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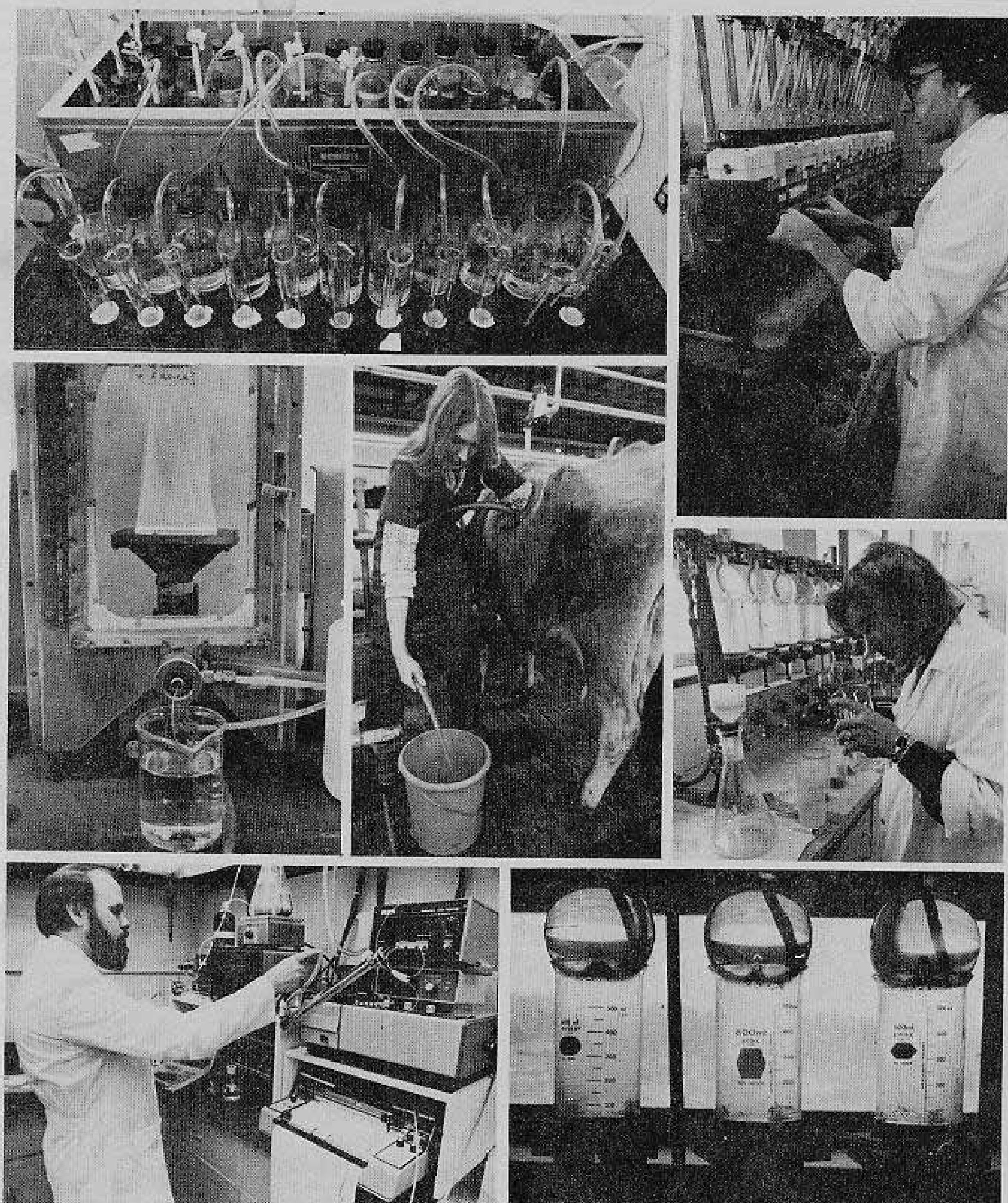


Agricultural Experiment Station Kansas State University, Manhattan John O. Dunbar, Director

ERLE E. BARTLEY
1922-1983

We dedicate this year's Cattlemen's Day publication to the memory of our friend and colleague, Dr. Erle E. Bartley. Erle completed the first two papers in this publication hours before his death.

Erle Bartley was a scientist of international stature. He lectured and consulted at prestigious research institutions in England, France, Sweden, and throughout the world. His former graduate students hold responsible positions in both industry and at universities. He published over 100 scientific papers on ruminant nutrition. He was a world authority on bloat. His research on legume bloat culminated in the development of poloxalene, the most effective and most widely sold bloat preventive in the world. His research on the polyether antibiotics led to the discovery of their effectiveness against feedlot bloat. That work is summarized in this Report of Progress. He contributed immeasurably to the understanding of ammonia utilization in the rumen, and how carbohydrates interact with urea to influence microbial protein synthesis. He and his co-workers found that rumen microorganisms produce a powerful endotoxin that may be related to the so-called "sudden death syndrome" in feed lot cattle. He was among the first to feed antibiotics to ruminants.

Erle Bartley was a true scientist and an effective teacher. His research was basic -- research on how the rumen operates. But he applied that basic knowledge to practical problems on the farm and in the feedlot. Erle's research and teaching were recognized by the University and the professional societies in which he held membership. In addition to earlier notable awards, he received the Morrison Award from the American Society of Animal Science in 1981 -- the highest award that group makes.

Erle was born of British parents in Bangalore, India, October 23, 1922. He was educated in India and England, and earned his MS and PhD degrees at Iowa State University. He came to Kansas State in 1949, and remained on the faculty until his death on February 10, 1983. We extend our deepest sympathy to his wife, Virginia, his daughter, Jill, and his sons, Mike, Kenneth, and Keith.

About the Cover

It takes more than cattle and feed to do animal science research. An integral part of our research program is sophisticated laboratory techniques and equipment, and highly trained technical personnel. From fistulated cattle and the "artificial rumen" to scanning electron microscopes and high pressure liquid chromatographs, laboratories help us to find out not just what happens in an experiment, but why it happens. Basic research -- the sophisticated and detailed studies on biological mechanisms -- depends especially heavily on laboratory instruments.

Some of the instruments on the cover give us insight into nutrient utilization and metabolism. Others let us measure the nutrient content of feedstuffs. Animal scientists use laboratories and instruments as additional tools to find the answers the industry needs.

Biological Variability and Chances of Error

The variability among individual animals in an experiment leads to problems in interpreting the results. Although the cattle on treatment X may have had a larger average daily gain than those on treatment Y, variability within treatments may mean that the difference was not the result of the treatment alone. Statistical analysis lets researchers calculate the probability that such differences were from chance rather than the treatment.

In some the articles that follow, you will see the notation "$P<.05$". That means the probability of the differences resulting from chance is less than 5%. If two averages are said to be "significantly different," the probability is less than 5% that the difference is from chance-- the probability exceeds 95% that the difference results from the treatment.

Some papers report correlations; measures of the relationship between traits. The relationship may be positive (both traits tend to get bigger or small together) or negative (as one trait gets bigger, the other gets smaller). A perfect correlation is one (+1 or -1). If there is no relationship, the correlation is zero.

In other papers, you may see a mean given as $2.50 \pm .10$. The 2.50 is the mean; .10 is the "standard error". The standard error is calculated to be 68% certain that the real mean (with unlimited number of animals) would fall within one standard error from the mean, in this case between 2.40 and 2.60.

Many animals per treatment, replicating treatments several times, and using uniform animals increases the probability of finding real differences when they exist. Statistical analysis allows more valid interpretation of the results regardless of the number of animals. In nearly all the research reported here, statistical analyses are included to increase the confidence you can place in the results.

Effect of Lasalocid[1] or Monensin[2] on Feedlot (Grain) Bloat in Cattle

E.E. Bartley and T.G. Nagaraja

Summary

Lasalocid or monensin (600 mg per 1000 lb body weight daily) was tested on cattle bloating on high grain diets. Bloat was reduced 92% by Lasalocid and 64% by monensin. When fed throughout the finishing period, lasalocid at 300 mg per 1000 lb body weight effectively prevented bloat from developing. However, 600 mg was required to control bloat in cattle that were already bloating.

Introduction

Feedlot (grain) bloat occurs in cattle fed large quantities of grain and little roughage. It is similar to legume pasture bloat in that both produce excessive foaming of the rumen contents. But in legume bloat, although rumen bacteria contribute to foaming, the primary foaming agents come from plants. In grain bloat, the major source of foaming agents appears to be a slime of bacterial origin that increases the viscosity of rumen contents; then fermentation gas becomes trapped in the viscous contents, creating foam.

This report describes the results of several studies that were initiated to study the effects of lasalocid and monensin on feedlot (grain) bloat.

Results

Experiment 1. Six rumen-fistulated adult cows were fed bloat-producing diets. Lasalocid or monensin was added to the grain diet to provide 600 mg drug per 1,000 lbs body weight per day. The six cows were divided into three groups of two cows, and each group was given either no drug (control), lasalocid, or monensin. The treatments and cows were rotated so each cow received each treatment. Each treatment period was 14 days followed by a 14 day control period. Bloat was scored (0 = no bloat to 5 = severe bloat), 2 to 3 hours after feeding.

[1]Lasalocid is sold under the registered trademark of Bovatec® by Hoffmann-LaRoche, Inc., Nutley, NJ. The approved use level of lasalocid to improve feed efficiency and increase weight gain for beef cattle is not less than 250 nor more than 360 mg per head per day. The manufacturer makes no claims for bloat prevention.

[2]Monensin is sold under the registered trademark of Rumensin® by Elanco Products Co., Indianapolis, IN. The approved use level of monensin to improve feed efficiency for beef cattle is not less than 50 nor more than 360 mg per head per day. The manufacturer makes no claims for bloat prevention.

The bloat scores for a treatment period were compared with the bloat scores of the previous control period (Table 1.1.) Both drugs reduced the degree of bloat, with the greatest reduction at the end of each drug treatment period. Lasalocid was more effective in reducing the degree of grain bloat than monensin.

Table 1.1. Effect of Lasalocid or Monensin (600 mg per 1000 lb Body Weight per Day) on Grain Bloat (Exp. 1)

Time after drug feeding started (days)	Bloat score[a]	
	Lasalocid	Monensin
0[b]	2.5	2.8
1 - 5	2.1	2.2
6 - 10	1.2	1.7
11 - 14	.2[c]	1.0[d]

[a]Mean of periods 1, 2 and 3. 0 = no bloat; 5 = severe bloat.
[b]Mean score for 2 days prior to initiation of drug feeding.
[c]Means in rows with unlike superscripts differ (P<.07).

<u>Experiment 2</u>. Two rumen-fistulated cows were used to determine if lasalocid would control bloat over an extended period of time. The cows were fed and managed as in Exp. 1, and lasalocid was fed daily at 600 mg per 1,000 lbs body weight. The cattle were bloating before drug feeding was initiated.

The effect of lasalocid appears to persist for an extended period, since it reduced the degree of bloat to zero and kept both animals bloat free for 64 days (Table 1.2). With antibiotics like tetracycline and penicillin, the bloat preventive effect wears off in a few days.

Table 1.2. Effect of Lasalocid (600 mg Per 1,000 lb Body Weight/Day) on Grain Bloat when Fed Continuously for 60 Days (Exp. 2)

Period	Elapsed time, days	Mean Bloat Index[a]	
		Animal No.1	Animal No.2
Preliminary	1-4	2.0	2.5
Drug feeding	5-8	0.8	1.4
	9-64	0	0
Post-drug Feeding period	65-71	0.4	0.5
	72-79	2.1	2.1
	80-87	2.1	2.2

[a]0 = no bloat; 5 = severe bloat.

Experiment 3. Six rumen-fistulated cows were divided into two groups. One group received 300 mg and the other 600 mg lasalocid daily per 1,000 lbs body weight. This experiment was conducted like the previous trials.

While 300 mg reduced bloat somewhat (Table 1.3), 600 mg was clearly more effective.

Table 1.3. Effect of Lasalocid (300 or 600 mg per 1000 lb Body Weight per Day) Controlling Bloat in Cattle That Were Already Bloating (Exp 3)

Period	Elapsed time, days	Mean bloat score Group I 300 mg	Mean bloat score Group II 600 mg
Before drug feeding	1 to 7	2.83[a]	2.16[c]
Drug feeding	8 to 14	2.21	2.44
	15 to 21	1.72	1.38
	22 to 28	1.71[b]	.11[d]
After drug removed	29 to 35	1.43	1.23
	36 to 42	2.18[a]	2.52[c]

[ab]Means in columns with unlike superscripts differ ($P<.05$).

[cd]Means in columns with unlike superscripts differ ($P<.0001$).

Experiment 4. In the previous experiments, lasalocid and monensin were evaluated in animals that already were bloating. In Exp. 4 lasalocid at two daily dosage levels (300 and 600 mg per 1000 lbs) was tested on animals receiving non-bloating hay-feed, which was gradually changed to a high-grain, bloat-producing ration.

The animals were fed alfalfa hay ad libitum and then gradually changed over to the bloat-producing diet in 14 days. The nine fistulated cows were divided into three groups of three cows each, balanced as to previous bloat potential (Table 1.4). If animals were fed lasalocid before bloating started, both 300 and 600 mg lasalocid dosage levels effectively prevented moderate to severe bloat.

Table 1.4. Effect of Lasalocid (300 or 600 mg per 1000 lb per Body Weight) Controlling Bloat in Cattle Before Bloat Starts (Exp. 4).

Period	Elapsed time, days	Mean bloat score Group I 300 mg	 Group II 600 mg
Drug feeding	1 to 7	0	0
(hay only)	8 to 14	0[a]	0[a]
Drug feeding continued	15 to 21	.3	0
(grain bloat diet)	22 to 28	0	.3
	29 to 35	0	.4
	36 to 42	.5[a]	0[a]
Drug feeding discontin.	43 to 49	1.6	1.3
(grain bloat diet)	50 to 56	2.5	2.0
	57 to 63	2.6[b]	3.0[b]

[ab]Means in columns with unlike superscripts differ (P<.0001).

The surprising effectiveness of lasalocid may be attributed to its unique ability to inhibit growth of all important strains of Streptococcus bovis. This bacterium has long been incriminated as a cause of feedlot bloat. We have screened hundreds of compounds for the prevention and control of feedlot or grain bloat, and lasalocid is undoubtedly the most effective agent we have tested.

A Summary of Recent Kansas State University Research on the Metabolism of Supplemental Niacin in the Rumen of Cattle

E.E. Bartley, D.O. Riddell,
M.A. Arambel and S.M. Dennis

Introduction

Benefits have been shown under certain conditions when niacin is added to the diets of beef cattle, dairy cattle or sheep. We attempted to find out what effects added niacin has on the rumen fermentation, and conversely, how the rumen metabolizes niacin.

Effect of Niacin on the Rumen Fermentation. We found that feeding niacin to rumen fistulated cattle increased rumen bacterial protein production and increased the percentage of rumen propionate. In a later study, we found that niacin increased microbial protein synthesis *in vitro* more when soybean meal rather than urea was the nitrogen source. Because niacin is involved intimately in energy metabolism, we had expected the opposite. Bacteria can synthesize niacin from tryptophan. Because rumen ciliate protozoa cannot synthesize niacin and must obtain it from bacteria or from feed, we thought the heating that occurs in commercial soybean meal processing might reduce the availability of either niacin or tryptophan for bacteria, thus reducing the supply of niacin to protozoa. To test that, we compared the effect of heated (conventionally processed) or unheated soybean meal, with or without niacin, on rumen protozoal numbers. Rumen protozoal numbers increased when niacin was added to diets containing heated soybean meal but not in diets containing unheated soybean meal. In a companion study we found that rumen bacterial protein synthesis was higher in cattle fed unheated than heated soybean meal (738 vs 554 mg bacterial N per gm total N). Niacin supplementation of cattle fed heated soybean meal increased bacterial N synthesis by 10.9%. Microbial protein in duodenal samples was increased in cattle fed heated soybean meal (22.2 vs 16.6 g bacterial-N per kg dry matter). Thus, niacin may be a limiting nutrient for rumen microorganisms when cattle are fed diets containing heated (conventionally processed) soybean meal.

Synthesis and Degradation of Niacin in the Rumen. Although rumen bacteria can synthesize niacin, there is little information as to how supplementary niacin affects ruminal niacin, and to what extent dietary niacin is degraded in the rumen. We studied these effects *in vitro*. Niacin synthesis was greatest when no niacin was added. Small quantities of supplemental niacin (.5 ppm) decreased niacin synthesis, and large quantities (2-8 ppm) were partially degraded. We believe there is an optimum rumen niacin concentration below which synthesis will occur and above which either no net synthesis, or degradation occurs.

Supplementing duodenal cannulated cattle with 2 gm niacin per feeding (30 ppm) resulted in higher niacin concentrations in both ruminal and duodenal digesta. Niacin flow to the small intestine and niacin absorption from the small intestine increased with niacin supplementation. Thus, while supplemental niacin may affect ruminal niacin synthesis and some may be degraded, considerable supplementary niacin reaches the duodenum and is absorbed. Furthermore, we found that blood niacin increased when the diet was supplemented with 6gm niacin per head per day, confirming the fact that supplemental niacin was absorbed.

Recommended levels of supplementary niacin for ruminant diets are 100 ppm for feedlot cattle and 200 ppm for fresh dairy cows.

FISTULAS AND CANNULAS

Rumen fistulas and duodenal cannulas are two basic tools for the rumen nutritionist. A fistula is simply an opening -- in our case, an opening in the rumen. Through that opening, samples can be taken to measure how foodstuffs are digested and how fast they pass out of the rumen. Often, the entire rumen contents are removed, measured, and replaced to find out how much feed is in the rumen at a given time. Rumen fluid can also be removed through the fistula to innoculate "artifical rumens." Duodenal cannulas are tubes installed in the small intestine, just below the outlet of the true stomach. They are useful in understanding the material that leaves the rumen. Using the duodenal cannula, the amount of material flowing into the duodenum per day can be measured. Suppose we measure the niacin concentration in duodenal contents and know how much material flows into the duodenum per day. Then we can calculate how much niacin per day leaves the rumen. That amount will probably be greater than the amount of niacin in the feed. The difference represents the niacin synthesized by rumen microorganisms. With proper care, these fistulated or cannulated animals have a normal life expectancy, and contribute greatly to our understanding of rumen nutrition.

Calcium Oxalate Crystals in Feedstuffs

L.H. Harbers, G.M. Ward, and A.J. Kahrs

Summary

Alfalfa, clovers, soybean meal and cottonseed meal have part of their calcium tied up as insoluble calcium oxalate. The oxalate crystals are relatively unavailable to animals and could be an important consideration in ration formulation. Extension dairymen presently are discounting total alfalfa calcium by 40%.

Introduction

Calcium from inorganic calcium compounds is usually more available to animals than calcium found in legumes, especially alfalfa, primarily because part of their calcium is tied up in calcium oxalate crystals. These are localized along the veins (vascular bundles) of legume leaflets and some are found in stems. Although the crystals dissolve under highly acid conditions, under normal feeding conditions the crystals pass undissolved in the feces. These calcium-containing crystals comprise 25 to 30% of the total alfalfa calcium. Research several years ago indicated that when dairy cows were fed alfalfa, they needed more calcium than when fed silage rations where most of the calcium came from inorganic sources.

Procedures

Calcium oxalate crystals were found in alfalfa, soybean meal and cottonseed meal by photographing low temperature-ashed samples with a scanning electron microscope or clover leaflets cleared with chloral hydrate with a polarized light microscope.

Calcium availability in alfalfa was measured in digestion trials using cockerels and lambs, and in a chick growth trial.

Results

Calcium oxalate crystals vary in structure with the type of plant. Figure 3.1a shows typical alfalfa crystals localized in their vascular bundles (scanning electron microscopy). They are apparently ensheathed in a cork-like (suberinized) cell wall that is virtually impossible for rumen bacteria to attack. Figure 3.1b is a red clover leaflet bundle showing the same type of calcium oxalate crystals (photographed by polarized light).

Other studies show that many of these crystals are loosened in the lower digestive tracts of cattle, sheep, hogs and chickens. By determining oxalate digestibilities, we have found that about 40% of the oxalate is digested by sheep and 10% by chickens. We assume the differences are due to rumen metabolism. We used chicks to compare nonoxalate calcium and oxalate-bound-calcium to inorganic calcium carbonate (precipitated chalk). Nonoxalate calcium was slightly more available than calcium carbonate, but both were much more available than calcium oxalate.

We also have found calcium oxalate crystals in soybean and cottonseed meals. Typical crystals of calcium oxalate from soybean meal are shown in Figure 3.1c. These crystals are shaped differently than those in alfalfa and clovers, probably because of the type of cell in which they originate.

Crystals from cottonseed meal (Figure 3.1d) have unique characteristics; they are conglomerates of several crystals. The calcium content of these two meals is low, but because part of it is tied up in crystals, they may contribute even less calcium than previously thought. Currently, we are measuring the amount of calcium tied up as oxalate in these oil meals.

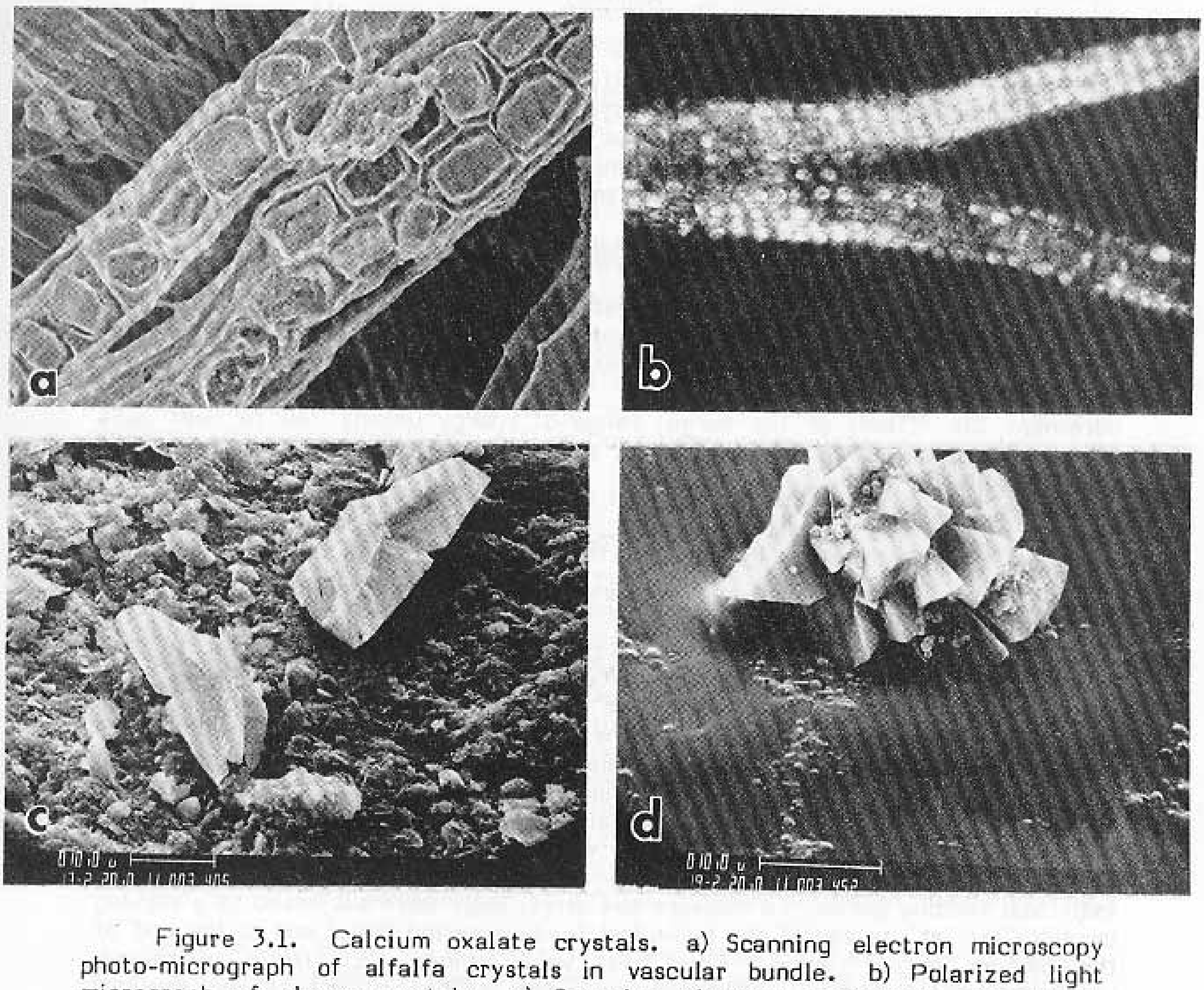


Figure 3.1. Calcium oxalate crystals. a) Scanning electron microscopy photo-micrograph of alfalfa crystals in vascular bundle. b) Polarized light micrograph of clover crystals. c) Scanning electron micrograph of soybean crystals. d) Scan- ning electron micrograph of cottonseed crystal.

(NOTE: A bibliography is available on request from the authors).

Effect of Energy Intake on Semen Characteristics, Sex Drive, and Scrotal Circumference of Yearling Beef Bulls

Dick Pruitt, Larry Corah, Guy Kiracofe,
Miles McKee and Mark Spire

Summary

Simmental and Hereford bulls were fed individually three levels of energy per breed for 200 days beginning shortly after weaning. Then all bulls were adjusted to a roughage ration for 10 days, before grazing brome pasture for 38 days as one group. High energy did not decrease semen quality or sex drive. Energy level affected scrotal circumference of the Simmentals but not Herefords. Weight loss on pasture did not decrease semen quality or sex drive.

Introduction

Studies at other universities indicate that high energy diets can decrease semen production of two-year-old beef bulls and sex drive of yearlings. Extremely low energy diets beginning at a young age can delay puberty and permanently impair sperm production. The objective of this study was to determine the effects of the normal range of energy usually fed to beef bulls after weaning on semen characteristics, sex drive and scrotal circumference of yearling bulls.

Procedure

Twenty-nine Simmental and 27 Hereford bulls were individually fed three levels of energy per head (Table .1) from an average age of 212 (weaning) to 412 days, ending in May. Then bulls were adjusted to a roughage ration for 10 days and grazed as one group on brome pasture for 38 days, ending in June. The nutritional scheme represents the range of energy normally fed to beef bulls from weaning to approximately 14 months of age, followed by a typical diet for bulls during the breeding season. All diets exceeded NRC protein and mineral requirements. Bulls were allotted to energy levels by herd of origin, sire, age, weight and hip height. At 25-day intervals, weight, height at the hip and scrotal circumference were measured after bulls were held off feed and water overnight. Backfat thickness was measured by ultrasonic scanning at the end of the individual feeding period. To measure sex drive, bulls were subjected to a serving capacity test at the end of the individual feeding period (May) and at the end of the pasture period (June). Four bulls were penned with three restrained, ovariectomized heifers in induced estrus. The number of mounts and services were recorded for 30 minutes. In May and June, semen was collected from all bulls with an artificial vagina and evaluated for volume, concentration, motility, aged acrosomes and percentage normal sperm.

Results were statistically analyzed one breed at a time and no breed comparisons were intended.

Results and Discussion

Initial measurements, May backfat and actual gains are shown in Table 1. The only semen characteristic affected by energy level was an unexplainable depression in semen volume for the Simmentals fed the medium level of energy. The only semen characteristic affected by month of collection was a decrease in motility for Herefords from May to June.

For Simmentals there was no overall effect of energy level on the number of services during the serving capacity tests (Table 4.2), but there was an interaction between month and energy level. The decrease in the number of services between May and June was greater for bulls on the medium and high levels of energy. Mounts per service were not affected by energy level, but were higher in June than May.

For Herefords the number of services increased as energy level increased but mounts per service were not affected (Table 4.2).

Simmentals fed more energy had larger mean scrotal circumferences in May. That advantage was maintained even at the end of the pasture period in June. Thus, small differences in scrotal circumference of bulls under different management may be the result of nutritional variations. Energy level did not affect scrotal circumference of the Hereford bulls.

Correlations with May backfat indicate that none of the energy levels resulted in bulls being too fat for optimum semen quality or sex drive. The Hereford bulls maintained or lost weight while on pasture, but that had no effect on semen characteristics (Table 4.3) or the number of services.

In general, Simmental bulls on the low level of energy gained weight while on pasture and those on medium and high energy levels maintained or lost weight. There was a positive statistical correlation between weight change on pasture and change in semen quality (Table 4.3). But bulls that gained more weight on pasture had lower semen quality at the beginning of the pasture period as indicated by the negative correlations between pasture weight change and May semen quality. Thus, Simmental bulls thin enough to gain weight on pasture from May to June had lower semen quality in May and more improvement in semen quality during the pasture period than Simmental bulls losing weight.

The range in May backfat thickness for the Simmentals was small. In this case, pasture weight change may have been a more accurate indication of body condition than backfat thickness. The correlations between weight change on pasture and semen quality indicate that some of the Simmental bulls were fed too little during the individual feeding period to have high semen quality in May.

High energy levels did not decrease semen quality and sex drive of yearling bulls. Within the range of energy normally fed to beef bulls up to 14 months of age, producers may be more likely to underfeed larger framed breeds like Simmentals, than overfeed British breed bulls like Herefords.

Table 4.1. Energy Intake, Initial Measurements and Actual Gains

	Simmental			Hereford		
	Low	Medium	High	Low	Medium	High
Number of bulls	10	9	10	9	9	9
Daily metabolizable energy intake (Mcal per day) during the individual feeding period						
Day 0-75	13.99	18.12	21.51	12.79	16.32	19.29
Day 76-150	14.47	19.22	24.18	13.38	17.69	23.19
Day 151-200	15.78	20.68	26.80	14.34	18.87	24.91
Day 0-200	14.62	19.17	23.83	13.40	17.47	22.16
Individual feeding period						
Initial age, days	211	212	212	211	208	213
Initial hip ht, in.	44.5	44.1	44.5	41.3	40.9	40.9
Initial wt., lbs	547	534	540	505	505	509
Average daily gain,lbs	1.70	2.49	2.82	1.85	2.29	2.82
May backfat, in.	.11	.13	.18	.24	.28	.41
(range)	(.08-.15)	(.08-.20)	(.10-.22)	(.15-.30)	(.20-.40)	(.22-.60)
Pasture period (May to June)						
Average daily gain,lbs	1.12	-.51	-.75	.13	-.88	-1.56

Table 4.2. Effect of Energy Intake and Month on Sex Drive and Scrotal Circumference

	Simmental				Hereford			
	Low	Medium	High	All Simmental	Low	Medium	High	All Hereford
Number of services[1]								
May	3.4^{ab}	4.0^{a}	3.3^{bc}	3.3^{d}	2.6	3.3	3.8	3.2^{d}
June	3.3^{ab}	1.8^{c}	1.8^{c}	2.3^{e}	1.6	2.3	3.4	2.4^{e}
Mounts per service								
May	7.2	8.7	5.2	7.0^{d}	5.9	4.8	3.3	4.7
June	8.7	15.0	13.8	12.5^{e}	6.7	9.3	4.3	6.8
Scrotal circumference, in.								
May	34.2^{a}	35.4^{b}	35.7^{b}	35.1^{d}	33.1	34.0	33.8	33.6
June	35.0^{a}	36.1^{b}	36.4^{b}	35.8^{e}	33.3	33.6	33.1	33.3

[1]The only interaction between energy level and month was for the number of services for Simmentals (P = .04).

[a,b,c]Within breed means with different superscripts differ (P<.05).
[d,e]Means in the same column with different superscripts differ (P<.05.

Table 4.3. Partial Correlations with Weight Change While on Pastre (May to June)[1]

	Simmental			Hereford		
	May	June	Change (May to June)	May	June	Change (May to June)
Semen characteristics						
Volume	-.04	.14	.15	-.15	.04	.14
Concentration	-.20	.06	.18	.02	-.03	-.04
Motility	-.43	.09	.36*	-.07	-.01	.03
Normal sperm	-.46**	.31	.59**	-.02	-.22	-.14

[1]The model included age as an independent variable.
*P<.05; **P<.01.

Comparison of Two Testosterone Treatments for Heat Detector Cows

M.D. Heekin and G.H. Kiracofe

Summary

Testosterone propionate and testosterone enanthate treated cows were equally effective as heat detectors but the testosterone enanthate treatment required at least 9 fewer injections and less time from first injection until the cow was active as a detector.

Introduction

Cows in heat can be missed during regularly scheduled heat observations due to large pasture size, short daylight, and high frequency of mounting between midnight and six a.m. Detector animals can detect cows in heat that would otherwise be missed.

Testosterone treated cows are generally more active, mount more often, have more libido, and maintain their libido longer than gomer bulls. Cull cows are also more readily available, safer, easier and less expensive to prepare than gomer bulls.

Previous KSU Cattlemen's Day reports (Laaser, 1977 and 1978) have shown the effectiveness of treating cows with testosterone propionate. Testosterone enanthate has been shown to be effective for preparing detector cows. Our research compared the effectiveness of the two testosterone forms.

Experimental Procedure

Eight cull open Hereford cows (four per year) were prepared with 10 injections of 200 mg of testosterone propionate every other day for 20 days, then maintained during heat detection with 200 mg testosterone propionate every 7 to 10 days. Eight more cows (four per year) were prepared with 2 gm testosterone enanthate (.5 gm intramuscularly and 1.5 gm subcutaneously in two locations) 3 days before use, then maintained with .5 to .75 gm of testosterone enanthate subcutaneously every 10 days to 2 weeks.

One testosterone propionate and one testosterone enanthate treated cow, with different color of dye in their chinball marker, was placed in each pasture. The number of cows marked by each testosterone treatment, or marked by both, was recorded. All cows were checked at least once a day.

Results

Three hundred and seventy-one markings were recorded over 2 years. The number of cows found in heat was almost identical between the testosterone propionate and the testosterone enanthate cows.

Testosterone enanthate saved time and labor and is now available[1] and ready to use at lower cost per cow than testosterone propionate. Both hormones are available by prescription only from a veterinarian as an "extra-label" use.

Proper management of testosterone-treated cows is vital. Select cows at least three years old or older in moderate to good condition. Use cows with sound feet and legs, with no prolapse history, and gentle enough to handle regularly. One testosterone treated cow can detect heat in 30 cows, during continuous use. More than one cow can be used in a pasture, but they will mount each other when no other cows are in heat.

Testosterone treated cows will show dominance over nontreated cows, but treated cows maintain a social relationship among themselves. Occasionally one treated cow will dominate another treated cow when paired together. The subordinate cow may not mount as often unless she is placed by herself. Treated heifers do not perform as well as mature cows, especially when paired with an older cow. Check detector cows frequently for soundness and chinball marker retention and operation. We found markers with leather straps more durable and less abrasive to the cow than those with nylon straps.

An additional use of testosterone treated cows is for artificial insemination practice, but avoid exposing them to bulls since some of them remain fertile.

[1]Henry Schein, Inc., Port Washington, NY.

Response Time to Estrus Synchronization

R.R. Schalles, Mark Spire, and Colleen Clarke

Summary

Heavy milking cows took longer to respond to estrus synchronization than light milking cows. There was no difference in response time between cows treated with Estrumate and Lutalyse. Cow weight, height or condition had no effect on estrus response time.

Introduction

Several products are available to synchronize estrus in cows. Response time from administration to estrus was compared using Lutalyse® and Estrumate®. The effect of breed, age, lactation status, weight, height, condition and level of milk production on response time were evaluated.

Experimental Procedures

Ninety observations were obtained from 70 Polled Hereford and Simmental cows synchronized with either Lutalyse® or Estrumate®. Cows were from 2 to 14 years old and all had at least one normal estrus after calving. Cows were synchronized on May 8, May 22 and June 5. Weights and hip heights were obtained on May 4 and weights on June 4. Milk production was measured using the standard weigh-suckle-weigh procedure on May 21-26 and June 21-26. Ratio of weight to height was used to estimate condition. Cows were checked twice daily and androgenized cows with markers were used to aid in estrus detection. A generalized linear model was used to obtain least squares means and regression coefficients.

Results and Discussion

Heavy milking cows took longer to respond to estrus synchronization than light milking cows (P=0.03). Each additional 10 lbs of daily milk production increased the response time by 9 hours.

There was no difference in response time between Estrumate® and Lutalyse® (Table 6.1), between Polled Hereford and Simmental cows or among the three treatment dates. Lactating cows tended to respond slower (P= .17) than dry cows. Older cows responded slightly sooner (P= .09) than younger cows (1.2 hours for each year older). Cow weight, height, or condition had no influence on response time.

Table 6.1. Time from Treatment to Estrus

Groups	No. observations	Hours
Date		
May 8	31	70.8±3.6
May 22	26	65.8±3.9
June 5	33	63.5±3.8
Breed		
Polled Hereford	37	66.5±4.4
Simmental	53	66.9±4.1
Lactation status		
Dry	10	62.9±5.0
Lactating	80	70.5±1.9
Product		
Estrumate®	43	68.1±3.0
Lutalyse®	42	65.3±3.3

HOW DO PROSTAGLANDINS SYNCHRONIZE ESTRUS?

When a cow ovulates, a corpus luteum forms and remains on the ovary. That corpus luteum produces progesterone, which prevents the cow from showing estrus (heat). If the cow is bred and settles, the corpus luteum remains, and the progesterone produced helps maintain pregnancy. If she is not pregnant, the corpus luteum regresses in about 17 days, and the ovary prepares for the next cycle. Prostaglandin and many of its related compounds will cause the corpus luteum to regress if it is injected between 5 and 17 days after heat. Because the corpus luteum is no longer present, progesterone secretion stops, and the cow exhibits heat in about 3 days. Since prostaglandin doesn't work during the first 5 days of the cycle, a single injection of prostaglandin will synchronize only about three-fourths of the cycling cows. So another injection 11 to 12 days after the first is needed to make sure that all the cycling cows come into heat. Obviously, prostaglandin will not cause estrus in a cow that is not cycling. Because progesterone from the corpus luteum is necessary to maintain pregnancy, an injection of prostaglandin will cause abortion up to about 150 days of pregnancy.

Heat Synchronization with Alfaprostol[1]

Lou Ellen Keay, Guy Kiracofe,
Ken Odde, and Jeff Stevenson

Summary

One-hundred eighteen heifers were used to determine the effectiveness of Alfaprostol as a heat synchronizing agent. Seventy-nine were injected twice (12 days apart) with 6 mg Alfaprostol per head and 39 were not treated. Twelve to 96 hours after the second injection 88.6% of the treated heifers were in standing heat and 81.4% of those in heat conceived at the first insemination. Eighty-one percent of the 37 untreated heifers in heat the first 21 days conceived at the first insemination. Ninety-one percent of the treated heifers and 89.2% of the untreated heifers conceived within a 50-day breeding period, so Alfaprostol did not affect reproductive performance.

Introduction

Prostaglandins (Lutalyse®) have been used since 1979 to synchronize heat in cattle. More recently a prostaglandin analog (Estrumate®) also has been used for heat synchronization. Our trial was conducted to determine the effectiveness of another prostaglandin analog, Alfaprostol, as a synchronizing agent and to determine its affect on conception rates.

Procedure

Treated heifers each received two I.M. injections of 6 mg of Alfaprostol. The first injection was given according to the day of the heifer's cycle. All days of the cycle (0-20, heat = 0) were represented. The heifers were observed for signs of heat every 6 hours, but none were inseminated after the first injection. A second injection was given 12 days after the first. All heifers were observed for signs of heat every 6 hours for the first 5 days after the second injection and twice daily for the next 45 days. Both treated and untreated heifers were artificially inseminated 12 to 18 hours after being detected in standing heat. Pregnancy was determined by rectal palpation approximately 50 days after the end of the breeding period.

[1] Alfaprostol is a prostaglandin analog provided by Hoffmann LaRoche, Inc., who provided partial financial assistance for the trial. Alfaprostol is not currently cleared by the FDA for use in cattle.

Results and Discussion

Table 7.1 shows the number of heifers and the interval from the second injection to heat and conception. Approximately 89% of the heifers were in heat between 12 to 96 hours after the second injection and 81.4% of these conceived at the first insemination. Approximately 77% of all treated heifers conceived within the first 21 days of the breeding period. Thirty-seven untreated heifers were in heat the first 21 days of the breeding period and 81% (30) conceived to the first insemination. Ninety-one percent of the treated heifers and 89.2% of the untreated heifers conceived during the 50 day breeding period.

Table 7.1. Distribution of Heat and Conception after Two Injections of Alfaprostol

Hrs to heat after second injection	Less than 24 hrs	25-36	37-48	49-60	61-72	73-84	85-96	Total to 96 hrs	Total in 21 days
No. in heat	1	3	13	22	13	8	10	70	78
No. conceived	0	2	8	18	12	8	9	57	60

Alfaprostol was effective in synchronizing heat to 4 days, but did not appear to synchronize heifers close enough for a single, timed insemination. Alfaprostol did not affect first insemination conception rates during the synchronized period (4 days) when 81.4% of the heifers conceived as compared to 81.0% for the untreated heifers the first 21 days of the breeding period. Alfaprostol had no long term effect, as indicated by the similar conception rates at the end of the 50 day breeding period.

Although Alfaprostol is not currently cleared for use, it appears to be a good potential synchronizing agent that has no effect on conception rates.

Cause and Effect of Calving Difficulty in First Calf Heifers on Subsequent Reproductive Performance and Weaning Weights of Progeny[1]

R.P. Bolze, R.J. Pruitt and L.R. Corah

Summary

Eight years of records for 1495 2-year old beef heifer calvings from two Kansas ranches were analyzed to determine the cause and effect of calving difficulty on subsequent reproductive performance and weaning weights of progeny. The study involved two herds of Simmental cattle (spring and fall calving) and one herd of fall calving Angus cattle. Heifers were classified as either requiring or not requiring assistance with their first calf. Herds were analyzed separately. Percentages of heifers requiring assistance for the Angus, spring calving Simmental and fall calving Simmental herds were 36%, 57% and 38%, respectively. In all herds, calves from 2-year-old heifers requiring assistance were 5.5 to 10.3 lbs heavier at birth and had a 4.5 to 10% higher mortality rate than calves from unassisted heifers. Overall conception during a subsequent 63 day breeding season after their first calf was 9% lower for assisted than unassisted heifers. Angus heifers requiring assistance were 8 days younger at their first parturition. Spring calving Simmental heifers requiring assistance delivered 15% fewer calves within the first 21 days of the subsequent calving season. Calves from fall calving Simmental heifers requiring assistance weaned (unadjusted) 18 lb heavier. Nineteen percent more heifers requiring assistance with their first calf also had required assistance during their own birth. Maternal grand sires had a significant effect upon their daughters' reproductive and growth performance and upon their daughters' progeny performance.

Introduction

To maximize the production from a herd, heifers must first calve as 2-year-olds. Those heifers have not yet reached their mature size, and resulting calving difficulties cause increased veterinary labor expense, increased death losses of cows and calves and decreased subsequent reproductive performance. The objectives of this study were to determine the cause and effect of calving difficulty on subsequent reproductive performance and on weaning weights of progeny in purebred cattle.

[1]Appreciation is expressed to Henry Gardiner, Gardiner Angus Ranch, Ashland, Ks, and Roy Parsons, Ecco Simmental Ranch, Buffalo, Ks for making data available.

Experimental Procedure

One Kansas ranch with fall calving Angus and another with both spring and fall calving Simmental cattle provided 8 years of records for 1495 2-year-old first calf heifers. Data collected included the heifer's birthdate, sire, degree of calving difficulty at her own birth, her birth weight, actual weaning weight and actual yearling weight (Table 8.1). For the Simmental cattle the heifer's percent Simmental breeding was also recorded. At the heifer's first parturition, we recorded her age in days, her calf's birth date, birth weight, degree of calving difficulty, calf mortality and sire. Unadjusted calf weaning weights were also recorded. Rebreeding data included first service and overall conception rates, days open from parturition to conception, percent of heifers detected in heat and bred by 21-day periods and percent of heifers delivering their second calf during the first 21 days of the following calving season. Second calf data included dam's age in days and the calf's unadjusted weaning weight. Heifer's sire and sire of her first calf were analyzed for their effect on the reproductive and performance traits.

Results and Discussion

Thirty-six percent of the first calf Angus heifers required assistance. Assisted calves were 6.8 lbs heavier at birth and had a 4.46% higher mortality rate than unassisted calves. Assisted heifers were 7.96 days younger at their first parturition and had a 8.96% lower subsequent overall conception rate.

Fifty-seven percent of the spring calving Simmental heifers required assistance. The calves were 10.32 lbs heavier at birth and had a 9.99% higher mortality rate than those unassisted. Percent of 1/2, 3/4 and 7/8 percentage Simmental heifers requiring assistance were 50, 71 and 55, respectively. Of assisted heifers, 15.25% fewer calved in the first 21 days of the subsequent calving season. Assisted heifers also had a 12.58% lower first service conception rate.

Thirty-eight percent of the fall calving Simmental heifers required assistance. Calves from assisted heifers were 5.54 lbs heavier at birth, 18.04 lbs heavier at weaning and had a 9.12% higher mortality rate. Subsequent overall conception rate was reduced in assisted heifers by 9.17%. Also, 57.78% of heifers requiring assistance at their own birth required assistance with their first calf. In contrast, only 38.88% heifers born unassisted required assistance with their first calf. Thus, cattlemen can probably reduce calving difficulty by using replacement heifers that were themselves delivered without assistance.

Our data indicate that sire selection significantly affects progeny growth performance and daughters' reproductive and growth performance. There were significant differences between maternal grand sires for daughters' birth weight, weaning weight, yearling weight, age in days at first and second parturition, days open, and weaning weights of first and second calves. There were significant differences between sires for calf birth weights and unadjusted weaning weights.

Although we did not intend to compare spring and fall calving Simmental herds, some differences are quite evident. The fall calving herd had an advantage in first service and overall conception rate, percent of heifers detected in heat and bred during the first 21 days of the breeding season and percent of heifers calving during the first 21 days of the following calving season (Table 8.2). The spring herd had higher actual weaning weights of first and second calves (Table 8.3).

Table 8.1. Relationship Between Heifers' Performance Data and Degree of Calving Difficulty

Trait	Fall calving Angus herd		Spring calving Simmental herd		Fall calving Simmental herd	
	First calf		First calf		First calf	
	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted
Heifers birth weight, lbs	72.15	70.72	71.98	72.69	73.02	73.07
Calving difficulty at heifer's birth, %						
Unassisted			47.02	52.98	61.67[a]	38.33[b]
Assisted			31.25	68.75	42.22[a]	57.78[b]
Heifer's unadjusted weaning wt, lbs	420.58	414.04	495.74	500.58	423.50	419.23
Heifer's unadjusted yearling wt, lbs	627.43	643.83				
Age first parturition (days)	723.93[a]	715.97[b]	714.39	716.15	719.58	717.52
Age second parturition (days)	1101.33	1100.37	1118.51	1107.11	1110.63	1115.79

[ab](P<.05) within a trait and herd.

Table 8.2. Influence of Calving Difficulty on Subsequent Reproductive Performance

Trait	Fall calving Angus herd		Spring calving Simmental herd		Fall calving Simmental herd	
	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted
Days open	93.26	97.78	122.04	111.03	113.05	115.07
Conception rates						
First service, %	56.35	47.33	46.25[c]	33.67[d]	54.55	54.14
Overall, %	84.25[a]	75.29[b]	73.68	64.57	79.26[a]	70.09[b]
% detected in heat and bred, 21 day periods						
First	83.67	80.24	50.00	47.52	76.16	69.57
Second	11.55	16.77	48.75	47.52	13.52	20.73
Third	4.78	2.99	1.25	4.96	10.32	9.76
% heifers calving first 21 days of second calving season	61.64	59.09	51.65[a]	36.36[b]	62.18	58.87

[ab](P<.05) within a trait and herd.
[cd](P=.08).

Table 8.3. Relationship of Calving Difficulty to Calf Mortality, Birth Weight and Weaning Weights

Trait	Fall calving Angus herd		Spring calving Simmental herd		Fall calving Simmental herd	
	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted
Calf mortality, %	3.84[a]	8.30[b]	2.11[a]	12.10[b]	1.43[a]	10.55[b]
Birth weight first calf, lbs	65.90[a]	72.71[b]	70.43[a]	80.75[b]	71.21[a]	76.73[b]
Unadjusted weaning weight first calf, lbs	396.89	403.51	471.27	475.60	420.71[a]	438.74[b]
Unadjusted weaning weight second calf, lbs	413.65	417.45	461.60	486.31	458.13	466.83

[ab](P<.05) within a trait and herd.

Aborting Feedlot Heifers with Alfaprostol[1]

Lou Ellen Keay, Guy Kiracofe,
Jack Riley, and Mike Simon

Summary

The effectiveness of alfaprostol in inducing abortion was tested in 93 pregnant heifers. Alfaprostol was injected intramuscularly, .7 mg per 100 pounds body weight. Twenty-four heifers were injected when they averaged 83 days (range 64 to 86) pregnant, while 23 were injected when 138 days (range 119 to 143) pregnant. A control injection of the Alfaprostol carrier, propylene glycol, was given 23 heifers averaging 81 or 134 days pregnant. By 14 days after the Alfaprostol injection 79% of the heifers 83 days pregnant and 96% of the heifers 138 days pregnant had aborted. Two of the 83-day controls and none of the 138 day controls aborted.

Since Alfaprostol (5.4 mg) was very effective up to at least 140 days of pregnancy, but somewhat less effective earlier, the dosage may need to be increased for lighter or earlier pregnancy heifers. No serious side effects were noted in aborted heifers.

Introduction

Prostaglandins (Lutalyse®) are used routinely to abort incoming feedlot heifers, but they are less effective in the second trimester of pregnancy. Our trial was conducted to determine the effectiveness of Alfaprostol, a prostaglandin analog, in aborting feedlot heifers in the first and second trimester of pregnancy when injected at .7 mg per 100 pounds of body weight.

Procedure

Twenty-four heifers averaging 83 days pregnant and 23 heifers averaging 138 days pregnant were each weighed and given a single intramuscular injection of Alfaprostol at the rate of .7 mg per 100 pounds of body weight. The Alfaprostol was in a propylene glycol carrier at a concentration of 1.0 mg per cc of carrier. Twenty-three heifers averaging 81 days pregnant and 23 heifers averaging 134 days pregnant served as controls. Each control was weighed and received a single, intramuscular injection of only the propylene glycol carrier, .7 cc per 100 pounds of body weight. After injection, all heifers were observed twice daily for 28 days for signs of stress, abortion-related complications, and heat. All heifers were rectally palpated at 14 and 28 days after injection to determine if they had aborted.

[1] Alfaprostol is a prostaglandin analog from Hoffmann-LaRoche, Inc., who provided partial financial assistance for this trial. Alfaprostol is not currently cleared by the FDA for use in cattle.

Results and Discussion

At the dosage given, Alfaprostol was not as effective in inducing abortion at 83 days pregnant (79%) as it was at 138 days (96%) (Table 9.1). Heifers were heavier at the later stage of pregnancy and received a larger dosage (5.9 vs. 5.4 mg) of alfaprostol, which may explain the difference. In contrast, Lutalyse® is less effective later in pregnancy when using a constant dosage.

Table 9.1. Abortion Rate in Pregnant Heifers Treated with Alfaprostol

Treatment	Mg (cc's) injected	Avg. wt. (lbs)	Days pregnant	Number treated	Number aborted 14 days	Number aborted 28 days	% aborted
Alfaprostol	5.4 (5.4)	790	83	24	19	19	79
Control[a]	0 (5.4)	789	81	23	2	2	9
Alfaprostol	5.9 (5.9)	858	138	23	22	22	96
Control	0 (6.6)	974	134	23	0	0	0

[a]Controls were injected with propylene glycol, which was the carrier for the Alfaprostol

Thirty-five Alfaprostol treated heifers aborted within 6 days after injection. Fetal membranes were retained up to 10 days in both groups. Uterine discharge was noted up to 20 days after injection in heifers aborted at 138 days of pregnancy. Only two heifers showed any signs of distress after being aborted. Except those two, all came to the feed bunk at every feeding. Eighty-seven percent of the Alfaprostol-treated heifers that aborted exhibited heat within 14 days after injection. Some udder development was observed in 11 heifers aborted in the later group. Performance was reduced in the heifers aborted at 138 days of pregnancy (see page 89, this progress report.

Although Alfaprostol is not currently cleared for use, it appears to be a potentially successful abortifacient for feedlot heifers up to at least 140 days of pregnancy. However, adjustments may be needed in dosage, as it was more effective in the heavier heifers in the second trimester than on the lighter heifers in the first trimester.

Efficacy of Lutalyse® as an Abortifacient in Feedlot Heifers[1]

Danny Simms,[2] Gerry Kuhl,
Steven Tonn[3] and Robert Schalles

Summary

Lutalyse aborted 86.7% of heifers 40 to 100 days pregnant. Of four heifers tested at 101 to 150 days pregnant, all aborted. Open heifers gained faster ($P<.05$) than heifers that either were aborted or pregnant at slaughter. Those pregnant at slaughter had lower ($P<.05$) dressing percentages than either open or aborted heifers.

Introduction

Recently, Lutalyse ($PGF_2\alpha$) was approved as an abortifacient in feedlot heifers. The purpose of this field trial was to study its effectiveness, and evaluate the effect of pregnancy on heifer performance, dressing percentage and carcass characteristics.

Experimental Procedure

Three hundred six beef heifers entering a commercial feedlot were rectally palpated during processing; 20.9% were in various stages of pregnancy. Forty-nine pregnant heifers were injected with 5 ml (5 mg $PGF_2\alpha$ /ml) of Lutalyse to induce abortion. Individual, non-shrunk weights were taken at the beginning and end of the 112 day trial. All cattle were fed and handled in the same manner. The heifers also were used in an implant trial, so the data were adjusted to eliminate implant effects.

Results

Lutalyse aborted 39 of 45 heifers (Table 10.1) that were 40 to 100 days pregnant. That was very close to what we expected based on previous research. Lutalyse has been shown to be less effective as the length of gestation increases. However, of four treated heifers 101 to 159 days pregnant, all aborted.

[1]Appreciation is expressed to Jerry Kobler, Riverside Feeders, Inc., Penokee, KS for supplying cattle and facilities, and Iowa Beef Processors, Holcomb, KS for slaughter and carcass data assistance.

[2]Northwest Area Extension Livestock Specialist.

[3]Graham County Extension Agricultural Agent.

Heifers that were open at arrival gained faster (P<.05) than heifers that were aborted or pregnant at slaughter (Table 10.2). Open heifers yielded carcasses that were 13 lbs heavier than aborted heifers (N.S.) and 41 lbs heavier than pregnant heifers (P<.05). As might be expected, the dressing percentage of pregnant heifers was lower (P<.05) than open or aborted heifers. There were no significant differences in ribeye area, backfat thickness or quality grade among treatments.

Table 10.1. Effectiveness of Lutalyse as an Abortifacient in Feedlot Heifers

Stage of Pregnancy	No. Injected	No. Aborted	% Aborted
40-100 days	45	39	86.7
101-159 days	4	4	100.0

Table 10.2. Effect of Pregnancy on Daily Gain and Dressing Percentage of Heifers

	Pregnancy Status		
	Open	Aborted	Pregnant
No. Heifers	249	43	14
Initial wt., lb	673.6	672.8	673.5
Final wt., lb	1001.8	970.7	970.3
Total gain, lb	328.2	297.9	296.8
Avg. daily gain, lb	2.93^a	2.66^b	2.65^b
Carcass wt., lb	607.8^a	594.5^{ab}	566.4^b
Dressing percent	60.7^a	61.3^a	58.5^b

^{a,b}Values with different superscripts differ significantly (P<.05).

Steer Gains on Burned and Nonburned Bluestem Pasture, 1978 to 1982

Ed F. Smith and Clenton Owensby

Summary

From 1978 to 1982, steers on a late spring burned pasture averaged 40 lbs more gain each summer than steers on a non-burned pasture.

Experimental Procedures

For many years we have studied the impact of late-spring burning of native bluestem pasture on vegetation and cattle. The effect on steer gain for the summers of 1978 through 1982 is reported here. The 44 acre pasture, was burned each year in late April. The non-burned pasture is 60 acres. Weights were taken in the morning after the steers were penned without feed or water overnight. Both pastures were stocked at about the same rate.

Results and Discussion

Annual burning increased average steer gains (P<.05) by 40 pounds (Table 11.1). The early spring burned pasture has been burned each year since 1951 and the gains have been greater on it nearly every year.

Table 11.1. Steer Gains on Burned and Non-burned Bluestem Pasture. April 27 to Oct. 3, 1978 (154 days), May 7 to Oct. 3, 1979 (149 days), May 1 to Oct. 2, 1980 (154 days), April 30 to Sept. 30, 1982 (152 days), May 10 to Sept. 28, 1982 (141 days)

	Acres per steer	Initial wt. lbs	Gain lbs	Daily gain lbs [a]
Nonburned				
1978	4.0	519	181	1.18
1979	3.2	429	184	1.23
1980	3.3	465	155	1.00
1981	3.3	524	210	1.38
1982	3.5	568	215	1.52
Burned				
1978	4.0	521	221	1.44
1979	3.1	435	229	1.44
1980	3.3	485	215	1.40
1981	3.4	518	240	1.58
1982	3.7	583	242	1.72

[a] Gains were significantly greater (P<.05) each year for the burned pasture.

Stocking Rate, Supplementation and Implants for Steers Grazing Bluestem Pasture in Early Summer

Rosalie Held, Jack Riley,
C.E. Owensby and E.F. Smith

Summary

Native bluestem pastures were grazed from May 10 to July 15, 1982 by steers averaging 599 lbs, at stocking rates 1.82, 1.5, 1.2 acres per steer. Daily gains were similar for all rates, but gain per acre increased with increased stocking rate.

Half of the steers were self-fed a salt-limiting sorghum grain-Rumensin® mixture, at about 1.8 lb per steer per day. Supplementation increased daily gain ($P<.05$) but actual differences were small (2.08 vs. 1.91 lb per day). Gain per acre was increased 7 lbs by supplementation.

Herbage yields at mid-July were least on the heavily stocked pastures, but by October regrowth on all pasture was equal. Stocking rate did not affect botanical composition.

There were no significant gain differences for steers implanted with either Compudose®, Ralgro® or Synovex®, even though 24 percent of the Compudose implants were lost by mid-summer.

Introduction

Previously, we found that early season intensive stocking of bluestem pastures (May to July 15) resulted in daily gains for that period similar to those made during the same period by steers grazing all summer at normal stocking rates. This trial continued to evaluate different intensive stocking rates.

This trial also repeated last year's study (Held and others, Cattlemen's Day, 1982) examining Rumensin® self-fed with sorghum grain in a salt-limiting mixture.

Experimental Procedure

One 63 acre and five 60 acre pastures were randomly assigned to one of three stocking rates: 1.82, 1.50 and 1.20 acres per steer from May 10 to July 15, 1982, two pastures per rate. Steers in one pasture per stocking rate received supplement (Table 12.2) while steers in the other pastures received only salt. The steers, primarily British breeding, averaged 599 lbs initially. Steers were implanted with either Compudose, Ralgro or Synovex.

Results and Discussion

Results are shown in Tables 12.1, 12.2, and 12.3. There were no differences in gain due to stocking rate (Table 12.1). Supplemented steers gained more than nonsupplemented steers, and gain per acre increased with both increasing stocking rates and supplementation (Table 12.2).

Herbage remaining in mid-July reflected the stocking rate with only 660 lbs per acre remaining at the highest stocking rate (Table 12.4). On October 1 the regrowth on all pastures was equal, regardless of stocking rate. Botanical composition was not affected by stocking rate.

Steers implanted with either Compudose, Ralgro or Synovex gained about the same, even though 24% of the Compudose implants could not be detected at mid-summer.

Table 12.1. Effect of Stocking Rate of Steers on Intensive, Early Stocked Bluestem, May 10 - July 15, 1982 (66 Days)

	Stocking rate (acres per steer)		
	1.82	1.50	1.20
Steers per treatment	66	80	103
Avg. beginning wt., lb	597	609	592
Avg. gain per steer, lb	136[a]	127[a]	131[a]
Daily gain per steer, lb	2.06[a]	1.92[a]	1.98[a]
Gain per acre, lb	75	85	110

[a]No significant differences (P<.05) were found.

Table 12.2. Effect of grain supplementation on performance of steers on intensive, early stocked bluestem

Stocking rate (acres/steer)	Supplement			Nonsupplemented		
	1.82	1.5	1.2	1.82	1.5	1.2
Steers per treatment	33	40	50	33	40	53
Supplement consumed per head daily (self-fed)						
Ground sorghum grain,lb	1.73	1.91	1.41	0	0	0
Salt, lb	.19	.21	.16	0	0	0
Rumensin, mg	192	210	156	0	0	0
Avg. gain per steer, lb	144	122	146	128	132	119
Daily gain per steer, lb	2.18	1.85	2.21	1.94	2.0	1.80
Gain per acre, lb	79	81	122	70	88	100
Supplemented vs. nonsupplemented						
Avg. gain per steer, lb		137[a]			126b	
Daily gain per steer, lb		2.08[a]			1.91[b]	
Gain per acre, lb		94			87	

[a,b]Values in same row with different superscripts differ significantly (P<.01).

Table 12.3. Effect of implant on steer gains on intensive, early stocked bluestem[a]

	Compudose	Ralgro	Synovex
Steers per treatment	85	84	80
Avg. gain per steer, lb	131	131	132
Daily gain per steer, lb	1.98	1.98	2.00

[a]No significant differences (P<.05) were found.

Table 12.4. Herbage Remaining on Loamy Upland and Breaks Range Sites on Pastures Stocked at Indicated Rates from May 1 to July 15, 1982 (lbs per acre).

	Stocking Rate					
	1.82 acres per steer		1.50 acres per steer		1.20 acres per steer	
	Grass	Forbes	Grass	Forbes	Grass	Forbes
			Mid October			
Loamy upland	3608	339	2692	447	2899	539
Breaks	2362	193	1847	94	2255	335
			Mid July			
Loamy upland	1776	212	1094	365	681	182
Breaks	1258	117	826	78	643	344

The Kansas State University Range Research Center is located in the Flint Hills west of the University. It consists of 1139 acres, divided into 18 pie-shaped pastures of about 60 acres each, all connecting to working facilities in the middle. The center was established in 1946, and is the only university range cattle research facility in the Flint Hills. Because of its unique location, research carried out there is applied throughout the tall grass region. The grasses are a mixture of big and little Bluestem, Indiangrass and others. Dr. Ed Smith, of the Department of Animal Sciences and Industry is in charge of the area, but much of the research is in cooperation with Dr. Clinton Owensby, range research specialist in the Department of Agronomy. Wildlife and botanical composition studies are carried out on the facility by the Department of Biology.

Much of the research on burning of Flint Hills grasses has been done here. Spring burning reduces weed infestations, removes the undergrowth, and destroys encroaching cedar trees. Because the fire blackens the earth, solar radiation warms the ground faster, resulting in earlier spring grass growth. Spring burning is generally delayed until late April. That shortens the time between burning and regrowth, when the soil is poorly protected against water erosion.

For summer-long grazing, the usual stocking rate is 3.5 acres per steer. But since more forage is available in the spring and early fall than during the hot periods of mid summer, extensive research has been carried out on heavy stocking (as much as double the usual rate) early in the season. Gains per acre are improved, and feeder cattle are available to the feedyards when availability from other sources is low.

Inoculant and Urea-molasses Additives for Forage Sorghum Silage[1,2,3]

Mark Hinds, John Brethour[4],
and Keith Bolsen

Summary

Inoculant (1177 in one trial) and non-protein nitrogen (LSA-100 in two trials) silage additives were evaluated with whole-plant forage sorghum silage. Steers fed LSA-100 silage gained faster than steers fed control silage supplemented with soybean meal (4.8% in trial 1; 12% in trial 2). Feed conversion was improved 11% in trial 1 and was similar to the control silage in trial 2. Silage inoculated with 1177 supported rates and efficiencies of gain similar to the control silage.

Of the nitrogen added from LSA-100, 90.9% in trial 1 and 86.2% in trial 2 was recovered from the concrete stave silos. Dry matter recoveries averaged 6.0 percentage units less for LSA-100 silages than controls, however 1177 increased recovery by 2.65 units. In general, silage from the bottom half of each silo was far more stable in air than that from the top half. The additives did not consistently affect aerobic stability.

Introduction

In Kansas, forage sorghum silage is often the main component in cattle growing rations. Improved hybrid forage sorghum varieties can produce comparable dry matter yields to corn, with less fertilizer and moisture. In a previous trial, an inoculant additive improved dry matter recovery of forage sorghum silage while a non-protein nitrogen additive improved rate and efficiency of gains over the control silage fed with soybean meal (Progress Report 413, Kansas Agriculture Expt. Station). The two trials reported here continued our evaluation of inoculant and NPN additives for forage sorghum silage.

[1] Research was conducted jointly at the Hays Branch Experiment Station, Hays, and at Kansas State University, Manhattan.

[2] Pioneer 1177® Silage Inoculant contains dried Lactobacillus plantarum fermentation product and dried Streptococcus faecium fermentation product. Pioneer Hi-Bred International, Inc., Des Moines, IA 50308.

[3] LSA-100® liquid feed (molasses, urea, phosphoric and sulfuric acids to reduce pH to 3.0-3.2, ammonium polyphosphate, and trace minerals) contains 100% crude protein (not more than 99.5% non-protein nitrogen). Namalco, Inc., Willow Grove, PA 19090.

[4] Beef Research Scientist, Hays Branch Experimental Station, Hays.

Experimental Procedure

Trial 1: Forage sorghum silages were made at the Hays Branch Experimental Station in September, 1981 using DeKalb FS 4 hybrid, direct-cut in the medium-dough stage at 27 to 29% dry matter (DM). Treatments were control (no additive), and LSA-100, applied by hand at the silage blower, at 36 lb per ton of fresh crop. Silages were made in concrete stave silos (10 x 30 ft).

Dry matter losses during fermentation, storage, and feedout were measured by accurately weighing and sampling all loads of fresh crop ensiled and later weighing and sampling all silage removed from the silos. Ensiling temperatures were monitored for the first 10 weeks.

About 225 lb of fresh crop was removed from each silo during filling, and for each treatment, six plastic container silos (5 gallon capacity) were tightly filled by hand. The containers were sealed by lids fitted with rubber O-ring seals and Bunson valves, then transported immediately to Manhattan and stored in a room at about 30 C.

Stave silos were opened after 70 days and the silage fed at a uniform rate for the next 17 weeks. Silages were sampled weekly and cornposited to form a biweekly sample for chemical analyses. The 5 gallon plastic silos were opened approximately 210 days post-ensiling.

Thirty crossbred steers were fed at the Hays Station in a 122 day growth trial (November 20, 1981 to March 21, 1982). The steers, averaging 500 lb, were implanted with 36 mg of Ralgro and randomly allotted by weight, breeding, and previous gains to the two silage rations, one pen of 15 steers per ration. One lot was fed control silage *ad libitum* plus 1.83 lb of soybean meal (SBM) and .40 lb of premix (DM basis). The other lot was fed LSA-100 silage *ad libitum* plus 1.39 lb of grain sorghum, .44 lb of SBM, and .40 lb of premix. Rations were mixed and fed once daily and salt was available free-choice.

Average initial and final steer weights were on a pay-weight to pay-weight basis. To allow for weight loss during the weighing day, the steers were weighed collectively by pens, at the start of each weighing day and then weighed individually. All individual steer weights were pencil shrunk 4.0% to obtain the adjusted individual steer weights.

To measure aerobic stability, approximately 60 lb of fresh silage was obtained from 3 ft below the surface in the center of each silo at three times that corresponded to the top, middle, and bottom thirds of the silos. Those samples were transported immediately to Manhattan where they were divided into 4.0 lb lots and each lot was placed in an expanded polystyrene container lined with plastic. A thermocouple wire was placed in the center of each container and cheese cloth stretched across the top. Containers were stored at 18 to 20 C and the silage temperature was recorded twice daily. After a designated number of days of air exposure, replicated containers of each silage were weighed, mixed, and sampled and dry matter loss was determined.

Trial 2: Forage sorghum silages were made at the Beef Research Unit in Manhattan on October 23, 1981 using Pioneer 947 hybrid, direct-cut in the hard-dough stage at 42 to 43% DM. Treatments were: 1) control (no additive); 2) LSA-100 (40 lb per ton of fresh crop); and 3) Pioneer 1177 inoculant (1.0 lb per ton of fresh crop). LSA-100 was poured over the top of each load of crop in the front unloading forage wagons just prior to ensiling and 1177 was applied by hand at the blower. Silages were made in three concrete stave silos (10 x 50 ft), filled by the alternate-load method. Total harvest and filling time was 6 hours.

Dry matter losses during fermentation, storage, and feedout were measured as described in trial 1. Ensiling temperatures were monitored for the first 5 weeks.

For each treatment, six 5 gallon plastic silos were prepared as described for trial 1, except a hydraulic press was used to compact the fresh crop. In addition, six nylon bags were filled with about 30 lb of crop and buried at each of two depths in the concrete silos.

Stave silos were opened after 21 days and silage was fed at a uniform rate for the following 8 weeks. Silage sampling procedures were the same as described in trial 1. The plastic container silos were opened at 70 days post-ensiling. The nylon bags were recovered approximately 10 and 45 days after the stave silos were opened.

Thirty-six crossbred steers were individually fed in a 56 day growth trial (November 9, 1981 to January 4, 1982). The steers, averaging 487 lb, were implanted with 36 mg of Ralgro and allotted by weight to the three silage rations (12 steers per ration). The rations were the appropriate silage fed *ad libitum* plus 2.00 lb of SBM, .09 lb of rolled grain sorghum, .07 lb of limestone, and .07 lb of premix (DM basis). In the LSA-100 silage ration, 1.61 lb of rolled grain sorghum replaced an equal amount of SBM. Rations were mixed and fed twice daily. All steers were weighed individually on 2 consecutive days, after 16 hr without feed and water, at the start and at the end of the growing trial.

To measure aerobic stability, silage was removed twice during the feeding trial that corresponded to the top and bottom halves of the silos as described in trial 1.

Results and Discussion

Trial 1: Chemical analyses of the two silages are shown in Table 13.1. Both silages were well preserved and had undergone lactic acid fermentations. The non-protein nitrogen in the LSA-100 silage caused it to have lower nitrogen-free extract (NFE) and hot water insoluble-nitrogen (HWIN) values; it had higher pH, lactic, acetic, and total fermentation acids (TFA), and ammonia-nitrogen than control silage. The ammonia produced from the NPN may have acted as a buffer and allowed more carbohydrate to be fermented to acids. The addition of 35.7 lbs of LSA-100/ton of fresh crop raised the crude protein (CP) content of the silage 4.36 percentage units above the original forage, a 90.9% recovery of the supplemental nitrogen.

Ensiling temperatures are shown in Figure 13.1. The graph shows changes from the initial forage temperatures and represents daily mean readings of three thermocouples per silo. LSA-100 silage had the fastest temperature rise, peaked at day 4, and plateaued at 7.5 C above its initial temperature for the first 30 days post-ensiling. Control silage peaked in 7 days and plateaued at 5.0 C above its initial temperature for the first 40 days.

Steer performances are shown in Table 13.2. LSA-100 silage supported 4.8% faster gains than the control silage supplemented with SBM. Feed intake was 5% less, but feed efficiency was 11% better for the LSA-100 silage.

The DM lost during fermentation, storage, and feedout was 2.45 percentage units higher for the LSA-100 silage than the control (Table 13.3). Losses from the 5-gallon silos were similar for the control and LSA-100 silages and lower than losses normally expected in large farm-scale silos. Silage in these experimental silos probably represents that which is produced under the ideal conditions in the concrete silos, ie., near the center of the ensiled mass.

Shown in Table 13.4 are steer gains per ton of crop ensiled. These data combine feedlot performance (Table 13.2) and silage recovery data from the concrete silos (Table 13.3). LSA-100 silage produced 3.9 extra pounds of steer gain per ton of ensiled crop.

Silage from the top third of both silos was unstable when exposed to air (Table 13.5). In subsequent measurements, aerobic stability of both silages increased but LSA-100 was still more stable than the control, as indicated by less heating and lower DM losses during exposure to air.

Trial 2: Chemical analyses of the three silages are shown in Table 13.1. All three silages underwent a restricted lactic acid fermentation, as indicated by the relatively high pH and low lactic acid and TFA levels. LSA-100 silage had the lowest lactic and highest acetic acid values. Acidity (pH's) were numerically similar for the control and 1177 silages, but LSA-100 silage was approximately one pH unit less acid. The addition of 40.0 lb of LSA-100 per ton of fresh crop raised the CP 2.23 percentage units above the original forage, a recovery of 86.2% of the supplemental nitrogen.

Ensiling temperatures increases are shown in Figure 13.2. LSA-100 silage temperature increased through the entire monitoring period, reaching 28 C over its initial temperature by day 18. The control and 1177 silages had much slower increases in temperature, reaching a plateau of 10 to 15 C above initial temperatures by day 12.

Steer performances are shown in Table 13.2. LSA-100 silage supported 12% faster gains than the control and 16% faster gains than 1177 silage ($P<.05$). Feed intake was highest ($P<.05$) for the LSA-100 silage. Feed efficiencies were numerically and statistically similar for all three silage rations.

The DM lost during fermentation, storage, and feedout was lowest for the 1177 silage and highest for the LSA-100 silage (Table 13.3). Five to six percent of the DM ensiled was discarded as non-feedable spoilage when the silos were opened. These high surface losses resulted from poor compaction and air penetration due to the dryness of the ensiled forage. Dry matter losses from the buried bags and 5-gallon silos were numerically similar for the three silage treatments.

Shown in Table .4 are steer gains per ton of crop ensiled. These data combine feedlot performance (Table 13.2) and silage recovery data (Table 13.3). Compared with the control, LSA-100 sorghum silage produced 6.6 fewer pounds and 1177 2.7 extra pounds of steer gain per ton of ensiled crop.

Silage from the top half of all three silos were highly unstable when exposed to air (Table 13.6). The control silage from the bottom half was still unstable, but the two additive silages were slightly more stable than the control and LSA-100 silage was somewhat more stable than 1177 silage.

Table 13.1. Chemical Analyses of the Forage Sorghum Silages Made in Concrete Stave Silos in Trials 1 and 2[1]

Item	Silage, trial 1		Silage, trial 2		
	Control	LSA-100	Control	LSA-100	1177
Dry matter, %	29.11	29.23	43.67	42.41	42.92
pH	4.01	4.21	4.48	5.66	4.75
	% of the DM				
Crude protein	8.29	12.65	10.11	12.34	9.72
Crude fiber	22.28	22.38	19.04	20.71	20.58
Ether extract	2.05	3.23	3.35	3.61	3.77
Ash	8.15	8.20	6.72	7.13	7.26
NFE	58.21	53.54	60.79	56.22	58.67
Lactic acid	4.98	5.50	2.99	2.68	3.13
Acetic acid	3.07	3.28	1.28	2.30	1.28
Propionic acid	.01	.01	.01	.01	.01
Butyric acid	.04	.07	Trace	Trace	Trace
TFA	8.19	8.99	4.30	5.04	4.44
	% of the total N				
HWIN	61.02	43.77	67.74	62.58	69.69
Ammonia-N	4.59	20.77	2.10	38.11	4.99

[1] Each value is the mean of nine composited samples in trial 1 and five composited samples in trial 2.

Table 13.2. Performance by Steers Fed the Forage Sorghum Silage Rations in Trials 1 and 2

Item	Silage, trial 1		Silage, trial 2		
	Control	LSA-100	Control	LSA-100	1177
Number of steers	15	15	12	11	11
Initial wt., lb	500	503	484	487	493
Final wt., lb	711	712	582	598	587
ADG, lb	1.87	1.96	1.74[ab]	1.98[a]	1.65[b]
Daily feed intake, lb[1]					
sorghum silage	12.41	11.79	10.23	11.27	9.66
soybean meal	1.83	.44	2.00	.51	2.00
grain sorghum	---	1.39	.09	1.61	.09
premix[2,3]	.20	.20	.07	.07	.07
ground limestone	.11	.11	.07	.07	.07
ammonium sulfate	.09	.09	---	---	---
total	14.70	14.02	12.46[b]	13.49[a]	11.88[b]
Feed/lb of gain, lb[1]	8.11	7.22	7.23	7.21	7.18

[1] 100% dry matter basis.
[2] Trial 1 premix supplied 30,000 IU vitamin A, 300 mg monensin, 90 mg Tylan. 5 mg cobalt, 30 mg copper, 7 mg iodine, 150 mg iron, 100 mg manganese, and 272 mg zinc per steer daily.
[3] Trial 2 premix consisted of 56.9% salt, 34.5% tallow and 8.6% trace mineral salt providing 30,000 IU vitamin A and 150 mg monensin per steer daily.
[a,b] Means in the same row with different superscripts differ ($P<.05$) within trial.

Table 13.3. Forage Sorghum Silage Recoveries and Losses from the Concrete Stave and Experimental Silos in Trials 1 and 2

Trial number, silo type and silage treatment	DM recovered		DM lost during fermentation, storage, and feedout
	Feedable	Non-feedable (spoilage)	
	% of the DM ensiled		
Trial 1:			
Concrete stave			
Control	79.98	1.90	18.12
LSA-100	75.99	3.44	20.57
5 gallon silo[1]			
Control	96.55	---	3.45
LSA-100	96.53	---	3.47
Trial 2:			
Concrete stave			
Control	84.39	4.41	11.20
LSA-100	76.22	5.47	18.31
1177	87.04	5.77	7.19
Nylon bag[2]			
Control	96.70	---	3.30
LSA-100	95.53	---	4.47
1177	96.66	---	3.34
5 gallon silo[3]			
Control	96.66	---	3.34
LSA-100	95.58	---	4.42
1177	96.86	---	3.14

[1] Each value is the mean of six silos opened at 160 days post-ensiling.
[2] Each value is the mean of six bags, except LSA-100 which is the mean of four bags.
[3] Each value is the mean of six silos opened at 70 days post-ensiling.

Table 13.5. Forage Sorghum Silage Temperature Changes and Losses of Dry Matter During Air Exposure in Trial 1

Silage location in silo	Day of initial rise above ambient temp.[1]	Maximum temp.[2]	Days of air exposure					
			Accumulated temp.[2]			DM loss[3]		
Top Third:			2	4	6	2	4	6
Control	2	42.4	19.6	60.9	71.5	2.33	11.11	--
LSA-100	1	47.0	27.4	61.6	73.9	7.92	16.18	--
			Accumulated temp.			DM loss		
Middle Third			3	9	22	3	9	22
Control	3	42.9	4.25	76.3	--	1.18	11.77	--
LSA-100	*	*	*	*	*	*	3.27	4.09
			Accumulated temp.			DM loss		
Bottom Third			5	8	13	5	8	13
Control	6	40.0	0	43.1	97.1	<1.0	2.92	8.73
LSA-100	9	23.0	0	1.4	11.8	<1.0	<1.0	<1.0

[1] 1.7 C rise or higher.
[2] Centegrade
[3] % of DM exposed
*No temperature rise.

Table 13.6. Forage Sorghum Silage Temperature Changes and Losses of Dry Matter During Air Exposure in trial 2

Silage location in silo	Day of initial rise above ambient temp.[1]	Maximum temp.[2]	Days of air exposure 1					
			Accumulated temp. [2]			DM loss [3]		
			2	4	8	2	4	8
Top Half:								
Control	1	50.8	24.1	71.2	133.2	3.57	10.38	--
LSA-100	1	40.7	25.2	53.0	76.5	4.45	9.80	--
1177	1	43.8	18.9	59.7	114.4	4.52	8.72	--
Bottom Half:								
Control	1	37.4	19.6	52.8	86.9	3.24	9.06	--
LSA-100	4	34.5	<1.0	2.5	33.7	1.20	4.07	--
1177	2	33.0	7.4	24.9	72.4	1.59	6.83	--

[1] 1.7 C rise or higher.
[2] Degrees Centegrade.
[3] % of DM exposed.

Table 13.4. Steer Gain Per Ton of Forage Sorghum Crop Ensiled in Trials 1 and 2[1]

Item	Silage, trial 1		Silage, trial 2		
	Control	LSA-100	Control	LSA-100	1177
Silage fed, lb/ton	1599.6	1519.8	1687.8	1524.4	1740.8
Silage/lb of gain, lb	27.03	24.07	24.10	24.03	23.93
Steer gain/ton of sorghum crop ensiled, lb	59.2	63.1	70.0	63.4	72.7

[1] Values are adjusted to the same dry matter content for each silage, 30%.

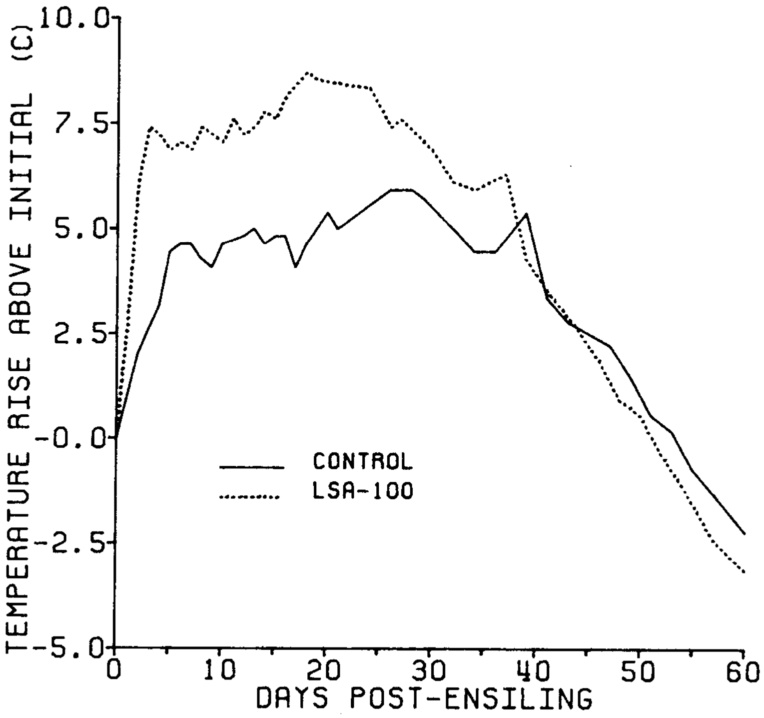


Figure 13.1. Temperature rise above initial forage ambient for the two forage sorghum silages in trial 1.

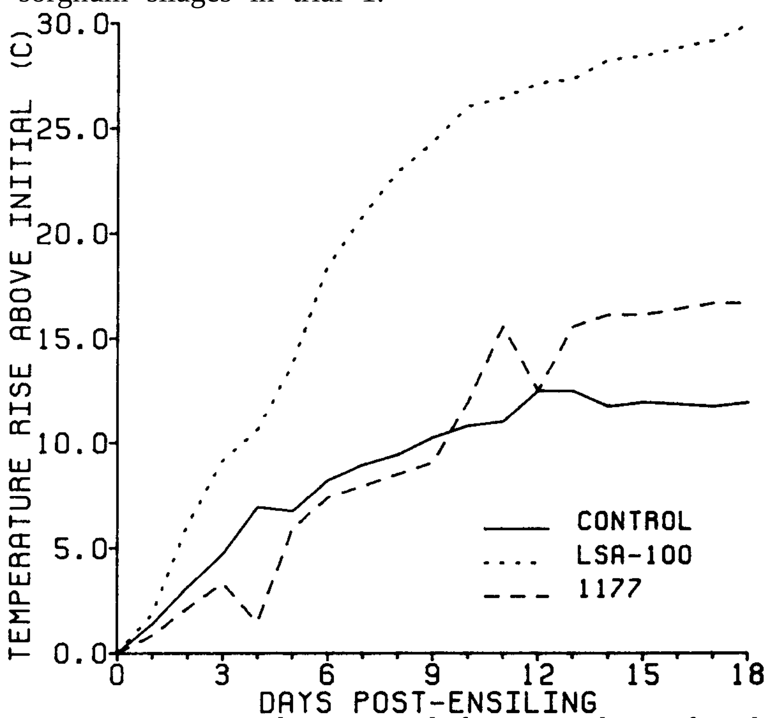


Figure 13.2. Temperature rise above initial forage ambient for the three forage sorghum silages in trial 2.

Commercial Culture and Inoculant Additives for Alfalfa and Whole-Plant Corn Silages[1]

Mark Hinds, Keith Bolsen,
Harvey Ilg and George Milliken[2]

Summary

Experimental 5 gallon plastic silos were used in three trials to evaluate these alfalfa and corn silages: 1) control (no additive); 2) CULBAC® culture; 3) McNess® inoculant; 4) SILA-GREEN® inoculant; and 5) Biomax S I® inoculant. Two silos per treatment were opened on days 1, 2, 4, 7, 14, and 56 post-ensiling in trial 1 (alfalfa) and trial 2 (corn) and the changes that occurred during the ensiling process were compared by using nonlinear models. Only 56-day silages were evaluated in trial 3 (alfalfa). All silages were of acceptable quality. The four culture/inoculant additives had no consistent effects on 56-day end-product silages in the three trials or the ensiling dynamics in trials 1 and 2. Aerobic stability of corn silage was enhanced by the culture/inoculant treatments, while all 10 alfalfa silages were highly stable in air, regardless of treatment.

Introduction

In our previous trials, enzyme, inoculant, and non-protein nitrogen additives have generally improved corn, sorghum, or alfalfa silages in farm-scale silos (Report of Progress 413, Kansas Agricultural Expt. Station). So many commercial silage additives are available that it is almost impossible to determine their effectiveness, using the limited number of farm-scale silos at most universities. By using laboratory-scale, experimental silos, more treatments can be studied, each treatment can be replicated several times, smaller amounts of crop are needed, the entire contents of a silo can be sampled, and silos can be opened at various time intervals.

In the following trials, an experimental silo we developed was used to evaluate four culture/inoculant additives for alfalfa and whole-plant corn silages. Silos were opened at various times to follow the changes during the ensiling process.

[1]Partial financial assistance was provided by TransAgra Corp., Memphis, TN 38138; Furst-McNess Co., Freeport, IL 61032; Casey Products, Inc., St. Joseph, MO 64501; and Chr. Hansen's Laboratory, Inc., Milwaukee, WI 53214.

[2]Department of Statistics, Kansas State University, Manhattan.

Experimental Procedures

The experimental silo was a plastic container (5 gallon capacity) made air-tight by a lid fitted with a rubber 0-ring seal and Bunson valve. The silos were packed with a hydraulic press, which permitted all silages to be made at similar densities.

The alfalfa and corn silage treatments compared were: 1) control (no additive); 2) CULBAC culture from TransAgra Corp.; 3) McNess inoculant from Furst-McNess Co.; 4) SILA-GREEN from Casey Products, Inc.; and 5) Biomax S I from Chr. Hansen's Laboratory, Inc. Additive rates were those recommended by the manufacturers. CULBAC, McNess, and SILA-GREEN were applied as dry products; Biomax was applied in a solution of de-ionized water.

Trial 1. Alfalfa silages were made on July 16, 1981, from 3rd cutting, pre-bloom alfalfa from a single field. The alfalfa was swathed with a mower-conditioner at 9 AM and approximately 1.5 tons were harvested at 1 PM on the same day at about 35% dry matter (DM). For each treatment, 500 lb of alfalfa was put into a Harsh Mobile Mixer and, after the additive had been applied, mixed for 10 minutes. Twelve plastic-container silos then were filled with 26 lbs of alfalfa each (32.5 lb per cubic ft). The order of applying the additives was selected at random; between treatments the mobile mixer was thoroughly cleaned with a chlorine solution and rinsed. In less than 2 hr, all 60 silos had been filled, sealed, weighed, and stored in a room at 32 C. Samples of pre-treated alfalfa were taken from each treatment and chilled immediately in liquid nitrogen to reduce the effect of plant respiration upon initial chemical composition.

Two silos per treatment were opened on days 1, 2, 4, 7, 14, and 56 post-ensiling.

Aerobic stability (bunk life) of each 56-day silage was measured in triplicate by procedures described on page 32 of this Progress Report.

Trial 2. Whole-plant corn silages were made on August 26, 1981, from late-dent, 35 to 36% DM corn from a single field. Procedures were similar to those in trial 1. Each silo was filled with 28.5 lb of corn plant material (35.6 lb per cubic ft).

Trial 3. Alfalfa silages were made on June 24, 1982, from 2nd cutting, pre-bloom alfalfa. Procedures were similar to those in trial 1. There were six silos per treatment and all silos were opened at 56 days post-ensiling.

Statistical Analyses. The 56 day, end-product silages were analyzed by one-way analysis of variance. In trials 1 and 2 a nonlinear estimation procedure and model comparison technique were used to describe how silage characteristics changed during the ensiling process.

Results

Dry matter recoveries, chemical analyses, and aerobic stabilities of the alfalfa and corn silages at 56 days are shown in Tables 14.1, 14.2, and 14.3.

In trial 1, all five silages were well preserved and free of mold or spoilage. pH was lowest for CULBAC and McNess silages; butyric acid, highest for SILA-GREEN and Biomax silages; and hot water insoluble nitrogen (HWIN), lowest for control silage. Lactic acid and ammonia nitrogen values were similar in all silages. Acetic acid values were exceptionally high in all five silages. Dry matter loss was highest for control silage (9.83%), and three additives (CULBAC, SILA-GREEN, and Biomax) significantly decreased DM loss. These lower losses for Sila-Green and Biomax silages are not consistent with their high butyric acid levels. The higher HWIN values in the four treated silages suggest that they contained more nitrogen as “true protein” than the control silage. All five silages were highly stable and showed no signs of spoilage during 14 days of air exposure.

In trial 2, all five corn silages were well preserved and had undergone normal lactic acid fermentations. Control and McNess silages had the lowest pH; Biomax silage, the highest lactic acid; control silage, the lowest acetic, propionic, and total acids; and control silage, the lowest ammonia-nitrogen. Dry matter loss was highest for control silage (11.42%), but only Biomax reduced DM loss significantly. Although significant differences occurred between the control and the four treated silages for silage quality measurements, these differences were small and reflect the high quality of all five silages. All four additive-treated corn silages were highly stable in air, but the control silage became unstable on the 2nd and 3rd day.

In trial 3, all five alfalfa silages were well preserved and, as indicated by chemical analyses, had undergone more efficient and desirable fermentations than alfalfa silages in trial 1. Silages in trial 3 had lower DM losses, higher lactic acid values, lower amounts of acetic, propionic, and butyric acids, and lower pH’s than silages in Trial 1. None of the four culture/inoculant additives significantly reduced the DM loss or improved the chemical composition when compared with control silage in trial 3. As in trial 1, all five alfalfa silages were highly stable in air.

Figure 14.1 shows curves of DM loss, developed from the mathematical models. When compared with the control silage, CULBAC silage lost less DM from days 7 to 30; SILA-GREEN silage, from days 2 to 36; and Biomax silage, from days 8 to 20. Although one-way analysis of variance (Table 14.1) indicated that these three additives lowered the DM loss in the 56 day silages, the models, which also considered the data at earlier periods, show DM losses were similar for all five silages. The DM loss curves for control and McNess silages were never different during the ensiling period. None of the other 12 models tested gave significant differences between curves for control and any of the four treated silages in trials 1 and 2.

Four conclusions can be made from these three trials:

1. The four culture/inoculant additives had no consistent effect on 56 day, end-product silages or the dynamics of the ensiling process.

2. In the 56 day silages there were several statistically significant differences. However, the magnitude of these differences was relatively small and, in most instances, not readily explainable.

3. Nonlinear modeling may be useful in describing the dynamics of silage fermentation. In trials 1 and 2, only alfalfa DM loss showed significant differences in the estimated models, when control silage was compared with each of the treated silages.

4. Aerobic stability of corn silage was enhanced by the culture/inoculant treatments, while all 10 alfalfa silages were highly stable in air, regardless of treatment.

Table 14.1. Dry Matter Losses and Chemical Analyses of the Alfalfa Silages in Trial 1 at 56 Days Post-ensiling[1]

Item	Silage treatment				
	Control	CULBAC	McNess	SILA-GREEN	Biomax
Dry matter:					
pre-ensiled, %	34.8	34.8	35.8	34.9	36.5
silage, %	31.9	32.5	33.1	32.6	33.8
	% of the dry matter ensiled				
Dry matter loss	9.83[c]	8.28[a]	9.23[bc]	8.56[ab]	8.73[ab]
	% of the silage dry matter				
Crude protein	20.35	20.00	20.30	20.12	19.95
Lactic acid	2.40	2.78	2.42	2.21	2.57
Acetic acid	6.94[abc]	7.59[c]	7.27[bc]	6.67[bc]	6.10[a]
Propionic acid	.22[b]	.19[a]	.19[a]	.26[c]	.22[b]
Butyric acid	.08[a]	.08[a]	.13[a]	.53[b]	.50[b]
Total ferm. acids	9.68[ab]	10.67[b]	10.04[ab]	9.70[ab]	9.41[a]
	% of the total nitrogen				
Ammonia-nitrogen	20.0	18.6	22.6	20.3	18.2
Hot water insol. nitrogen	31.5[a]	36.2[b]	35.3[b]	36.1[b]	38.0[b]
pH	5.36[c]	5.17[a]	5.19[a]	5.34[b]	5.38[d]

[1] Each value is the mean of two silos.

[abcd]Values on the same line with different superscripts differ (P<.05).

Table 14.2. Dry Matter Losses, Chemical Analyses, and Aerobic Stability of the Corn Silages in Trial 2 at 56 Days Post-ensiling

Item	Silage treatment				
	Control	CULBAC	McNess	SILA-GREEN	Biomax
Dry matter:					
pre-ensiled, %	37.15	36.10	37.30	35.95	35.85
silage, %	33.16	32.62	33.57	32.60	32.78
	% of the dry matter ensiled				
Dry matter loss	11.42[b]	10.86[b]	11.10[b]	10.76[a b]	9.74[a]
	% of the silage dry matter				
Lactic acid	6.28[a b]	6.30[a b]	5.20[a]	5.55[a]	7.33[b]
Acetic acid	3.13[a]	3.88[a b]	5.83[b]	5.77[b]	3.82[a b]
Propionic acid	.03[a]	.51[c]	.40[b c]	.48[c]	.33[b]
Butyric acid	.07	none	none	.04	none
Total ferm. acids	9.50[a]	10.68[a b]	11.41[a b]	11.83[b]	11.48[b]
	% of the total nitrogen				
Ammonia-nitrogen	6.9[a]	10.5[c]	9.4[b c]	9.5[b c]	8.7[b]
Hot water insol. nitrogen	45.3	40.9	43.6	44.4	42.7
pH	3.81[a b]	4.08[c]	3.89[a b]	4.03[c]	3.97[b c]
Day of initial temperature rise above ambient[2]	3.0	*	*	*	*
Max. temperature, C	50	*	*	*	*
Dry matter loss after 7 days[3]	22.65	<1.0	<1.0	1.12	2.49

[1]Each value is the mean of two silos.

[2]1.7 C rise of higher.

[3]% of the dry matter exposed to air.

*No rise in temperature occurred.

[a b c]Values on the same line with different superscripts differ (P<.05).

Table 14.3. Dry Matter Losses, Chemical Analyses, and Aerobic Stability of the Alfalfa Silages in Trial 3 at 56 days Post-ensiling

Item	Silage treatment				
	Control	CULBAC	McNess	SILA-GREEN	Biomax
Dry matter:					
pre-ensiled, %	36.3	36.3	36.0	35.8	35.9
silage, %	34.1	34.1	33.8	33.8	33.8
	% of the dry matter ensiled				
Dry matter loss	7.96	7.80	7.74	7.53	7.88
	% of the silage dry matter				
Lactic acid	4.68[a b]	5.03[b]	5.34[b]	4.56[a b]	3.94[a]
Acetic acid	5.18[a b]	5.00[a b]	4.74[a]	5.22[a b]	5.57[b]
Propionic acid	.10[a]	.10[a]	.11[a]	.12[a]	.17[b]
Butyric acid	.04	.01	.01	.02	.05
Total fermentation acids	10.03	10.23	10.20	9.76	9.73
	% of the total nitrogen				
Ammonia-nitrogen	16.0	15.1	15.1	15.5	14.5
Hot water insol. nitrogen	33.4[a]	32.3[a b]	32.9[a b]	33.0[a b]	31.0[b]
pH	5.08[a]	5.05[a]	5.13[b]	5.13[b]	5.16[b]
Day of initial temperature rise above ambient[2]	13.0	*	13.5	12.7	*
Max. temperature, C	30	*	34	51	*
Dry matter loss after 14 days[3]	5.0	<1.0	5.0	5.0	<1.2

[1] Each value is the mean of two silos.

[2] 1.7 C rise of higher.

[3] % of the dry matter exposed to air.

* No rise in temperature occurred.

[a b] Values on the same line with different superscripts differ (P<.05).

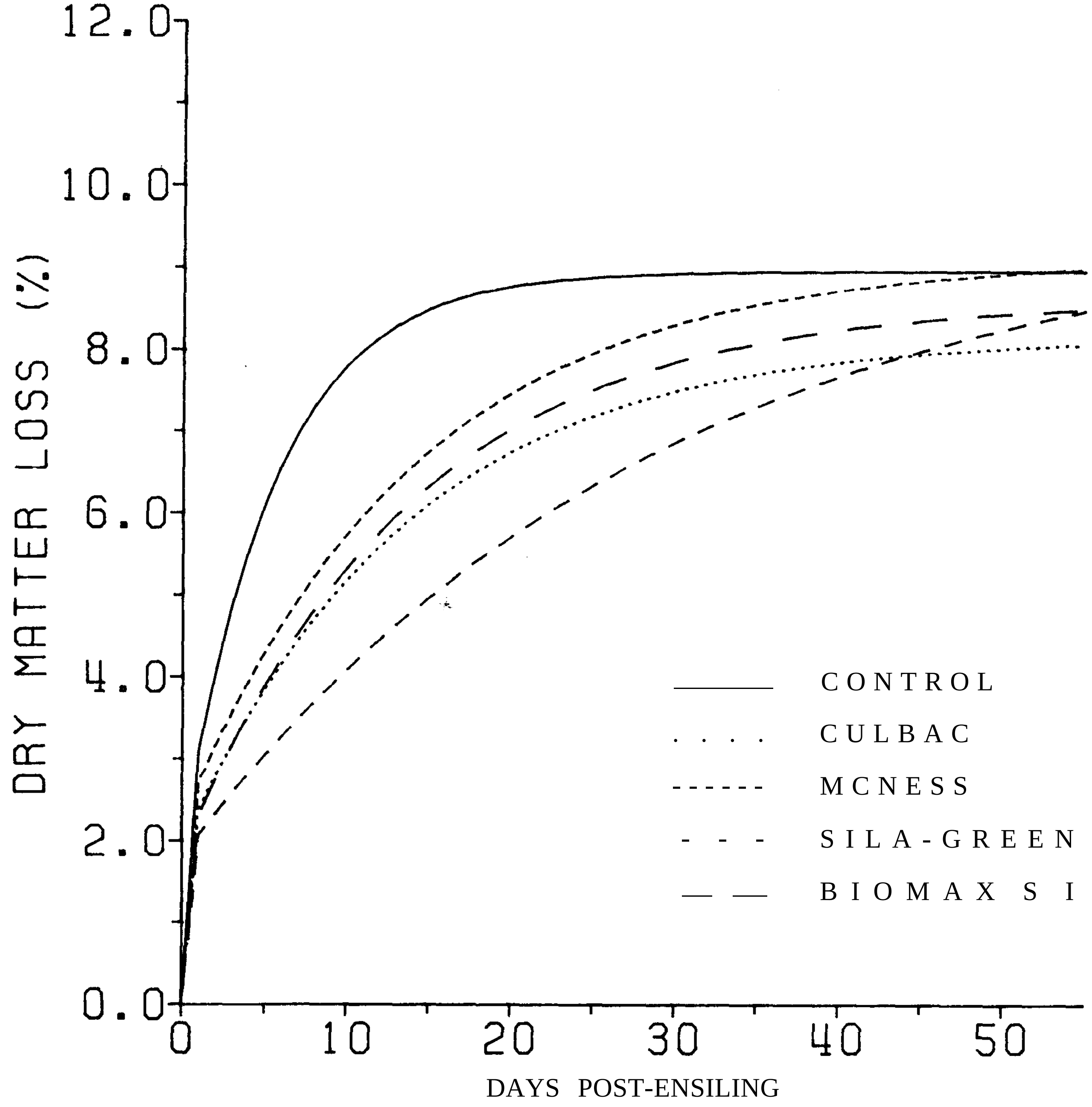


Figure 14.1. Model response curves for alfalfa silage dry matter loss dynamics (0-56 days) in trial 1

Whole-plant Forage, Grain or Non-heading Sorghum Silages, Cornlage, and Feed Flavor Supplements for Growing Calves [1,2]

Keith Bolsen, Harvey Ilg, Ron Pope, Mark hinds, and Jim Hoover

Summary

Four whole-plant silages produced in 1981 and 1982 were evaluated using 176 calves in two growing trials. Based on comparative rates and efficiencies of gain, feeding values were 115, 100, 78.5, and 62 for the cornlage, grain sorghum, forage sorghum, and non-heading sorghum silages, respectively. The poorer values for the forage and non-heading silages were due, in part, to low feed intakes. Rolling the grain and forage sorghum silages to break 85% to 95% of the kernels did not improve their value, and the good performance by calves suggests that the whole grain was well utilized.. A feed flavor supplement, Omniflavor, did not improve performance in trial 1 but did increase rates and efficiencies of gain in trial 2,

Introduction

Sorghum silages are often the major energy feeds in cattle growing rations, but limited information is available concerning nutritional values of today's improved hybrids. Also, we had not previously compared non-heading sorghum, grain producing forage sorghum, or grain sorghum-types with corn silage. This was one objective of these trials.

Previously, research at the Hays Branch Expt. Station showed that processing forage sorghum silage did not improve its feeding value. However, research at Manhattan showed that the value of grain sorghum head-chop silage was significantly improved by processing to break 95% of the kernels. A second objective was to compare processed and unprocessed sorghum silages.

Cattle feeders frequently see low dry matter intakes with sorghum silages, especially those that are high in moisture or low in digestibility. Flavor compounds are sometimes used in the feed industry to improve palatability or acceptability of a feed. A third objective was to evaluate the effect of a commercial feed flavor on intake and utilization of silage rations by growing calves.

[1]The feed flavor was Ultra Sweet Livestock Omniflavor, produced by Agrimerica, Inc., Northbrook, IL 60062.

[2]Partial financial assistance was provided by Agrimerica, Inc. and A.O. Smith Harvestore Products, Arlington Heights, IL 60006.

Experimental Procedures

Trial 1. Three whole-plant silages were made in the fall of 1981: 1) Dekalb FS-25A+forage sorghum; 2) Ferry-Morse 81 grain sorghum; and 3) Ferry-Morse 3020 corn. The harvest dates, dry matters (DM), and grain yields of the three crops are shown in Table 15.1.

Table 15.1. Crops, Harvest Dates, Dry Matter Contents, and Yields, Trials 1 and 2

Trial and crop	Harvest dates	Dry matter at harvest	Grain yield	Forage yield[1]
Trial 1: 1981		%	bu/acre	tons/acre
Forage sorghum	Sept. 23, 25, and 28	35.0	73[e]	--
Grain sorghum	Sept. 16 and 17	37.0	124[e]	--
Corn	Sept. 1, 4, and 7	54.4	153[e]	--
Trial 2: 1982				
Non-heading	Oct. 4	23.8	--	24.3[a]
Forage sorghum	Sept. 23	31.0	84[e]	21.1[a]
Grain sorghum	Sept. 20	36.6	110[e]	18.1[a]

[1] Adjusted to 30% dry matter.
[a] Actual.
[e] Estimated.

All crops were direct-cut using a Field Queen forage harvester equipped with a 2-inch recutter screen. About 80 to 85% of the sorghum and corn kernels remained whole. Both sorghums were ensiled in 16 x 50 ft concrete stave silos. The corn was ensiled in a 14 x 40 ft Harvestore® . The cornlage was also used in another trial (see page 54 of this Progress Report). All three structures were opened during the 1st week of January, 1982.

Five silage rations were compared: each of the three silages fed without further processing (whole), and the forage and grain sorghum silages fed after processing through a Roskamp roller mill to break 85 to 90% of the kernels (processed). Each silage ration was fed to 16 Hereford, Simmental, or Hereford x Angus steer and heifer calves (four pens of four calves per ration). In addition, two pens per silage ration received a supplement containing feed flavor (Omniflavor) at 4.0 lb per ton of complete ration (DM basis). Another two pens, received a control supplement. Each silage was full-fed with 2.0 lb of supplement per calf daily. Rations were formulated to provide 12.5% crude protein (DM basis), 150 mg of monensin per calf daily, and equal amounts of calcium, phosphorus, and vitamin A. The growing trial was 84 days (January 20 to April 20, 1982).

For the 6 weeks before the trial began, all the calves were fed free-choice prairie hay and 3 lb of rolled milo plus soybean meal concentrate. All calves were weighed individually on 2 consecutive days after 16 hr without feed or water, at the start and at the end of the trial, Prior to the final weighings, all calves were fed the same amount of feed (about 10 lb of DM). Intermediate weights were taken before the A.M. feeding on days 28 and 56. The calves were implanted with 36 mg of Ralgro at the start of the trial.

Samples of each silage were taken twice weekly. Feed intake was recorded daily for each of the 20 pens and the quantity of silage fed adjusted daily to assure that fresh feed was always in the bunks. Feed not consumed was removed, weighed, and discarded as necessary.

Trial 2. Three whole-plant silages were made in the fall of 1982: 1) G 1990 non heading hybrid forage sorghum (non-heading sorghum); 2) Pioneer 947 forage sorghum (forage sorghum); and 3) Dekalb E 67 red grain sorghum (grain sorghum). The harvest dates, DM contents, grain, and forage yields are shown in Table 15.1.

All crops were harvested as described in trial 1. The non-heading sorghum and forage sorghum were ensiled in 10 x 50 ft, and the grain sorghum in a 16 x 50 ft concrete stave silo. The silos were opened on November 18 and 19, 1982.

Four silage rations were compared: each of the three silages fed without further processing, and grain sorghum silage fed after rolling to break about 95% of the kernels. Each silage ration was fed to 16 Angus, Angus x Hereford, Angus x Simmental, and Hereford x Simmental steer calves (four pens of four calves per ration). In addition, two pens per silage ration received an Omniflavor supplement (4.4 lb per ton of ration DM for the first 2 weeks, then 2.2 lb per ton for the remaining 6 weeks). Another two pens received a control supplement. The growing trial was 56 days (November 20, 1982 to January 15, 1983).

Four pens of four calves were also fed each of two additional Pioneer 947 forage sorghum silages, one treated with a silage additive and one urea-treated. Two pens from each silage received the Omniflavor supplement, and two pens the control. Rations were formulated, fed, and calves weighed as in Trial 1, except calves were fed hay and concentrate for only 3 weeks before the trial began.

In both trials, statistical analysis showed no interaction between the silage rations and supplement treatments. Therefore, results for silages and supplements are presented seperately within each trial.

Results and Discussion

The seven silages in the two trials were well preserved and free of visable mold, spoilage, or seepage.

Trial 1. Performance of calves receiving the three whole-plant silages are shown in Table 15.2. Cornlage produced the fastest gains and highest intakes (P<.O5); forage sorghum, the slowest gains and lowest intakes (P<.O5). Grain sorghum silage and cornlage had better feed efficiencies than the forage sorghum silage. For both forage and grain sorghums, calves fed the processed silages gained slightly faster and consumed slightly more feed than those fed unprocessed silages (Table 15.3). Processing increased feed efficiencies by only 4.4 and 1.2% for the forage and grain sorghum silages, respectively.

Eighty-four day performances by calves fed the control and Omniflavor supplements were nearly identical (Table 15.4). As the trial progressed, calves receiving Omniflavor tended to consume less feed than those not receiving it and, thus, had slightly better feed conversions.

Trial 2. Performances by calves fed the four silages are shown in Table 15.5. The two grain sorghum silages gave the fastest gains and highest intakes (P<.O5); non-heading sorghum silage, the slowest gain and lowest intake (P<.O5). Performance by calves fed forage sorghum silage was intermediate, except calves fed forage sorghum made 3.3% more efficient gains than those fed grain sorghum silage. Processing the grain sorghum silage did not improve calf performance.

The Omniflavor supplements improved rates and efficiencies of gain over the controls throughout the trial (Table 15.6). Although feed intakes were similar, calves fed Omniflavor were 8.5 and 6.9% more efficient at 28 and 56 days, respectively.

Processing the sorghum silages in these two trials did not significantly improve their nutritional values. Although cattle feeders often express concern about how effectively the sorghum grain is digested from whole-plant silages, the good performance by calves in these trials suggests that the grain was well utilized. Also, high DM intakes (except for the non-heading silage) and mild weather contributed to fast and efficient gains. Some compensatory gain may have occurred, since the pre-trial hay + grain rations were rather low in energy. But weighing procedures used should have prevented excessive fill from biasing the gains upward.

The grain and forage yields of the crops are shown in Table 15.1. Silage yields were not obtained in 1981. The two growing seasons were favorable in Manhattan and contributed to the high grain content in the whole-plant silages. Grain made up 31.4 and 47.9% of the silage dry matter in the forage and grain sorghum silages in 1982.

Relative feeding values for the whole-plant silages were compared by assigning a value of 100 to the grain sorghum silages, based on comparative rates and efficiencies of gain. Cornlage had a relative feeding value of 115 and this probably reflects its higher grain content. Forage sorghum silage had a feeding value of 78.5 in trial 1 and 94.0 in trial 2. A major contributing factor was a 20% lower feed intake. The non-heading sorghum silage had a feeding value of only 62.0, which was likely the result of its extremely low feed intake and very high moisture content. Calves fed the non-heading silage consumed 29 and 43% less DM than those fed forage and grain sorghum silages, respectively.

The feed flavor, Omniflavor, did not improve calf performance in trial 1 but did increase rates and efficiencies of gain in trial 2. In previous trials with feeder lambs, feed flavor supplements have consistently improved feed efficiency without affecting feed intake (Report of Progress 387, Kansas Agriculture Expt. Station). The slightly reduced intake of the Omniflavor rations in trial 1 may have been because the flavor was used at a higher average rate than in trial 2. Additional trials are needed to determine the effect of combinations of feed flavors and their use rates on performance of growing cattle fed silage-based rations.

Table 15.2. Overall Performance by Calves Fed the Three Whole-plant Silages, Averaged Across the Two Supplements (Trial 1)

	Whole-plant silage		
Item	Forage sorghum	Grain sorghum	Cornlage
No. of calves	32	32	16
Initial wt., lb	418	414	415
Final wt., lb	546	604	641
Avg. daily gain, lb	1.53[c]	2.26[b]	2.69[a]
Avg. daily feed, lb[1]	11.68[c]	15.43[b]	16.63[a]
Feed/lb of gain, lb[1]	7.66[b]	6.84[a b]	6.17[a]
Relative feeding value[2]	78.5	100.0	115.0
Silage dry matter, %	34.0	36.3	54.2
Silage CP, %	7.4	9.3	8.4

[a b c]Values with different superscripts differ significantly (P .05).

[1]100% dry matter basis.

[2]Based on comparative rates and efficiencies of gain, with performance by calves fed grain sorghum silage given a value of 100.

Table 15.3. Overall Performance by Calves Fed the Four Sorghum Silage Rations, Averaged Across the Two Supplements (Trial 1)

Item	Forage sorghum silage		Grain sorghum silage	
	Whole	Processed	Whole	Processed
No. of calves	16	16	16	16
Initial wt., lb	418	418	412	416
Final wt., lb.	542	550	596	611
Avg. daily gain, lb	1.48[b]	1.57[b]	2.19[a]	2.32[a]
Avg. daily feed, lb[1]	11.61[b]	11.72[b]	15.11[a]	15.75[a]
Feed/lb of gain, lb[1]	7.83[b]	7.48[b]	6.88[a]	6.80[a]

[a b c]Values with different superscripts differ significantly (P<.05).

[1]100% dry matter basis.

Table 15.4. Performance at 28, 56, and 84 Days by Calves Fed the Control an Omniflavor Supplements, Averaged Across the Five Silages (Trial 1)

Item	0 to 28 days		0 to 56 days		0 to 84 days	
	Control	Omni-flavor	Control	Omni-flavor	Control	Omni-flavor
Avg. daily gain, lb	1.96	1.94	2.13	2.13	2.06	2.05
Avg. daily feed, lb[2]	12.15	12.03	13.37	13.15	14.35	13.98
Feed/lb of gain, lb[2]	6.29	6.30	6.35	6.28	7.10	6.97

[1]10 pens of four calves/pen were fed each supplement.

[2]100% dry matter basis.

Table 15.5. Performance by Calves Fed the Four Silage Rations, Averaged Across the two Supplements (Trial 2)

Item	Silage			
			Grain sorghum	
	Non-heading	Forage sorghum	whole	processed
No. of calves	16	16	16	16
Initial wt., lb	452	453	453	452
Final wt.., lb	505	552	572	568
Avg. daily gain, lb	.95[c]	1.77[b]	2.12[a]	2.07[a]
Avg. daily feed, lb[1]	8.43[c]	11.88[b]	15.01[a]	14.45[a]
Feed/lb of gain, lb[1]	9.02[b]	6.82[a]	7.09[a]	7.02[a]
Relative feeding value[2]	62.0	94.0	100.0	100.0
Silage dry matter, %	22.0	30.7	35.9	
Silage CP, %	7.5	9.0	9.5	9.5

[a b c]Values with different superscripts differ significantly ($P<.05$).

[1]100% dry matter basis.
Based on comparative rates and efficiencies of gain, with performance by calves fed grain sorghum silage given a value of 100.

Table 15.6. Performance at 28 and 56 Days by Calves Fed the Control and Omniflavor Supplements, Averaged Across the Six Silages (Trial 2)[1]

Item	0 to 28 days		0 to 56 days	
	Control	Omniflavor	Control	Omniflavor
Initial wt., lb	453	453	453	453
28-day wt., lb	496.6	500.6	--	--
56-day wt., lb	--	--	542.3	548.8
Avg. daily gain, lb	1.56	1.70	1.60	1.71
Avg. daily feed, lb[2]	11.15	11.10	12.23	12.28
Feed/lb of gain, lb[2]	7.49	6.85	8.08	7.52

[1] 12 pens of four calves/pen were fed each supplement.
100% dry matter basis.

Additive-treated Corn Silage, Harvestore Cornlage, and Sodium Bicarbonate Supplement for Yearling Steers[1]

Steve Soderlund, Keith Bolsen,
Harvey Ilg, and Jim Hoover

Summary

Steers fed Silo Guard II® treated corn silage gained 3.5% faster and were 8.3% more efficient than those fed the control silage. Cornlage (54% dry matter corn silage in an oxygen-limiting structure) produced numerically slower and less efficient gains than either treated or untreated silage, but differences in silages were not statistically significant. Steers fed sodium bicarbonate throughout the trial consumed 8.5% more silage, gained 14% faster ($P<.05$), and were 3% more efficient than those not fed bicarbonate; performance of steer fed bicarbonate for the first half of the trial was intermediate. Steers fed cornlage had a higher rumen fluid acetate:propionate ratio ($P<.05$) than those fed the control or Silo Guard II silages but there were no significant differences due to bicarbonate in rumen fluid volatile fatty acids.

Silage DM recoveries and aerobic stabilities were similar for the control and Silo Guard II silages. Cornlage was less stable in air than the other two silages.

Introduction

Calves fed high silage rations generally consume less dry matter than calves fed hay. Research conducted at the Hays Branch Experiment Station (Kansas Agriculture Expt. Sta. Bull. 556) showed that steers fed sorghum silage rations supplemented with 100 gm of sodium bicarbonate ($NaHCO_3$) consumed 4% more dry matter and gained 8% faster than steers not receiving bicarbonate. Similar results were reported by South Dakota researchers; however, they found that the effect of bicarbonate was not sustained, suggesting that maximum benefit from bicarbonate may be in the early silage feeding period. To find out how long its effect lasts, we evaluated bicarbonate supplements for calves fed corn silage for 4 or 8 week periods. Additional objectives were to continue our evaluation of commercial additives for corn silage and to compare the nutritional value of early-harvested corn silage made in a stave silo with late-harvested cornlage made in a Harvestore.

Experimental Procedures

Three whole-plant corn silages made in the late summer, 1981 were compared: 1) ensiled in a concrete stave silo with no additive (control); 2) ensiled in a concrete stave silo with Silo Guard II® applied at 1.0 lb per ton of fresh crop (Silo Guard II); and 3) ensiled in a Harvestore without an additive.

[1] Silo Guard II is an enzyme and its co-factors, produced by International Stock Foods, Inc., Waverly, NY 14892. Partial financial assistance were provided by International Stock Foods, Inc. and A.O. Smith Harvestore Products, Arlington Heights, IL 60006.

(cornlage). The corn, Ferry-Morse 3020, was grown under irrigation near Manhattan. Its grain yield was 153 bushels per acre. Harvest began on August 19 using a Field Queen harvester adjusted to a 3/8-inch chop length. To reduce variation among silages, a similar number of rows from each area in the field was used to fill each structure.

The control and Silo Guard II silages were made on August 19, 20, 21, and 24 in two 14 x 60 ft silos which were filled by the alternate load method. The corn was in the dent stage of maturity. Silo Guard II was applied in a dry, granular form with a continuous-feed applicator attached to the silage blower. Average dry matter (DM) of the crop was 40%. Six plastic container silos and three nylon bags were filled with fresh crop while filling each concrete stave silo. Details of the procedures are on page 32 and 33 of this Progress Report.

The cornlage was made in a 14 x 40 ft Harvestore on September 1, 4, and 7. The harvest was delayed 3 days by a heavy rain on September 1. The average stage of maturity of the corn was glaze to flint. To exclude air, approximately 200 lb of dry ice (a carbon dioxide source) was placed in the air space above the crop at the end of each filling day. Average DM of the crop was 54%.

All three structures were opened in early November, 1981 and the silages were fed over a 6-month period. Although occasional interruptions in feeding occurred, samples of each silage were collected every 4 or 5 days.

Each silage was full-fed to 12 yearling Hereford and Simmental steers during a 57-day growing trial from January 4 to March 2, 1982. All steers were individually fed twice and received 2.0 lb of supplement, daily (Table 16.1). Four steers fed each silage received the control supplement throughout the trial; four steers fed each silage received the bicarbonate throughout the trial; and four steers, the bicarbonate supplement for the first 29 days and the control supplement for the last 28 days. Sodium bicarbonate was added to the supplement to provide 112 g per steer daily. Rations were formulated to contain 11.75% crude protein, .5% calcium, and .3% phosphorus and to supply 150 mg of monensin per steer daily.

All steers were weighed individually after 16 h without feed or water on 2 consecutive days at the start and again at the end of the trial. Two days before the initial and final weighings, all steers were fed the same amount of feed (12 lb of ration dry matter). An intermediate weight was taken on day 28 after the steers were without feed or water for 16 hours. Rumen fluid samples were collected via stomach tube from all steers approximately 4 h after feeding on days 29 and 58.

Two aerobic stability (bunk life) measurements were made on each silage as described on page 32 of this Progress Report.

Results

The two silages and cornlage were preserved and each had undergone normal lactic acid fermentations. Chemical analyses are shown in Table 16.2. The pH values were relatively low and, not surprisingly, the higher DM cornlage had about 50% less lactic acid than the corn silages. There were no clostridial fermentations, as evidenced by low NH_3-N and butyric acid values. Silo Guard II corn silage had more lactic acid and hot water insoluble nitrogen than control corn silage. The cornlage was much less stable in air than the other two corn silages (Table 16.3).

Steers fed Silo Guard II corn silage gained 3.5% faster and 8.3% more efficiently than those fed control corn silage (Table 16.4). Although the differences were not statistically significant, these results agree with two previous trials which showed improved rate and efficiency of gains from Silo Guard treated corn and sorghum silages (Progress Report 377, Kansas Agriculture Expt. Station). Steers fed control corn silage and cornlage had similar performances, however those fed cornlage consumed nearly 1.0 lb less dry matter, due at least in part, to a greater refusal of the cob and husk portion of the drier cornlage. Studies at other universities have shown that the digestibility of whole-plant corn silage increases to a maximum at the dough-dent stage and decreases only slightly as the corn matures through the dent, glaze, flint, and mature stages. Although bicarbonate numerically improved gain and feed intake, the only statistically significant improvement was a faster rate of gain for steers fed bicarbonate throughout the trial.

Rumen fluid analyses results are shown in Table 16.5. The addition of bicarbonate did not consistently alter rumen fluid pH or VFA's when fed in combination with the corn silages or cornlage. Corn silage treatments had no significant effect on rumen fluid pH. The molar proportion of acetate was highest for steers fed cornlage and propionate was highest for steers fed control corn silage. Steers fed control corn silage also had the lowest acetate to propionate ratio; those fed cornlage, the highest. Since cattle use acetate less efficiently than propionate, this could partially explain the slower gains for steers fed cornlage.

Dry matter recoveries for the control and Silo Guard II corn silage were similar (Table 16.2). Results of four previous trials showed consistent improvements in DM recovery with Silo Guard silages compared with control silages (Progress Reports 377, 394, and 413, Kansas Agriculture Expt. Station).

Table 16.1. Composition of the Supplements Fed with the Two Corn Silages and Cornlage

	Supplement	
Ingredient	Control	Sodium bicarbonate
	lb/ton	
Soybean meal	1500	1545
Rolled sorghum grain	320	---
Sodium bicarbonate[1]	---	275
Salt	42	42
Dicalcium phosphate	80	80
Limestone	28	28
Tallow	20	20
Trace mineral premix	5	5
Vitamin mineral A[2]	2.5	2.5
Rumensin-60[3]	2.5	2.5

[1]Added to provide 112 g/steer daily.
[2]Added to provide 30,000 IU/steer daily.
[3]Added to provide 150 mg/steer daily.

Table 16.2. Chemical Analyses and Dry Matter Recoveries for the Two Corn Silages and cornlage.

Item	Corn silage Control	Corn silage Silo Guard	Cornlage
Dry matter:			
Pre-ensiled	39.48	40.02	54.13
Silage, %	40.92	41.81	54.25
pH	3.65	3.69	4.07
	% of the DM		
Lactic acid	7.12	7.60	3.95
Acetic acid	2.11	1.87	1.40
Propionic acid	.01	.01	.01
Butyric acid	.07	.03	.01
Total fermentation acids	9.27	9.62	5.63
Crude protein	8.49	8.53	8.39
	% of total N		
Ammonia-N	8.27	8.08	8.46
Hot water insoluble-N	39.85	42.95	50.03
	% of the DM ensiled		
Dry matter recovery:			
Buried bag	95.42	96.59*	---
5-gallon silo	94.53	94.67	---

*Only one bag recovered.

Table 16.3. Changes in Temperatures and Losses of Dry Matter During Air Exposure for the Three Corn Silages

Replication and silage	Day of initial temp. rise above ambient temp.*	Maximum temp.	Loss of DM**
Replication 1[a]:			
Control	6.5	44	5.1
Silo Guard II	6.5	46	4.0
Cornlage	.9	49	12.1
Replication 2[b]:			
Control	9.0	47	<1.0
Silo Guard II	10.0	42	<1.0
Cornlage	.9	48	10.4

*1.7 C rise or higher.
**Percent of the DM exposed to air after 7 days.
[a] Silage removed from the structures on January 27, 1982.
[b] Silage removed from the structures on March 24, 1982.

Table 16.4. Performance of Steers Fed the Whole-plant Corn Silages and Cornlage and Supplement Treatments (57 Days: January 4 to March 2, 1982).

	Whole-plant corn: Corn silage: Control	Whole-plant corn: Corn silage: Silo Guard II	Whole-plant corn: Cornlage	Supplement: Control	Supplement: Sodium bicarbonate	Supplement: Sodium bicarbonate control
No. of steers	12	12	12	12	12	12
Initial wt., lb	588.4	587.8	588.4	588.1	590.4	586.3
Final wt., lb	717.5	721.2	709.5	707.8	726.6	714.0
Avg. daily gain, lb	2.26	2.34	2.12	2.10^{b}	2.39^{a}	2.24^{ab}
Avg. daily feed, lb						
silage	15.11	14.17	14.15	13.83	15 .01	14.59
supplement	1.80	1.80	1.80	1.80	1.80	1.80
total	16.91	15.97	15.95	15.63	16.81	16.39
Feed/lb of gain, lb[1]	7.55	6.92	7.68	7.42	7.20	7.54

[1] 100% dry matter basis.
Values with different superscripts differ significantly (P<.05).

Table 16.5. Molar Proportions of Rumen Volatile Fatty Acids for Steers Fed the Whole-plant Corn Silages and Cornlage and Supplement Treatments

	Whole-plant corn: Corn silage: Control	Whole-plant corn: Corn silage: Silo Guard II	Whole-plant corn: Cornlage	Supplement: Control[1]	Supplement: Sodium bicarbonate[2]
			day 29		
pH	6.50	6.38	6.51	6.45	6.47
A/P ratio	2.13^{b}	2.28^{b}	2.41^{a}	2.25	2.28
			Molar %		
Acetate	57.1^{b}	57.1^{b}	59 .9^{a}	57.8	58.1
Propionate	27.0^{a}	25.4^{b}	25.0^{b}	25.9	25.8
Butyrate	12.5^{b}	14.3^{a}	11.8^{b}	13.1	12.8
			day 58		
pH	6.44	6.57	6.41	6.46	6.51
A/P ratio	2.13^{b}	2.50^{b}	2.65^{a}	2.49	2.49
			Molar %		
Acetate	59.0^{b}	61.1^{b}	61.9^{a}	60.8	60.6
Propionate	25.7^{a}	24.7^{a}	23.8^{b}	24.9	24.6
Butyrate	11.2	10.6	10.4	10.7	11.0

[1] Average of 12 steers for day 29 and 24 steers for day 58.
[2] Average of 24 steers for day 29 and 12 steers for day 58.
[a b] Values with different superscripts differ significantly (P<.05).

High-moisture or Dry Corn, Roughage Sources, and Protein Supplements for Short-fed Finishing Steers.

Bruce Young, Harvey Ilg and Keith Bolsen

Summary

Dry corn, stave ensiled high-moisture corn (HMC), stave ensiled HMC treated with urea, and Harvestore ensiled HMC were evaluated in a steer finishing trial. Alfalfa hay and corn silage were the roughages and soybean meal or urea, the nitrogen sources. There were no differences in steer performance for corn treatments, but steer performance was significantly improved when alfalfa hay rather than corn silage was the roughage. Urea supplements significantly depressed steer performance compared with soybean meal additions; a combination of urea and soybean meal gave intermediate performance.

Introduction

Feeding values for dry and high moisture corn (HMC) in cattle finishing rations are nearly equal but a major advantage of HMC is reduced field losses during harvest. However, changes in roughage or supplemental nitrogen source fed with HMC may affect cattle performance more adversely than with dry corn. Corn silage and urea supplementation have shown conflicting results when fed with HMC, so we compared combinations of urea, corn silage, soybean meal and alfalfa hay. We also compared adding urea to HMC at ensiling with traditional urea additions in the supplement.

Experimentia1 Procedure

One thousand bushels of HMC harvested at 72 to 74% dry matter were stored in two 10 x 50 ft concrete stave silos. Another 4000 bushels were stored in a Harvestore. Stave silo HMC treatments were: 1) no additive (stave) and 2) 42 lb of a urea and water solution (50:50 wt./wt.) per ton of HMC, added prior to ensiling (NPN stave). All corn treatments were of the same variety and from the same field. An additional 1000 bushels of field dried corn was harvested and stored in an aerated bin. Stave silo HMC was coarsely cracked by a roller mill before ensiling. Harvestore HMC was ensiled whole. Harvestore and dry corns were coarsely rolled before feeding.

The three structures were opened after 25 days and complete mixed rations were full-fed for 71 days to 96 yearling Hereford steers (24 pens of four steers per pen). There were two roughage sources, alfalfa hay or corn silage; four nitrogen sources, soybean meal (SBM), urea, combination (urea for the first 21 days; soybean the last 50 days), or stave urea (urea added to the corn prior to stave ensiling); and four corn treatments, dry, Harvestore, stave, and NPN stave. Treatments were combined as shown in Table 17.1.

Corn silage (14 x 60 ft stave silo) was early-dent, 38% dry matter (DM), and yielded 153 bushels of grain per acre. Grain was 47% of the corn silage (DM basis). The alfalfa hay was 88% DM, 16% crude protein (CP) and was tub ground to lengths of 1 to 3 inches.

Net energy for gain (NEg) values assigned to corn, alfalfa, corn silage, and supplements were 66.3, 20.0, 45.7, and 50.0 Mcal per 100 lb, respectively. Fat was added to the supplements to make them isocaloric (Table 17.5) and the rations were formulated to 60.5 Mcal NEgain per 100 lb, 12.0% CP, .60% calcium, .33% phosphorous, and .81% potassium. Crude fiber in the corn silage rations was 6.8%, while the alfalfa rations contained 5.3%. The alfalfa rations were 78.6% corn, 7.6% alfalfa, and 13.8% supplement; the corn silage rations were 69.0% corn, 17.2% corn silage, and 13.8% supplement (DM basis). All cattle were implanted with 36 mg of Ralgro and adjusted to full feed with intermediate energy rations over 21 days. Rumensin was gradually introduced over the first 21 days to a final level of 27.6 grams per ton of ration dry matter (304 mg per steer per day). Steers received 34,900 IU of supplemental vitamin A, 17,600 IU of vitamin D, and 23 IU of vitamin E per head daily, based on 22 lb of dry matter intake.

Urea furnished 28% of the ration CP for the alfalfa rations (treatments 2 and 6) and 34.8% for the corn silage rations (treatments 4 and 8). SBM provided 31% of the ration CP for the alfalfa rations (treatments 1 and 5) and 38.5 % for the corn silage rations (treatments 3 and 7). In treatments 9 and 10, urea was the supplemental nitrogen for the first 21 days; SBM for the last 50 days. Supplemental nitrogen in treatments 11 and 12 was from urea the first 21 days. Both SBM and urea were used the last 51 days. The SBM was added to the protein supplement; the urea came from NPN stave corn.

Ingredient samples were collected weekly and feed consumed was recorded daily. The quantity of complete ration offered was adjusted according to the amount the cattle would consume and feed was always present in the bunks. Feed not consumed was removed, weighed, and discarded as necessary.

At the start and again at the end of the feeding trial, all cattle were weighed individually after 16 hr without feed or water on 2 consecutive days and the averages of the two weights were used for initial and final live weights. Intermediate full weights were taken before the AM feeding on days 28 and 56. Final weights for steer performance calculations were derived from hot-carcass weights and a dressing percentage of 62.

Results

Performance of cattle for individual treatments are shown in Table 17.1. Individual treatment results are combined by corn harvest and storage method, roughage source, and supplemental protein source in Tables 17.2, 17.3, and 17.4, respectively.

Corn Harvest and Storage Methods (Table 17.2): There were no differences (P>.05) between dry, Harvestore, stave, and NPN stave corn for rate of gain or feed conversion. Daily feed intake was greater (P<.05) for rations containing dry corn than NPN stave corn (23.47 vs 21.96 lb).

Roughage sources (Table 17.3): Although steers fed alfalfa gained slightly faster than those fed corn silage (2.68 vs 2.50 lb per day) the difference was not statistically significant. Daily feed intake was greater ($P<.05$) for corn silage rations (23.61 lb) than alfalfa rations (22.15 lb), but feed conversions favored ($P<.05$) the alfalfa hay rations (8.36 vs 9.52).

Supplemental protein sources (Table 17.4): Average daily gain was greater ($P<.05$) when the supplemental nitrogen was SBM (2.93 lb) rather than the urea (2.27 lb) or stave urea (2.52 lb). Daily feed intake was highest ($P<.05$) for SBM. Feed efficiency was similiar for steers fed SBM, the SBM-urea combination, or stave urea; but, steers fed urea in the supplement were least efficient ($P<.05$).

Discussion

A NEg for corn silage of 45.71 Mcal per 100 lb represents 69% of the energy value used for corn grain. If corn is 47% by weight of the DM, then the roughage portion of the corn silage should be 14.5 Mcal NEg per 100 lb. Our cattle performances suggest that 45.7 Mcal per 100 lb overestimates the NEg of corn silage, at least as compared with good quality alfalfa hay. Rations containing 12% CP should contain excess protein for finishing steers that are within 70 days of slaughter. Thus, we were surprised to find SBM superior to urea. Although we have examined a number of alternative explanations, none seem to justify this observation.

Table 17.1. Performances by Steers Fed the HMC, Roughage and Nitrogen Source Treatments

Treatment	No. of pens	No. of steers	Final weight[1]	Initial weight	ADG	Daily intake[2]	Feed/gain[2]
Dry corn:							
1, alfalfa/soybean	2	8	1001	799	2.85^{ab}	21.99^{cd}	7.73^{a}
2, alfalfa/urea	2	8	983	801	2.57^{abc}	21.72^{cd}	8.49^{ab}
3, corn silage/soybean	2	8	1029	809	3.11^{a}	27.70^{a}	8.93^{abc}
4, corn silage/urea	2	8	958	802	2.20^{bc}	22.48^{bcd}	10.83^{c}
Harvestore corn:							
5, alfalfa/soybean	2	8	1015	798	3.07^{a}	24.00^{bc}	7.95^{ab}
6, alfalfa/urea	2	8	958	799	2.24^{bc}	21.01^{d}	9.44^{bc}
7, corn silage/soybean	2	8	993	800	2.72^{abc}	25.26^{ab}	9.29^{bc}
8, corn silage/urea	2	8	948	800	2.09^{c}	21.70^{cd}	10.38^{c}
Stave corn:							
9, alfalfa/combination	2	8	985	800	2.61^{abc}	21.48^{cd}	8.23^{ab}
10, corn silage/combination	2	8	984	801	2.57^{abc}	23.31^{bcd}	9.14^{abc}
11, alfalfa/stave urea	2	8	988	795	2.72^{abc}	22.72^{bcd}	8.34^{ab}
12, corn silage/stave urea	2	8	959	795	2.32^{bc}	21.20^{cd}	9.19^{abc}

[1] Final live weights adjusted to dressing percentage of 62.
[2] 100% dry matter basis.

[abcd] Means with different superscripts within columns differ ($P<.05$) as determined by one-way analysis of variance and Duncans mean seperation.

Table 17.2. Performance by Steers Fed the Corn Harvest and Storage Treatments

Item	Dry	Harvestore	Stave	NPN stave
No. of pens	8	8	8	8
No. of steers	32	32	16	16
Final weight, lb[1]	993	978	984	974
Initial weight, lb	802	799	800	795
Avg. daily gain, lb	2.68	2.53	2.59	2.52
Daily intake, lb[2]	23.47[a]	22.99[ab]	22.39[ab]	21.96[b]
Feed/gain[2]	8.84	9.26	8.68	8.76

[1]Final live weights adjusted to dressing percentage of 62.

[2]100% dry matter basis.

[ab]Means with different superscripts within rows differ(P<.05) as determined by one-way analysis of variance and multiple comparison LSD.

Table 17.3. Performance by Steers Fed the Source Treatments

Item	Alfalfa	Corn silage
No. of pens	12	12
No. of steers	48	48
Final weight, lb[1]	988	979
Initial weight, lb	798	801
Avg. daily gain, lb	2.68	2.50
Daily intake, lb[2]	22.15[b]	23.61[a]
Feed/gain, lb[2]	8.36[a]	9.52[b]

[1]Final live weights adjusted to dressing percentage of 62.

[2]100% dry matter basis.

[ab]Means with different superscripts within rows differ (P<.05) as determined by one-way analysis of variance and multiple comparison LSD.

Table 17.4. Performance by Steers Fed the Supplemental Nitrogen Source Treatments

Item	Soybean	Urea	Combination	Stave urea
No. of pens	8	8	4	4
No. of steers	32	32	16	16
Final wt., lb[1]	1010	962	984	974
Initial wt., lb	801	800	800	795
Avg. daily gain, lb	2.93[a]	2.27[b]	2.59[ab]	2.52[b]
Daily intake, lb[2]	24.74[a]	21.73[b]	22.39[b]	21.96[b]
Feed/gain[2]	8.47[a]	9.63[b]	8.68[a]	8.76[a]

[1]Final liveweights adjusted to dressing percentage of 62.
[2]100% dry matter basis.

[ab]Means with different superscripts within rows differ (P<.05) as determined by one-way analysis of variance and multiple comparison LSD.

Table 17.5. Supplement Formulations for the HMC Trial

Item	Alfalfa supplements			Corn silage supplements		
	Soybean	Urea	Stave urea	Soybean	Urea	Stave urea
Supplement ID	212	214	216	213	214	217
Fed to treatments[a]	1 and 5	2 and 6	11[b]	3 and 7	4 and 8	12[b]
	....	....	...... As fed %	....	....	....
Ground corn	17.0	59.7	63.0	--	53.6	40.0
Soybean meal	61.5	--	15.0	76.0	--	35.0
Urea	--	8.5	--	--	10.5	--
Limestone	8.5	9.0	9.0	9.7	9.3	9.8
Potassium chloride	3.2	5.8	4.8	2.7	5.8	4.1
Salt	3.6	3.6	3.6	3.6	3.6	3.6
Dicalcium phosphate	.25	1.5	1.0	--	1.7	.6
Ammonium sulfate	.45	1.4	1.1	.8	2.0	1.4
Fat	3.0	3.0	--	4.7	11.0	3.0
Premix[c]	2.5	2.5	2.5	2.5	2.5	2.5

[a]Treatments 9 and 10 received the urea supplement (214 and 215, respectively) for days 1-21 and soybean supplement (212 and 213, respectively) for days 22-71. This is described as the "combination" protein supplementation.
[b]Treatments 11 and 12 received the urea supplement (214 and 215, respectively) for days 1-21 and then stave urea supplements (216 and 217, respectively for days 22-71.

KSU

ELPWA[1] and Molasses Additives for High Moisture Sorghum Grain

Jean Heidker[2], Harvey Ilg, Keith Behnke[2] and Keith Bolsen

Summary

ELPWA (a lactobacillus inoculant with antioxidant), molasses, or both combined were evaluated as additives to high moisture sorghum grain ensiled in concrete stave silos. ELPWA treated grain had the greatest temperature increase during ensiling. Final lactobacillus counts were higher in the ELPWA + molasses treated grain, however, the initial rate of increase was greatest in ELPWA or molasses treated grains. Control and molasses treated grains had the fastest decline in pH and the lowest final pH. Aerobic stability of the ensiled grain depended on the strata of the silo sampled and the temperature to which the grain was exposed but aerobic stability was adequate in all grains.

Group-fed steers receiving control grain were more efficient ($P<.05$) than those receiving molasses + ELPWA treated grain. There were no significant differences among grain treatments for rates or efficiencies of gains for heifers or individually-fed steers.

Introduction

Previous Kansas research indicated that sorghum grain treated with a lactobacillus inoculant produced increased average daily gains and feed efficiencies in finishing cattle when compared to control, molasses, or molasses + inoculant treated grains. Grain treated with the lactobacillus inoculant was more stable on exposure to air than the other grain treatments.

Our objective was to find if adding a lactobacillus inoculant or a readily available carbohydrate source (dry cane molasses) or both would consistently improve the quality of ensiled high moisture sorghum grain and improve its utilization by feedlot cattle.

[1]ELPWA is an experimental lactobacillus inoculant product with antioxidant supplied by Pioneer Hi-Bred International, Inc., Des Moines, IA 50308.

[2]Department of Grain Science and Industry, Kansas State University, Manhattan.

Experimental Procedure

Four concrete stave silos (10 ft x 50 ft) were filled with approximately 40,000 lb (as-received weight) of high moisture sorghum grain harvested at 20 to 31% moisture. Treatments were: 1) control (no additive); 2) .1% experimental lactobacillus inoculant product (ELPWA); 3) 1.0% dry cane molasses; and 4) 1.0% molasses + .1% ELPWA. Additives were applied to the grain on an as-received basis. All grain was rolled to lightly crack the kernels, then treated, mixed, and augered into one of four silos. Grain with a moisture content less than 25% had enough water added to bring it to 25% moisture. Dry grain was harvested from the same field at a later date, dried to 12% moisture in a solar grain dryer, and rolled prior to feeding.

Samples were taken from each load at ensiling. Five hundred gm samples of the grain being ensiled were placed in air-tight plastic bags. Three bags for each treatment were placed in 5-gallon containers, packed with high moisture sorghum grain, and sealed by an air-tight lid fitted with a Bunsen valve. The containers were stored in a chamber where the temperature was adjusted to correspond with the temperatures recorded in the concrete stave silos. Bags were removed at intervals, mixed, and analyzed for lactobacilli, pH, and fermentation acids.

Silos were opened after approximately 60 days. Twenty-five Hereford heifers and 71 crossbred steers were randomly allotted to give 1 pen of 5 heifers, 2 pens of 5 steers, and 4 or 5 individually fed steers per grain ration. Rations contained (DM basis) 83% of the appropriate sorghum grain, 12% corn silage, and 5% supplement. Rations were formulated to contain 11.5% crude protein, .62% calcium, .32% phosphorus and .64% potassium. The supplement supplied 200 mg of monensin per head daily. Rations were fed <u>ad libitum</u> twice daily. Refused feed was removed and weighed. Grain samples were collected twice weekly from the silos.

All cattle were weighed individually after 16 hr without feed or water, at the beginning and the end of the feeding trial. Intermediate weights were taken on 28, 56, and 84 days. Final weights were calculated using average dressing percentage of all cattle slaughtered on a given date.

Grain dry matter losses during fermentation, storage, and feedout were measured by weighing and sampling each load at ensiling and on removal. Ensiling temperatures were monitered for the first 38 days by six thermocouple wires evenly spaced in each silo.

Aerobic stability (bunk life) was measured as described on page 31 of this progress report. Stability was determined at room temperature of 19 and 27 C.

Results

Lactobacillus counts and pH change at different times post-ensiling are shown in Table 18.1. ELPWA + molasses treated grain had the highest initial counts; ELPWA treated grain had the fastest increase while molasses treated grain had the highest final counts. Molasses treated grain had the most rapid pH drop; molasses treated and control grains, the lowest final pH at 38 days; and ELPWA + molasses, the highest pH at 38 days.

Chemical analyses after fermentation are shown in Table 18.2. Control and molasses treated grains had similar pH's while ELPWA and ELPWA + molasses treated grains had the highest. Lactic acid was highest in the control and molasses treated grains. Acetic acid was highest in the ELPWA treated grain; lowest in the molasses and molasses + ELPWA treated grains. Ethanol was highest in the control and ELPWA treated grains and lowest in the molasses + ELPWA treated grain.

Actual ensiling temperatures are shown in Figure 18.1. Molasses + ELPWA treated grain had the highest ensiling temperature; molasses treated grain the lowest. Grains were not the same temperature upon entering the silos. Molasses treated grain was 10 C cooler than molasses + ELPWA treated grain. The temperature rises above initial grain temperatures are shown in Figure 18.2. ELPWA treated grain had the greatest increase (7.7 C); control grain, the lowest (5.6 C).

Cattle performance is shown in Table 18.3. There were no significant differences in average daily gain among any of the grain treatments. Group-fed steers receiving control grain were more efficient than those receiving dry rolled or treated grains, but there were no significant differences in animal performance among grain treatments in heifers or individually-fed steers.

Losses due to fermentation, storage, and feedout were smallest for the molasses treated grain (5.4%); control and molasses + ELPWA treated grain the greatest DM loss (14.4% and 14.3%, respectively); and DM loss of the ELPWA treated grain was intermediate (10.9%). The high DM loss may be partially explained by the long period of time between the end of the cattle feeding trials and the actual time the silos were emptied. A large portion of the grain removed when the silos were emptied was spoiled which would result in a much greater loss of grain DM.

Aerobic deterioration is characterized by dry matter loss, increased temperature and pH, and loss of fermentation acids. The stability of the grains at 19 C for the top and bottom half of the silos, respectively, were control 12 and 14 days; ELPWA 30 and 8 days; molasses 12 and 8 days; and molasses + ELPWA 7 and 10 days. When exposed to 27 C air, molasses treated grain showed no heat rise until day 15. ELPWA treated grain was stable until day 12; control was stable until day 10, while molasses + ELPWA was stable until day 7.

Table 18.1. Lactobacilli counts[1] and pH of the ensiled sorghum grains at different intervals post-ensiling

Time post-ensiling	Sorghum Grain							
	Control		ELPWA		Molasses		ELPWA + molasses	
	Lactobacilli	pH	Lactobacilli	pH	Lactobacilli	pH	Lactobacilli	pH
Hours:								
0	2.4×10^{4}	6.03	1.2×10^{4}	6.13	1.8×10^{4}	6.15	1.2×10^{5}	6.13
8	1.6×10^{5}	6.08	1.4×10^{7}	5.90	3.2×10^{6}	5.98	4.0×10^{6}	6.26
16	2.7×10^{6}	6.10	2.2×10^{7}	5.67	1.6×10^{8}	5.45	5.8×10^{7}	5.92
24	2.4×10^{7}	5.83	5.2×10^{7}	5.53	2.8×10^{8}	5.24	1.4×10^{8}	5.71
48	1.4×10^{8}	4.34	1.6×10^{8}	5.16	2.8×10^{8}	4.59	2.1×10^{8}	5.38
96	2.2×10^{8}	3.90	9.2×10^{7}	4.33	3.0×10^{8}	4.34	1.8×10^{8}	4.90
Days:								
7	6.8×10^{7}	3.95	1.4×10^{8}	4.15	3.5×10^{8}	3.93	2.5×10^{8}	4.62
14	6.2×10^{7}	3.89	1.1×10^{7}	4.00	6.1×10^{7}	3.85	1.3×10^{8}	4.13
38	-------	3.86	-------	3.92	-------		-------	4.10

[1]Lactobacilli counts are given as lactobacilli/gram of grain (wet basis).

Table 18.2. Chemical analyses of control, ELPWA, molasses, and molasses + ELPWA ensiled sorghum grain[1,2]

Sorghum grain	Control	ELPWA	Molasses	Molasses + ELPWA
Chemical Analyses				
%DM	66.11	69.46	70.69	73.45
pH	3.97	4.11	4.01	4.16
	% of DM			
Lactic acid	2.16	1.76	2.09	1.54
Acetic acid	.40	.53	.29	.28
Propionic acid	.04	.06	.03	.02
Valeric acid	.06	.07	.07	.05
Ethanol	.49	.50	.34	.26

[1]Each dry matter value is the mean of 16 samples; all other values are the mean of 7 samples.
[2]All analyses were determined using wet grain samples.

Table 18.3. Performances by heifers and yearling steers fed the five sorghum grain rations

	Sorghum grain ration				
Item	Control	ELPWA	Molasses	Molasses + ELPWA	Dry
Heifers:[1]					
Number	5	4	5	5	5
Initial wt., lb	789	806	794	789	781
Final wt., lb	987	1043	1000	991	1012
Avg. daily gain, lb	2.53	2.99	2.58	2.55	2.92
Avg. daily feed, lb[2]	19.96	22.13	20.64	23.05	21.23
Feed/lb of grain, lb[2]	7.89	7.40	8.00	9.04	7.27
Group-fed steers:[3]					
Number	10	10	10	10	10
Initial wt., lb	786	792	791	775	789
Final wt., lb	1115	1104	1112	1062	1113
Avg. daily gain, lb	2.99	2.83	2.92	2.61	2.95
Avg. daily feed, lb[2]	20.51	19.97	21.08	20.72	21.04
Feed/lb of gain, lb[2]	6.86[b]	7.05[ab]	7.22[ab]	7.94[a]	7.12[ab]
Individual-fed steers:[4]					
Number	4	4	4	4	5
Initial wt., lb	950	956	952	958	971
Final wt., lb	1190	1206	1187	1202	1214
Avg. daily gain, lb	2.89	3.00	2.82	2.95	2.93
Avg. daily feed, lb[2]	21.18	21.90	22.23	22.33	23.56
Feed/lb of gain, lb[2]	7.33	7.30	7.92	7.57	8.04

[1]79-day trial; January 22 to April 12, 1982.
[2]100% DM basis.
[3]110-day trial; January 22 to May 12, 1982.
[4]83-day trial; February 18 to May 12, 1982.
[a,b]Values with different superscripts differ significantly ($P<.05$).

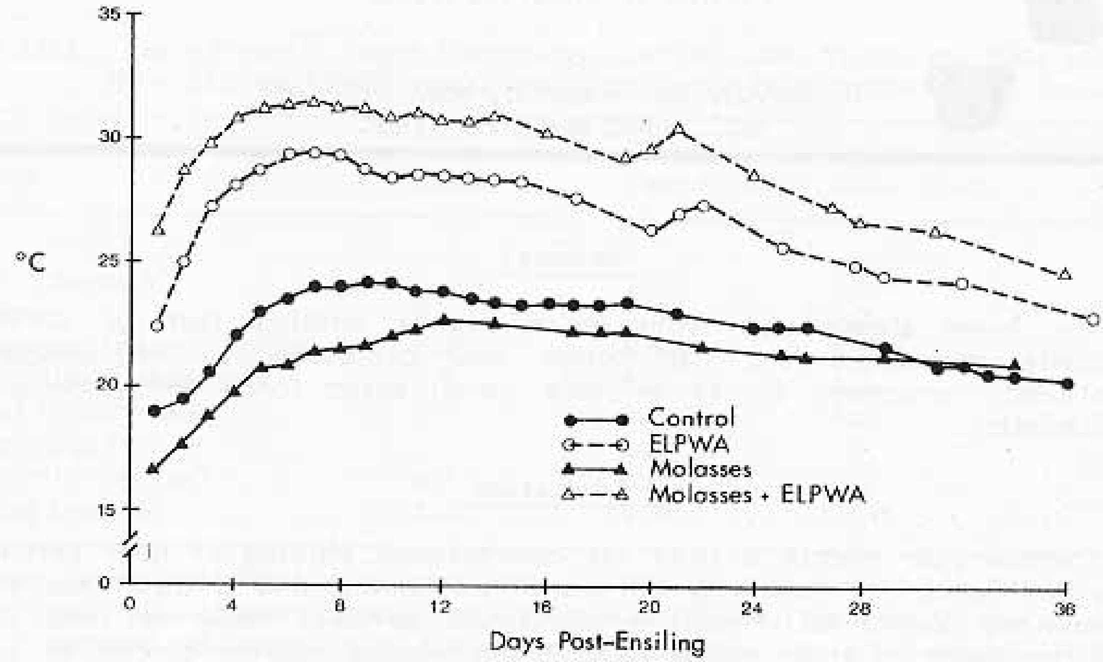


Figure 18.1. Ensiling temperature for the four sorghum grains at various days post-ensiling

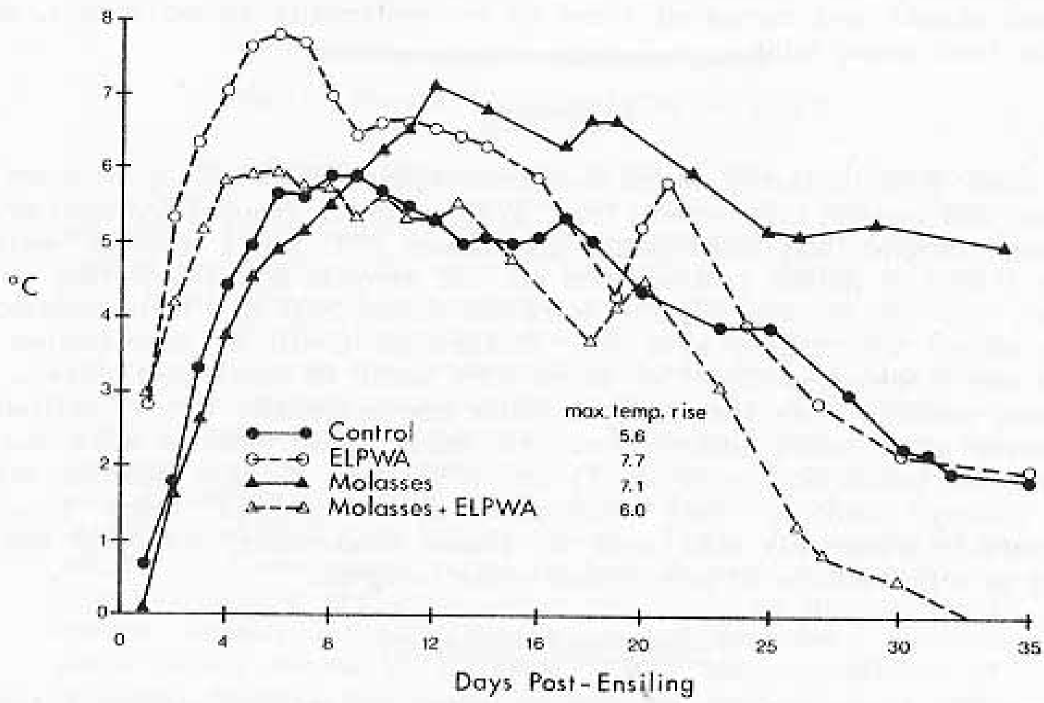


Figure 18.2. Ensiling temperature (degrees above initial temperature) for four sorghum grains at various days post-ensiling.

Eating and Cooking Loss Characteristics of Electrically Stimulated and Hot Boned Bull Inside Round Muscle Chilled at Different Rates

S.D. Shivas, C.L. Kastner, M.E. Dikeman, M.C. Hunt, and D.H. Kropf

Summary

We found steaks cut from inside rounds (chilled fast or slow) of electrically stimulated and hot boned bull carcasses, to be similar to conventionally processed steaks in taste panel, shear force and cooking loss characteristics.

Introduction

Considerable energy is used for conventional chilling of beef carcasses. Boning beef while the muscle is still warm (hot boning) and chilling muscle only (not bone and excess fat) results in significant savings. However, meat boned before the onset of rigor mortis (postmortem muscle stiffening) can be tough, especially if subjected to low temperatures. Electrical stimulation of carcasses hastens the onset of rigor mortis, thus, allowing use of hot boning without decreasing tenderness. We examined the effects of fast and slow chilling on the eating and cooking loss characteristics of electrically stimulated and hot-boned inside round steaks and compared them to conventionally boned steaks, all of which were from young bulls.

Procedure

We used 30 bulls, ten of which had been implanted with Ralgro® from birth (Greathouse and others, Cattlemen's Day, 1982). At 45 minutes postmortem, one side of each carcass was electrically stimulated (ES) for 2 minutes with 420 volts, and 1 amp of pulsed (.68 seconds on, .32 seconds off) alternating current (60 cycles). The inside round muscles were hot boned (HB) at 2 hours postmortem and were either fast chilled in a tray (ESHB-Fast Chill) or slow chilled in a cardboard box (ESHB-Slow Chill) at 41 to 45°F until 48 hours postmortem. The inside round muscles were removed from the conventionally (Conv) chilled and cut carcasses at 48 hours postmortem. All inside round muscles were cut into steaks, vacuum packaged, aged at 35 to 39°F until 6 days postmortem and frozen. Eating qualities were evaluated by a trained taste panel. A Warner-Bratzler shear was also used to assess tenderness. Cooking loss was calculated as a percentage of pre-cooked steak weights.

Results and Discussion

Means for taste panel scores, shear force values and cooking losses are shown in Table 19.1. Both Fast and Slow Chill ESHB steaks had values similar to the Conv steaks. Only beef flavor intensity was scored as less intense ($P<.05$) for the ESHB steaks when compared to the Conv steaks. Stimulating bull carcasses at 45 minutes postmortem, hot boning at 2 hours postmortem and aging until 6 days postmortem, produced steaks comparable in eating quality and similar in cooking losses to the Conv treatment.

Table 19.1. Taste Panel[a], Shear Force and Cooking Loss Means for Fast and Slow Chilled ESHB[b] and Conv[b] Processed Bull Inside Round Steaks

Variable	Conv	ESHB-Fast Chill	ESHB-Slow Chill
Flavor intensity	6.1[c]	5.9[d]	6.0[d]
Juiciness	5.5	5.3	5.3
Connective tissue amount	5.4	5.4	5.5
Myofibrillar tenderness	5.7	5.7	5.7
Overall tenderness	5.5	5.5	5.5
Warner-Bratzler shear force (lbs)	8.5	8.3	8.2
Cooking loss (%)	23.43	24.99	27.18

[a]Scores: 7=very intense flavor, very juicy, practically no connective tissue, or very tender; 6=moderately intense flavor, moderately juicy, trace amount of connective tissue, or moderately tender; 5=slightly intense flavor, slightly juicy, slight amount of connective tissue, or slightly tender.
[b]ESHB=Electrically stimulated and hot boned; Conv=Conventionally processed.
[c,d]Means within the same row with different superscripts are different ($P<.05$).

TASTE PANEL EVALUATION OF BEEF

Trained taste panels score much of the beef from our experiments for such factors as juiciness, beef flavor intensity, tenderness of the muscle proteins, tenderness of connective tissue, and overall tenderness. Panel members have been screened to exclude people who are not sensitive to taste factors. Then they are trained to accurately score the various flavor and tenderness factors. Beef for the taste panel is prepared carefully to remove any differences in cooking method or temperature. Then half-inch cores are removed for the individual panel members. A session starts with a "warm-up" sample so no sample has the advantage of being served first to a hungry taster. Then, the panel tastes and fills out evaluation forms on four to eight beef samples. The evaluations are done under red light so the panelists cannot visually estimate the degree of doneness. Trained taste panels enable us to measure the specific effects of breeding, feeding, pre-slaughter handling, post-slaughter chill rates, or such treatments as electrical stimulation and/or hot boning on the eating characteristics of beef.

Effects of Electrical Stimulation and Hot Boning on the Functional Characteristics of Presalted Beef Muscle Used in Sausage Manufacturing

Yang I. Choi, Curtis L. Kastner, Michael E. Dikeman, Melvin C. Hunt, and Don H. Kropf

Summary

Presalted, hot-boned muscle has excellent emulsifying properties for sausage manufacturing. However, electrical stimulation degrades these properties. Thus, while electrical stimulation and hot boning produce acceptable steaks and roasts, the value of the trimmings used in manufactured meat products may be lowered. Presalting maintained the high pH values of the hot-boned muscle during 24 hours storage.

Introduction

Muscle pH decreases as lactic acid accumulates during rigor mortis. Before rigor, muscle can bind more fat and water than after. So high pH, prerigor muscle is desirable in finely chopped products like bologna. Adding salt to prerigor muscle (presalting) for sausage manufacturing further increases its fat and water binding capacity.

Electrical stimulation has been used to accelerate rigor mortis in hot-boned beef carcasses, producing steaks and roasts of acceptable palatability. Emulsifying capacity and emulsion stability are critical characteristics in meat used for sausage manufacture. Since large quantities of beef trimmings are produced, and may be used in sausage manufacturing, we designed this experiment to determine the effects of electrical stimulation (ES) and hot boning (HB) on those characteristics.

Experimental Procedure

Thirty cattle were slaughtered in three groups at the KSU meat laboratory. Half of each group (5 cattle) was processed in the following manner: one side of each carcass was hot boned at 1 hour postmortem (HB), and the other side was conventionally boned after chilling at 36 to 46 F for 48 hours (CB). The other 5 cattle were electrically stimulated at the time of bleeding. The electrical stimulus was applied for 2 minutes with approximately 50 volts and 60 Hertz of alternating current (1 second on; 1 second off). After ES, cattle were skinned, eviscerated, and split into sides. One side of each carcass was hot boned at 1 hour postmortem (ESHB). The other side was conventionally boned after chilling at 36 to 46 F until 48 hours postmortem (ESCB).

The Triceps brachii (TB) chuck muscle was removed, coarsely ground, presalted (3.0%), placed in a polyethylene bag, and stored at 39 F for 24 hours. The pH was measured at 3 times: 1) from the intact TB muscle, 2) after presalting, and 3) after 24 hours storage of presalted meat.

Emulsifying capacity was measured as the total volume of vegetable oil emulsified by the presalted meat. To measure thermal emulsion stability, presalted meat emulsion was weighed both before and after cooking for cooking loss, and the amount of released fat, liquid, and solid was measured.

Results and Discussion

At all measurement times, prerigor HB muscle had a higher pH than postrigor CB muscle, but ES decreased the pH in ESHB samples (Table 20.1). Presalting maintained the high pH values of HB muscle during 24 hours of storage.

Table 20.2 shows that although HB muscle had the advantage of higher emulsifying capacity and thermal emulsion stability than CB muscle, electrical stimulation destroyed that advantage, and in fact created a product with lower thermal emulsion stability than CB beef.

ES may change the protein characteristics and thus lower the heat stability of the protein-fat matrix in a meat emulsion.

Table 20.1. Means for pH of Chuck (Triceps brachii) Muscle by Carcass Treatments.

Time of pH measurement	Treatments			
	CB	HB	ESCB	ESHB
Intact muscle	5.45^{a}	6.37^{c}	5.51^{a}	5.77^{b}
After presalting	5.43^{a}	6.24^{c}	5.48^{a}	5.71^{b}
24 hr after presalting	5.43^{a}	5.89^{c}	5.46^{a}	5.61^{b}

[abc]Means in the same row bearing different superscripts are significantly different (P<.05).

Table 20.2. Means for Emulsifying Capacity (EC) and Thermal Emulsion Stability of Presalted Meat after 24 Hours Storage by Carcass Treatments.

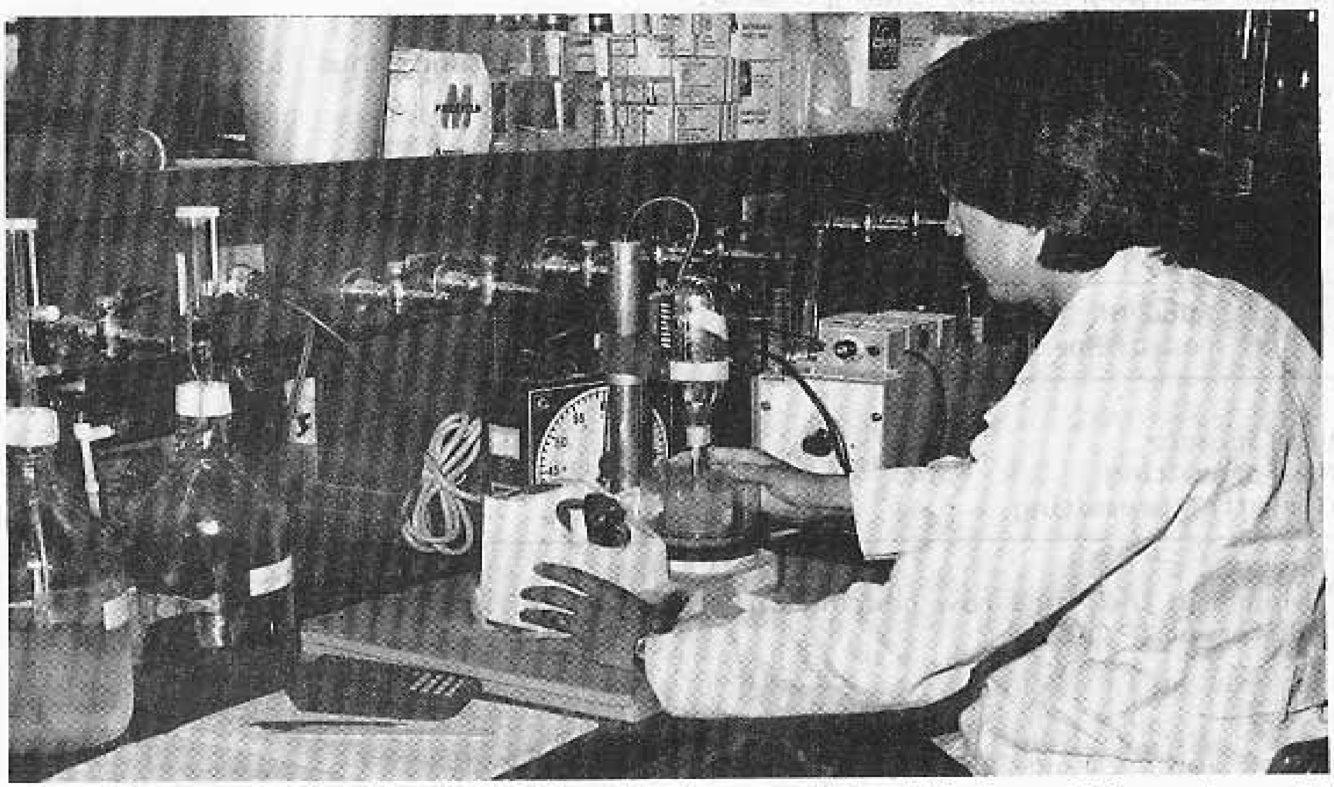
Emulsion characteristics	Treatments CB	HB	ESCB	ESHB
EC (ml)[a]	77.3[e]	98.1[f]	68.3[d]	76.3[e]
Thermal Emulsion Stability				
Cooking loss (%)[b]	14.73[e]	4.47[d]	22.45[f]	19.70[f]
Fat (ml)[c]	0.01[de]	0[d]	0.17[e]	0.60[f]
Liquid (ml)[c]	11.11[e]	1.31[d]	18.31[f]	15.74[f]
Solid (ml)[c]	0.29[e]	0[d]	0.79[g]	0.61[f]

[a]Oil emulsified per 1 gram of presalted meat.

[b](Wt. of meat emulsion before cooking - wt. after cooking) ÷ wt. before cooking × 100.

[c]Amount of released fat, liquid, and solid after cooking per 100 gram of meat emulsion.

[defg]Means in the same row bearing different superscripts are significantly different (P<.05).



When meat is blended with oil, the resulting thick emulsion slows this homogenizer. But when more oil is added than the meat can emulsify, the emulsion "breaks" and the homogenizer speeds up, giving an estimate of the meat's emulsifying capacity.

Ascorbic Acid and Ground Beef Display Life

S.D. Shivas, D.H. Kropf, C.L. Kastner,
M.C. Hunt, J.L.A. Kendell and A.D. Dayton

Summary

Adding 0.05 and 0.10% ascorbic acid to ground beef resulted in brighter color and longer display life, more intense taste panel beef flavor and less rancidity. Those advantages should encourage centralized retail cutting and packaging by reducing spoilage and loss.

Ground beef with 25% fat had brighter color scores and lower microbial counts but was more off-flavor than 20% fat ground beef.

Introduction

Shoppers often use meat color as a quality indicator. A cherry red color is preferred, but display conditions lead to rapid discoloration, especially when beef is ground. Color changes occur much sooner than flavor changes or spoilage. Ascorbic acid (vitamin C) is used in processed meat (ham, bacon, bologna, wieners, etc.), but is not allowed in fresh meat. By slowing discoloration without masking other quality deterioration, adding ascorbic acid to ground beef could reduce losses. We looked at the effects of adding low levels of ascorbic acid to ground beef of two fat levels.

Experimental Procedure

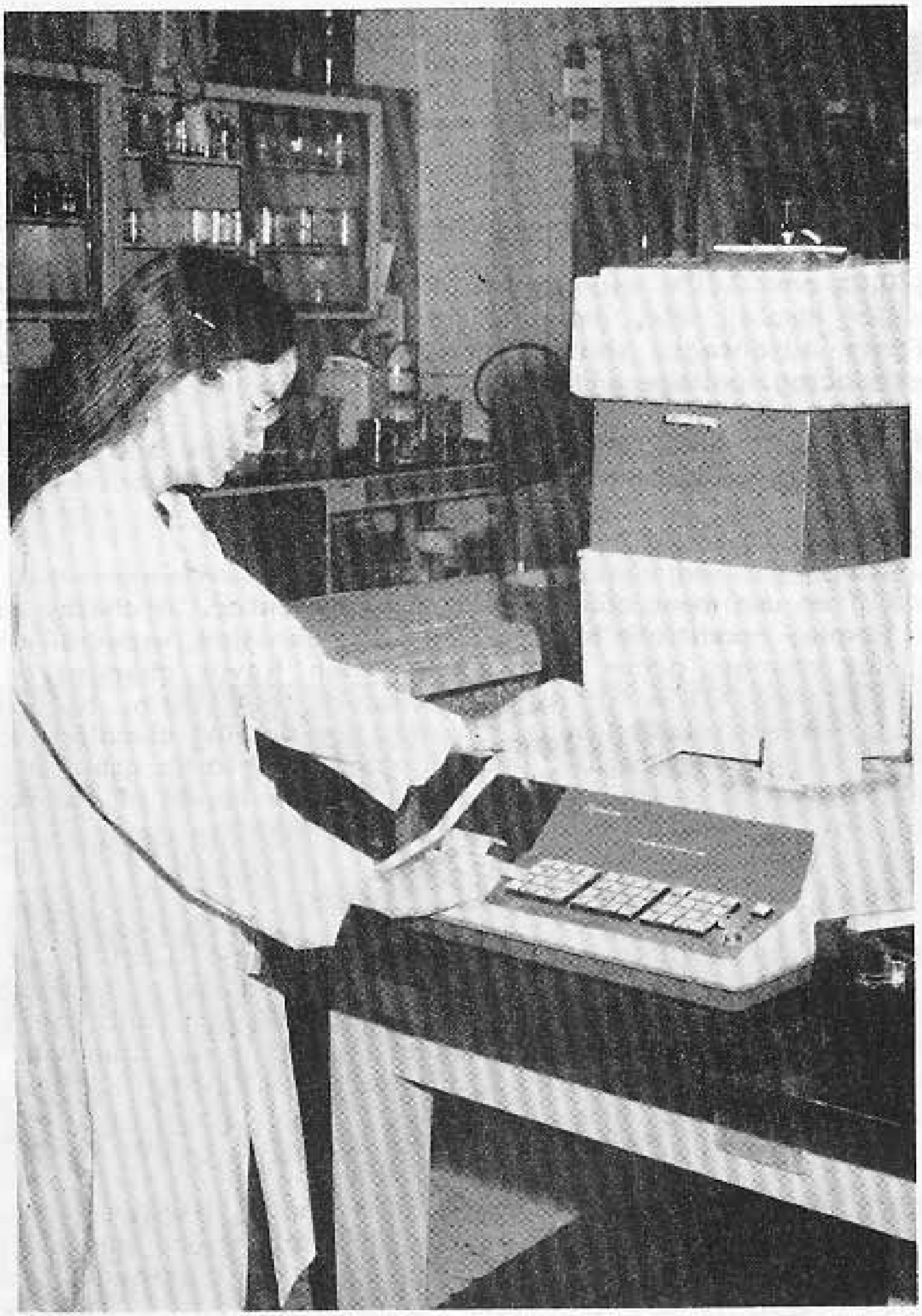
We added ascorbic acid at levels of 0, 0.1, 0.05 and 0.10% to ground beef that was 20 or 25% fat. Packages were displayed under retail conditions. At 0, 1, 3, 5 or 10 days of display, color was evaluated visually and by reflectance measurements. Taste panel traits, microbial counts, and chemical rancidity (thiobarbituric acid) were also determined for each treatment.

Results and Discussion

The higher ascorbic acid treatments (0.05 and 0.10%) were brighter red visually than the 0 and 0.01% treatments, and 25% fat ground beef was brighter red than 20%. Reflectance measurements supported the color panel findings.

A trained taste panel found more off-flavor in the higher fat ground beef (25%), and off-flavor scores were not affected by addition of ascorbic acid. Beef flavor was scored as more intense for ground beef containing 0.05 and 0.10% ascorbic acid. Chemical rancidity was greater for the 0 and 0.01% ascorbic acid treatments than the 0.05 and 0.10% treatments. Ascorbic acid did not affect microbial counts, but the 25% fat product had lower microbial counts than 20%.

By using 0.05 and 0.10% ascorbic acid, we obtained a 5 day display life for ground beef of both 20 and 25% fat. Presently, ground beef has a 2 to 3 day display life. Thus, adding ascorbic acid to ground beef could decrease product rework and loss, and make centralized ground beef production more feasible.



Color is hard to describe, except by comparing to a color with which we are familiar -- "cherry red" is the preferred color for beef. But sensitivity to color varies between people. This is a reflectance spectrophotometer that translates color into a set of numbers that describe beef color precisely and accurately.

Lighting Effects on Beef Carcass Grade Factors

D.H. Kropf, M.E. Dikeman, M.C. Hunt and H.R. Cross[1]

Summary

Beef carcass quality factors were evaluated under 25 different lighting systems (five lighting types each at five light intensities). Cool White fluorescent caused the darkest and most mature lean score, but marbling quantity score was not affected by lighting type or intensity. Lean was scored progressively brighter and more youthful with increasing lighting intensity.

Introduction

USDA beef carcass quality grade is largely determined by carcass maturity and marbling. Beef is graded under a variety of lighting conditions, but research on how lighting affects evaluation of beef quality factors is very limited. This study determined the effect of lighting type and intensity on quality scores.

Experimental Procedure

Rib steaks were obtained from 43 beef carcasses from the 1981 Beef Germ Plasm Evaluation study. Carcass sides were transported to the Kansas State University Food Service Center where steaks were cut at 72 to 126 hours after slaughter. Rib steaks were selected to fit into 5 marbling levels: Traces+, Slight-, Slight+, Small and Moderate.

Each steak was evaluated visually for amount of marbling, marbling distribution (even to uneven), lean color, lean maturity and lean texture by four experienced evaluators under all possible combinations of five lighting types and five lighting intensities. Lighting types were incandescent and Deluxe Cool White, Cool White, Grolux Wide Spectrum and Standard Grolux fluorescent. These were selected because they represent different proportions of red emission. Lighting intensities included 10, 20, 50, 100 and 300 foot candles.

Results

Scores for amount of marbling were not affected by lighting type or intensity. Marbling distribution and lean texture scores were not strongly affected by lighting.

[1]Roman L. Hruska U.S. Meat Anim. Res. Center, AR-SEA, U.S.D.A., Clay Center, NE 68933.

However, lean color was scored both brighter and more youthful under incandescent and Standard Grolux fluorescent lighting and darker and more mature under Cool White fluorescent. Grolux Wide Spectrum and Deluxe Cool White fluorescent lights were intermediate and resulted in 16% and 14% of a maturity score increase compared to Incandescent. Cool White caused a markedly older maturity score, raising it to B-08 compared to A-59 under the incandescent lighting.

More intense lighting resulted in brighter, more youthful appearing lean, but the maximum difference was A-91 under 10 foot candles and A-64 under 300 foot candles. Thus, an investment in more intense lighting could improve quality grade of a small percentage of A+ and of B maturity beef carcasses.

BEEF COLOR -- LIGHT MAKES A DIFFERENCE

White light is a combination of all the colors of the spectrum. Beef looks red to us because it reflects the red portion of the spectrum. But if one light source produces more red light than another, beef will look redder under that light. Thus, the kind of light in coolers and show cases influences the way we see beef color. Incandescent light contains a high proportion of red light, and makes beef look bright red and youthfull. Some fluorescent lights contain lots of blue and green light, and make beef look too dark. Because the blue end of the spectrum can cause changes in muscle pigments, some fluorescent lights may also decrease the display life of beef. Because high electrical costs have made fluorescent lighting almost mandatory, fluorescent tubes have been developed that vary in their spectral output, and consequently differ in the way beef looks under them. "Cool white" fluorescent lights contain lots of blue and less red. "Grolux" lights contain more red and less blue. "Grolux wide spectrum" and some other lights bring out the natural color of beef.

Factors Affecting Prices of Calves and Yearlings in Kansas

Chuck Lambert, Larry Corah
and Orlen Grunewald

Summary

Data were collected on 85,195 cattle sold in 15 Kansas auctions during October and November 1981. Buyers discounted sick cattle heavily, and discounts were heavier on sick calves than yearlings. The discount for bulls vs. steers increased as weight increased, but the discount for heifers vs. steers decreased with increasing weight. Buyers pay little if any premium for thin cattle, but severely discount very thin or fat cattle. Cattle with average fill sold as well or better than shrunk cattle. Gaunt or tanked cattle were heavily discounted. Best prices were paid for lots of 20 to 40 head, with heavy discounts for lots less than 5. Since the price advantage to uniform lots was small, sorting should be kept to a minimum. Large framed, thick muscled cattle sold best, and smaller framed cattle were discounted more in western than eastern Kansas.

Introduction

This research was designed to determine management and marketing factors affecting the price of calves and yearlings. We made an effort to place a dollar value on the differences in management and marketing, especially the factors a producer could control.

Procedure

The data were gathered by trained evaluators at 15 cooperating Kansas auctions. Cattle were evaluated as they went through the ring. Traits evaluated and recorded were price, weight, time of sale, sex, breed, horns, frame, muscle, fleshing, health, fill, uniformity and lot size. A total of 85,915 cattle were evaluated during the study conducted October and November of 1981. The study was a joint effort of the Departments of Animal Science and Industry and Agricultural Economics at Kansas State University.

Results

The producer can take advantage of many of the price differences we measured simply by adjusting his management and marketing program. In each of the following tables, average prices for the highest selling category are listed. Minus figures are discounts from that price. This paper is a summary of our results. A complete report of results can be obtained by ordering Ag Fact Sheet #MF-667 from Weber Hall, Kansas State University, Manhattan 66506.

EFFECTS OF HEALTH
77,692 cattle

Health	Percent	<600 lbs Steers	<600 lbs Heifers	600-900 lbs Steers	600-900 lbs Heifers
Thrifty	96.5	$63.76	$55.14	$60.98	$54.02
Stale	2.6	-2.86	-2.69	-4.57	-2.71
Few Sick	.65	-4.62	-4.00	-7.08	.85
Obviously ill	.2	-15.67	-9.19	-6.48	-9.13
Chronic	.05	-24.78	-21.50	-7.45	-7.61

It will pay to either sell calves fresh off the cow or keep them long enough after weaning to have them straightened out. It is better to keep them until they are eating and have some of their bloom back. Calves in less than healthy categories were discounted $2.75 to $25.00 per hundred weight. Sick yearlings were discounted less than sick calves. No one else wants to own your sick cattle anymore than you do.

EFFECTS OF SEX AND WEIGHT
76,314 cattle

Weight	Percent	57.6% Steers	3.4% Bulls	.3% Bulls & Steers	38.7% Heifers
<400	12.4	$66.26	- 2.74	- .03	-9.46
400-499	25.9	64.10	- 3.80	- .04	-9.05
500-599	21.6	62.06	- 4.58	-1.69	-8.23
600-699	17.6	61.02	- 7.08		-6.94
700-799	16.2	61.20	- 8.03		-7.12
800-899	6.3	60.39	-10.05		-7.10

Castrate calves before going to grass in the spring or before selling in the fall. Bulls sold for $2.75 to $10.00 per hundred weight less than steers, depending on what they weighed. Heifer discounts decreased from $9.50 to $7.00 as weights increased from 400 to 900 pounds.

Producers should study the steer-heifer price spread. It may pay to sell steers and grow or winter heifers. The price for steers was highest for all weights. Keeping cattle to heavier weights will depend on the producers' cost of production and cash flow situation.

EFFECTS OF HORNS
48,022 cattle

	Percent	<600 lbs Bulls	<600 lbs Steers	<600 lbs Heifers	600-900 lbs Bulls	600-900 lbs Steers	600-900 lbs Heifers
Dehorned	72.6	$60.39	$64.15	$55.31	$53.06	$61.21	$54.42
Horned	8.0	-1.07	-.58	-.24	-1.08	-2.62	-1.72
Mixed	18.6	2.29	.83	.70	4.07	.44	- .31
Tipped	.8	1.42	.24	-1.29	-4.56	-1.87	-1.66

Horned calves sell for about $1.00 per hundred weight less than calves with no horns, but yearlings with horns are discounted more. Other traits such as grade or breed are more important than horns. In this study, cattle with tipped horns or mixed cattle actually sold for more than either horned or dehorned cattle.

EFFECTS OF CONDITION
73,455 cattle

		<600 lbs		600-900 lbs	
	Percent	Steers	Heifers	Steers	Heifers
Very thin	.1	-14.32	-5.60	-7.27	
Thin	9.7	+ .19	+ .16	-1.48	- .80
Average	63.0	$64.07	$55.35	$61.14	$54.09
Fleshy	27.0	- 1.59	-1.12	+ .04	+ .13
Fat	.2	- 6.57	-8.15	-5.65	-3.35

Buyers may say they like thin cattle but the premium is still on bloom and shine. A little fat can cover a multitude of errors, and average fleshed cattle sell for about the same price per hundred weight as thin cattle. Fleshy calves were discounted $1.00 to $1.50. Fleshy and average yearlings sell for about the same price. When feed costs are low, it may even pay to sell cattle fleshy.

EFFECTS OF FILL
73,434 cattle

		<600 lbs		600-900 lbs	
Fill	Percent	Steers	Heifers	Steers	Heifers
Gaunt	.1	-7.99	-4.01	-3.62	+ .31
Shrunk	14.0	+ .08	- .06	- .63	- .09
Average	57.8	$64.26	$55.46	$61.32	$54.59
Full	27.7	-1.57	-1.14	- .54	- .91
Tanked	.4	-12.90	-11.40	-6.86	-7.79

In our study shrunk and average fill cattle sold for the same price, with full calves discounted about $1.00 to $1.50. The producer might just as well sell fill, since there is no premium for shrunk cattle.

EFFECTS OF LOT SIZE
33,758 cattle

		<600 lbs		600-900 lbs	
Head/Lot	Percent	Steers	Heifers	Steers	Heifers
1	4.1	-3.97	-3.54	-4.06	-4.65
2-5	18.2	-2.47	-1.92	-2.04	-2.45
5-10	22.4	-1.09	- .98	-1.42	-1.88
10-20	22.3	- .77	- .75	- .42	-1.28
20-30	10.4	- .35	$57.72	- .17	- .81
30-40	7.0	$67.07	-2.69	- .09	$57.40
>40	15.6	- .20	-1.58	$63.74	- .57

The premium is for lots of 20 to 40 head. Singles are discounted $3.50 to $5.00 and small lots sell for less than lots of 20 head or more. So, minimize sorting in order to keep lots large.

EFFECTS OF WEIGHT SPREAD
73,947 cattle

Weight spread	Percent of total	Steers	Average head/lot	Heifers	Average head/lot
			<600 lbs		
<25	36.6	-2.43	3.50	-2.26	2.7
26-50	45.4	- .62	8.2	- .98	8.6
51-100	15.8	-1.00	11.2	- .63	11.4
>100	2.2	$65.60	17.7	$56.93	15.8
			<600-900 lbs		
<25		-2.33	4.1	-2.96	3.6
26-50		$62.24	13.9	- .82	10.6
51-100		- .09	18.3	$56.08	19.1
>100		$62.24	28.5	- .10	11.0

This table shows that the premium for larger lots is more than the premium for uniformity. Uniform lots are popular as long as they are over 20 head. Don't sort for uniformity and lose the advantage of big lots.

THE EFFECTS OF AUCTION SIZE
73,755 cattled

Cattle/Year	Number Auctions
<25,000	3
25-70,000	8
70-110,000	3
>110,000	1

Transportation costs, individual auction management and personal preference of the seller are larger factors than the number of cattle an auction sells per year.

EFFECTS OF QUARTILE OF SALE ON PRICE
32,199 cattle evaluated

Quarter of sale	Percent	<600 lbs Steers	<600 lbs Heifers	600-900 lbs Steers	600-900 lbs Heifers
1st	12.2	$66.02	$57.05	- .37	- .62
2nd	30.8	- .20	- .61	+ .05	- .30
3rd	37.1	- .94	- .88	$62.57	$55.79
4th	19.9	-1.50	-1.27	- .36	- .51

Calves sell for the most money in the first quarter of the auction. They sell for $1.25 to $1.50 less in the fourth. The price spread is less than $1.00 for yearlings but those sold in the second quarter have a slight advantage.

Cattle should be sold in the normal flow of the auction. Other factors are more important than the time within the sale day. Work with your auction manager in advance and have an orderly marketing program.

EFFECTS OF FRAME
73,485 cattle

		<600 lbs		600-900 lbs	
	Percent	Steers	Heifers	Steers	Heifers
Large	9.2	$65.13	$56.03	$60.91	$54.66
Medium	87.8	- .92	- .68	+ .32	- .47
Small	3.1	-7.44	-4.25	-3.94	-5.70

In calves, medium frame cattle were discounted $1.00 and small frame cattle, $4.25 to $7.50. Medium and large framed feeder cattle sold at the same price, but small framed feeders were docked $4.00 to $5.70 per hundred weight.

EFFECTS OF GRADE
73,449 cattle

			<600 lbs		600-900 lbs	
Frame	Grade	Percent	Steers	Heifers	Steers	Heifers
Large	1	8.5	$65.81	$56.38	$61.53	$55.14
	2	.7	-4.00	-3.59	-3.84	-3.44
	3	.01	-13.15	--	-10.16	--
Medium	4	84.7	-1.51	- .97	- .37	- .87
	5	3.0	-2.74	-1.29	-1.91	-2.27
	6	.09	-8.22	-9.95	-12.84	--
Small	7	2.91	-7.91	-4.66	-4.51	-5.91
	8	.08	-8.04	-2.96	--	--
	9	.01	-25.:6	-7.32	--	--

When frame and muscling are combined as grade, large frame thick cattle (Grade 1) sell highest. However, large frame medium muscled cattle (Grade 2) are discounted more than either medium frame thick muscled or medium frame medium muscled cattle (Grades 4 and 5). So, it pays breeders of large frame cattle to select for thick muscling.

EFFECT OF GRADE
East Half of Kansas (38,043 hd)
vs. West Half (35,298 hd)

			<600 lbs		600-900 lbs	
Grade	Percent East	Percent West	East	West	East	West
1	6.6	10.5	$64.13	$66.88	$60.56	$62.20
2	.4	1.2	-2.68	-4.79	-5.15	-3.47
4	84.5	85.2	- .02	-2.23	+ .51	- .47
5	5.1	.6	-1.37	- .36	-1.09	- .45
7	3.4	2.5	-6.12	-9.93	-3.28	-5.73

Different types of farming operations and climates affect the type of cattle in demand. There is a premium for large frame (Grade 1) cattle in the west half of Kansas.

Medium frame (Grade 4) cattle sell as well as Grade 1 in the east. Small frame (Grade 7) cattle are discounted less in the east.

The size of auction had little influence on prices, and is probably much less important than transportation costs, management of the indivdual auction, and seller's personal preferences.

During the data collection, steer calves averaged $63.66 and heifers, $55.07 per CWT, with spreads among the weekly averages of $3.64 and $3.95, respectively. During the same time, yearling steers averaged $60.83 and heifers, $53.87, with spreads of $1.62 and $3.18.

Comparison of Cattle Types and Management Systems

R.R. Schalles, Keith Bolsen and Michael Dikeman

Summary

No differences were found in total feed energy required to produce a pound of retail cuts between breeds or management systems. However, across breeds, faster gaining steers were more efficient. When yardage, facilities, labor and interest were also considered, faster gaining cattle and accelerated management programs were more economical.

Introduction

During the last 15 years the availability of different cattle types and the relative value of feeding facilities, equipment, land, interest rates, feed and labor have changed drastically. For cattle production to be profitable, producers must re-evaluate all resources and be willing to make changes as needed. We compared two cattle types and two post-weaning management systems for energetic efficiency of beef production.

Experimental Procedure

Twenty Simmental and 21 Polled Hereford steers were fed either an accelerated or conventional feeding program. Steers on the accelerated program were placed on a finishing ration (90% rolled milo plus supplement, 10% corn silage, dry basis) 33 days after weaning at an average age of 7½ months. Steers on the conventional program were fed sorghum and corn silage from 7½ months to 11 months of age before being placed on the finishing ration. Steers were slaughtered at high Good to low Choice quality grades. Records were analyzed from conception through slaughter on both the dam and the calf.

Results and Discussion

The Simmental cows were heavier, taller and gave more milk than the Polled Herefords (Table 24.1). Winter supplemental feeding and range stocking rate were based on metabolic weight (weight to the .75 power). Simmental cows consumed more energy for maintenance and milk production than the Polled Hereford cows. For each pound increase in daily milk production, weaning weight increased 10 lb. Simmental calves were heavier than Polled Hereford calves at all ages.

Steers on the accelerated program gained faster and were slaughtered younger than similar steers on the conventional program (Table 24.2). All steers were slaughtered at a similar quality grade. Simmental steers produced heavier carcasses with less backfat and larger loin eyes than Polled Hereford steers.

Although there was considerable variation in feed energy utilization in both breeds, the energy required to produce a pound of retail cuts was the same for both breeds and both management systems. This included energy required for cow milk production and maintenance, and energy consumed by the steer from weaning to slaughter. Across breeds, the faster gaining steers were significantly more efficient and produced more pounds of retail cuts of higher quality grade than slower gaining steers. When yardage, facilities, labor, and interest are also considered, the faster gaining steers and the accelerated program are favored.

Table 24.1. Cow Traits and Steer Preweaning Performance

Traits	Simmental	Polled Hereford
Cow traits		
No.	20	21
Cow wt. at weaning, lb	1364.0 ± 25.7^{a}	1118.0 ± 24.4^{b}
Ht. at weaning, in	52.2 ± 0.4^{a}	48.4 ± 0.4^{b}
Post calving condition score	4.1 ± 0.2^{a}	4.4 ± 0.2^{a}
Avg. daily milk production,lb	23.1 ± 1.1^{a}	16.0 ± 1.0^{b}
Age, yr	5.9 ± 2.4^{a}	5.8 ± 3.3^{a}
Energy for maintenance (lyr)[1]	3864.0 ± 53.0^{a}	3297.0 ± 51.0^{b}
Energy for milk (205 days)[1]	1591.0 ± 73.0^{a}	1101.0 ± 70.0^{b}
Calf traits		
Birth date	March 24 ± 17 days	March 29 ± 11 days
Birth wt, lb	91.7 ± 2.9^{a}	81.4 ± 2.8^{b}
May wt, lb	179.4 ± 6.8^{a}	152.8 ± 5.9^{b}
June wt, lb	258.7 ± 7.4^{a}	207.0 ± 7.0^{b}
July wt, lb	335.6 ± 9.2^{a}	264.2 ± 8.8^{b}
Aug. wt, lb	467.1 ± 11.4^{a}	374.5 ± 10.8^{b}
Sept. wt,lb	516.3 ± 11.8^{a}	453.0 ± 13.1^{b}
Oct. wt, lb	573.3 ± 13.8^{a}	453.0 ± 13.1^{b}
Oct. Ht., in	44.1 ± 0.3^{a}	40.0 ± 0.3^{b}

[ab]Value in the same sow with different superscripts are different (P<.05).

[1]Mcal of energy.

Table 24.2. Postweaning Steer Performance

	Simmental		Polled Hereford	
Management system	Accelerated	Conventional	Accelerated	Conventional
No. steers	10	10	10	11
Starting wt, lb	605 ± 19^a	572 ± 20^a	474 ± 19^b	468 ± 18^b
56 day wt	733 ± 22^a	666 ± 22^b	654 ± 22^b	572 ± 21^c
84 day wt, lb	856 ± 22^a	740 ± 22^b	723 ± 22^b	645 ± 21^c
113 day wt, lb	913 ± 20^a	799 ± 20^b	764 ± 20^b	701 ± 19^c
NE_m 113 days, Mcal	700 ± 4^b	662 ± 4^b	600 ± 4^c	576 ± 4^d
NE_g 113 days, Mcal	579 ± 8^a	406 ± 8^b	630 ± 8^c	316 ± 8^d
Slaughter wt, lb	1313 ± 27^a	1335 ± 28^a	991 ± 27^b	1077 ± 26^c
NE_m 113 days to Sl., Mcal	1049 ± 10^a	1340 ± 10^b	628 ± 10^c	874 ± 10^d
NE_g 113 days to Sl., Mcal	958 ± 15^a	1252 ± 15^b	531 ± 15^c	825 ± 14^d
Days fed	242	283	205	235
Slaughter age, days	466 ± 23	516 ± 20	429 ± 10	458 ± 13
Hot carcass wt, lb	803 ± 14^a	793 ± 15^a	606 ± 14^b	636 ± 14^b
Backfat, in.	0.34 ± 0.04^a	0.37 ± 0.04^a	0.59 ± 0.04^b	0.52 ± 0.04^b
Loin eye area, sq. in.	13.5 ± 0.4^a	13.0 ± 0.4^a	10.6 ± 0.4^b	10.9 ± 0.4^b
Yield grade	2.7 ± 0.1^a	2.8 ± 0.1^{ab}	3.4 ± 0.1^c	3.2 ± 0.1^{bc}
Quality grade[1]	4.75 ± 0.13^a	4.84 ± 0.13^a	5.02 ± 0.13^a	4.72 ± 0.12^a
Retail cuts, lb	548 ± 11^a	537 ± 11^a	396 ± 11^b	422 ± 10^b
Total energy per lb retail cuts,(Mcal/lb)	16.6 ± 0.4^a	16.7 ± 0.5^a	17.1 ± 0.4^a	16.7 ± 0.4^a

[abcd] Values in the same row with different superscripts are different (P<.05).

[1] 4 = high Good, 5 = low Choice.

Survey of Kansas Cow-calf Producers

Jack Riley

Summary

Results of a 1982 survey were compared to a similar survey conducted 5 years earlier to determine if the acceptance of management practices had changed during that time period. The cow herd size was similar in both surveys but there was a 6% increase in crossbred cows and a substantial change in sire breed. The breeding season had been shortened to 110 days but was still too long. There was no apparent change in acceptance of semen testing or pregnancy checking but 23% more producers were using a worming program. Fly control ear tags were not available in 1977-78 but 68% were using them in 1982 (69% used 1 tag per animal and 31% used 2) with a majority tagging both the cow and calf. Implanting had increased from 25% to 58%, with 95% of those using Ralgro and 43% re-implanting at least once. In 1977-78 a feeder calf price of $47.25 per cwt. was considered desirable; $65 per cwt. was the average response in 1982.

Introduction

Report of Progress 350 (March, 1979) summarized the results of a survey conducted between Nov. 1977 and April 1978 of 350 Kansas producers. That survey showed that many recommended management practices were not being utilized.

Procedure

Another survey was conducted during Sept. - Nov. 1982. This survey, like the previous one, was conducted by the Beef Science class at Kansas State University. While not conducted according to standardized statistical methods, the survey has proven a valuable educational experience for the students, and we think the results represent a cross section of the management practices and attitudes within the Kansas cattle industry.

Results

Questions which appeared on both surveys are detailed in Table 25.1. Space does not allow duplication of the entire survey results but additional information can be obtained by contacting the author.

Table 25.1. Survey Results from Kansas Cow-Calf Producers

Question	1977-78 Survey	1982 Survey
No. surveyed	350	227
No. cows/producer	126	129
Cow breed:		
Angus	16.9%	23.1%
Hereford	33.5%	25.3%
Crossbred	18.6%	24.9%
Bull breed:		
Angus	19.1	23.1
Hereford	35.2	25.6
Simmental	6.5	13.7
Length breeding season:	134	110
Semen test bulls:		
Yes	43%	45%
Pregnancy check cows:		
Yes	50%	52%
Do you worm:		
Yes	40%	63%
Do you use fly control ear tags:		
Yes	---	68% < 69% 1 tag, 31% 2 tags
Do you fly control tag:		
Cow	---	19%
Calf	---	24%
Both	---	57%
Do you implant:		
Yes	25%	58%
Which implant is used:		
Ralgro	56%	95%
Do you re-implant:		
Yes	---	43%
Price considered desirable for calves/cwt.	$47.25	$65.00

Managements Options for Pregnant Feedlot Heifers

Jack Riley, Mike Simon, Lou Ellen Keay, and Guy Kiracofe

Summary

Heifers that were 167 days pregnant when slaughtered gained faster and more efficiently than open heifers, or heifers that had been aborted with a prostaglandin analog at 83 or 138 days, unless the slaughter weight was adjusted for the 1.7% lower carcass yield (dressing %). When the slaughter weights for all these management options were adjusted using the carcass yield of open heifers, there was no difference in gain except for the depressed performance associated with late abortions. However, open heifers were 6.7% more efficient than heifers pregnant when slaughtered. Heifers aborted at 138 days had substantially reduced gains and feed conversion.

These results indicate that because of increased carcass yield, packers can afford to pay a premium for heifers that are open or have been aborted during the first trimester. Unless a premium is paid for open heifers, pregnant heifers (provided they are sold before calving) sold on a live weight basis might be more profitable because of the apparent increased gain and efficiency.

Introduction

Pregnant heifers create problems for cattle feeders because they may calve during the feeding period. However, a heifer in early pregnancy when placed on a finishing ration might be slaughtered before she calves, and thus have the potential to gain faster and more efficiently because of altered hormone production.

Recent FDA approval of prostaglandin as an abortifacient for feedlot heifers has given cattle feeders added management choices. This trial was conducted to gather essential information regarding performance and potential side effects of four pregnancy management options.

Procedure

All heifers were Angus X Hereford, purchased at weaning from one Kansas ranch, then fed a growing ration from November 21, 1981 to start of finishing trial on August 31, 1982. Eighteen were left open, 24 were aborted at an average of 83 days (Abort early), 23 aborted at an average of 138 days (Abort late), and 23 were left pregnant. The abortifacient aspect of the trial is summarized on pages 22 and 23 of this Progress Report. A finishing ration composed of (dry matter basis) 84% rolled milo, 10% sorghum silage and 6% protein and mineral supplement was fed for 84 days, except for the late abortion group which was slaughtered after 77 days. Each group was fed together in a feedlot pen, without replication. Another group of bred heifers will be maintained on a grower ration until calving, then changed to a finishing ration for a 30 day nursing period (calves will be early weaned) and an additional 30 days, in an attempt to produce a live weight and carcass grade comparable to the other four management groups. Those results will be published in 1984.

Table 26.1. Effect of Pregnancy Management Options on Performance of Feedlot Heifers

Management options:	Open	Pregnant	Abort early	Abort late
No. heifers	18	23	24	23
Initial wt, lb	779.3	779.8	790	858
Final wt, lb	1035.8	1065.6	1041.6	1034.1
Gain, lb	256.5	285.8	251.6	176.1
ADG, lb	3.05 (84 d)	3.40 (84 d)	3.00 (84 d)	2.29 (77 d)
Efficiency, DM/lb gain	7.36	7.06	8.04	9.39
Carcass wt, lb	630.2	629.2	634.9	615.0
Dressing %	60.8	59.1	61.0	59.5
USDA grade:				
No. Prime	1	0	1	0
No. Choice	15	23	23	22
No. Good	2	0	0	1
Adj. final wt, lb[1]	1035.8	1034.9	1044.3	1011.5
Adj. gain, lb[1]	256.5	255.1	254.3	153.05
Adj. ADG, lb[1]	3.05	3.04	3.03	2.00
Eff. DM/lb adj. gain	7.36	7.89	7.96	10.75

[1] Final weight, gain, daily gain and efficiency adjusted to the same carcass yield as the open heifers.

Results and Discussion

The effect of pregnancy management options on the performance of pregnant feedlot heifers is shown in Table 26.2. The heifers slaughtered at an average 167 days of pregnancy were not visually different from the open heifers or those aborted at 83 days, and would probably have brought the same price if sold on a live weight basis. The pregnant heifers gained faster (3.4 vs. 3.0 and 3.05) than the open or early aborted heifers and were the most efficient. But probably because of the conceptus, the carcasses yielded 1.7% less. To more accurately compare the management options, all gains and efficiencies were adjusted, using carcass weight and the carcass yields of the open heifers. After adjustment, the open, pregnant and early aborted heifers all gained equally, but the open heifers were 6.7% more efficient. Carcass quality grade did not differ for the four pregnancy management options.

One group of heifers was continued on a growing ration until mid-pregnancy (aborted at avg. 138 days) and then fed the same finishing ration for 77 days in order to obtain approximately the same slaughter weight as the other 3 management groups. This late aborted group gained substantially slower (at least 1.0 lbs per day on an adjusted basis) and less efficiently suggesting that an abortifacient, if used, should be used early.

One major problem with marketing heifers is that packer buyers may assume a certain pregnancy rate and discount the entire pen for the expected lower yield. Our trial indicates that a feeder with a pen of open or early aborted heifers is justified in asking a premium price. If traditional marketing assumes a 20% pregnancy rate, then a premium of at least $.30/cwt live weight would be realistic.

THE PROBLEM WITH DRESSING PERCENT

Cattle feeders sell live weight. Meat packers sell carcass weight. Dressing percent is the relationship between them. Experimental treatments are generally evaluated using live weight gains, but dressing percent is often included. Carcass weight can be determined with a high degree of accuracy, but live weight is influenced by such factors as feed and water intake, gut fill, and anything that must be discarded. Evaluating treatments based on dressing percent is dangerous because an over-fat animal will have a higher dressing percent than his leaner counterpart. Rate of gain (lbs per day) will be influenced by any errors in measuring live weight. Because rate of gain is an important end-point in most of our experiments, we often determine the dressing percent for an entire group of cattle, then "reconstruct" the ending weight by dividing the carcass weight by the dressing percent. That yields a much more accurate measurement of rate of gain than using simple live weight at the end of the experiment.

Revaccination of Recently Processed Cattle

M.F. Spire, J.G. Riley, and A.J. Edwards

Summary

Two trials were conducted to evaluate the effectiveness of revaccinating recently processed cattle with modified live IBR and BVD vaccine. Revaccination decreased total illness 24 to 26%. A significant reduction in clinically sick calves occurred by 48 hours after revaccination and continued for the remainder of the observation period.

Introduction

Out of a total of 495,000 cattle received by Kansas and Nebraska feedlots (Figure 27.1) consulted by the KSU College of Veterinary Medicine 8 to 9% were treated for illness; respiratory diseases accounted for 66 to 78% of that illness. Of 758 head of yearling cattle entering six feedlots, 73% (range 94 to 57%) were susceptible to IBR virus, and 36% (range 7 to 41%) were susceptible to BVD virus.

Thus, respiratory diseases and the varying susceptibility to IBR and BVD in incoming cattle place considerable burden on the producer and his veterinarian. We evaluated the effectiveness of revaccinating recently processed cattle with modified live IBR and BVD on sickness levels and death loss.

Experimental Procedures

The first 28-day trial evaluated the effectiveness of revaccination 10 days after initial processing in mixed calves weighing less than 550 lbs. At processing, 360 calves were given modified live IBR-BVD[a] vaccine, multicomponent Clostridial bacterin/toxoid,[b] implanted, ear tagged for identification, dipped, and half selected to be revaccinated with IBR/BVD 10 days later.

The second 28-day trial evaluated the effectiveness of revaccination at 5 days after initial processing in mixed calves weighing less than 450 lbs, purchased in a local salebarn. All cattle were in-processed 24 hours after arrival as in Trial 1, except they were not implanted nor dipped. Five days later, half were revaccinated as in trial 1.

[a]Resbo IBR-BVD, Norden Laboratories, Inc., Lincoln, NE 68501.

[b]Sitegard ML, Jensen-Salsery Laboratories, Kansas City, MO 64141.

Animals were defined as being sick, based on one or a combination of the following clinical signs: depressed, gaunt, off feed, increased respiratory rate, heavy nasal or ocular discharge, diarrhea, and/or a temperature above 103.0°F. All cattle were treated a minimum of 4 days and returned to their original group.

Results and Discussion

Sickness levels and death loss for trial 1 are shown in Table 27.1. Although illness level and death loss tended to be lower in revaccinated cattle, the differences were not statistically significant.

The results of trial 2 are shown in Table 27.2. Although sickness level was 26% lower in revaccinated cattle, the difference was not statistically significant. However, revaccination significantly reduced the number of calves treated later than two days after revaccination (7 days after processing), and the number of calves that had to be retreated.

Table 27.1. Effects of Revaccination with Modified Live Virus Infectious Bovine Rhinotracheitis (IBR) and Bovine Viral Diarrhea (BVD) Vaccine 10 Days after Initial Processing in Feedlot Cattle Weighing Less than 550 lbs

	Normal processing	Revaccination 10 days after initial processing
Total head	180	180
Sickness level (%)	11.7	8.9
Death loss (%)	1.7	0.6

No significant differences (P>.05).

Table 27.2. Effects of Revaccinating with Modified Live Virus Infectious Bovine Rhinotracheitis (IBR) and Bovine Viral Diarrhea (BVD) Vaccine 5 Days After Initial Processing in Feedlot Cattle Weighing Less Than 450 lbs

	Normal processing	Revaccination 5 days after initial processing
Total head	64	65
Sickness level (%)	48.4	35.3
Death loss (hd)	1	0
Number of calves treated after revaccination	10	4
Number of calves treated more than 2 days after revaccination	8[a]	1[b]
Retreatment	6[c]	1[d]

[ab]Means in same row with different superscripts are different (P<.025).
[cd]Means in same row with different superscripts are different (P<.05).

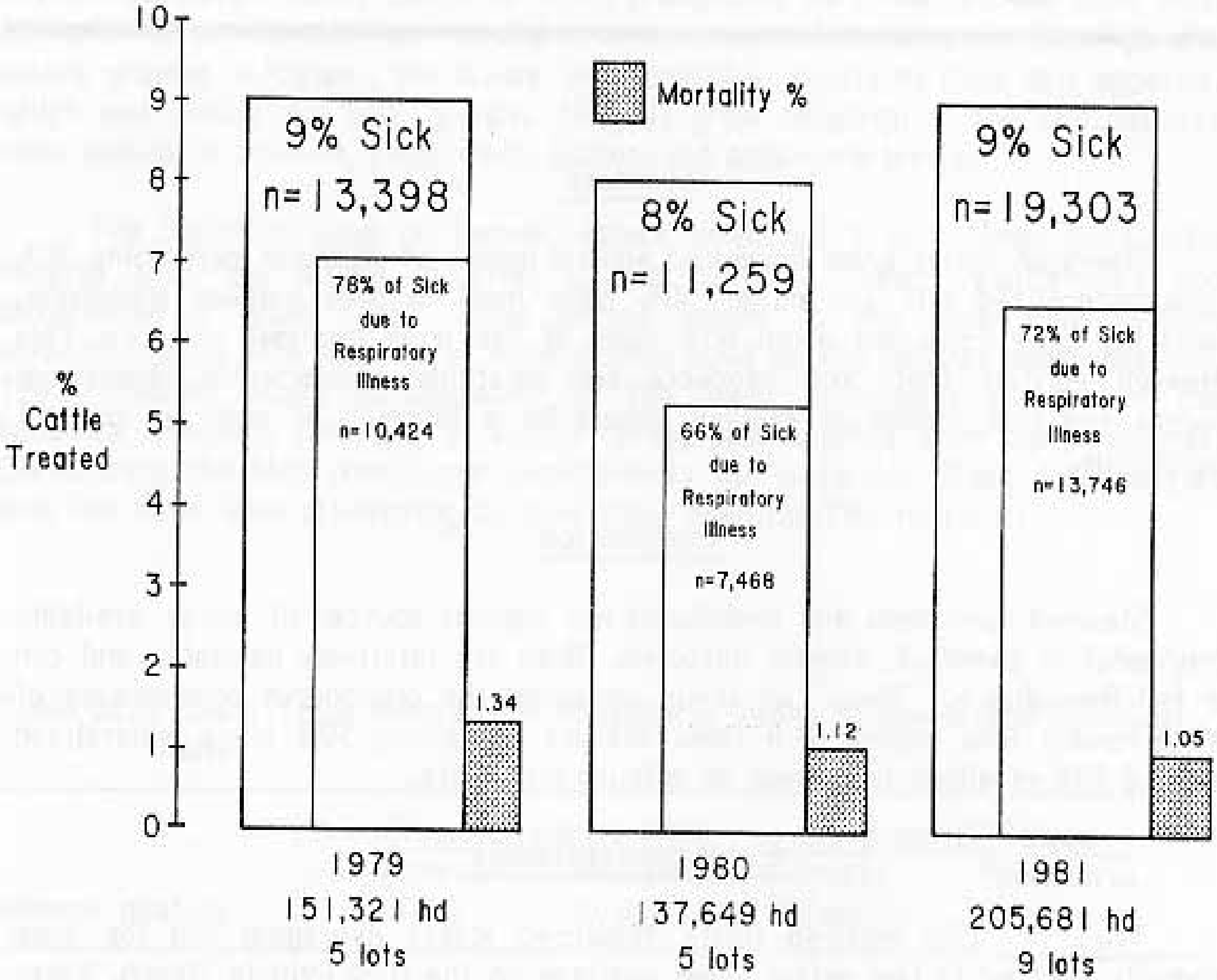


Figure 27.1 Incidence of feedlot disease in feedlots on routine health programs (1979-1981) consulted by the College of Veterinary Medicine, Kansas State University.

Comparative Intake of Bone Meal and Calcium Phosphate Mineral Mixtures as Phosphorus Sources for Grazing Steers and Lactating Cows

Frank Brazle,[1] Gerry Kuhl,
Ted Wary[2] and Dale Lanham[3]

Summary

Steers on native grass consumed equal amounts of mixtures containing 50% trace mineralized salt and either 50% bone meal or 50% calcium phosphate. Lactating cows consumed about 60% more of the bone meal:salt mixture. This research verifies that both products are palatable supplemental phosphorus sources and that choice of product should be a function of cost per unit of phosphorus.

Introduction

Steamed bone meal and phosphates are popular sources of highly available phosphorus in livestock mineral mixtures. Both are relatively palatable and can be fed free-choice. These two trials compared the phosphorus consumption of cattle having free access to a loose mixture containing 50% trace mineralized salt and 50% of either bone meal or calcium phosphate.

Experimental Design

Trial 1: One hundred thirty crossbred steers averaging 600 lbs were randomly allotted to two native grass pastures on the Dick Pringle Ranch, Yates Center, KS. Cattle in one pasture were offered a mixture of 50% bone meal and 50% salt, while the other group received a 50% calcium phosphate and 50% salt mix. Mineral mixes were switched between pastures once a month to eliminate pasture effects. Intake was monitored weekly. The trial ran from May 19 to July 28.

The 50% bone meal mixture averaged 6% phosphorus, 14.5% calcium and 50% salt, while the 50% calcium phosphate (mono- and di-calcium forms, Farmland CoPhos®) mix averaged 10.5% phosphorus, 9% calcium and 50% salt.

Trial 2: Thirty-six Simmental cow-calf pairs were divided between two late fall K-31 Fescue pastures at the Dave Meyers Farm, Columbus, KS. Pastures were fertilized and stocked similarly. The mineral mixtures were the same as in Trial 1. Intake was checked weekly.

[1]Southeast Area Extension Livestock Specialist.
[2]Cherokee County Extension Agricultural Agent.
[3]Woodson County Extension Agricultural Agent.

Results

Average daily intake of the two mineral mixtures and the calculated daily phosphorus consumption of the steers and cow-calf pairs are shown in Table 28.1. The steers ate nearly identical amounts of the two mineral mixtures. Because the calcium phosphate mixture contained more phosphorus, steers fed this free choice mixture consumed nearly twice as much phosphorus as those fed the bone meal mixture. Since research has not shown a phosphorus deficiency in steers grazing native grasses in Kansas, the steers were probably satisfying their salt appetite, which was similar for both groups. Monthly grass clippings of the two pastures were similar in calcium, phosphorus, sodium and potassium levels.

The lactating cows on fescue pasture consumed 2 to 4 times more total mineral than the steers in Trial 1, due to their higher requirements and differences in grass type. Cows having access to the bone meal mixture consumed about 60% more total mineral than cows on the calcium phosphate mix. The increased intake compensated for the lower phosphorus content of the bonemeal mixture, resulting in similar phosphorus intakes from both mixtures. Considering the high phosphorus requirements for lactation, these data suggest that the cows were attempting to meet their need for This nutrient.

Table 28.1. Daily Total Mineral and Phosphorus Intake of Steers and Cow-Calf Pairs

	Steers on native grass		Cows on fall fescue	
Mineral mixture	Mineral lb/day	Phosphorus lb/day	Mineral lb/day	Phosphorus lb/day
50% calcium phosphate: 50% trace mineral salt	.079	.0083	.19	.020
50% bone meal: 50% trace mineral salt	.076	.0045	.30	.018

Effect of Salt Form and Processing Method[1] on Salt Intake and Beef Cattle Performance

Lyle W. Lomas[2]

Summary

Processing method (evaporated vs rock) had no effect on salt consumption or weight gain of growing stocker cattle. Steers consumed 2.18 times more loose salt than block salt.

Introduction

Whether to feed beef cattle loose salt or a salt block has been a controversial subject for many years. Cattle with free access to loose salt will generally consume more salt than when salt is in compressed blocks. Many cattlemen disagree as to whether cattle eat enough salt from licking blocks. In an effort to reduce energy and production costs, a compressed rock salt block has been developed. Our study compared cattle performance using rock salt and white evaporated salt, in the loose and block form.

Procedure

Experiment A

Eleven groups of cows were provided free access to both evaporated and rock salt blocks, placed in side by side separate feeders during late winter, spring and summer of 1982. No other source of salt was available. Salt consumption was determined by weighing the blocks.

Experiment B

Fifty-six crossbred steers with an average initial weight of 643 lb were randomly allotted to eight 5-acre brome pastures on May 12, 1982. A 2 x 2 factorial design with two replicates was used to evaluate the following salt treatments: 1) rock salt block, 2) evaporated salt block, 3) rock mixing salt, 4) evaporated mixing salt.

All salt was fed in covered windvane feeders. Consumption was determined weekly by weighing the unconsumed salt. All steers were implanted at the onset of the study with Synovex-S and were fed 150 mg Rumensin in 3 lb dry rolled milo for the first 84 days of the study and 200 mg Rumensin in 4 lb dry rolled milo during the last 28 days.

[1] Salt and partial financial assistance provided by Carey Salt, Hutchinson, KS 65701-0322.

[2] Southeast Kansas Branch Experiment Station, Parsons, KS 67357.

Cattle were rotated among pastures every 14 days and were weighed at 28 day intervals. Initial and final weights were obtained following a 16 hr shrink from feed and water. The study was terminated September 1, 1982 (112 days).

Results

Results of Experiment A are presented in Table 29.1. There was no significant difference (P>.20) in average salt consumption between the evaporated and rock salt blocks.

Results of Experiment B are summarized in Table 29.2. Processing method (evaporated vs rock) had no effect (P>.20) on cattle weight gain or salt consumption. Salt form (loose vs block) had no effect on steer performance (P>.20) but cattle consumed 2.18 times more loose salt than block salt (P<.05).

This research indicates that although grazing steers consumed more loose salt, intake from blocks is sufficient.

In addition, there is no difference between consumption of rock salt or the more expensive evaporated salt, when fed either loose or in blocks.

Table 29.1. Cattle Preference for Rock and Evaporated Blocks When Both Were Available

Location	No. of Days	No. of Cows	Salt Consumption (oz/hd/day) Evaporated	Rock
A	139	34	.26	.19
B	93	19	.26	.32
C	94	18	.21	.28
D	94	25	.14	.14
E	131	13	.37	.47
F	131	21	.20	.23
G	69	15	.92	.84
H	62	14	.65	.65
I	131	35	.42	.22
J	131	13	.63	.51
K	131	16	.30	.39
AVERAGE	110	20	.40[a]	.39[a]

[a](P>.20)

Table 29.2. Effect of Salt Form and Processing Method on Salt Intake and Beef Cattle

	Performance Evaporated	Rock	Means
Loose			
Daily gain (lb/head)	1.24	1.40	1.32
Daily salt intake (oz/head)	1.78	1.67	1.72[a]
Block			
Daily gain (lb/head)	1.38	1.26	1.32
Daily salt intake (oz/head)	.72	.86	.79[b]
Means			
Daily gain (lb/head)	1.31	1.33	
Daily salt intake (oz/head)	1.20	1.22	

[a,b]Values in the same column with different superscripts differ significantly (P<.05).

Value of Implanting and Reimplanting Feedlot Heifers[1]

Scott Laudert,[2] Gerry Kuhl and Robert Schalles

Summary

Implanting incoming feedlot heifers with Ralgro® or Synovex-H® increased weight gain an average of 9.4%. Reimplanting half way through the 119 day feeding period did not improve gain significantly. There were no differences between Ralgro and Synovex-H when used as the initial or second implant.

Introduction

Research has consistently shown that implanting increases feedlot gains about 10% and feed utilization about 8%. Reimplanting steers midway through the finishing period increases rate of gain and feed efficiency an additional 4 to 5%. This trial was conducted because there is little research on reimplanting finishing heifers.

Experimental Procedure

Two hundred eleven Brahman-cross heifers averaging 600 lbs were randomly allotted to one of the following seven implant treatments: 1) control (no implant); 2) initial Ralgro, no reimplant; 3) initial Ralgro, Ralgro reimplant; 4) initial Ralgro, Synovex-H reimplant; 5) initial Synovex-H, no reimplant; 6) initial Synovex-H, Ralgro reimplant; 7) initial Synovex-H, Synovex-H reimplant. All cattle were fed in the same pen and handled similarly throughout the feeding period. All heifers were individually identified and weighed at the beginning of the 119 day trial. Final weights were calculated from individual hot carcass weights and the average dressing percentage (62.7%) of the entire group. Heifers in the reimplant treatments were given the second implant midway through the feeding period. All data were analyzed by Least Squares Analysis of Covariance to remove the effects of variation in initial weight.

[1] Appreciation is expressed to Grant County Feeders, Ulysses, KS for supplying cattle and facilities; Charles Sauerwein and Donald Wiles, Gray and Ford County Extension Agricultural Agents, and Excel Corporation, Dodge City, KS for slaughter and carcass data assistance; and International Minerals and Chemical Corporation and Syntex Agri-Business, Inc. for implants.

[2] Southwest Area Extension Livestock Specialist.

Results

The results are presented in Table 30.1. All implant treatments increased (P<.01) daily gain over the controls except for the single Ralgro implant (P=.08). There were no significant differences between any of the groups that received a single implant or that were reimplanted. Daily gain of the heifers receiving a single implant was 2.79 lbs vs. 2.86 lbs for those reimplanted. Heifers reimplanted with Synovex-H gained 2.89 lbs per day vs. 2.83 lbs per day for those reimplanted with Ralgro.

Table 30.1. Effect of Implanting on Performance of Feedlot Heifers.

					Least square means, lbs			
Treatment	Initial implant	Reimplant	No. heifers	Initial wt., lbs	Final wt.	Carcass gain	Total gain	Daily gain
1	None	None	29	595	905	568	304	2.55^{a}
2	Ralgro	None	30	593	927	581	326	2.74^{ab}
3	Ralgro	Ralgro	28	599	937	587	335	2.82^{b}
4	Ralgro	Synovex-H	31	604	942	591	341	2.87^{b}
5	Synovex-H	None	31	610	939	589	338	2.84^{b}
6	Synovex-H	Ralgro	29	601	940	589	338	2.84^{b}
7	Synovex-H	Synovex-H	33	599	948	594	347	2.91^{b}

[abc]Means with different superscripts are significantly different (P<.01).

Effects of Compudose® and Ralgro® Implants and Tramisol® Injectable Wormer on the Performance of Grazing Yearling Steers[1]

Scott Laudert,[2] Charles Sauerwein[3]
and Gene Harris[4]

Summary

Compudose and Ralgro improved (P<.05) average daily gain 15% over non-implanted controls. No difference was observed between the two implants. Tramisol injectable wormer increased (P<.05) average daily gain 8% over non-wormed cattle.

Experimental Procedure

Trial 1. Seventy-four native straightbred and crossbred yearling steers averaging 713 lbs were randomly allotted by breed to the following treatments: 1) control (no implant), 2) Ralgro implants, or 3) Compudose implants. All steers were individually weighed at the beginning (June 2) and end of the 124 day trial. The cattle grazed the same native grass pasture on the Wiley McFarland Ranch, Cimarron, KS.

Trial 2. Thirty-eight 452 lb yearling Angus steers from Utah were randomly allotted to Ralgro or Compudose implant groups, with half of each group receiving Tramisol injectable wormer at the recommended dose. Individual weights were taken at the beginning (June 7), and 85 and 190 days later. The steers grazed the same native range at the Larry Meyers Ranch, Meade, KS.

Data from both trials were analyzed by Least Square Analysis of Covariance to remove the effects of differences in initial weight.

Results

In trial 1, implanting with either Ralgro or Compudose improved (P<.05) weight gain an average of 15% over controls (Table 31.1), with the difference between implants approaching significance (P =.08).

[1]Appreciation is extended to Wiley McFarland, Cimarron, KS and Larry Meyers, Meade, KS for supplying cattle and facilities, Elanco Products Co. and International Minerals and Chemical Corp. for supplying implants and American Cyanamid Co. for supplying Tramisol.

[2]Southwest Area Extension Livestock Specialist.

[3]Gray County Extension Agricultural Agent.

[4]Meade County Extension Agricultural Agent.

In trial 2, daily weight gains of Compudose and Ralgro implanted steers were similar throughout the trial (Table 31.2). Two of 18 Compudose implants were lost. Tramisol injectable wormer increased ($P<.05$) daily gain 8% (Table 31.3), resulting in 19 lbs more gain during the grazing season. Sixty-five percent (12 lbs) of this benefit occurred during the first 85 days.

Table 31.1. Response of Yearling Steers Grazing Native Range to Ralgro and Compudose Implants -- Trial 1

Treatment	No. steers	Initial weight lbs	Least Squares Means, lbs: Final weight	Total gain	Daily gain
Control	24	719	901[a]	188[a]	1.51[a]
Ralgro	26	709	920[b]	207[b]	1.67[b]
Compudose	24	711	938[b]	225[b]	1.81[b]

[a,b]Means with different superscripts differ ($P<.05$).

Table 31.2. Response of Yearling Steers Grazing Native Range to Ralgro and Compudose Implants -- Trial 2

Treatment	No. steers	Initial weight lbs	Least Squares Means, lbs: Initial 85 Day ADG	Final 105 Day ADG	Total 190 Day ADG
Compudose	18	459	1.71	0.92	1.27
Ralgro	20	444	1.75	0.84	1.25

Table 31.3. Response of Yearling Steers Grazing Native Range to Tramisol Injectable Wormer -- Trial 2

Treatment	steers	Initial weight lbs	Least Squares Means, lbs: Initial 85 Day ADG[a]	Final 105 Day ADG	Total 190 Day ADG[b]
Control	19	443	1.66	0.85	1.21
Tramisol	19	460	1.80	0.91	1.31

[a]Means within this column differ, $P = .06$).
[b]Means within this column differ ($P<.05$).

Effect of Synovex-H and Ralgro Implants on Weight Gain of Heifers Grazing Wheat Pasture[1]

Scott Laudert[2] and Ricky Nelson[3]

Summary

Heifer calves grazing winter wheat pasture and implanted with Synovex-H or Ralgro gained 18 and 14% faster (P<.01) respectively, than heifers not implanted. Weight gains were similar for both implants.

Experimental Procedure

One hundred and eighty-two straightbred and crossbred heifer calves averaging 415 lbs were randomly allotted by breed and purchase source to one of the following four treatments: 1) control (no implant); 2) Synovex-H inserted at the recommended site; 3) Synovex-H inserted at the base of the ear, or 4) Ralgro inserted at the base of the ear. Each heifer was individually weighed at the beginning and end of the 138 day trial. All heifers grazed together throughout the trial.

Results

Both implants increased (P<.01) rate of gain over that of the control heifers (Table 32.1). There were no significant differences among the implants, and there was no advantage to altering the site of implanting Synovex-H.

Table 32.1. Effect of Implanting Wheat Pasture Heifers with Ralgro or Synovex-H.

Treatment	No. Heifers	Initial Weight (lb)	Final Weight (lb)	Total Gain (lb)	Daily Gain (lb)
Control	44	412	562	150[c]	1.09[c]
Synovex-H[a]	47	407	585	178[d]	1.29[d]
Synovex-H[b]	47	415	595	180[d]	1.30[d]
Ralgro[a]	44	424	596	172[d]	1.24[d]

[a]Implant inserted at recommended site in middle third of ear.
[b]Implant inserted at base of the ear.
[c,d]Means with different superscripts differ (P<.01).

[1]Appreciation is expressed to Jim Harper, Ashland, KS for supplying cattle and facilities, Synovex-H Agri Business, Inc. for financial support and implants, and International Minerals and Chemical Corporation for implants.
[2]Southwest Area Extension Livestock Specialist, Garden City, Ks 67846.
[3]Clark County Agricultural Extension Agent.

Comparison of Ralgro® and Compudose® Implants for Suckling Steer Calves[1]

Danny Simms[2], Allen Dinkel[3],
Del Jepsen[4], and Robert Schalles

Summary

Two field trials were conducted to compare Ralgro and Compudose for suckling steer calves. Ralgro, Ralgro re-implanted, and Compudose increased gain over controls 2.5, 5.9, and 1.5%, respectively, with only the increase from Ralgro re-implanted being significant (P<.05). Ralgro reimplanted steers gained more than Compudose steers (P<.05).

Introduction

A new 200 day implant, Compudose, was approved recently for suckling steer calves. These trials were conducted to compare Compudose with a single Ralgro implant and a Ralgro re-implant program for suckling calves.

Experimental Procedure

Suckling Simmental-cross steer calves on 2 Kansas ranches were randomly assigned to the following treatments: 1) Control (no implant), 2) a 36 mg Ralgro implant at 1 to 3 months of age, 3) a 36 mg Ralgro implant at 1 to 3 months of age and again at 4 to 6 months of age, or 4) a Compudose implant at 1 to 3 months of age. Individual, non-shrunk weights were taken at the time of initial implanting (branding) and at weaning. Starting and weaning dates were May 8 and October 8 (153 days) for trial 1 and May 3 and October 25 (175 days) for trial 2. Reimplanting was on day 92 of trial 1 and day 115 of trial 2.

Results

Based on least square means for both trials (Table 33.1), Ralgro, Ralgro re-implanted, and Compudose increased average daily gains 2.5, 5.9, and 1.5%, respectively, over control. Ralgro reimplanted steers gained significantly (P<.05) faster than Compudose or control steers. A single Ralgro implant increased ADG slightly more than Compudose in both trials, but the difference was not significant. Retention of the Compudose implants was not a major problem; only 5 out of 84 (6%) were lost by the end of the trials.

[1]Appreciation is expressed to Norman Rohleder, Russell, KS and Roger Wilson, Oberlin, KS for cattle and facilities, and to Elanco Products Co. and International Minerals and Chemical Corp. for providing implants.

[2]Northwest Area Extension Livestock Specialist.

[3]Decatur County Extension Agricultural Agent.

[4]Russell County Extension Agricultural Agent.

Table 33.1. Comparison of Ralgro and Compudose Implants for Suckling Calves

	Implant treatment			
	Control	Ralgro	Ralgro-Reimplanted	Compudose
			Trial 1 - 153 days	
No. of steers	13	19	20	42
Initial wt, lb	171.5	173.2	168.8	168.3
Final wt, lb	463.8	472.9	466.5	462.4
Total gain, lb	292.3	299.7	297.7	294.1
Avg. daily gain, lb	1.91	1.96	1.95	1.92
			Trial 2 - 175 days	
No. of steers	13	50	19	42
Initial wt, lb	203.8	210.7	211.1	202.7
Final wt, lb	572.5	591.3	613.8	576.7
Total gain, lb	368.7	379.6	402.7	374.0
Avg. daily gain, lb	2.11	2.17	2.30[a]	2.14
			Trials 1 and 2	
Overall Avg. daily gain, lb	2.04[a]	2.09[ab]	2.16[b]	2.07[a]

[ab]Values with different superscripts differ significantly ($P<.05$).

WHAT IS COMPUDOSE?

Compudose-200 is a new, long lasting implant for use in suckling, growing and finishing steers. The 3/16" X 1" implant consists of an inert, cylinderical core of silicone rubber coated with another thin layer of silicone that is impregnated with 24 mg of estradiol, a natural hormone. This estradiol is slowly, eavenly released from the silicone over about 200 days. Because the implant is pliable, there is no trouble with crushing during implanting. Compudose has no withdrawal period prior to slaughter.

Compudose® Implant vs a Ralgro® plus Synovex-S® Reimplant Program for Finishing Steers[1]

Scott Laudert,[2] Joe Eder[3] and Gerry Kuhl

Summary

Compudose implanted feedlot steers performed similarly to steers initially implanted with Ralgro and reimplanted with Synovex-S. Steers lost 2.9% of the Compudose implants.

Introduction

There is little research comparing Compudose with other implants used in feedlot cattle. This trial was conducted to compare Compudose with a Ralgro + Synovex-S reimplanting program in a commercial feedlot.

Experimental Procedure

Three hundred and forty-three Brahman-cross steers averaging about 700 lb each were randomly assigned to two treatment groups: a Compudose implant at processing, or a Ralgro implant at processing plus Synovex-S midway through the feeding period. Steers were randomly allotted to the two treatments in 10 head groups as they were processed, dipped and moved to a holding pen. From the holding pen, five or six steers of each 10 head group were individually weighed. Then pen weights were taken on each treatment group. The two treatment groups were fed in adjoining pens and handled similarly throughout the 132 day feeding period. The steers in the Ralgro + Synovex-S group were reimplanted on day 55. Both treatment groups were weighed at reimplanting time but the Compudose cattle were not run through the processing chute. All cattle were slaughtered on the same day. Final weights on the individually weighed steers were calculated using hot carcass weights and the average dressing percentage of their treatment group. Loss of Compudose implants was determined at slaughter.

1 Appreciation is expressed to Don and Mark Smith, Smith Cattle, Inc., Tribune, KS for supplying cattle and facilities, Elanco Products Company, International Minerals and Chemical Corporation and Syntex Agri-Business, Inc. for implants and Iowa Beef Processors, Holcomb, KS for slaughter assistance.
2 Southwest Area Extension Livestock Specialist.
3 Greeley Sounty Extension Agricultural Agent.

Results

Weight gain and carcass data of the individually weighed steers are reported in Table 34.1. No significant differences (P>.05) were detected between the two treatment groups for weight gain, carcass quality or yield grade.

Group performance is shown in Table 34.2. The Ralgro+Synovex-S reimplanted steers gained 10 lbs more than the Compudose implanted steers, on only slightly more feed and with no difference in feed efficiency. Compudose implant loss was 2.9%. No unusual bulling problems were encountered in either treatment.

Table 34.1. Effect of Implants on Gain and Carcass Responses of Individually Weighed Steers.

	No. Steers	Final Weight lb.	Carcass Weight lb.	Total Gain lb.	Daily Gain lb.	Quality Grade[a]	Yield Grade
Compudose	89	1172	737	469	3.55	10.3	2.4
Ralgro+Synovex-S reimplant	90	1183	748	479	3.63	10.7	2.3

[1]Good = 10, Good + = 11

Table 34.2. Pen Performance of Steers Implanted with Compudose or Ralgro+Synovex-S

Treatment	No. steers	Initial weight lb.	Final weight lb.	Total gain lb.	Daily gain lb.	Feed intake[1] lb.	Feed gain	Dressing percent
Compudose	172	699	1173	474	3.59	24.8	6.89	62.9
Ralgro+Synovex-reimplant	171	701	1185	484	3.67	25.1	6.85	63.2

[1]Dry matter basis

Effect of Reimplanting with Ralgro on Performance and Carcass Characteristics of Feedlot Heifers[1]

Danny Simms,[2] Gerry Kuhl,
Steven Tonn[3] and Robert Schalles

Summary

A field study was conducted to evaluate the effect of reimplanting, and of implanting technique, on the performance of yearling heifers. Daily gains of reimplanted, single implanted and non-implanted cattle averaged 3.00, 2.93 and 2.81 lb, respectively. Implanting Ralgro at the base of the ear produced a slight and not statistically significant increase in gain over the "old" site 1 to 2 in. from the base of the ear. Feed efficiency of the single implant heifers was 5.5% better than controls, with an additional 1.9% improvement due to reimplanting. Carcass characteristics were not materially influenced by implant treatment.

Introduction

Many cattle feeders question the value of re-implanting, particularly for 100 to 120 day feeding periods. To answer that question, we studied the effect of reimplanting heifers with Ralgro under commercial feedlot conditions. We also compared "old" and "new" implant sites.

Experimental Procedure

Three hundred six yearling heifers weighing approximately 670 lbs were randomly assigned to three treatments: 1) control (no implant), 2) one 36 mg Ralgro implant at processing, or 3) one 36 mg Ralgro implant at processing and another 36 mg Ralgro implant approximately mid-way through the 112 day trial. In addition, half of the heifers in treatments 2 and 3 received the implant in the "old" site (1 to 2 in. from the base of the ear), while the other half were implanted at the "new" site (at the base of the ear). At reimplanting time, only the heifers in treatment 3 were removed from their feeding pen.

Individual, non-shrunk weights were taken at the beginning and end of the trial. Cattle in each treatment were fed and managed alike in three adjoining pens. Since about 21% of the heifers were pregnant at arrival, the data were corrected for pregnancy effects on performance.

[1]Appreciation is expressed to Jerry Kobler, Riverside Feeders, Inc., Penokee, KS for providing cattle and facilities, International Minerals and Chemical Corp. for implants and financial assistance, and Iowa Beef Processors, Holcomb, KS for slaughter and carcass data assistance.

[2]Northwest Area Extension Livestock Specialist.

[3]Graham County Extension Agricultural Agent.

Results

All implanted cattle gained faster than controls (Table 35.1), but differences were significant (P<.05) only for those implanted once at the "old" site and those reimplanted at the "new" site. When averaged across implant sites, single implant heifers gained 13.4 lbs more and reimplanted heifers gained 21.8 lbs more than non-implanted heifers. Implanting once at processing improved feed efficiency 5.5% over controls; reimplanting resulted in an added 1.9% improvement. The relatively moist rations made the feed to gain values appear high.

The effect of implant site on performance was inconsistent. Implanting at the "new" site produced more gain than the old site in the reimplanted cattle, but the "old" site was superior in the single implant group. Although the "new" implant site gave only slightly better performance overall, we prefer it because of added ease and speed.

Hot carcass weight, dressing percentage, backfat thickness and quality grade were not significantly affected by implant treatment. Ribeye areas of the reimplanted (new site) cattle were larger (P<.05) than controls, perhaps due to their larger carcasses.

Table 35.1. Effect of Implanting on Gain, Feed Efficiency and Carcass Character-istics of Feedlot Heifers.

	Treatment				
	Control	Single Ralgro		Reimplant Ralgro	
Implant Site[f]	No implant	Old	New	Old	New
No. heifers	103	50	49	51	53
Final wt., lb	987.5	1007.5	994.1	1000.0	1019.0
Total gain, lb	314.7	334.9	321.4	327.0	346.1
Daily gain, lb	2.81^{de}	2.99^{bc}	2.87^{cde}	2.92^{bcd}	3.09^{ab}
Carcass wt., lb	596.2	611.5	606.6	612.3	611.1
Dressing percent	60.4	60.7	61.0	61.3	60.0
Ribeye area,sq.in.	12.0^{a}	12.5^{ab}	12.2^{ab}	12.4^{ab}	12.7^{b}
Backfat, in.	.46	.48	.49	.47	.48
Quality grade[b]	7.5	7.4	7.6	7.7	7.7
Feed/gain,as fed[h]	10.94	10.34		10.13	

[a,b,c,d,e]Means with different superscripts differ significantly(P<.05).

[f]"Old" implant site 1 to 2 in. out from base of ear; "new" site at base of ear.

[g]5 = Good, 6 = High Good, 7 = Low Choice, 8 = Choice.

[h]Cattle implanted in old and new sites were fed in same pen, so separate feed conversions could not be obtained.

Effect of Reimplanting Feedlot Heifers with Ralgro® and/or Synovex-H® [1]

Dan LaTourell, Gerry Kuhl and Calvin Drake

Summary

Implanting heifers initially and mid-way through the finishing period with Ralgro and Synovex-H in any combination produced similar weight gains. Daily gains of cattle implanted with Ralgro + Ralgro, Ralgro + Synovex-H, Synovex-H + Ralgro and Synovex-H + Synovex-H were 3.66, 3.61, 3.66 and 3.75 lbs, respectively.

Introduction

There is little research data as to the preferred sequence of Ralgro and Synovex in feedlot reimplanting programs. This field trial was conducted to provide such data on implanting combinations with feedlot heifers.

Experimental Procedure

One hundred twenty seven 700 lb yearling heifers mostly from Alabama were randomly allotted to four implant treatments: 1) initial Ralgro, Ralgro reimplant; 2) initial Ralgro, Synovex-H reimplant; 3) initial Synovex-H, Ralgro reimplant; 4) initial Synovex-H, Synovex-H implant. All implants were placed in the soft tissue at the base of the ear. All heifers were individually identified and non-shrunk weights were taken at the beginning of the trial, at reimplanting time (43 or 52 days) and at the end of the trial (107 days), when the heifers averaged 1050 lbs. The cattle were fed in the same pen and handled similarly throughout the trial.

Results

Average daily gains are shown in Table 36.1. There were no significant ($P<.05$) differences among any of the implant combinations. Daily gain prior to reimplanting (first period) averaged 4.44 lb with Ralgro and 4.52 lb with Synovex-H; those reimplanted (second period) with Ralgro averaged 3.07 lb vs. 3.10 lb with Synovex-H. The seemingly high gains achieved were due to a 6% shrink from pay weight to in-weight of these southern cattle, and the absence of shrink at the end of the trial.

[1]Appreciation is expressed to the Knight Feedlot, Lyons, KS for cattle management and facilities, and International Minerals and Chemical Corp. and Syntex Agri-Business, Inc. for implants.

Table 36.1. Effect of Implant Sequence on Daily Gain of Feedlot Heifers

Implant sequence	No. Heifers	Feeding period First	Second	Overall
		...... Average Daily Gain, lb		
Ralgro + Ralgro	31	4.41	3.10	3.66
Ralgro + Synovex-H	32	4.48	2.97	3.61
Synovex-H + Ralgro	32	4.58	3.04	3.66
Synovex-H + Synovex-H	32	4.47	3.22	3.75

IS REIMPLANTING PROFITABLE?

Research has consistently shown that one implant will boost steer and heifer gains from 15 to 25 lbs and increase feed efficiency 8 to 10%. However, the effective lifespan of Ralgro, Synovex and Steer-oid implants is only about 70 to 100 days. Thus, cattle need to be reimplanted every 2 1/2 to 3 1/2 months for implants to perform best. Numerous trials have shown that reimplanting with Ralgro mid-way through the suckling period will increase steer and heifer weaning weights an additional 20 to 30 lbs. Similarly, reimplanting feedlot steers has improved daily gain and feed efficiency 4 to 5% over single implanted steers in several 120 to 160 day trials. Reimplanted heifers fed for 110 to 120 days have outperformed single implanted heifers by 2 to 3 % in two recent KSU trials.

Effect of Bovatec®[1] and Synovex-S®[2] Implants on Finishing Steer Performance

Lyle W. Lomas[3]

Summary

Cattle fed Bovatec consumed 18.3% less feed and were 19.4% more efficient in feed conversion than controls, with no effect on gain. Synovex-S implants improved gain by 8.2% with no effect on feed intake and feed efficiency. The effects of Bovatec and Synovex-S were additive.

Introduction

Bovatec is the trade name for lasalocid sodium, a feed additive similar to Rumensin®. Both are antibiotics, previously used as poultry coccidiostats. Both alter the proportion of rumen volatile fatty acids toward more propionate and less acetate. Bovatec was cleared for use in feedlot cattle by the Food and Drug Administration in August, 1982. The approved dosage is 10 to 30 grams per ton of ration dry matter.

Procedure

Eighty-four Simmental steers from a ranch in Southeast Kansas, averaging 842.5 lb, were randomly allotted by weight to 12 pens of seven head each for a finishing study. Treatments were: 1) control (neither Bovatec nor Synovex-S), 2) Bovatec only (30 gm per ton of dry ration), 3) Synovex-S implant only, and 4) Bovatec and Synovex-S implant combined. Each treatment was replicated in three pens. The pens had no cover or wind protection. Water and feed were available at all times. When the study began (October 28, 1981) cattle were fed 30% concentrate and 70% corn silage (dry basis). Then, the concentrate was increased and the silage decreased by 5% daily until the final ration contained 80% concentrate and 20% corn silage. Initial and final weights were taken after a 16 hour shrink from feed and water. Implanted cattle received Synovex-S only once at the onset of the study. One steer was removed from Synovex-S and one from the Bovatech plus Synovex-S treatments for health reasons unrelated to the experiment. The trial ended on March 19, 1982. Cattle were slaughtered on March 23 and individual carcass data were collected.

[1] Bovatec is the trademark name for lasalocid sodium produced by Hoffman-LaRoche, Inc., Nutley, NJ 07110, who provided the feed additive and partial financial assistance.

[2] Synovex-S is the trademark name for steer finishing implants containing progesterone and estradiol benzoate produced by Syntex Agribusiness, Inc., Des Moines, IA 50303, who provided implants and partial financial assistance.

[3] Southeast Kansas Branch Experiment Station, Parsons, KS 67357.

Results

During the 142 day finishing study, gains with and without Bovatec were similar (P>.10), Table 37.1). Feeding Bovatec decreased feed intake 18.3% (P=.04) and improved feed efficiency 19.4% (P=.06), with no effect on external fat thickness, rib eye area, marbling score, and quality or yield grade.

Cattle implanted with Synovex-S gained 8.2% more (P=.05), had larger rib eye areas (P=.003) and lower numerical yield grades (P=.06) than nonimplanted steers. Implants had no effect on daily feed intake, feed efficiency, fat thickness, marbling score or quality grade.

Table 37.1. Effect of Bovatec and Synovex-S on Feedlot Performance (142 days) of Simmental Steers

	Effect of Bovatec			Effect of Synovex-S		
	No Bovatec	Bovatec, 30g/ton	P[a]	No Implant	Synovex-S	P[a]
No. of steers	41	41	---	42	40	---
Initial wt., lb	841.0	844.0	---	840.7	844.4	---
Final wt., lb	1271.0	1282.1	---	1258.3	1295.6	---
Gain, lb	430.0	438.1	N.S.[a]	417.6	451.2	.0048
ADG, lb	3.03	3.08	N.S.	2.94	3.18	.0048
Daily DM intake,lb	28.03	22.89	.0386	24.49	26.43	N.S.
Feed/gain	9.26	7.46	.0563	8.39	8.33	N.S.
Fat Thickness,in.	.31	.26	N.S.	.30	.28	N.S.
REA, sq. in.	13.6	13.8	N.S.	13.4	14.1	.0025
Marbling score[b]	5.1	5.2	N.S.	5.1	5.2	N.S.
Quality grade[c]	9.8	10.0	N.S.	9.8	10.1	N.S.
Yield grade	2.5	2.3	N.S.	2.5	2.3	.0639

[a]P = probability of effects due to chance. N.S. = (P>.10).
[b]Marbling score: Small = 5; modest = 6.
[c]Quality grade: Gd^+ = 9; Ch^- = 10; Ch^o = 11.

Effect of Aureomycin®, Injectable Tramisol®[1] and Ectrin®[2] Fly Control Ear Tags on Grazing Steer Performance

Larry Corah, Jack Riley, Stan O'Neill and Ron Pope

Summary

Steers consuming a free choice mineral mix containing Aureomycin (437 mg per hd per day) gained 15.3% faster than controls during a 129 day grazing trial on brome grass pasture. There was considerable variation in daily mineral intake and daily Aureomycin consumption among the 12 pasture replicates. Worming the locally produced steers with Tramisol resulted in a small but non-significant improvement in gain. Two Ectrin fly control ear tags per steer (three pastures within each mineral treatment for the final 61 days of the trial) resulted in a 0.25 lb daily gain increase. Average horn fly counts for tagged steers was <1 vs. 60 for non-tagged steers.

Introduction

Although Aureomycin has been studied extensively in growing and finishing feedlot cattle, only limited data is available for grazing animals. The purpose of this trial was to determine the effect of Aureomycin (fed in a free choice mineral-salt mix), worming (Tramisol) and fly control tags (Ectrin) on the performance of grazing yearling steers.

Procedure

We took individual shrunk weights of 80 locally produced yearling Hereford and Hereford x Angus steers at the beginning of the 129 day grazing trial (April 9 to August 18, 1982). Steers were allotted to 12 pasture replicates by weight with six pasture groups being fed a free choice non-medicated salt-mineral mix and the other six, the same salt-mineral mix plus Aureomycin to provide a desired intake of approximately 350 mg of antibiotic per head per day. Composition of the mineral mixes are shown in Table 38.1. Half of the steers in each pasture were dewormed with injectable Tramisol prior to going to pasture. Steers in 3 pasture replicates for each mineral treatment were given two individual Ectrin fly control ear tags.

[1]Aureomycin and Tramisol are trademark names for products produced by American Cyanamid Co., Princeton, N.J., which provided Aureomycin, Tramisol and partial financial assistance.

[2]Ectrin is the trademark name for fenvalerate fly control tags produced by Diamond Shamrock Co., Cleveland, Oh., which provided Ectrin tags for the study.

Mineral mix intake was monitored each week and pastures were rotated regularly to reduce pasture effects. Daily observations were made for incidence of disease and horn fly counts were taken 5 times during the final 61 days of the trial. The 68-day interim non-shrunk weights were adjusted by 6% and the final weights by 4% to compensate for fill.

Results

Table 38.2 shows the average mineral and Aureomycin intake. There was considerable variation in mineral and Aureomycin intake within each treatment and among pastures. Aureomycin intake for the trial averaged 437 mg per steer per day. Daily mineral intake was not affected by the presence of Aureomycin.

During the 129 day grazing period, Aureomycin-fed steers gained 36 pounds, (15.3%) more than their counterparts (Table 38.3), even though the level of gain was much poorer during the final 61 days than the first 68 days. Deworming with injectable Tramisol prior to going to pasture resulted in a small but non-significant gain increase as shown in Table 38.4.

Two Ectrin fly control ear tags per steer during the last 61 days of the trial increased daily gain by 0.25 lbs per steer (Table 38.5), and decreased horn fly counts from 60 per steer to less than one.

Table 38.1. Composition of Free Choice Mineral Mix Used in Grazing Trial.

	Treatment	
Date fed	Aureomycin	Control
April 9 - June 11	217½ lbs salt	250 lbs salt
	217½ lbs dical	250 lbs dical
	40 lbs Aureo 50	
	25 lbs SBOM	
June 11 - August 18	230 lbs salt	250 salt
	230 lbs dical	250 lbs dical
	25 lbs Aureo 50	
	15 lbs SBOM	

Table 38.2. Aureomycin and Mineral Intake for Grazing Steers

Pasture treatment:	Medicated	Non-medicated
Aureomycin intake, mg/steer/day:		
1st 68 days	552	0
2nd 61 days	312	0
Total 129 days	437	0
Mineral intake, lb/steer/day:		
1st 68 days	0.14	0.13
2nd 61 days	0.12	0.10
Total 129 days	0.13	0.11

Table 38.3. Effect of Aureomycin on Gain of Grazing Steers

	No Aureomycin	Aureomycin	
No. steers	40	40	
Initial shrunk wt., lb	525.8	527.0	
Interim 68 day adjusted wt,lb[1]	676.8	699.9	
Final adjusted wt., lb[1]	753.7	789.6	
ADG, 1st 68 days	2.22	2.54	(P=.02)
ADG, 2nd 61 days	1.26	1.47	(P<.001)
ADG, total 129 days	1.77	2.04	(P<.001)

[1] Interim individual weights were adjusted by 6% and final individual weights by 4% to compensate for fill.

Table 38.4. Effect of Tramisol on Gain of Grazing Steers

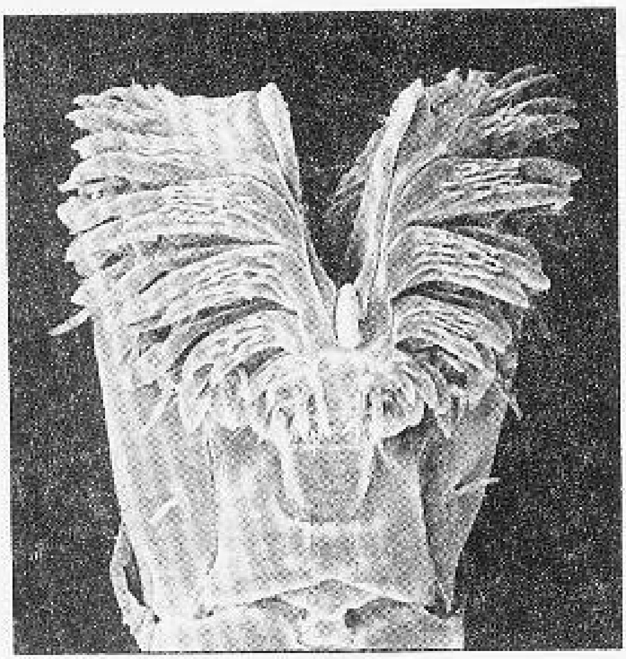
	No Tramisol	Tramisol	
No. steers	41	39	
Initial shrunk wt., lb	534.0	519.0	
Interim 68 day adjusted wt,lb[1]	692.1	684.7	
Final adjusted wt., lb[1]	773.8	769.5	
ADG, 1st 68 days	2.33	2.44	(P=.41)
ADG, 2nd 61 days	1.34	1.39	(P=.78)
ADG, total 129 days	1.86	1.94	(P=.44)

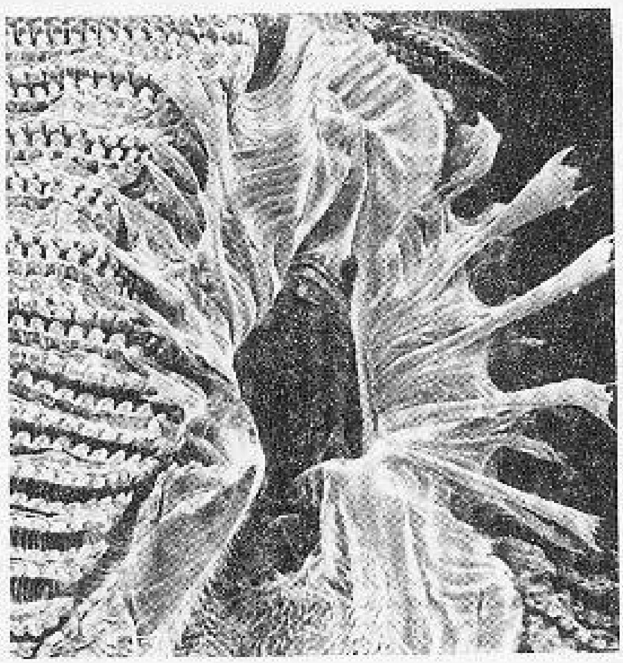
[1] Interim individual weights were adjusted by 6% and final individual weights by 4% to compensate for fill.

Table 38.5. Effect of Ectrin Fly Control Ear Tags on Gain of Grazing Steers During Late Summer

	No Ectrin tags	2 Ectrin tags
No. steers	38	42
Interim adjusted wt,lb[1]	692.1	684.9
Final adjusted wt., lb[2]	767.6	775.8
Gain, lb	75.53	90.9
ADG, 61 days	1.24	1.49 (P<.001)
Horn flies/steer, (avg. 5 counts)	60	<1

[1]Interim individual weights were adjusted by 6% and final individual weights by 4% to compensate for fill.





These are photographs taken with a scanning electron microscope of the mouthparts of the hornfly (left) and the face fly (right). Horn flys use their "teeth" to penetrate an animal's skin and suck blood -- up to 38 times a day. Face flies feed on tears, so they make the eyes of cattle water by using their "teeth" to irritate the sensitive membranes around the eye.

The Livestock and Meat Industry Council

Dear Friends:

Much of the research reported here was possible only through support of the Livestock and Meat Industry Council (LMIC). In terms of real dollars, federal and state research support has decreased seriously over the past few years. But the need for research keeps growing. The LMIC serves as a vehicle for helping Kansas State University meet its obligations to the Kansas livestock industry.

During the past year, the LMIC has arranged two "Charitable Remainder Unitrusts" totaling over $500,000. A third is being completed for over $1.8 million. Under these unitrusts, land and other assets are donated to the LMIC. The property is sold and the the proceeds are invested. The donor then receives a percentage return on the proceeds as long as they live. At the donor's death, title to the trust passes to the LMIC. Suppose a donor establishes a charitable remainder trust with 600 acres of land worth $500 per acre. The tax benefits of the gift go the the donor. Assuming an 8% return, the donor also receives $24,000 per year for life.

Funds donated to the LMIC can be earmarked for specialized activities. Examples are the Staff Memorial Library, livestock judging teams, and educational activities. Memorial funds have been established in the names of A.D. Weber, Erle Bartley and Larry Kohl.

This year, cash gifts, and gifts in kind to the LMIC have totaled over $150,000. Those funds have made it possible to help support several research projects, to construct a new building at the farm headquarters, to help repair several farm facilities, to give the department two word processing systems and a microcomputer, and to provide funds for the enrichment of the Department's teaching program. State funds for those very necessary items was simply not available.

For 1982-83, President of the LMIC is Gene Watson. Vice President is Scott Chandler. Fred German is Secretary, Orville Burtis, Jr. is Treasurer, and W.C. Oltjen is the Immediate Past President. Other directors are Earl C. Brookover, Charles N. Cooley, Henry Gardiner, Walter M. Lewis, Linton Lull, A.G. Pickett and Wayne Rogler.

The Department and the LMIC need your help to make sure research and teaching can continue at the level your industry deserves.

Sincerely,

Calvin L. Drake

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Acknowledgments

Listed below are individuals, organizations and firms that have contributed to our beef research programs through financial support, product donations or services. We appreciate your help!

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