.18
% chronically ill	5.4	3.8	3.6	.78

[a] Standard error.
[b] Probability that treatment effects are similar.

Table 2. Economic implications of early vs late castration in highly stressed bull calves, costs averaged within each treatment group and expressed as dollars per head[a].

	Time of castration		
Item	Arrival	21 days	Difference
Value of dead cattle	$48.28	$16.59	$31.68
Value of chronically ill	$12.06	$8.29	$3.77
Value of weight gain	$35.77	$36.75	$0.98
Treatment cost	$17.40	$15.00	$2.40
Feed cost	$28.79	$28.48	$0.31
		Total	$39.14

[a]After adjusting for shrink, cattle cost $79 per cwt delivered, cost of a chronically ill animal was one half that of a dead animal, value of weight gain was assumed to be $50 per cwt, treatment cost was assumed to be $20 per animal treated, and feed cost was calculated at $90 per ton on a DM basis.

chronically ill cattle. Only small advantages occurred in treatment cost and improved performance with delayed castration. Because this study lasted only 49 days, we were not able to monitor long-term effects of delayed castration in terms of growth performance and carcass characteristics. If further differences did occur, then the economic value of delayed castration would change.

From these data, we conclude that highly stressed bull calves should be castrated at some time after arrival at the feedyard, when shipping stress is less. The appropriate amount of time (1 week, 1 month) would probably differ for each particular situation.

A COMPARISON OF SURGICAL VS BANDING CASTRATION METHODS IN NONSTRESSED STOCKERS

by

Kelly K. Kreikemeier, Gerald L. Stokka, Dale A. Blasi, and Tom P. Eck

SUMMARY

Ninety-six nonstressed stocker bulls (685 lbs) were allotted randomly to eight pens. Cattle in four pens were castrated by banding, and those in four other pens were castrated by a surgical technique. Cattle were fed a corn silage diet for 50 days. Cattle surgically castrated consumed more feed, but castration method had no effect on daily gain, feed efficiency, or animal health. In winter months with nonstressed bulls, the castration method used should be based on personal preference.

INTRODUCTION

In recent years, castration by banding has been evaluated as an alternative to surgical castration as a means of managing bulls at the feedyard. Cattle often begin eating just a few hours after banded castration. This rapidly regained appetite often is interpreted to mean that banding is less stressful than surgical castration. Also, because there is no open wound or blood loss, banding may have merit during summer months to avoid fly problems. Research data comparing surgical vs banding castration methods have yielded mixed results, and peoples' attitudes vary as well. This experiment was conducted to evaluate surgical vs banding castration methods in nonstressed stockers, to see if any difference occurred in growth performance.

PROCEDURES

One hundred thirty bulls were purchased from three sale barns in south central Missouri, October 17-20 and October 24-27. Bulls were transported to SWREC the week when they were purchased. Cattle were mainly crossbreds of Angus, Hereford, and Charolais. They had no Brahman, dairy, or Corriente influence. Bulls were processed on arrival, payweight was 580 lbs, and they were fed a corn silage-based diet. On December 13, the heaviest 96 bulls were sorted out of the group and used in a 50-day experiment. Therefore, bulls were nonstressed, and in terms of age, they were either stockers or short yearlings.

Experimental treatments were castration by banding or surgery. Banding was performed by using a mechanical device that stretched latex tubing (3/8 inch outside diameter) around the scrotum and just above the testicles. A small metal clamp was crimped to ensure that the tubing remained stretched around the scrotum. Surgical castration was performed using a surgical blade and an emasculator. All cattle were given a tetanus shot at the time of castration.

Cattle were allotted randomly to each treatment and then within treatment to six pens with eight head each. Cattle were placed in open lot pens with concrete flooring. Cattle had 70 sq ft of pen space, and 27 inches of linear bunk. Pens were cleaned weekly.

During the experiment, cattle were fed a diet composed of 82% corn silage, 16% sunflower meal, and 2% mineral premix (DM basis). It was balanced to contain 11% crude protein, and it contained Bovatec at 29 grams per ton. Cattle were fed ad lib, once daily in the morning. Initial and final weights were based on two consecutive daily weights.

RESULTS AND DISCUSSION

Initial and final weights were about 10 lbs heavier for surgically castrated cattle than banded cattle. Cattle surgically castrated consumed more feed than cattle castrated by banding (P = .04), but no differences occurred in daily gain or feed efficiency. These cattle had no health problems. This was expected, because they had arrived 6 or 7 weeks before the experiment began and had been vaccinated for tetanus.

In the banded group, with the exception of two bulls, all of the scrotal sacs containing testicles had atrophied and/or fallen off between 14 and 28 days after banding. On day 30, two cattle were put through the squeeze chute for visual examination, because the scrotal sac plus testicles had enlarged to about twice the original size. We removed the enlarged scrotal sac, just below the latex band, with a surgical blade. Bleeding was minimal, and cattle were put back in their pen with no apparent problems.

Based on these data, we conclude that during winter months, castration method has no effects on nonstressed stockers. Therefore, the method used should depend on personal preference.

Table 1. Effect of banding vs castration on growth performance of non-stressed stockers fed a silage based diet.

	Time of castration			P
Item	Arrival	21 days later	SE[a]	value[b]
# of pens	6	6		
# of cattle	48	48		
Starting weight, lb	681	690		
Final weight, lb	764	778		
Feed intake, lb	17.59	18.29	.21	.04
Daily gain, lb	1.71	1.76	.11	.70
Feed/gain	10.56	10.52	.70	.97

[a] Standard error.
[b] Probability that treatment effects are similar.

CHANGING WITH THE TIMES: VARYING RELATIONSHIPS AMONG FEEDER CATTLE PRICES AND CHARACTERISTICS

by
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SUMMARY

Analysis of data on price-characteristic relationships for feeder cattle collected at Kansas and Missouri auction markets in 1986/1987 and 1993 using the same data collection and modeling procedures revealed that implicit values of many feeder cattle characteristics changed with time. This report concentrates on changes in values associated with breed, frame size, and muscling of 600-899 lb feeder steers and heifers. Generally, directional impacts of feeder cattle characteristics on price remained the same from 1986/1987 to 1993, although the amounts of several individual premiums and discounts changed greatly.

INTRODUCTION

Past research showed that many factors affect feeder cattle prices. Prices paid for individual lots of feeder cattle vary with changing market conditions and because of differences in their physical characteristics. Previously, it has been difficult to determine whether changes in the values of feeder cattle characteristics were due to structural changes in demand for feeder cattle characteristics, differences in data collection or modeling procedures, or geographical differences. This study examined whether the values of selected characteristics change with time when the characteristics are measured and modeled in the same way across the same geographical area.

PROCEDURES

To test whether values of characteristics changed over time, data were collected at two different stages in the cattle cycle: fall 1986/spring 1987 and spring and fall of 1993. Data were collected at seven weekly Kansas feeder cattle auctions in 1986/1987 and at seven Kansas markets and one Missouri auction in 1993. Evaluators for both data collection periods received the same training. Evaluators recorded price per hundredweight for each lot; also, individual lots of cattle were evaluated with respect to nine animal characteristics (breed, frame size, muscling, fill, condition, horns, health, uniformity, and average weight per head). Data recorded for each lot also included lot size, the time of sale, market location, and nearby feeder cattle and corn futures prices.

The combined data set consisted of information collected on 15,272 lots of heavy-weight steers and heifers weighing from 600 to 899 lbs for a total of 189,566 head. Thirty-six percent of the cattle were sold in 1986/1987, and 64% were marketed in 1993. Sixty-seven percent of the cattle were steers, and 33% heifers in 1986/1987 compared with 61% steers and 39% heifers in 1993. During 1986/1987, 52% of the lots sold in the fall and 48% sold in the spring, whereas 47% of the lots sold in the fall and 53% in the spring during 1993.

Cattle prices were substantially higher in 1993 than they were in 1986/1987. The mean price of a 600-699 lb steer was $83.15 per hundredweight (cwt) in 1993 compared to $63.68 per cwt in 1986/1987. Significant changes in the general price level during the 7 years between the two studies was accounted for by deflating feeder cattle lot price and the feeder cattle and corn futures prices using the USDA NASS Production Items price index (1993=100). This allows examination of price differences with time in real terms, independent of inflation.

Demand for individual lots of feeder cattle is affected by each lot's physical traits. In this study, feeder cattle price was modeled as a function of the physical characteristics possessed by an individual lot and external market forces that reflect feeder cattle supply and demand changes during the study period. Nearby feeder cattle and corn futures prices were used to capture the effects of changes in fundamental market forces. Price-characteristic relationships were modeled separately for steers that weighed 600 to 899 lbs and heifers that weighed from 600 to 899 lbs.

RESULTS AND DISCUSSION

A structural change occurred in price-characteristic relationships for Kansas feeder cattle between 1986/1987 and 1993. Selected results that detail some of the price shifts associated with this structural change are reported in Table 1. Premiums and discounts having at least a 95% probability of being different from zero are identified in the tables with an asterisk. Consequently, those price differentials not noted with an asterisk should be interpreted with caution, because they have a greater than 5% probability of not being statistically different from zero. The table reports the price changes, positive or negative, associated with the presence of a trait relative to a base animal. All premiums and discounts are relative to a healthy, large-framed, heavy muscled Hereford without horns that sold in average fill and flesh during the first quarter of the sale at a particular market.

Unlike cow-calf producers, who can directly affect several economically important traits through genetic selection, stocker/feeder operators can influence these traits only through their cattle procurement practices. Breed, muscling, and frame size are among those important physical traits that cattle producers control when buying and selling feeder steers and heifers.

BREED IMPACTS ON PRICE:

Compared with Hereford cattle, Angus steers received a price premium in 1993 after selling at a discount in 1986/1987. Hereford-Angus cross (black or red baldies) steers and heifers gained in price compared with Herefords from 1986/1987 to 1993. Heifers categorized as "other English cross" (which included Shorthorns and Red Angus) sold at a discount to Herefords in 1986/1987 but sold at a premium in 1993. Exotic (Continental) steers and heifers did not sell at a significantly different price level relative to Herefords in 1986/1987 but received a premium in 1993. These shifts in premiums and discounts are notable, because they accompanied a significant shift in breed percentages from English to Exotic blooded cattle. In 1986/1987, English blooded steers (Hereford, Angus, Hereford-Angus crosses, and other English crosses) totaled 43.4% of the 600-800 lb steers in the survey compared with 26.7% Exotic steers. By 1993, however, Exotic blooded steers had overtaken English steers 44.5% to 26.3%. The shift from English to Exotic was present in the 600-899 lb heifers, also.

Feeder steers with less than one-fourth Brahman breeding shifted from selling at a discount to Herefords in the earlier period to no significant price differential in 1993. Discounts associated with feeder cattle with more than 1/4 Bos indicus blood in 1993 were similar to the deductions imposed in 1986/1987. Discounts for Longhorn steers and heifers, however, increased during the study period. This may have been associated with poorer feedlot performance and lack of muscling compared to other beef breeds of cattle.

EFFECTS OF MUSCLING ON PRICE:

Feeder cattle buyers prefer heavily muscled cattle. Consequently, light- and medium-muscled feeder cattle received discounts compared to heavy muscled cattle. The heavy muscled designation was given primarily to beef cattle, whereas medium and light muscled scores were applied most often to dairy cattle.

Compared with heavy muscled steers and heifers, medium- and light-muscled stocker cattle received considerable price reductions. The light muscled discount for heavyweight steers increased by $11.18 per hundredweight from 1986/1987 to 1993. Increased concern about carcass quality in recent years apparently has led to larger discounts for cattle not expected to produce desirable carcasses.

INFLUENCE OF FRAME SIZE ON PRICE:

Frame size was determined by estimating the weight at which an animal would finish. Large framed steers sold for $1.13 per hundredweight more than lower medium-

Table 1. Effects of breed, muscling, and frame size on 600-899 lb feeder cattle prices, fall 1986/spring 1987 and 1993 (1993 $)[abc].

Characteristics	1986/87 Steers 600-899 lb	1993 Steers 600-899 lb	1986/87 Heifers 600-899 lb	1993 Heifers 600-899 lb
	($/CWT)			
Breed				
Hereford	Base	Base	Base	Base
Angus	-0.90*	1.77*	-1.52*	0.34
Hereford-Angus crosses	0.22	1.77*	-0.09	1.33*
Other English crosses	-1.73*	0.42	-2.14*	1.27*
Exotic crosses	0.02	1.95*	0.45	1.23*
Brahman, 1/4 or less	-1.52*	0.43	-0.75	-0.42
Brahman, more than 1/4	-3.90*	-3.54*	-4.01*	-4.30*
Dairy	-7.32*	-8.93*	-12.63*	-10.39*
Longhorn	-5.29*	-7.99*	-5.55*	-7.14*
Mixed breeds	-0.65*	1.40*	-0.59	1.20*
Muscling				
Heavy	Base	Base	Base	Base
Medium	-3.36*	-3.46*	-4.35*	-1.98*
Light	-4.28*	-15.46*	-7.64*	-11.83
Frame Size				
Large	Base	Base	Base	Base
Upper medium	-0.07	0.08	-0.23	-0.67*
Lower medium	-1.80*	-1.13*	-3.14*	-1.94*
Small	-4.17*	-8.90*	-9.77*	-9.13*
Adjusted R-squared	.74	.59	.66	.55
Dependent variable mean, in 1993 dollars	$78.97	$81.72	$73.46	$78.50
Observations (lots)	4071	5475	2173	3553

* Indicates significantly different from zero at .05 level

[a] All premiums and discounts are relative to a healthy, large-framed, heavy muscled Hereford without horns that sold in average fill and flesh during the first quarter of the sale at a particular market.

[b] Data were collected in 1986/1987 at Dodge City, Fort Scott, Manhattan, Parsons, Pratt, Russell, and Salina, KS. Markets included in the 1993 study were Dodge City, Junction City, Manhattan, Oakley, Parsons, Pratt, and WaKeeney, KS, in addition to Joplin, MO.

[c] The authors appreciate the help of Ron Bolze, Dale Blasi, Tom Eck, Jimmy Collins, Marvin Reynolds, Charlie Peters, Dale Lanham, and Andy Clawson in collecting data. The cooperation of the auction market managers involved in this study also was greatly appreciated.

framed steers in 1993, indicating that buyers preferred large-framed feeder cattle. Steers and heifers in the small frame category received a discount around $9.00 per hundredweight compared with their large framed counterparts. Larger-framed feeder cattle are desirable because their growth patterns and finish weights are more acceptable to the industry.

CONCLUSIONS:

Weight, lot size, uniformity, health, condition, fill, time of sale, and prices of feeder cattle and corn futures along with the three traits discussed in this report all significantly affected auction prices of feeder cattle. The results indicate clearly that price discounts for several important characteristics can be avoided through careful procurement strategies, sound herd management, health and nutrition programs, and marketing savvy.

Results of this KSU study provide cattle producers information about the impact of various characteristics on feeder cattle prices and can be used as a guide when making decisions about feeder cattle procurement, sale, and management. Many feeder cattle buyers and sellers use publicly available information in developing management and/or marketing strategies. This research reveals that a structural change occurred in the Kansas feeder cattle auction market from 1986/1987 to 1993. Producers should not rely on dated information on characteristics-value relationships.

For more information on characteristics not included in this report, please consult *Buying and Selling Feeder Cattle: The Impact of Selected Characteristics on Feeder Cattle Prices* by Sartwelle et al., Kansas Cooperative Extension Service, 1995.

STABLE FLY POPULATIONS IN CATTLE FEEDLOTS

by
Gerald L. Greene

SUMMARY

Stable fly populations in southwest Kansas cattle feedlots were recorded weekly on sticky traps. They peaked from week 25 to week 35, depending on the rainfall and temperature from year to year. Highest numbers occurred from June 12 to September 1 during most years. The highest population during a 4-year parasite release study occurred in 1993, and the lowest in 1995. Numbers were lower during 1988, with about 20% as many as during other years.

INTRODUCTION

A 4-year, large-scale, integrated pest management demonstration—research study was conducted during 1992-95. Twenty-four to 34 cattle feedlots participated in the study, with many of them providing much appreciated financial support. Feedlots were sampled each week and provided summary sheets of fly populations present. A summary of the stable flies sampled during the 4-year study is presented. A locally adapted stable fly parasite was released, with the trap counts used to estimate release numbers.

The objective of this large-scale study is to monitor the stable fly populations in cattle feedlots in various environments and feedlot management situations in Kansas. The 4 years of results provide a picture of natural fly populations.

PROCEDURES

Twenty-four to 34 cooperating commercial cattle feedlots, ranging in size from 2,400 to 100,000+ head have been used in this 4-year study. The 1988 samples were from eight feedlots. Adult stable fly abundance was monitored weekly on each feedlot using Alsynite fiberglass sticky traps from the middle of May through the first week in October. Four traps were placed at the margins of each lot in each of the four ordinal directions, except in larger yards, where eight traps were used. The adult stable fly samples are combined here for all the feedlots sampled and include parasite-release feedlots and nonrelease feedlots.

The stable fly numbers for 1992, 93, and 95 were combined and averaged. Totals for 1988 and 1993 are presented to compare high and low fly population years. The beginning of fly season was noted when 10 to 20 stable flies occurred on Alsynite traps for a week of sampling.

RESULTS AND DISCUSSION

Stable fly season started 3 weeks later in 1995 than during previous years (Fig. 1). The cool spring delayed fly development, even though by week 30, numbers surpassed the 1992 and 94 populations. Along with dry, hot weather beginning on the 34th week of 1995, the stable fly population decreased and was below those of the 3 previous years. By the 40th week, it was lower than populations for the other years.

The 1993 populations appeared earlier in the season and were much higher. The feedlots were wet that spring from record snowfall, and the temperatures were warmer during May. Those conditions favored stable fly development early in the 1993 season.

During 1988, an extremely dry, hot year, (Fig. 2) stable fly populations were very low. The total yearly numbers were approximately 20% of those for the other years. When the three median years are combined into one mean line, comparison of wet versus average years is easier to see. Peak populations occurred later and were lower; the population dropped to about 100 flies near the 40th week. After that (mid-September), populations remained low compared to those in other years.

Fig. 1. Average weekly trap counts of stable flies from 24 to 33 cattle feedlots in Southwest Kansas.

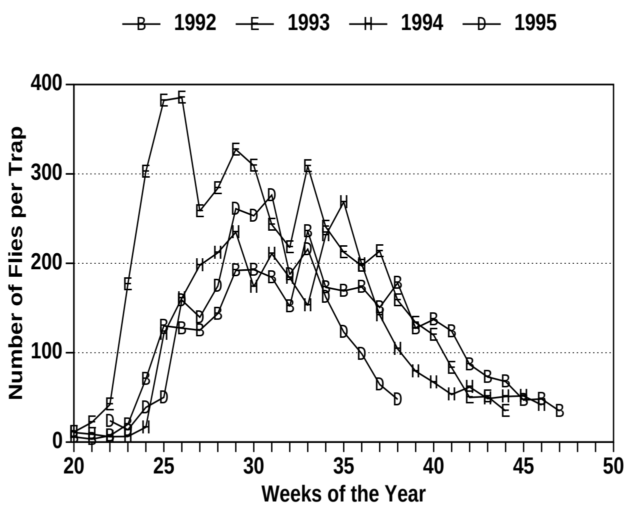
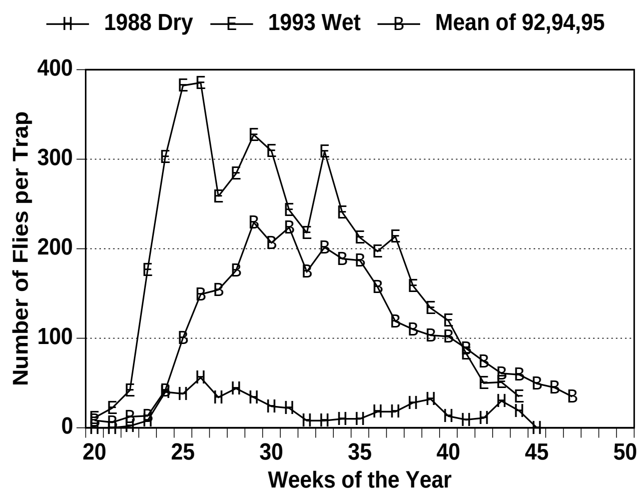


Fig. 2. Average stable fly populations from 8 to 33 feedlots sampled weekly in Southwest Kansas.



KSU Southwest Research-Extension Center

SUMMARY OF 1994-1995 SOUTHWEST KANSAS 4-H CATTLE-FEEDING PROJECT

by
James D. Sartwelle, III, and Frank D. Swan

SUMMARY

Summary results from the 1994-1995 Southwest Kansas 4-H Cattle Feeding Project indicate that the early summer of 1995 was a rough time to market fed cattle. Average loss for the 121 head of steers was $54.39 per head. The largest determinant of profit in 1995 was animal health. Unhealthy steers that received veterinary treatments lost $54.35 per head more than healthy cattle.

INTRODUCTION

The Southwest Kansas 4-H Cattle Feeding Project is a hands-on opportunity for 4-H youths to learn about the large commercial cattle feeding industry in this part of the country. This popular program allows youth to select cattle to place on feed, learn detailed record keeping practices, and participate in educational opportunities that teach about the beef industry—with limited financial risk.

PROCEDURES

One hundred twenty-seven steers were placed on feed at Winger Feedyard near Johnson City, Kansas, on December 3, 1994. They remained on feed until May 19, 1995—a total of 167 days. Five steers died during the feeding period, and one steer was condemned at the packing plant.

RESULTS AND DISCUSSION

CATTLE PERFORMANCE:

Growth performance compared favorably with a 5-year average from 1990 through 1994 (Table 1). Although the starting on-feed weight increased by only 9 lbs relative to the historical average, shrink-adjusted ending weights decreased by 23 lbs, from 1224 to 1201 lbs. Both starting and ending weights were within a range acceptable to the beef packing and processing industries, although individual weights varied a great deal about the averages. Average daily gain (ADG) in 1995 was 3.04 lbs, compared with 3.05 lbs from 1990 to 1994. ADG for individual steers ranged from 1.66 to 4.14 lbs/day.

Percent USDA Choice increased. Approximately 61% graded Choice in 1995 compared with 38.8% Choice from 1990-1994. Cost of gain increased; the 1995 cost of gain ran $10.53/cwt more than the long-term average. This change in cost of gain affected the profitability of individual animals and the lot of steers as a whole.

PROFITABILITY:

The average loss per head on this group of steers was $54.39. Profitability per head ranged from a loss of $152.84 to a profit of $55.03. Eighty-seven percent of the cattle lost money. Various profitability indicators and carcass information are reported in Table 2.

Profitability per head varied considerably by quality grade. These steers were sold on a dressed weight basis at IBP-Holcomb. On the day the cattle were marketed, IBP paid $103/cwt for Prime and Choice grades and $94/cwt for Select and Standard grades. Steers grading Choice lost less money than steers grading Select or Standard. In a segment of the cattle feeding cycle characterized by tight margins, it is easy to see why quality grade has such a large impact on profitability.

Profitability also varied with yield grade. Yield Grade 3 steers lost the least amount of money per head when compared to Yield Grades

Table 1. Southwest Kansas 4-H cattle feeding project, summary statistics, 1990-1995.

Item	Averages, 1990-1994	1995
Starting on-feed weight	684 lbs.	693 lbs.
Off-feed weight (with 4% shrink)	1224 lbs.	1201 lbs.
Average Daily Gain	3.05 lbs./day	3.04 lbs./day
Days on Feed	161 days	167 days
Cost of Gain ($/cwt.)	$48.75	$59.28
Percent USDA Choice	38.8%	61.2%

Table 2. Summary of 1995 southwest Kansas 4-H cattle feeding project[a].

USDA Quality Grades

	Number of head	Percent	Avg. profit/head
Prime	2	1.7	($92.54)
High Choice	13	10.7	($39.87)
Middle Choice	22	18.2	($12.05)
Low Choice	39	32.2	($23.81)
Select	40	33.1	($98.00)
Standard	5	4.1	($152.84)

USDA Yield Grades

	Number of head	percent	Avg. profit/head
YG 1	42	34.7	($70.01)
YG 2	61	50.4	($51.94)
YG 3	16	13.2	($15.12)
YG 4	2	1.7	($94.21)

Average yield grade for 121 Head = 2.32

Carcass Information

	Average	Low	High
Dressing percent	64.4%	60.1%	69.4%
Hot carcass weight	773 lbs.	609 lbs.	940 lbs.
Ribeye area (sq. in.)	14.0	10.9	18.4
Backfat thickness (in.)	0.32	0.10	0.80

Profitability Indicators

	Average	Low	High
Profit per head, 121 head	($54.39)	($196.75)	$55.05
Profit per head, 5 deads	($571.85)		
Cost of gain ($/cwt.)	$55.60	$46.54	$86.41
Veterinary costs	$3.81	$0.00	$61.73
Profit per head, 104 healthy steers	($46.76)		
Profit per head, 17 sick steers	($101.11)		

Sale Prices (Carcass Weight Basis), IBP

Choice and Prime	$103/cwt.
Select	$ 94/cwt.
Standard	$ 87/cwt.

[a]Bracketed profit figures are negative.

1, 2, and 4. As a rule of thumb, cattle with higher yield grades are more likely to grade Choice, because they carry more external fat. This rule does not always hold, because if the amount of external fat is too great (causing the yield grade to be high), cattle usually will be discounted. Although IBP did not apply a discount for the two steers that graded YG 4, discounting such steers is common in the packing industry.

Dressing percent significantly affects income and profitability when cattle are sold by grade and yield, because the producer is paid on a dressed weight basis. Dressing percent across this lot of steers averaged 64.6% and ranged from 60.1 to 69.4%. Income increases as dressing percent increases, because the producer gets paid on a higher percent of actual live weight at the time of slaughter.

Animal health had a large impact on profitability during this project. Seventeen steers (of the 121 head that completed the feeding trial) required veterinary treatment during the feeding period. Veterinary expenses per head for these 17 steers averaged $27.11 and ranged from $1.65 to $61.73. Steers that remained healthy throughout the feeding period lost an average of $46.76 per head. Unhealthy steers, however, lost $101.11 per head. This supports conventional wisdom among cattle feeders and industry observers that the health status of a pen of cattle on feed is among the main indicators of profit or loss.

CONCLUSION:

Review of several indicators of profitability indicate that, in a time of negative net returns to cattle feeders, steers that graded USDA Choice with a moderate amount of external fat and remained healthy throughout the time on feed lost the smallest amount of money.

GROWTH PERFORMANCE AND RUMINAL FERMENTATION CHARACTERISTICS OF STEERS FED HIGH FORAGE DIETS SUPPLEMENTED WITH ASPERGILLUS ORYZAE EXTRACT (AMAFERM)

by

Kelly K. Kreikemeier and Vince Varel

SUMMARY

One hundred steers (593 lbs) were allotted to 20 pens and fed a corn stalk/wheat midd diet for 104 days. Treatments were no supplementation or supplementation with Aspergillus oryzae extract (AO). Although ruminal cellulolytic bacterial counts were greater in steers fed AO, feed intake and growth performance were not affected.

INTRODUCTION

Previous studies in the laboratory have indicated that Aspergillus oryzae fermentation extract (AO) increased degradation of feedstuff fiber fractions by mixed ruminal microorganisms. Generally, the rate of degradation is increased, but not the extent, and this occurs both in the test tube and in the rumen. Reports also indicate increased bacterial numbers in the rumen and an increase in the rate of uptake of lactic acid in the rumen of cattle adapting to a high grain diet.

Because of the positive effects that have been reported in the laboratory and in rumen metabolism studies, we conducted a feeding study with steers fed a diet based on corn stalks and wheat midds. The objective was to determine if supplementation with AO affected feed intake, animal growth, ruminal bacteria, or ruminal fermentation end products.

PROCEDURES

The study was conducted from December 6, 1994 to March 10, 1995. It included 100 steers that were of mixed breeding of mainly Angus, Hereford, and Charolais. The calves had arrived 50 to 80 days before the experiment began and were processed routinely (no implant) shortly after arrival. Any bulls were castrated within 3 weeks of arrival. Steers were implanted with Ralgro at the start of the experiment. From arrival to the start of the experiment, calves were fed a corn silage-based diet and gained weight at about 1.50 lbs per day.

One hundred steers were allotted randomly to 20 pens (five hd/pen) and then pens were allotted to treatment (10 pens per treatment). The two treatments consisted of no dietary addition or the addition of AO to the complete mixed ration. The AO was added at 2 grams per head per day, within the manufacturer's recommendation (Biozyme; St. Joseph, MO).

Pens were open lot, dirt pens with fenceline bunks and a concrete feeding apron. Per steer, there were 43 inches of linear bunk space and 216 sq ft of pen area. Cattle were fed a complete mixed ration once daily that consisted of corn stalks and wheat midds (Table 1). It was formulated to contain 12% crude protein, .84% calcium, and .56% phosphorous. Vitamin A, D, and E and a trace mineral mix were added to meet or exceed NRC minimum requirements. Cattle were fed once daily between 9:00 and 11:00 AM, and they were offered feed so that 5 to 10 lbs of feed refusals remained before each feeding. Water was available ad lib.

Corn stalks were harvested in October, about 2 weeks after grain harvest. Corn stalks were windrowed and made into stacks using a stacker with a flail pickup unit. Before the experiment began and at monthly intervals, corn stalks were ground through a tub grinder containing a 2.5 inch screen.

Half of the wheat midds were pelleted and the other half were in meal form. Therefore, the ration contained 20% "fines", which acted as a carrier for the AO. This was done because of the dry nature of the ration and the potential for feed ingredient separation.

Table 1. Ingredient composition.

Ingredient[a]	% of Diet dry matter
Corn stalks	53
Wheat midds	40
Sunflower meal	5
Limestone	1.73
Vitamin ADE premix[b]	.20
Trace mineral premix[c]	.03
Mineral oil[d]	.04

[a] Corn stalks contained 5.1% CP, wheat midds 18.7% CP, and sunflower meal 34.9% CP.
[b] Contained 1,000,000 IU of vitamin A, 500,000 IU of vitamin D, and 1,000 IU of vitamin E per pound of premix.
[c] Contained 14.98% Zn, 12.51% Mn, 12.50% Fe, 6.66% S, 3.69% Cu, .19% I, and .05% Co.
[d] Included in the mineral supplement as a binder.

Rumen fluid was collected from one steer per pen just before the end of the experiment; 10 pens on day 100 and 10 pens on day 101. Between 7:00 AM and 8:30 AM, one steer was selected randomly from each pen and restrained in the squeeze chute. Rumen fluid was collected via the esophagus using a vacuum pump and clear plastic tubing. Five hundred mls were collected into flasks, stoppered, placed on ice, and transported within 6 hours to the Meat Animal Research Center at Clay Center, NE. There, the rumen fluid was analyzed for concentrations of ammonia and volatile fatty acids and enumeration of total and cellulolytic bacteria. The methods for enumeration of bacteria included agar, selective media, roll tubes, and colony formation.

Initial and final weights were based on the mean of two consecutive daily weights. Each pen mean served as the observation. Data were analyzed using GLM procedures of SAS with a statistical model for a completely randomized design.

RESULTS AND DISCUSSION

The AO supplementation had no effect on steer growth performance (Table 2; P > .20). Ruminal fluid collected at the end of the experiment had a lower molar proportion of isobutyrate when collected from steers fed AO (P < .07; Table 3). Because isobutyrate was less than 1% of the total volatile fatty acid (VFA), this effect is probably of little importance. The AO supplementation had no effect on concentrations or molar proportions of the other VFA.

Table 2. Effect of Amaferm (AO) supplementation on steer growth performance.

Item	Without AO	With AO	SE[a]	P-value[b]
# of steers	50	50		
# pens	10	10		
Initial weight, lb	594	591	5.4	.46
Final weight, lb	723	715	4.8	.22
Feed intake, lb/d	14.5	14.	6.2	.58
Gain, lb/d	1.29	1.24	.05	.47
Feed/gain	11.47	11.95	.47	.48

[a]SE = standard error.
[b]Probability that treatment effects are similar.

A significant increase occurred in ruminal cellulolytic bacteria with AO feeding (P = .07), (Table 3). The increased bacterial counts are consistent with previous observations in vitro and in rumen metabolism studies. The fact that feed intake and daily gain of steers fed AO were not affected suggests that increased ruminal counts of cellulolytic bacteria were not beneficial in this particular situation. Alternatively, because rumen sampling occurred on only one day at the end of the experiment, perhaps the greater numbers of cellulolytic bacteria did not occur throughout the entire experiment. We would expect that greater numbers of cellulolytic bacteria with AO supplementation might increase the rate of fiber fermentation and/or result in more microbial protein being synthesized in the rumen and flowing to the small intestine, thereby, improving animal performance.

In this experiment using nonstressed stockers adapted to a high forage diet, there was no benefit to feeding AO. However, it may be warranted in other production situations.

Table 3. Effect of Amaferm (AO) supplementation on ruminal fluid characteristics and bacterial numbers and species from steers fed a high forage diet.

Item	Without AO	With AO	SE	P-value
No. of animals/pens	10	10		
Total VFA, mM	76.1	77.5	4.24	.81
Mol/100mol				
Acetate	54.6	56.0	3.28	.76
Propionate	13.1	14.1	.82	.42
Isobutyrate	.8.	7	.05	.07
Butyrate	6.4	5.7	.41	.21
Isovalerate	.6	.6	.04	.90
Valerate	.6	.6	.05	.93
Acetate:propionate	4.27	4.02	.18	.34
Ammonia, mg/dl	2.81	3.06	.21	.41
Anaerobic bacteria, 10^9/g	58.7	76.2	13.9	.39
Cellulolytic bacteria, 10^7/g	7.4	12.1	1.72	.07
Butyvibrio sp., %[c]	71.5	83.3	6.42	.21
R. flavefaciens, %[c]	5.0	.7	1.78	.10
R. albus, %[c]	23.5	16.0	5.94	.38

[a] Standard error.
[b] Probability that treatment effects are similar.
[c] Percentage of total cellulolytics.

AN EVALUATION OF SUNFLOWER MEAL IN GROWER DIETS[1]

by

Dale A. Blasi, Kelly K. Kreikemeier, and Tom P. Eck

SUMMARY

In a 50-day trial, 96 steers (705 lb) were allotted randomly to 12 pens (eight hd/pen) and fed corn silage-based diets containing either sunflower meal or soybean meal (six pens per protein source). Protein source had no effect on animal performance. Because sunflower meal was cheaper, feed cost per pound of gain was 16% less for cattle fed sunflower meal than cattle fed soybean meal.

INTRODUCTION

Feed by-products arising from the sunflower oilseed crushing and confectionary industries located in Kansas can provide beef feeders with additional flexibility as they strive to capture competitive feeding costs of gain. The availability of sunflower meal from the sunflower crushing plant located in northwestern Kansas is one such example. However, beef producers may be unfamiliar not only with the substitution rates for protein and energy value, but also the modified feeding and storage requirements that may be required to attain comparable animal performances typically observed with traditionally used feed ingredients.

Table 1 illustrates the compositional differences between oil, confectionery, and bird seed type sunflowers. Sunflower meal results solely from the processing of black hulled oil-type seeds. Protein and fiber contents may vary with the amount of hull removed during processing, whereas the fat content is influenced

Table 1. Comparative composition of sunflowers*.

	Type of sunflower		
Item	Oil	Confectionery	Bird seed
Hull, %	22.00	44.80	46.30
Oil, %	41.90	25.90	22.50
Protein, %	18.60	23.10	22.90
Calcium, %	0.18	0.10	0.13
Phosphorus, %	0.58	0-.59	0.70
Total ash, %	3.68	3.40	4.10
Acid det. fiber, %	15.00	27.00	29.70
Acid det. lignin, %	2.50	3.00	4.80

*North Dakota State Univ. 1979. Analysis of only one variety within type.

Table 2. Comparative composition of sunflower meal containing different proportions of protein.

Nutrient	28% Protein	32% Protein	38% Protein
Protein, %	28.0	32.0	38.0
TDN, %	53.0	58.0	61.0
NE_m mcal/cwt.	54.0	59.0	52.0
Neg, mcal/cwt.	24.0	30.0	30.0
Fat, %	2.5	2.5	3.0
Fiber, %	25.0	20.0	15.0
Phosphorus, %	.90	1.00	1.15
Calcium, %	.35	.35	.35
Potassium, %	1.10	1.12	1.15

ADM, 1994.

[1]Appreciation is extended to Northern Sun, Goodland, Kansas for generously donating sunflower meal used in this trial.

by the oil extraction process. The protein content of sunflower meal may exceed 40% (on a dry matter basis) if the seed is fully dehulled. Partially dehulled sunflower meal contains 34 to 36% protein, whereas sunflower meal with hulls contains 28% or more protein. Table 2 shows the nutrient differences that may exist for sunflower meals containing different proportions of crude protein (ADM, 1994). In 1986, approximately one-half of the sunflower meal produced in the United States contained a 28% protein. About 40% was a fully dehulled protein, and the balance was a partially dehulled meal (National Sunflower Association, 1986).

Previous research conducted at North Dakota State University has shown sunflower meal to be equivalent to soybean meal for growing heifers and steers gaining approximately 2 lbs/day. Other studies have shown that, although small performance differences exist between sunflower and soybean meal, they can be interchanged on a pound of protein basis provided the cost per pound of protein is the same. To determine if similar results would be observed with sunflower meal produced in Kansas, a 50-day growing trial was conducted to compare the protein values of sunflower meal to soybean meal.

Table 3. Diet composition of soybean and sunflower meal diets (dry matter and as fed basis).

	Soybean meal		Sunflower meal	
Ingredient	% DM	% As fed	% DM	% As fed
Corn silage	87.3	93.7	82.1	90.82
Sunflower meal	-	-	125.9	8.20
Soybean meal	10.7	5.35	0	0
Mineral	2.0	0.95	2.0	0.98

Table 4. Feedstuff nutrient analysis (dry matter basis).

Nutrient	Corn silage	Sun-flower meal	Soy-bean meal	Mineral
DM, %	45.2	90.0	85.4	95.0
Protein, %	6.8	34.4	50.1	8.5
Calcium, %	0.24	0.59	0.40	11.0
Phosphorus, %	0.18	1.00	0.68	6.6
Magnesium, %	0.18	0.54	0.31	-
Potassium, %	1.30	1.89	2.52	-
Salt, %	-	-	-	19.0
Bovetec, mg/lb.	-	-	-	720.0

PROCEDURES

Ninety-six steers averaging 685 lbs were allotted randomly to one of two treatments. Each treatment was represented by six pens each containing eight head of steers. The diet composition of each treatment and the nutrient analysis of each feedstuff included in the diets are shown in Tables 3 and 4, respectively. Each protein source was fed to equalize crude protein intake at 11% of either diet. So that protein quality could be evaluated, diets were balanced to contain only 11% of crude protein, which is below the steers' protein requirements. If the quality of one protein was inferior to that of the other, reduced growth performance would be expected. At the beginning and after a 50-day feeding period, steers were weighed on 2 consecutive days, and weights were averaged to minimize variations caused by fill.

RESULTS AND DISCUSSION

No apparent differences occurred in average daily gain of steers fed the sunflower and soybean meal treatments (Table 5). The feed costs per pound of gain for each treatment were calculated. Based on the results of this trial, when sunflower meal was priced at $100/ton and SBM at $180/ton, feed costs for cattle fed sunflower meal were 16% less.

Table 5. Comparison of soybean meal vs. sunflower meal for growing steers.

Item	Soybean meal	Sunflower meal	SE[a]	P-Value[b]
# pens	6	6		
Feed intake, lb	18.13	17.75	.24	.30
Daily gain, lb	1.76	1.71	.11	.78
Feed/gain	10.59	10.49	.70	.92
Feed cost/lb gain[c]	48.80	40.91		

[a] SE = standard error.
[b] Probability that treatment means are similar.
[c] On a dry-matter basis, feed costs are: corn silage = $66/ton, soybean meal = $180/ton, sunflower meal - $100/ton, and supplement = $400/ton.

EFFECTS OF FEEDING COMBINATIONS OF STEAM-FLAKED CORN AND STEAM-FLAKED SORGHUM ON FINISHING HEIFER PERFORMANCE AND CARCASS MERIT

by

Kelly K. Kreikemeier, Gerry L. Kuhl, and Tom P. Eck

SUMMARY

Two hundred heifers were fed a finishing diet containing steam-flaked corn and steam-flaked sorghum either singly or in combination. Diets included (corn:sorghum) 100:0, 75:25, 50:50, 25:75, 0:100. With increasing levels of sorghum in the diet, cattle gained less and were less efficient. Carcass quality was not affected, but hot carcass weight declined with increased levels of sorghum. Numerically, cattle fed 75% corn:25% sorghum had similar growth performance and hot carcass weights compared to cattle fed 100% corn. Based on weighted values of feeding each grain singly, performance of cattle fed grain combinations was 2% to 6% better than predicted.

INTRODUCTION

Previous research has shown that when two grains are fed in combination in a cattle finishing ration, positive associative effects occur. That is, when grain mixtures are fed, cattle performance is better than predicted, based on the weighted value of feeding each grain individually. This has been shown to occur when feeding various grain combinations; dry-rolled wheat and high-moisture corn, dry-rolled corn and high-moisture corn, dry-rolled sorghum and dry-rolled corn, dry-rolled sorghum and high-moisture corn, and, high-moisture sorghum and dry-rolled wheat.

Historically, sorghum is priced at 90% the price of corn, making it a good buy for yards that steam flake their grain. If positive associative effects occur when steam-flaked sorghum is fed in combination with steam-flaked corn, the opportunity exists to lower feed costs even further. Therefore, the objective of this study was to determine the effect of feeding steam-flaked sorghum and steam-flaked corn either singly or in combination on growth performance and carcass merit of finishing heifers.

PROCEDURES

Two hundred seventeen yearling heifers were purchased from three different sale barns in southern Kansas (Anthony, Pratt, and Dodge City) in August, 1994. Heifers appeared to be straightbreds and crossbreds of Angus, Hereford, Shorthorn, and Charolais. About one fourth of the heifers had a small percentage of Brahman influence. In terms of quality, the cattle were plain. From arrival until the experiment began (September 30), heifers were fed a corn silage-based diet and gained weight at about 1.5 lbs per day.

Two hundred heifers were selected and blocked by weight into two groups. The heavy block included 120 head assigned randomly to 15 pens, and the light group was 80 head assigned to 10 pens. This resulted in eight head per pen and five pens per treatment. Five experimental diets consisted of various combinations of steam-flaked corn:steam-flaked sorghum (Table 1).

Table 1. Ingredient composition of finishing diets (dry matter basis).

	Corn:Sorghum				
Ingredient	100:0	75:25	50:50	25:75	0:100
Corn silage	15	15	15	15	15
Flaked corn	77	57.75	38.5	19.25	0
Flaked sorghum	0	19.25	38.5	57.75	77
Supplement	8	8	8	8	8

Cattle were stepped up to their final diet in 14 days using two step-up diets; 60% corn silage in step-up 1, and 30% corn silage in step-up 2 (dry matter basis, 7 days each). The final diet contained 15% corn silage, 77% grain, and 8% supplement.

The heavy group of heifers was placed in open lot pens with concrete flooring. There was 27 inches of linear bunk space and 70 sq ft of pen area per animal. This group was fed for 126 days. The light group of heifers was placed in open lot dirt pens with a concrete feeding apron. There was 27 inches of linear bunk space and 262 sq ft of pen area per heifer. This group was fed for 147 days. Initial weight was based on the average of two consecutive daily weights (no shrink), and the final weight was based on hot carcass weight, adjusted to a 62% dress. Cattle were reimplanted with Finaplix-H on day 56 of the feeding period.

Cattle were fed once daily in the morning. Cattle would come up to the bunk at feeding time in a nonaggressive manner. The bunk was empty just before feeding on about 2 out of every 3 days.

At the end of the feeding period, carcass data were recorded, including incidence of liver abscesses, hot carcass weight, backfat, and marbling score. Means were calculated for each pen, and data were analyzed using GLM procedures of SAS. The model included block and treatment. Sums of squares due to treatment were partitioned into linear, quadratic, cubic, and quartic effects.

Table 2. Composition of pelleted supplement (dry matter basis)[a]

Ingredient	% of Supplement
Soybean meal	62.34
Limestone	16.25
Urea	9.40
Potassium chloride	7.50
Salt	3.75
Rumensin - 80[b]	.196
Tylan - 100[c]	.620
Trace mineral premix[d]	.250
Vitamins ADE premix[e]	.250

[a]Complete ration balanced to contain 12% crude protein, .3% P, .5% Ca, and .7% K.
[b]Rumensin added so complete diet contained 25 g/ton Rumensin.
[c]Tylan added so complete diet contained 10 g/ton Tylan.
[d]Contained 5.5% Ca, .5% Co, 2.4% Cu, 1.6% I, 4.0% Fe, 16% Mn, .8% Se, and 24% Zn.
[e]Added so each ton of complete diet contains 3,200,000 IU Vitamin A, 320,000 IU Vitamin D, and 3,200 IU Vitamin E.

RESULTS AND DISCUSSION

Grain was steam flaked under the following conditions. Retention time in the steam chest was about 20 minutes, temperature just above the rolls was 210° F, and the moisture of the fresh flake was 19 to 20%. Both the corn and sorghum were flaked to 28 lbs per bushel. Starch availabilities at the end of the study were 71% on a sorghum composite and 58%on a corn composite.

Corn contained 8.8 to 9.0% crude protein, and sorghum grain contained 9.9 to 10.2% crude protein. The corn diet was formulated to contain 12% crude protein, and then this supplement was fed with all five diets (Table 2). Therefore, diets containing increased amounts of sorghum had greater crude protein.

One heifer fed the 25% corn:75% sorghum diet died after the study began. Cause of death was peritonitis.

Average starting weight for the cattle was 659 lbs. Final weight decreased ($P < .05$) as the level of sorghum in the diet increased (Table 3). Treatment had no effect on feed intake, but daily gain decreased ($P < 05$) and cattle were less efficient ($P < .05$) with increasing levels of sorghum in the diet. Numerically, cattle fed 75% corn:25% sorghum performed similarly to cattle fed diets containing 100% corn.

The incidence of abscessed livers was very low, carcass backfat was .35 inch, and the average quality grade was just less than average Choice. Hot carcass weight declined in cattle fed diets containing increasing levels of sorghum ($P < .05$). Treatment effects on final live weight were similar to those of hot carcass weight, because final live weight was calculated based on hot carcass weight.

The positive associative effects that occurred for daily gain and feed efficiency are shown in Table 4. The predicted response for the grain combinations is tallied by the weighted value of each grain fed individually. The associative effect (expressed as a percent) is determined by comparing actual versus predicted performance. For both gain and efficiency, the biggest associative effect occurred when the diet contained 75% corn:25% sorghum. The percent improvement is comparable with that in other published reports where dry rolled sorghum was fed in combination with either dry-rolled corn or high-moisture corn or high-moisture sorghum was fed with dry-rolled wheat.

Table 3. Effect of feeding flaked corn and flaked sorghum either singly or in combination on finishing cattle performance and carcass merit.

	Corn:Sorghum						
Item	100:0	75:25	50:50	25:75	0:100	SE	P Value[a]
# Pens	5	5	5	5	5		
# Cattle	40	40	40	39	40		
In weight lb.	665	661	664	651	654	5.4	.29
Out weight lb.	1028	1032	1010	988	964	14.7	.02, L
Feed Intake, lb/d	17.34	17.89	17.73	17.63	17.30	.40	.79
Gain, lb/d	2.59	2.65	2.46	2.40	2.22	.10	.06, L
Feed/Gain	6.71	6.79	7.38	7.38	7.87	.278	.04, L
Liver abscess score[b]	.14	.04	.04	.04	.10	.06	.67
Back fat, in.	.35	.41	.33	.32	.35	.02	.11
Quality grade,[c]	3.97	3.76	3.56	3.91	3.93	.13	.22
Hot carcass weight, lbs	637	640	626	612	598	9.1	.02, L

[a] Probability that treatment effects are similar. L = a significant linear effect across corn:sorghum combinations (P< .05).
[b]0 = no liver abscess, 1 = 1 small abscess, 2 = one moderate abscess, 3 = several abscesses or liver adhered to the body wall.
[c]1 = Standard, 2 = Select, 3 = Choice-, 4 = Choice°, 5 = Choice +

Table 4. Associative effects of feeding steam-flaked corn and steam-flaked sorghum either singly or in combination.

	Corn:Sorghum				
Item	100:0	75:25	50:50	25:75	0:100
Daily gain					
predicted	2.59	2.50	2.41	2.31	2.22
actual	2.59	2.65	2.46	2.40	2.22
% improvement	—	+6.0%	+2.1%	+3.9%	—
Feed/gain					
predicted	6.71	6.99	7.29	7.57	7.87
actual	6.71	6.79	7.38	7.38	7.87
% improvement	—	+2.8%	-1.4%	+2.5%	—

EFFECT OF TREATING HIGH-MOISTURE CORN WITH A BACTERIAL INOCULANT (BIOTAL) AT ENSILING ON FERMENTATION EFFICIENCY AND GROWTH PERFORMANCE AND CARCASS MERIT OF FINISHING STEERS

by
Kelly K. Kreikemeier and Keith K. Bolson

SUMMARY

One hundred twenty-eight steers were allotted to 16 pens (eight hd/pen) and fed a finishing diet containing high moisture corn for 140 days. The two experimental diets were high-moisture corn treated with a bacterial inoculant at ensiling and nontreated high-moisture corn. Cattle fed treated high-moisture corn consumed 4% more feed and gained 6.7% faster. This equated to 27-lb heavier final weights and 15-lb heavier carcasses. Treatment had no effect on feed efficiency, but quality grade was greater for cattle fed nontreated corn.

INTRODUCTION

Silage inoculants have been used for several years to treat various silages and high-moisture corn. These inoculants generally consist of lactic acid-producing bacteria that hasten the ensiling process, that is, a more rapid production of lactic acid and a subsequent more rapid decline in silage pH. This is beneficial, at least in theory, because ensiling dry matter losses are fewer and fermentation end products are more desirable. This makes the feedstuff more palatable to the animal, and the ensiled feedstuff has greater aerobic stability.

In the past, silage inoculants were less well understood, and perhaps the quality control in the manufacturing process was less. The cost of silage inoculants ranges from $.40 to $.80 per ton of treated material (as-is basis). This means that for forages, a 2 to 4% improvement must be realized just to recover the cost of the product.

Because of these factors, the success of silage inoculants in the past has been mixed. Generally, the success of inoculants has been better with legumes and very wet silages (> 70% H_2O), and only limited success has occurred with corn silage and high-moisture corn. In this experiment, the objective was to determine if inoculating high-moisture corn affected silo fermentation characteristics, improved cattle growth performance, or affected carcass merit in finishing steers.

PROCEDURES

Corn was harvested in the fall of 1994 when it contained 28 to 31% moisture. It was coarsely rolled with a roller mill that had six cuts per inch. Two bunker silos were filled simultaneously; one with nontreated corn and the other with treated corn. To minimize cross contamination, we used one feed truck and one tractor for packing in each silo. The payloader that was used to push the corn up into the silo had the tires and bucket washed each time that it was switched from the corn in the treated silo to the other silo.

Four thousand pounds of corn were rolled into the feed truck. The correct amount of bacterial inoculant was dissolved in 3/4 gal of tap water and applied to the corn while it was mixing. The load then was mixed for 2 min and unloaded in the silo. The nontreated corn was handled similarly, except no bacterial inoculant was used. Approximately 5,000 bu (84.5% dry matter basis) of corn were put in each silo, silo filling took 4 days, and silos were covered with black plastic. For each silo, the dimensions of the ensiled corn were 13 ft wide, 70 ft long, and 6 ft high.

The inoculant used contained the following bacteria: Pediococcus pentosaceus, Lactobacillus plantarum, and "propionibacterium". When applied at recommended rates, each gram of feedstuff was inoculated with 100,000 colony forming units (cfu) of lactic acid-producing bacteria and 10,000 cfu of "propionibacterium". The inoculant was manufactured by Biotal Inc., Eden Prairie, MN, 55346.

At ensiling time, treated high-moisture corn and nontreated high-moisture corn were put into small PVC silos and allowed to ferment. Silos were opened at various times to determine the effect of the inoculant on ensiling characteristics. PVC silos were 4 inches wide and 12 inches long and were fitted with a temporary rubber seal on each end after the high-moisture corn was added and compacted. Corn was compacted with a continuous force of 1500 lbs applied over the entire surface (4 inch diameter) for 10 sec. Silos were stored in a room at 60ºF. Five replicate PVC silos of each grain were opened on days 1, 3, 5, 7, 21 and 90 after ensiling. The PVC silo plus grain was weighed, emptied, and subsampled for subsequent laboratory analysis.

During silo filling, 24 nylon bags (3 inch by 5 inch) were filled with treated high-moisture corn (200 grams each), and 24 others were filled with nontreated corn. The nylon bags containing nontreated corn were buried in the bunker silo containing nontreated corn. All bags were buried 3 foot from the bottom of the silo; 8 bags were buried 10 feet from the front, 8 bags 35 feet from the front, and 8 others 60 feet from the front of the silo. Of the 8 bags at each location (distance from the front), 4 were buried 3 feet from one sidewall and the other 4 were buried 3 feet from the other sidewall. The 24 bags containing the treated corn were buried in the silo containing treated corn in a similar manner. During feedout, bags were recovered from the face of the silo at the beginning, middle, and end of a cattle feeding trial that took place February 3 to June 24, 1995. Bags were stored frozen for subsequent laboratory analysis.

During feedout, corn was removed from the face of the silo to determine aerobic stability. This was done by filling insulated buckets (9 inch by 9 inch) with ensiled high-moisture corn and placing the buckets in a room at 90ºF. Thermometers were placed in the center of the grain, 4.5 inches deep. Temperature was recorded every 12 hours for 4 days and then daily for an additional 6 days.

Cattle used in this study were purchased as calves and stockers in September and October of 1994 and used in growing studies. Cattle were straightbreds and crossbreds of Angus, Hereford, and Charolais. From arrival until the start of the finishing experiment, steers were fed a corn silage-based diet and gained between 1.50 and 1.75 lbs per day.

One hundred twenty-eight steers were selected, stratified by weight into eight groups of 16 head each. Within each weight strata, steers were assigned randomly to 16 pens (eight hd/pen). Pens were open lots and had a concrete floor. Per steer, there were 27 inches of linear bunk space and 70 sq ft of pen area. Cattle were fed for 140 days and implanted with Compudose on day 1, and Synovex-S on day 84. Beginning and final weights were based on the average of two consecutive daily weights.

Two experimental diets were fed (Table 1): one containing treated high-moisture corn and the other nontreated high-moisture corn. Cattle were stepped up to the finishing diet in 14 days using two step-up diets; 60% corn silage for step-up 1 and 30% corn silage for step-up 2 (dry matter basis; 7 days each). A mineral type supplement constituted 4.54% of the finishing ration (dry matter basis; Table 1). This same mineral was fed at 4.54% of the ration during the step-up diets.

Cattle were fed once daily in the morning. Cattle would come up to the bunk at feeding time in a nonaggressive manner. The bunk was empty just before feeding on about 2 out of every 3 days.

At the end of the feeding period, carcass data were recorded, including incidence of liver abscesses, hot carcass weight, backfat, and marbling score. Means were calculated for each pen, and data were analyzed using GLM procedures of SAS. The model was completely random. For data on PVC silos, each silo served as an observation and those data were analyzed as a completely random design with a 2 by 6 factorial arrangement of treatments (inoculant and day of ensiling). With the buried nylon bags, each nylon bag served as a replicate, and data were analyzed as a completely random design with a 2 by 3 factorial arrangement of treatments (inoculant and time of feedout).

RESULTS AND DISCUSSION

Cattle had an average initial weight of 800 lbs and were fed for 140 days (Table 2). Steers fed inoculated corn were 27 lbs heavier (P = .04), consumed 4% more feed (P = .01), and gained almost 7% faster (P = .01) than cattle fed nontreated corn. Treatment had no effect on feed efficiency, and the incidence of liver abscesses was small. Similar to final live weight, cattle fed treated high-moisture corn had carcasses that were 14 lbs heavier (P = .10) than cattle fed nontreated corn. Carcass backfat was .41 inch in both treatment groups, but quality grade was greater for cattle fed nontreated corn (P = .04).

When ensiled corn was tested for aerobic stability, corn from both silos was stable for 10 days. That is, temperature within the insulated container of high moisture corn rose to 30°F (room temperature)over a 48-hour period and remained at 30°F for the next 8 days.

Table 1. Ingredient composition of the finishing diet (dry matter basis)[a].

Ingredient	Percent of diet
Corn silage	15.0
High moisture corn	80.46
Urea	1.57
Limestone	1.142
Dical	.57
Potassium chloride	.567
Magnesium oxide	.10
Rumensin-80[b]	.0156
Tylan-120[c]	.0042
Vitamin A&D premix[d]	.0017
Vitamin E premix[d]	.0167
Trace mineral premix[e]	.02
Mineral oil[f]	.23

[a] Formulated to contain 12.5% CP, .7% K, .5% Ca,
.3% P, and .15% Mg.
[b] Rumensin added at 25 g/ton of complete diet.
[c] Tylan added at 10 g/ton of complete diet.
[d] Vitamin A added at 2000 IU, Vitamin D added at 200 IU, and Vitamin E at 20 IU per lb of complete diet.
[e] Contained 5.5% Ca, .5% Co, 2.4% Cu, 1.6% I, 4.0% Fe, 16% Mn, .8% Se, and 24% Zn.
[f] Added to the mineral supplement for a binder.

Table 2. Effect of treating high-moisture corn with a bacterial inoculant at ensiling time on feedlot performance and carcass merit of finishing steers.

	High-moisture corn			
Item	Treated	Non-treated	SE[a]	P-value[b]
# pens	8	8		
# steers	64	63		
Initial weight, lb	799	801	2.7	.68
Final weight, lb	1240	1213	8.3	.04
Feed intake, lb/day	21.2	20.3	.21	.01
Gain, lb/day	3.15	2.95	.05	.01
Feed/gain	6.76	6.89	.10	.40
Liver abscess[c]	.19	.22	.07	.74
Hot carcass weight, lb	769	754	5.9	.10
Backfat, inch	.41	.41	.02	.92
Quality grade[d]	3.07	3.50	.13	.04

[a] SE = Standard error.
[b] Probability that treatment means are similar.
[c] 0 = no abscess, 1 = one small abscess, 2 = one moderate abscess or two small abscesses, and 3 = one large abscess, several small abscesses or the liver is adhered to the body wall.
[d] 1=standard, 2=select, 3=low choice, 4=average choice, 5=high choice, etc.

Data on the effect of inoculation on ensiling characteristics in PVC silos will be presented first. P-values for treatment effects are in Table 3 and data are in Figures 1-8.

Dry matter recovery decreased with greater number of days of ensiling and was greater in PVC silos containing control corn as compared to inoculated corn (Figure 1). For lactic acid concentration, the same occurred; it was greater in inoculated corn (Figure 2). The greater lactic acid concentration, caused a lowering of ensiled corn pH; it was lower at all time points in inoculated corn (Figure 3).

Soluble protein is a measure of protein breakdown that occurs during the ensiling process. In the PVC silos, protein breakdown was small compared to 50 to 70% typically seen in ensiled high-moisture corn. Compared to control corn, inoculated corn had lower souble protein at days 1, 3 and 5 but greater values at days 7, 21, and 90 (Figure 4). For ammonia, concentration increased with greater ensiling time and was greater in inoculated corn (Figure 5).

Table 3. P-values for treatment effects of fermentation characteristics in PVC silos.

Item	Effect: Inoculant	Day of ensiling	Interaction
Dry matter recovery	.01	.01	.84
Lactate	.01	.01	.02
pH	.01	.01	.01
Soluble protein	.14	.01	.01
Ammonia	.10	.01	.83
Ethanol	.01	.01	.26
Acetate	.20	.01	.89
Propionate	.01	.01	.01

[a]Probability that treatment means are similar.

Figure 1. Dry matter recovery of corn in PVC silos.

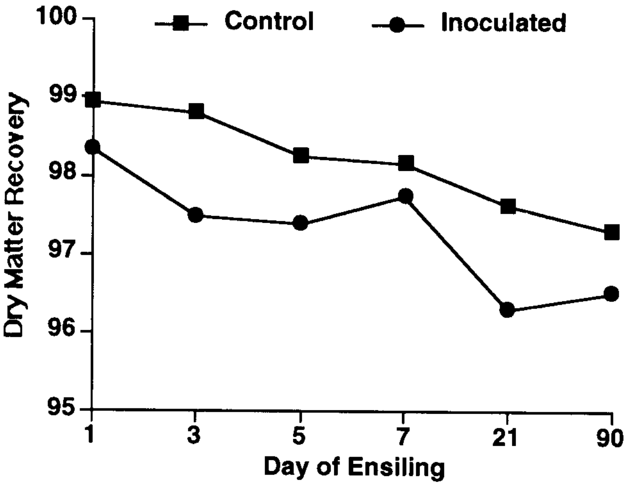


Figure 2. Lactic acid content of corn in PVC silos.

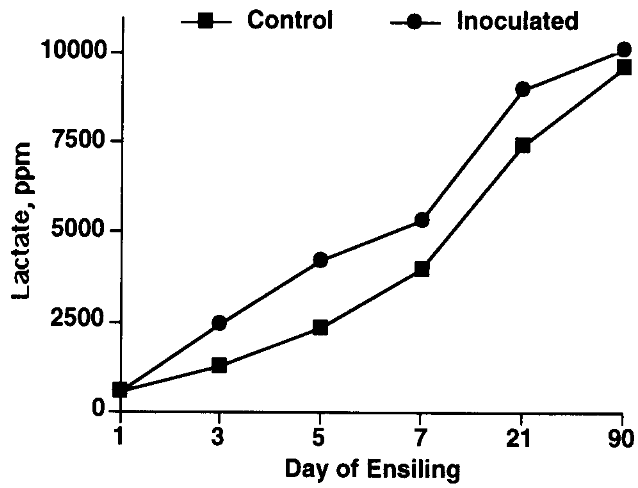


Figure 3. pH of corn in PVC silos.

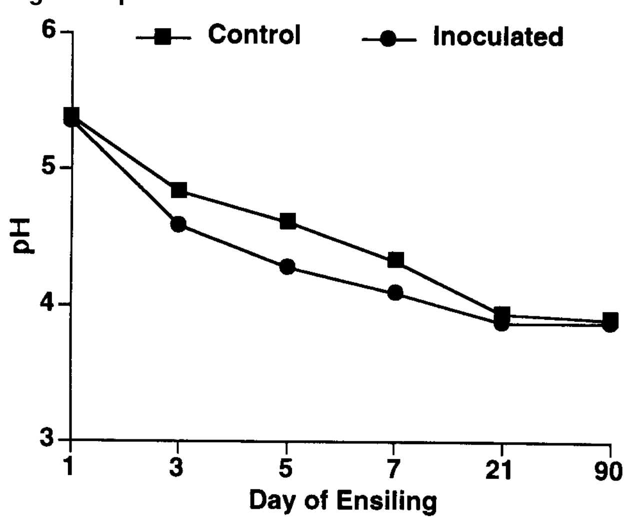


Figure 4. Soluble protein content of corn in PVC silos.

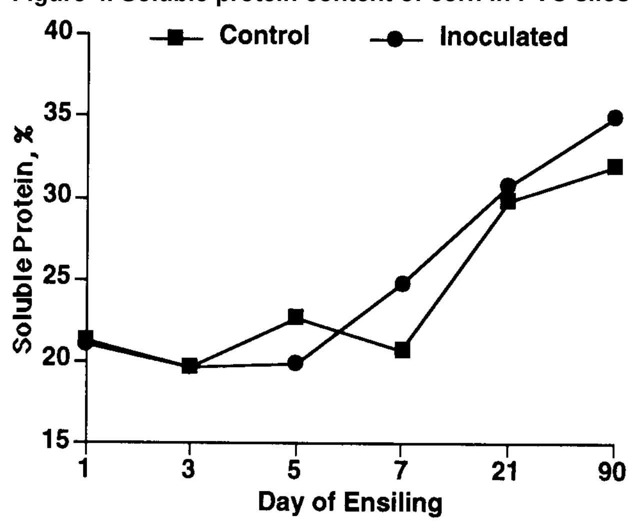


Table 4. P-values for treatment effects of fermentation characteristics in bunker silos[a].

Item	Effect: Inoculant	Day of ensiling	Interaction
Dry matter recovery	.58	.47	.52
Lactate	.01	.01	.26
pH	.01	.01	.01
Soluble protein	.03	.01	.33
Ammonia	.02	.01	.32
Ethanol	.18	.66	.09
Acetate	.26	.05	.01
Propionate	.08	.01	.13

[a]Probability that treatment means are similar.

Figure 5. Ammonia content of corn in PVC silos.

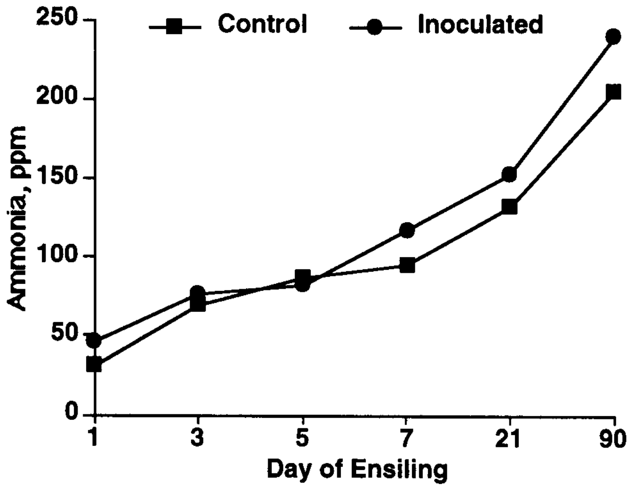
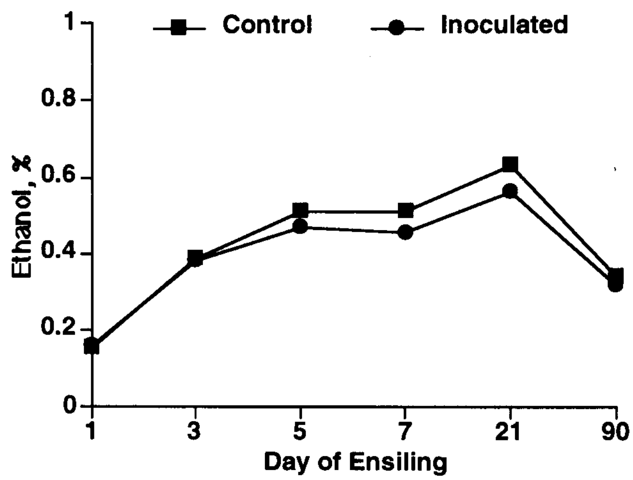


Figure 6. Ethanol content of corn in PVC silos.



Ethanol concentration increased with time of ensiling and then declined at day 90 (Figure 6). Overall, it was lower for inoculated corn. Ethanol is undesirable, because it acts as a buffer that prevents a decline in pH. The acetate concentration was low and increased with time (Figure 7). Although propionate concentration was low, it increased to a greater extent over time in inoculated corn (Figure 8). The source of the greater propionate concentration may have been the "propionibacterium" that was in the inoculant. Having greater amounts of propionate is desirable, because it gives the high-moisture corn greater aerobic stability. The minimal amount of propionate required in an ensiled feedstuff to elicit greater aerobic stability is dependent on several factors.

Figure 7. Acetate content of corn in PVC silos.

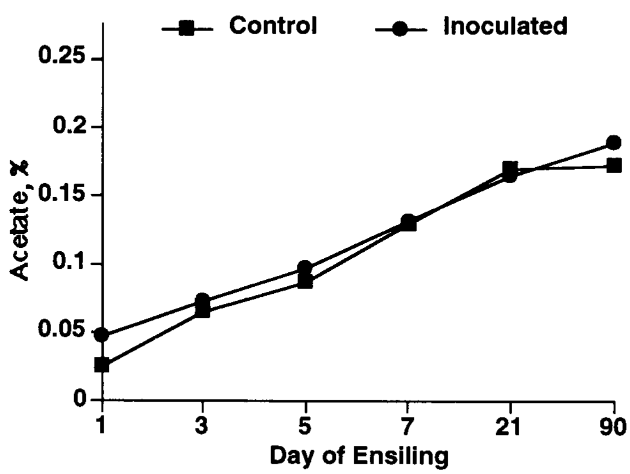


Figure 8. Propionate content of corn in PVC silos.

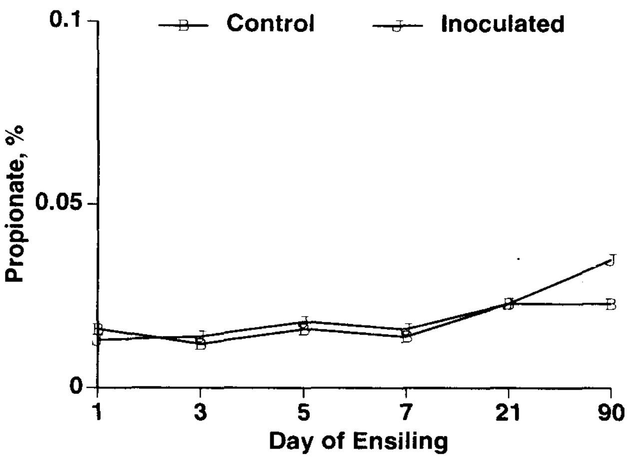
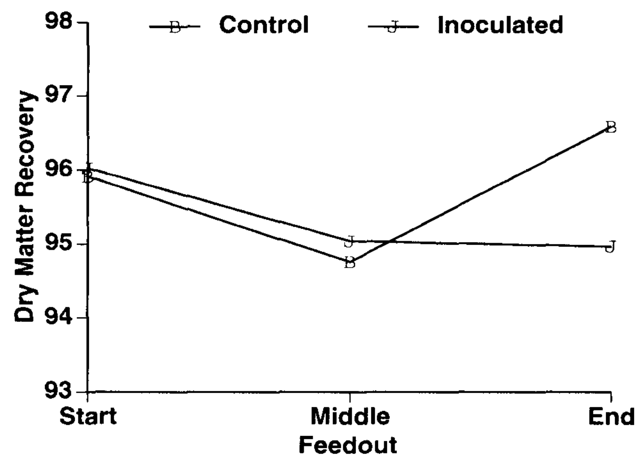


Figure 9. Dry matter recovery of corn in bunker silos.



Data on fermentation characteristics in bunker silos are presented in Figures 9-16. Ensiling dry matter recovery was unaffected by time or inoculation (Figure 9). Lactic acid concentration was greater at all times in bunkers with inoculated corn (Figure 10). Ensiled pH was similar at the start, but lower at the middle and end. This occurred because lactic acid is the strongest acid produced during the ensilng process, so it causes the greatest decline in pH. Therefore, it is a critical gauge by which the success of inoculants is judged. In both the PVC silos and in the bunker, greater concentrations of lactic acid and a lower pH occurred with inoculation.

Soluble protein concentrations in the bunker silos were typical for high-moisture corn ensiled at 30% moisture. Concentration was lower at all times in inoculated corn (Figure 12). Protein that is solubilized during ensiling is probably of little "protein benefit" to the animal, because it is broken down by the ruminal microflora. It can be used only as an energy source. Therefore, in ensiled high-moisture corn, lower soluble protein is desirable.

Figure 10. Lactic acid content of corn in bunker silos.

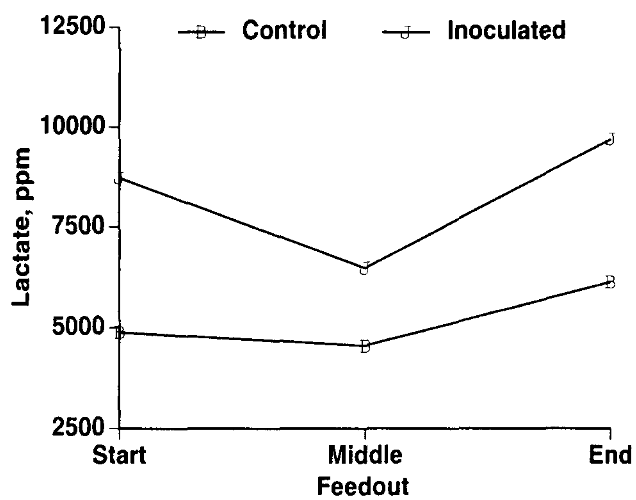


Figure 11. pH of corn in bunker silos.

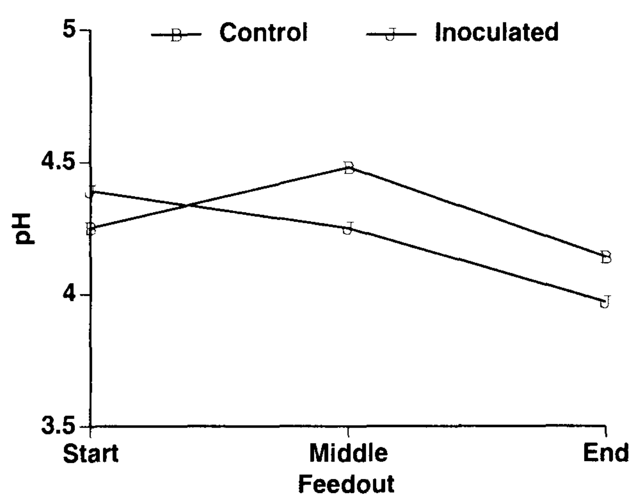
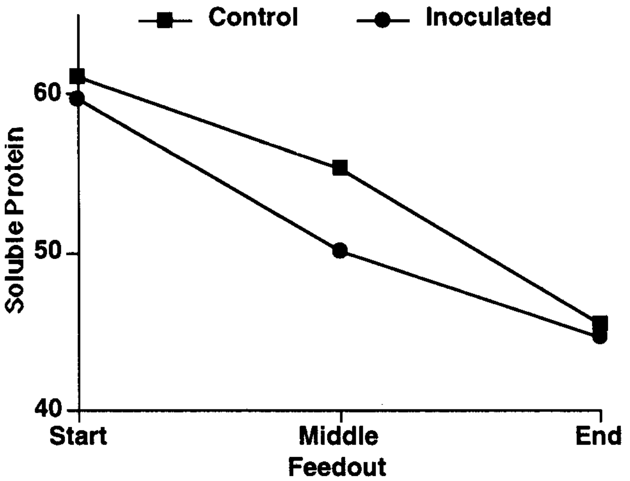
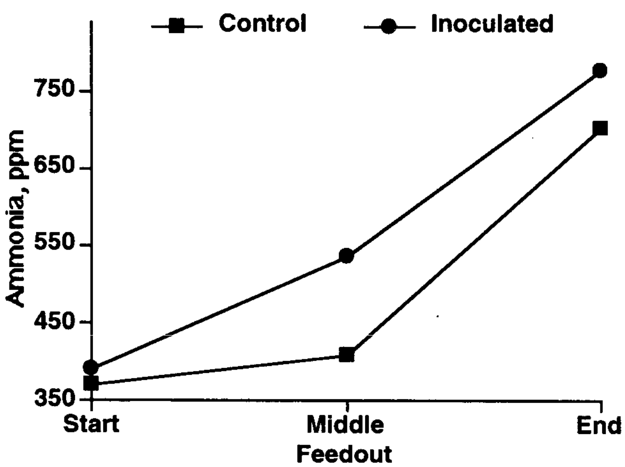


Figure 12. Soluble protein content of corn in bunker silos.



Ammonia concentration increased with time and was greater in inoculated corn (Figure 13). Ethanol concentration was lower at the start, greater during the middle, and lower again at the end of the feedout period in inoculated corn (Figure 14). Acetate was low, increased with time, and was not affected by inoculation (Figure 15). Propionate concentration was low at the start and increased to a greater extent in inoculated corn (Figure 16). This was also observed in PVC silos.

Figure 13. Ammonia content of corn in bunker silos.



In both silo types, the inoculant caused a greater concentration of lactic acid and a more rapid decline in pH. This likely shortened the ensiling process. The greater concentration of propionic acid may have resulted in greater aerobic stability, Soluble protein also was less with inoculation. These improvements in ensiling were likely what caused the improved finishing cattle performance.

Figure 14. Ethanol content of corn in bunker silos.

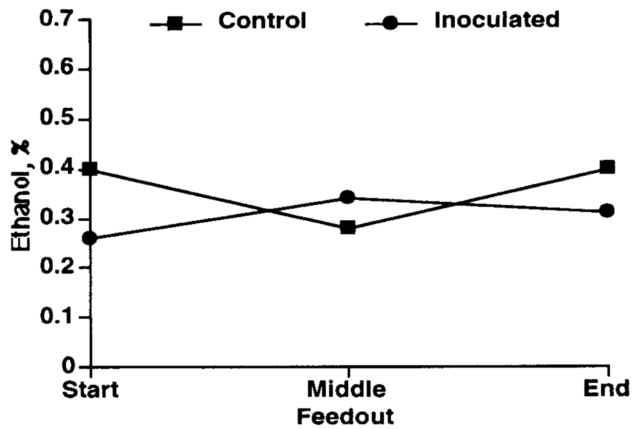


Figure 15. Acetate content of corn in bunker silos.

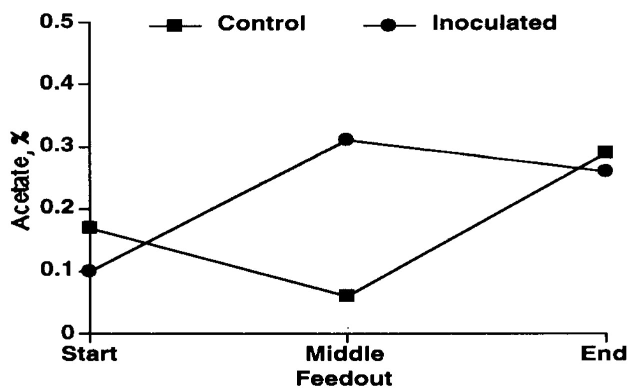
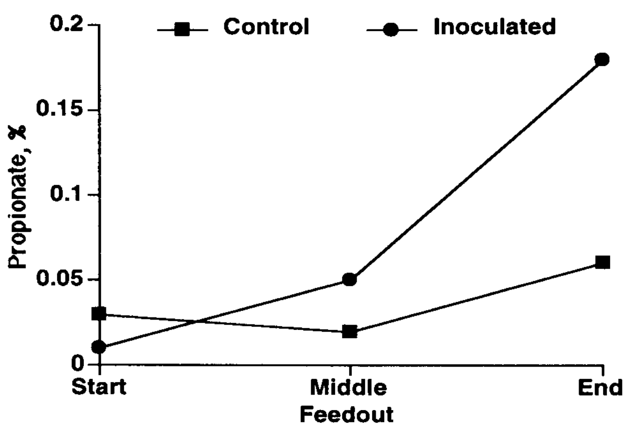


Figure 16. Propionate content of corn in bunker silos.



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