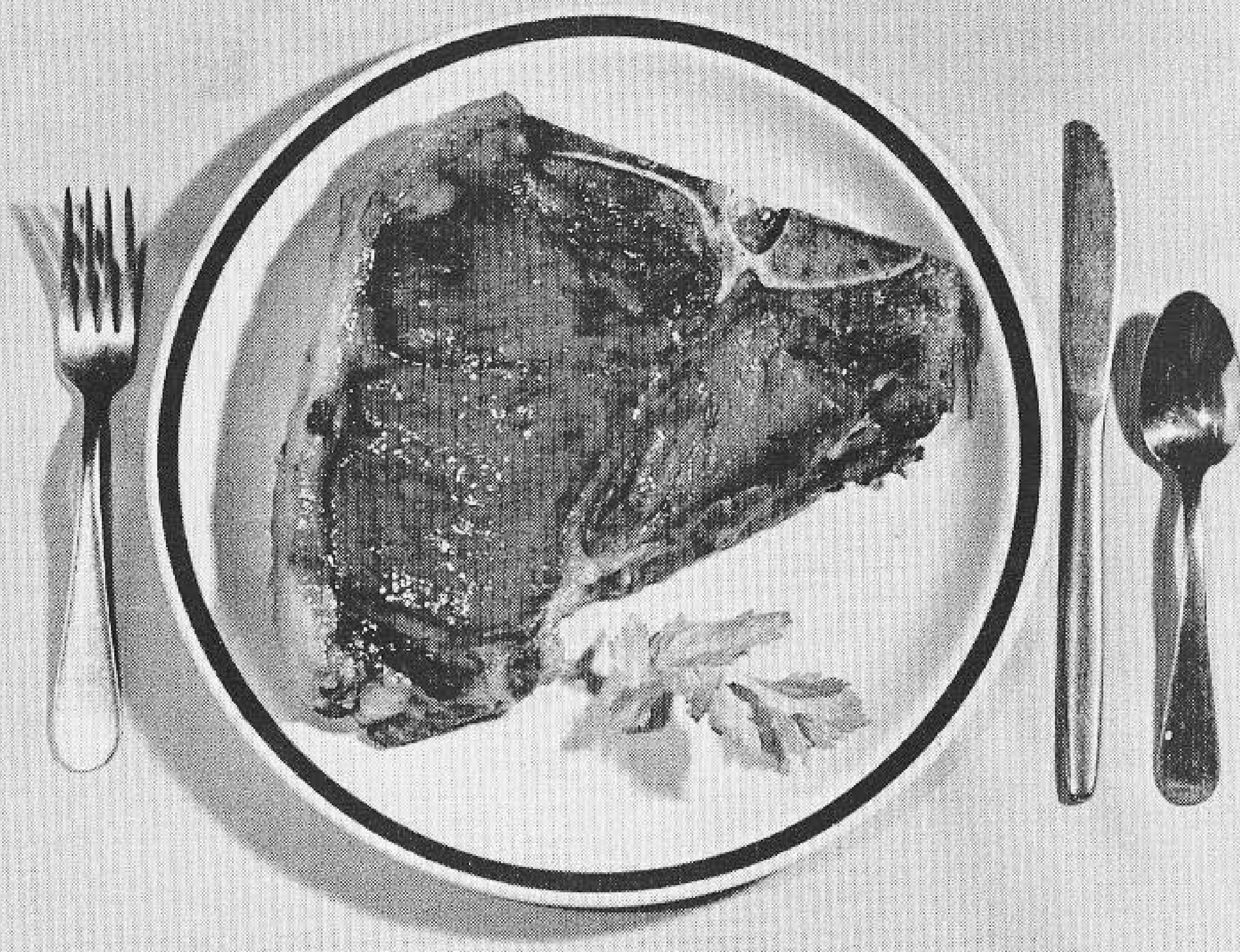
1984 CATTLEMEN'S DAY



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JOHN O. DUNBAR, DIRECTOR

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 of 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 traits 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± .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 unlimit 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.

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Contribution No. 84-300-S from the Kansas Agricultural Experiment Station.

Effects of Low Voltage Electrical Stimulation During Bleeding and Hot Boning on Beef Loin Eye and Top Round Muscles

J.B. Axe, C.L. Kastner, M.E. Dikeman,
M.C. Hunt, D.H. Kropf, and D.G. Gray

Summary

Our study evaluated the effects of low voltage electrical stimulation (ES) during bleeding and hot boning at 1 hr postmortem on loin eye (LE) and top round (TR) muscles. Possibly because of the relatively slow initial chilling rate used in our study, hot-boned (HB) muscles, even without ES, were comparable to conventionally chilled and boned counterparts. In fact, coupling ES with HB proved less desirable than HB only.

Introduction

Over recent years, a variety of electrical stimulation (ES) and hot-boning systems have been investigated. However, further research is needed to define optimal ES and hot-boning parameters considering the variety of potential processing conditions used by industry. Researchers have examined both high and low voltage ES. However, limited information is available on low voltage ES during bleeding coupled with hot boning as soon as 1 hr postmortem. Additionally, due to safety hazards and required precautions associated with high voltage ES, low voltage ES warrants investigation.

When hot-boned (HB) muscle is rapidly chilled soon after slaughter, muscle toughening can occur. Some have found that chilling HB muscle at approximately 40° F followed by aging at conventional refrigeration temperatures produced beef equal in tenderness to that conventionally boned. However, others have found that using similar storage conditions and aging practices resulted in a less tender HB product.

ES of carcasses reduces the sensitivity of muscle to rapid chilling; thus, reducing the incidence of any toughening effects encountered with hot boning. In fact, researchers have noted that when ES was combined with hot boning, the HB beef muscles were equal or superior in tenderness to control counterparts.

We examined the effects of low voltage ES during bleeding and hot boning on pH and temperature declines, cooking losses, Warner-Bratzler shear force, and taste panel evaluations of beef loin eye (LE) and top round (TR) steaks.

Experimental Procedure

Forty steers were slaughtered in four groups of 10 each at the KSU meat laboratory. Half of each group (five cattle) was electrically stimulated during bleeding while the other five cattle were not. ES was administered by inserting two ground probes near the base of each achilles tendon and attaching an electrode clamp to the nose. ES was applied for 2 min, using approximately 50 V and 60 Hz of pulsed (1 sec on, 1 sec off) current. One side of each ES carcass and one side of each non-stimulated carcass was hot boned (HB) at 1 hr postmortem and are designated ESHB and HB, respectively. The other side of each non-stimulated carcass (control, C) was conventionally boned after storage at 36 to 46° F until 48 hr. postmortem. ESHB and HB LE (longissimus) and TR (semimembranosus) muscles were chilled at 36 to 46° F until 48 hr postmortem. At that time, C, HB, and ESHB LE and TR muscles were vacuum packaged and aged until 6 days postmortem. LE and TR steaks were then cut and stored at -4° F until evaluated for Warner-Bratzler shear force (WBS) and cooked for taste panel evaluation. Temperature and pH were monitored at 1, 2, 4, 6, 8 and 24 hr postmortem. In a companion study, C versus ES comparisons were made (see the article by Unruh et al. in this publication).

Results and Discussion

Both LE and TR muscles from the ESHB treatment had lower pH values at all times postmortem (except 24 hr) than HB and C counterparts (Figure 1.1 and 1.2).

Figures 1.3 and 1.4 show that muscles removed from the carcass (HB and ESHB) generally cooled faster than when left attached (C) during chilling.

Taste panel members detected no differences (P>.05) between C and HB for the LE (Table 1.1). When comparing LE ESHB to C counterparts, differences (P<.05) were found for all variables, except juiciness, connective tissue amount and percent thaw loss. C was consistently superior to ESHB for those variables where a statistical difference was noted. When comparing LE ESHB to HB, ESHB had less desirable (P<.05) values for Warner-Bratzler shear force, percent cooking and combined loss, overall tenderness and connective tissue amount (Table 1.1). No differences (P>.05) were observed between treatments for the TR muscle.

Many researchers have found ES to be advantageous when coupled with HB. However, the results from our study indicate that ES was not needed to aid the HB procedure. In fact, ES had a detrimental effect on HB muscle tenderness (WBS and overall tenderness). If the initial chilling rates had been faster, ES may have alleviated any apparent muscle toughening due to HB. These results agree with our previous findings that by slowing the initial chilling rate for HB muscles, HB is generally found equal or superior to C. Additionally, ES is not needed to facilitate HB under slow chilling conditions similar to those of our study.

Table 1.1. Taste Panel, Warner-Bratzler Shear Force, Percent Thaw, Cooking, and Combined Loss Means for Loin Eye (LE) and Top Round (TR) Steaks by Carcass Treatments

Variable	LE			TR		
	C	HB	ESHB	C	HB	ESHB
Flavor intensity[c]	6.3[a]	6.2[ab]	6.1[b]	6.2	6.2	6.1
Juiciness[c]	6.1	6.0	5.8	5.7	5.7	5.8
Myofibrillar tenderness[c]	6.4[a]	6.4[ab]	5.7[b]	5.6	5.7	5.7
Connective tissue amount[c]	6.8[ab]	6.9[a]	6.6[b]	4.8	4.6	4.9
Overall tenderness[c]	6.5[a]	6.5[a]	6.0[b]	5.1	5.0	5.2
Warner-Bratzler shear force (lb)	6.0[a]	5.9[a]	7.1[b]	12.4	12.3	12.7
Thaw loss (%)	0.9	1.0	1.0	1.9	1.6	1.8
Cooking loss (%)	21.6[a]	20.9[a]	24.6[b]	31.4	28.9	31.8
Combined loss (%)	22.2[a]	21.7[a]	25.4[b]	32.7	30.0	33.0

[ab]Means within the same row and muscle with different superscripts differ (P<.05).

[c]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.

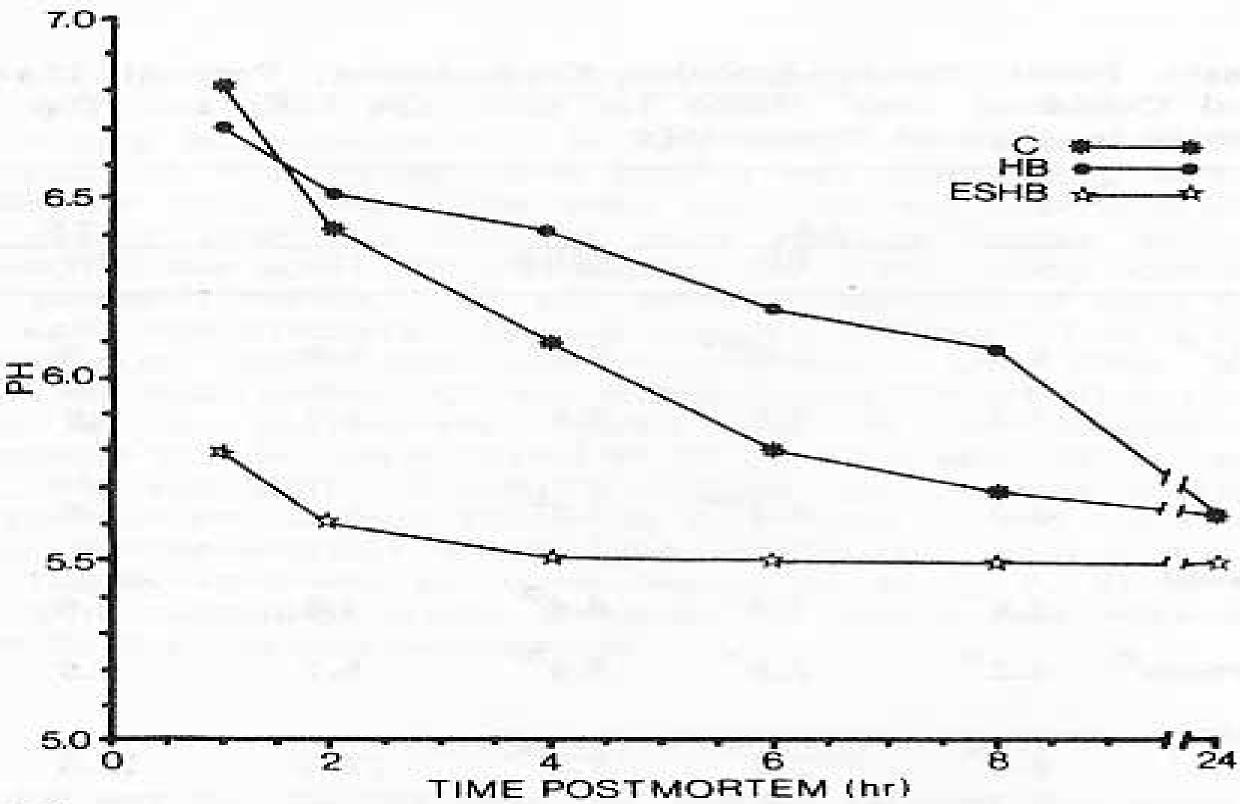

Figure 1.1. Postmortem pH declines for the loin eye muscle.

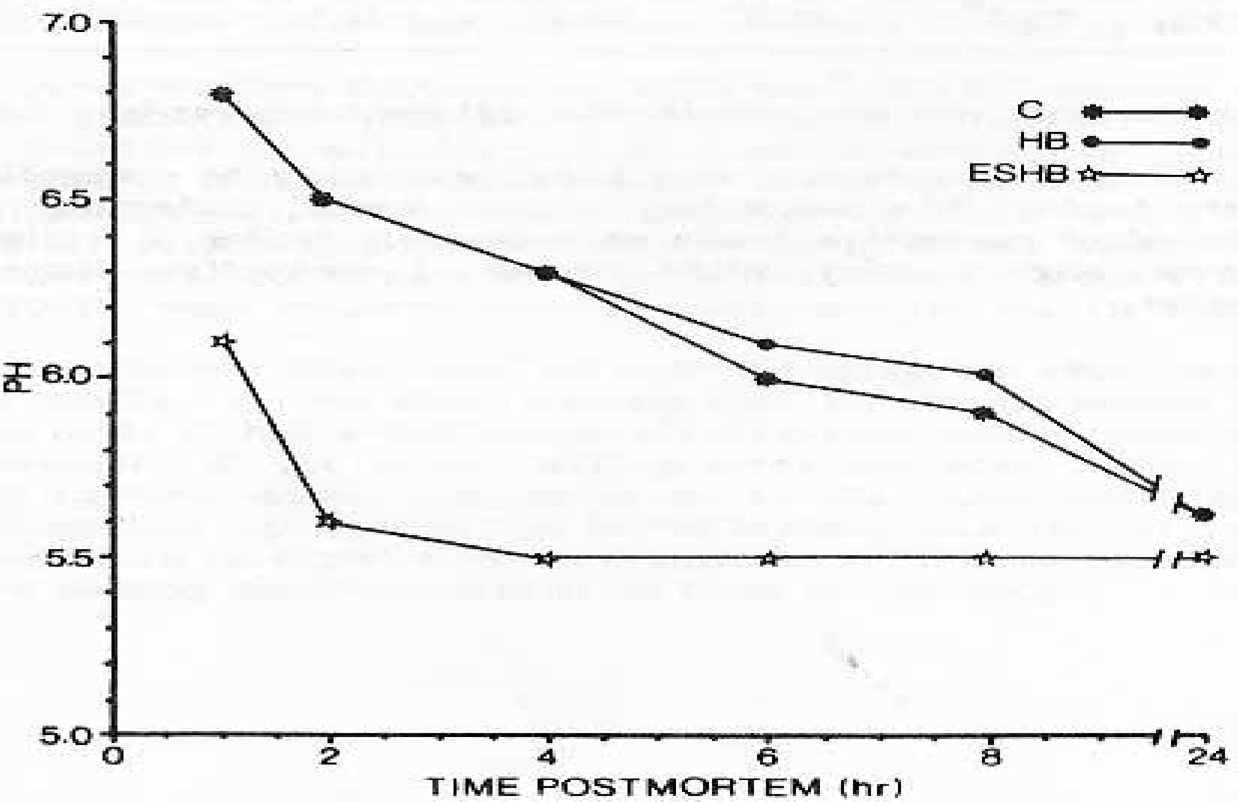

Figure 1.2. Postmortem pH declines for the top round muscle.

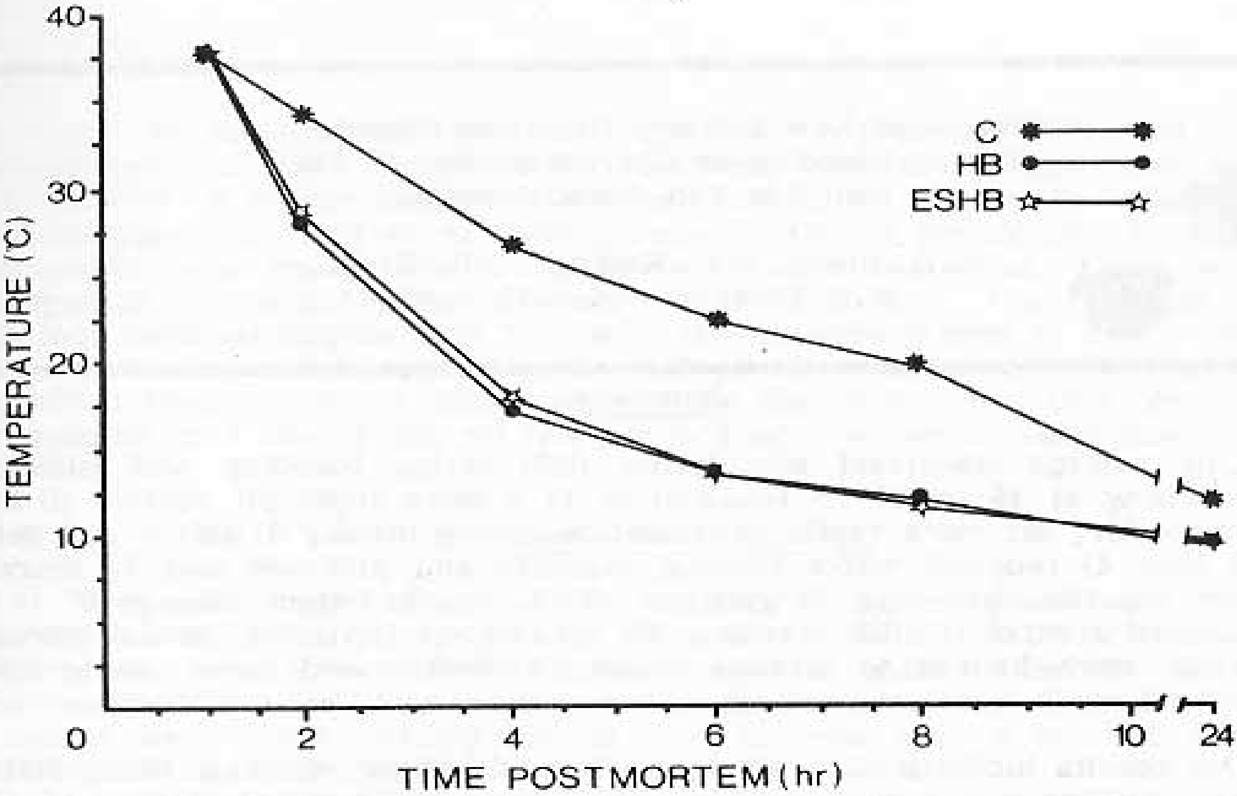

Figure 1.3. Postmortem temperature declines for the loin eye muscle.

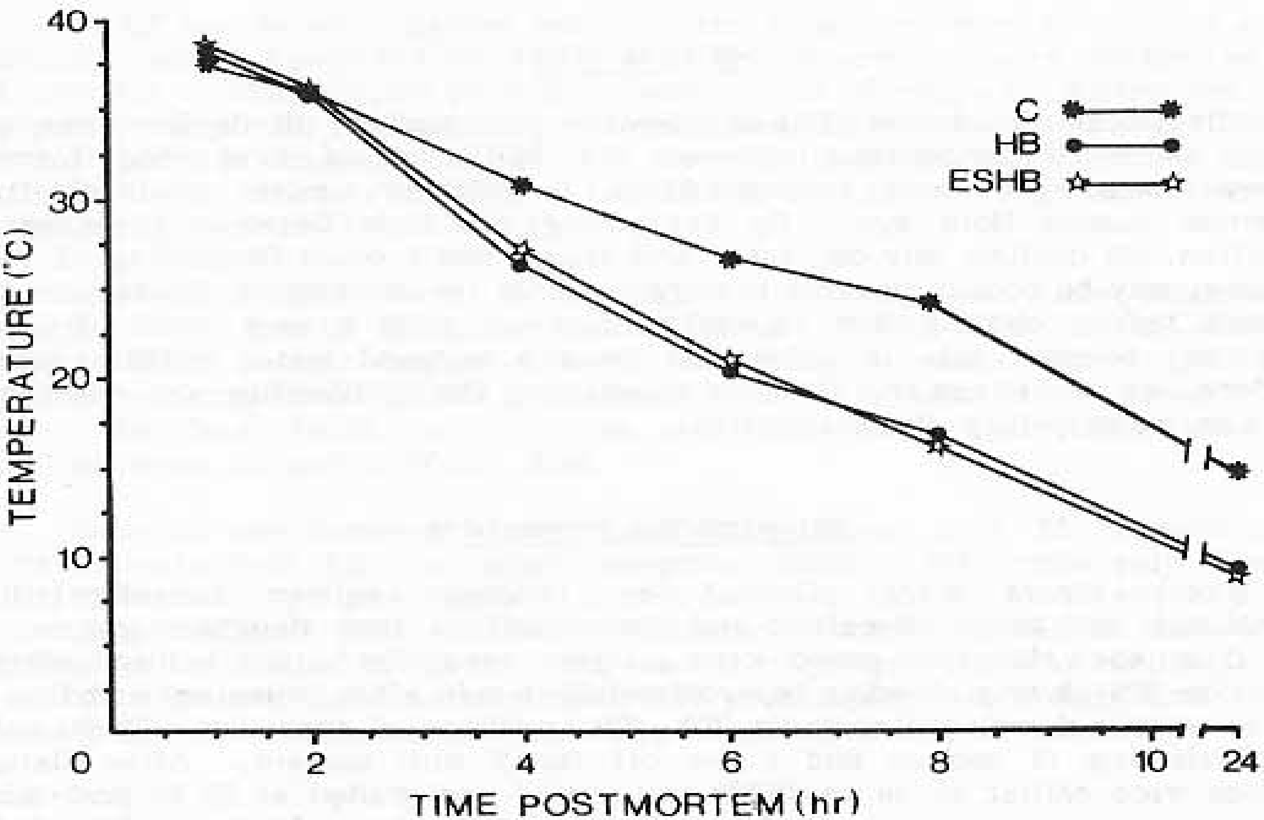

Figure 1.4. Postmortem temperature declines for the top round muscle.

Effects of Low Voltage Electrical Stimulation During Bleeding on Characteristics of Beef Loin Eye Top Round Muscles

J.A. Unruh, C.L. Kastner, D.H. Kropf, M.E. Dikeman and M.C. Hunt

Summary

Low voltage electrical stimulation (ES) during bleeding and subsequent carcass chilling at 36 to 46° F resulted in 1) a more rapid pH decline 2) initial lighter red color, but more rapid discoloration during display 3) softer and coarser textured lean 4) reduced water holding capacity and juiciness and 5) decreased tenderness of the loin eye longissimus (LE) muscle when compared to the non-stimulated control (C) LE muscle. ES effects on top round semimembranosus (TR) muscle were limited to a more rapid pH decline and lower water holding capacity.

Our results indicate that ES soon after slaughter, coupled with relatively slow initial chilling may reduce meat quality. More rapid initial chilling of C and ES carcasses and/or delaying the ES application may be necessary for ES to express its frequently observed desirable results.

Introduction

Electrical stimulation (ES) accelerates post-mortem pH decline (measure of acidity), improves tenderness, reduces the incidence of heat ring formation, improves marbling scores and produces a brighter, more youthful colored longissimus muscle (loin eye). By decreasing the time between bleeding and stimulation, pH decline may be faster and rigor mortis onset (beginning of carcass stiffening) may be sooner, making it more feasible for commercial operations to cut carcasses before chilling (hot boning). However, with a very rapid pH decline, muscle may become pale in color and have a reduced water holding capacity. Therefore, we minimized the time by stimulating during bleeding and observed the effects on meat quality characteristics.

Experimental Procedures

Forty steers were allotted by feeding regimen (accelerated and conventional) and breed (Hereford and Simmental) to four slaughter groups. Five steers from each slaughter group were assigned randomly to low voltage electrical stimulation (ES) during bleeding (approximately 5 min after stunning) and five were assigned as non-stimulated controls (C). ES consisted of approximately 50 volts of 60 Hz pulsating (1 sec on and 1 sec off for 2 min) current. After slaughter, carcasses were chilled at 36 to 46° F and ribbed and graded at 28 hr post-mortem. Temperature and pH measurements were recorded at 1, 2, 4, 6, 8 and 24 hr post-mortem.

At 48 hr post-mortem, the loin eye longissimus (LE) and top round semimembranosus (TR) muscles were removed, vacuum packaged and aged for 4 days. LE and TR steaks then were cut for taste panel, Warner-Bratzler shear force (WBS), display color and water holding capacity (WHC) evaluation. Taste panel and WBS steaks were frozen and stored at -4° F until evaluated. Color steaks were packaged in polyvinylchloride film and evaluated at 0, 1, 3 and 5 days of lighted (100 foot candles) display (37° F). WHC steaks were stored at 35 to 39° F for 2 days. Then triplicate (approximately 0.5 g) meat cores on individual sheets of humidified Whatman No. 1 filter paper were placed between two plexiglas plates and pressed for 1 min at 500 psi (lbs per in^2) using a Carver Laboratory Press.

Results and Discussion

Temperature of the LE and TR muscles of ES carcasses were similar to C counterparts (P>.05) at 2, 4, 6, 8 and 24 hr after death. At 24 hr the LE and TR temperatures were 52 and 56° F, respectively, for both ES and C. LE pH values were lower (P<.05) for ES through 6 hr, but similar (P>.05) at 24 hr (Table 2.1). TR pH values were lower (P<.05) for ES than C from 1 to 8 hr, but were similar (P>.05) at 24 hr (Table 2.1).

When observed at 28 hr post-mortem, ES LE was lighter in color, softer, coarser in texture (P<.05) and had less marbling (P=.08) than C (Table 2.2). Several ES LE muscles had a two-toned color appearance.

ES LE steaks were lighter red at 0 and 1 day and more discolored at 5 days of display than C steaks (P<.05, Table 2.3). ES TR muscles were lighter red (P<.05) at 0 day but similar (P>.05) to C at 3 and 5 days of display. Within the TR, the deep portion adjacent to the adductor was lighter red at 0 day but more discolored at 3 and 5 days of display, and had less water holding capacity than the superficial TR (P<.05). ES LE and TR samples had less (P<.05 and P=.08, respectively) water holding capacity than C (Table 2.3).

A trained taste panel found that ES LD was less juicy and had more myofibrillar and overall toughness than C (P<.05, Table 2.4). ES LE also tended (P=.13) to have greater Warner-Bratzler shear force values than C. ES LE had increased cooking loss (P<.05) compared with C in two of the four slaughter groups. SM shear force, cooking loss and taste panel evaluations were similar (P>.05) between ES and C (Table 2.4).

Even though numerous researchers have shown that ES is benefical, our results indicate that ES soon after slaughter coupled with relatively slow initial chilling (36 to 46° F) may produce undesirable results. ES resulted in decreased WHC, tenderness and color stability. Therefore, caution should be observed when using conditions similar to those in our study. More rapid initial chilling of C and ES carcass than that used in this study and/or delaying the ES application may be necessary for ES to express its frequently observed desirable results.

Table 2.1. Means for pH of the Loin Eye (LE) and Top Round (TR) Muscles by ES[a] and Control (C) Treatments

Hours postmortem	LE		TR	
	ES	C	ES	C
1	5.9[b]	6.8[c]	6.0[b]	6.8[c]
2	5.6[b]	6.4[c]	5.7[b]	6.5[c]
4	5.5[b]	6.1[c]	5.6[b]	6.3[c]
6	5.5[b]	5.8[c]	5.5[b]	6.0[c]
8	5.5[d]	5.7[d]	5.5[b]	5.9[c]
24	5.6	5.6	5.6	5.6

[a]Low voltage electrical stimulation during bleeding

[bc]Means in the same row for the same muscle bearing different superscripts are different ($P<.05$)

[d]Treatment x slaughter group interaction resulted from ES in 3 of 4 slaughter groups having lower ($P<.05$) pH values than C.

Table 2.2. Twenty-eight Hour Post-mortem Carcass Characteristics by ES[a] and Control (C) Treatments

Carcass characteristics	ES	C
Marbling score	Slight [54c]	Slight [71d]
Lean color[b]	2.2[e]	2.9[f]
Lean firmness[b]	3.9[e]	2.5[f]
Lean texture[b]	4.0[e]	3.0[f]

[a]Low voltage electrical stimulation during bleeding

[b]Scores: 7 = very dark cherry red, extremely soft or very coarse texture; 4 = slightly dark cherry red, slightly soft or slightly fine texture; 3 = cherry red, moderately firm or moderately fine texture; 2 = light cherry red, firm or fine texture

[cd]Means in the same row bearing different superscripts are different ($P=.08$).

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

Table 2.3. Display Color and Water Holding Capacity (WHC) of Loin Eye (LE) and Top Round (TR) Muscles by ES[a] and Control (C) Treatments

Days of display[b]	LE		TR	
	ES	C	ES	C
0	1.3[d]	1.9[e]	1.3[d]	1.6[e]
1	1.6[d]	2.1[e]	2.0	2.2
3	2.4	2.5	3.1	3.0
5	3.3[d]	3.0[e]	3.6	3.5
WHC[c]	3.11[d]	2.69[e]	3.54[f]	3.34[g]

[a]Low voltage electrical stimulation during bleeding

[b]Scores: 1 = very bright red, 2 = bright red, 3= slightly dark red or brown, 4 = dark red or brown and 5 = extremely dark red or brown

[c]Moisture area divided by meat sample area.

[de]Means in the same row for the same muscle bearing different superscripts are significantly different ($P<.05$).

[fg]Means in the same row for the same muscle bearing different superscripts are different ($P=.08$).

Table 2.4. Taste Panel Evaluation, Shear Force, and Cooking Loss Means for the Loin Eye (LE) and Top Round (TR) Muscles by ES[a] and Control (C) Treatments

Variable	LE		TR	
	ES	C	ES	C
Flavor intensity[b]	6.0	6.3	6.1	6.2
Juiciness[b]	5.8[c]	6.1[d]	5.8	5.7
Myofibrillar tenderness[b]	5.8[c]	6.4[d]	5.6	5.6
Connective tissue amount[b]	6.6	6.8	5.0	4.8
Overall tenderness[b]	6.0[c]	6.5[d]	5.2	5.1
Warner-Bratzler shear force (lbs)	7.0	6.1	11.8	12.4
Cooking loss (%)	24.9[e]	21.5[e]	32.6	31.2

[a]Low voltage electrical stimulation during bleeding

[b]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.

[cd]Means in the same row for the same muscle bearing different superscripts are different ($P<.05$).

[e]Treatment x slaughter group interaction resulted from ES having increased cooking loss ($P<.05$) in 2 of 4 slaughter groups.

Effects of Low Voltage Electrical Stimulation on Quality Characteristics of Young Bulls Fed to 14, 16 and 18 months of Age.

J.A. Unruh, D.G. Gray, C.L. Kastner and M.E. Dikeman

Summary

Low voltage electrical stimulation of young bulls at 30 to 45 min after bleeding resulted in a lower muscle pH, higher marbling score, lighter cherry red color and reduced incidence of heat ring formation when compared to non-stimulated controls. Ribeye steaks from electrically stimulated sides were more tender than non-stimulated controls, but bottom round steaks were not different.

Our results indicate that low voltage electrical stimulation, incorporated into a continuous slaughter operation as late as 30 to 45 min after bleeding, can improve USDA quality characteristics and tenderness of meat from young bulls.

Introduction

Electrical stimulation accelerates the rate of pH decline (measure of acidity), reduces the incidence of cold toughening and heat ring formation, increases marbling score and produces a brighter, more youthful colored ribeye muscle. Low voltage electrical stimulation (ES) has been introduced because it is safer and cheaper than high voltage electrical stimulation.

Young bulls for slaughter gain faster and grow more efficiently than steers, but have more variable carcass and meat quality. Our study was designed to find if ES would minimize these problems.

Experimental Procedure

Fifty-four high percentage Simmental bulls were allotted to three slaughter groups of 14, 16 and 18 months of age. Bulls were fed an 85% concentrate ration from weaning (8 mo) until slaughter at a commercial packing plant.* At 30 to 45 min after bleeding (post-mortem), one side of each carcass was stimulated, using low voltage electrical stimulation (ES) consisting of 50 volts of 60 Hz pulsating (1 sec on and 1 sec off for 1 min) current. Carcasses were chilled at 33-37° F. Temperature and pH measurements of ribeye (longissimus, RE) and bottom round (biceps femoris, BR) muscles were taken at 1, 3, 6 and 24 hr after bleeding. Carcass quality measurements were taken at 24 and 48 hr post-mortem.

Wholesale rounds and ribs were stored at 35-39° F. RE and BR steaks were removed at 7 days after death and stored at -4° F until Warner-Bratzler shear force determinations were made.

*Appreciation is extended to Roode Packing Co., Fairbury, Nebraska for their cooperation in slaughtering these bulls.

Results and Discussion

Rates of cooling of the ribeye (RE) and bottom round (BR) muscles were similar (P>.05) for ES and control (C) sides. pH values were lower (P<.05) in ES sides through 6 hr, but by 24 hrs after death pH's were similar (P>.05, Table 3.1). These data indicate a slight increase in pH decline rate due to ES.

At 24 hr after death, ES sides displayed more marbling, a lighter cherry red color and less heat ring than C (P<.05, Table 3.2). ES sides also had a lighter cherry red color, softer lean, and a lower incidence of heat ring than C sides at 48 hr after death (P<.05, Table 3.2). ES improved tenderness (P<.05) for the RE muscle as indicated by a lower Warner-Bratzler shear force (Table 3.3). Overall, ES sides had equal or improved quality characteristics when compared to C sides.

Marbling increased (P<.05) with slaughter age at both 24 and 48 hr evaluation times (Table 3.4). Lean color at 48 hr became darker cherry red with increased slaughter age (P<.05). Also, at 48 hr, bulls slaughtered at 18 mo had (P<.05) a softer and coarser textured lean than bulls slaughtered at 14 and 16 months of age. In addition, bulls slaughtered at 18 mo had greater (P<.05) shear values (less tender) for the BR muscle than bulls slaughtered at 14 mo (Table 3.3). In agreement with other researchers, these results indicate that the optimum slaughter age for young bulls is approximately 14-16 mo of age.

Table 3.1. pH Values of Ribeye (RE) and Bottom Round (BR) Muscle for ES[a] and Control (C) Bull Carcass Sides at 1, 3, 6 and 24 hr After Death.

Hours after death	RE		BR	
	ES	C	ES	C
1[b]	6.7[c]	7.0[d]	6.6[c]	6.8[d]
3	6.3[c]	6.6[c]	6.3[c]	6.5[d]
6	6.0[c]	6.3[d]	6.2[c]	6.3[d]
24	5.7	5.7	5.7	5.7

[a]Low Voltage Electrical Stimulation

[b]pH at 1 hr was taken only on carcasses slaughtered at 14 and 18 mo.

[cd]Means in the same row for each muscle bearing different superscripts are different (P<.05).

Table 3.2. Quality Characteristics at 24 and 48 hr After Death of ES[a] and Control (C) Bull Carcass Sides

Characteristic	24 hr ES	24 hr C	48 hr ES	48 hr C
Marbling	Slight[64c]	Slight[58d]	Slight[69]	Slight[69]
Lean Color[b]	3.6[c]	4.0[d]	3.4[c]	3.7[d]
Lean Firmness[b]	4.8	5.0	4.5[c]	4.8[d]
Lean Texture[b]	4.5	4.3	4.6	4.4
Heat Ring[b]	4.9[e]	3.8[f]	4.9[c]	3.9[d]

[a]Low Voltage Electrical Stimulation

[b] Scores: 3 = light cherry red, moderately soft, moderately coarse or moderate; 4 = cherry red, slightly soft, slightly coarse or slight; 5 = slightly dark red slightly firm, slightly fine, or none.

[cd]Means in the same row for either 24 or 48 hr bearing different superscripts are different ($P \leq .05$).

[ef]Treatment x slaughter group interaction resulted from ES having less ($P < .05$) heat ring with each successive slaughter group.

Table 3.3. Warner-Bratzler Shear Force Values (Lbs) for Ribeye (RE) and Bottom Round (BR) Muscles of ES[a] and Control (C) Carcass Sides and Bulls Slaughtered at 14, 16 and 18 Months of Age

Muscle	Treatment ES	Treatment C	Months of age 14	Months of age 16	Months of age 18
RE	6.0[b]	7.0[c]	6.4	6.2	6.9
BR	10.1	10.0	9.3[b]	10.2[bc]	10.7[c]

[a]Low Voltage Electrical Stimulation

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

Table 3.4. Quality Characteristics at 24 and 48 hr After Death of Bulls Slaughtered at 14, 16 and 18 Months of Age

Characteristic	24 hr			48 hr		
	14 mo	16 mo	18 mo	14 mo	16 mo	18 mo
Marbling	Slt[34b]	Slt[64c]	Slt[84d]	Slt[44b]	Slt[77c]	Slt[87d]
Lean Color[a]	3.3	4.0	4.1	3.2[b]	3.6[c]	3.9[d]
Lean Firmness[a]	4.5	5.2	5.0	4.8[b]	5.0[b]	4.1[c]
Lean Texture[a]	4.5	4.5	4.2	4.7[c]	5.1[b]	3.7[d]

[a]Scores: 3 = light cherry red, moderately soft, or moderately coarse; 4 = cherry red, slightly soft, or slightly coarse; 5 = slightly dark red, slightly firm or slightly fine.

[bcd]Means in the same row for either 24 or 48 hr bearing different superscripts are different (P<.05).

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Why Electrical Stimulation Works with Hot Boning

Muscle cells contain a reserve energy source called glycogen. When an animal is killed, the muscle cells continue to metabolize for several hours, converting the glycogen to lactic acid. That causes muscles to become slightly acid (the pH drops), and normal rigor mortis occurs. If a carcass is hot-boned soon after slaughter and the meat chilled rapidly before rigor mortis occurs, a less tender product can result. However, if the carcass is electrically stimulated at slaughter, the resulting muscle contractions cause a quick conversion of glycogen to lactic acid, rigor mortis occurs rapidly, and a tender product results, even though the carcass was hot-boned, chilled and boxed without the usual 48 hours of initial cooling before cutting.

****

Effects of Ralgro® Implantation Periods on Masculinity and Carcass Traits of Young Bulls and Steers.

D.G. Gray, J.A. Unruh, M.E. Dikeman, and L.R. Corah

Summary

Repeated Ralgro® implantation of young bulls from birth to slaughter resulted in gains and carcass traits intermediate between non-implanted bulls and steers, and meat palatability traits similar to steers. On the other hand, implanting bulls near birth reduced postweaning gains and both live and carcass masculinity. There is little advantage to implanting bulls from weaning to slaughter without initial implantation at birth.

Introduction

The increased performance and efficiency of young bulls in the feedlot coupled with advantages in carcass cutability makes their feeding attractive. However, problems arise with the handling, slaughtering, grading and merchandizing of bulls and beef from them. Using growth promoting-implants near birth in young bulls has been indicated as a possible method of relieving some of these problems while retaining many of the advantages.

Experimental Procedure

Fifty-five fall-born Simmental crossbred bull calves were allotted randomly at birth to one of five treatments: non-implanted bulls (NIB); bulls implanted from birth to weaning (BI-BW); bulls implanted from weaning to slaughter (BI-WS); bulls implanted from birth to slaughter (BI-BS); and steers (St) castrated at 5 mo and implanted from birth to slaughter. All implant treatments were of 36 mg of Ralgro® every 100 days. Calves were weaned at an average age of 8.3 mo. and fed an 85% concentrate (corn-based) diet for 259 days until slaughter at 17 mo. of age. Hip height and scrotal circumference were measured at weaning and slaughter, and live masculinity was scored prior to slaughter. Cattle were slaughtered commercially and all carcasses were electrically stimulated. Testicles were weighed, and USDA carcass grade data were collected at 24 hr. postmortem. Carcasses also were scored for masculinity or bullock appearance. The wholesale rib from one side was shipped to KSU where two 1 in. steaks from the 12th rib region were removed 7 days postmortem for shear force determinations and sensory evaluations by a taste panel.

Results

Implanting did not affect (P>.05) weaning weights or hip heights, but steers tended to be the lightest and shortest (P<.01) at slaughter. Scrotal circumference was markedly decreased by implanting from birth to weaning (Table 4.1). Steers gained slowest (P<.01) and bulls implanted from birth (BI-BW and BI-BS) were intermediate and slower gaining (P<.10) than BI-WS and NIB. Although there was a 56 lb spread in average slaughter weights of bulls, the difference was not significant. NIB were taller (P<.05) at slaughter than BI-WS and BI-BS. Scrotal circumference was larger (P<.05) for NIB and BI-WS bulls than either BI-BS or

BI-BW bulls. Steers were scored as the least masculine (P<.05) live, and BI-BS were less masculine (P<.05) than the other bull treatments.

Steers had the lightest (P<.05) carcasses while NIB were heavier (P<.10) than BI-BS (Table 4.2). Dressing percentage was similar among treatments. Steers had more (P<.05) fat cover than NIB or BI-BW, with all other treatments being similar. Steers also had the smallest (P<.05) ribeyes and the most (P<.05) kidney knob. USDA Yield grades were least desirable for steers and BI-WS but still averaged below Yield Grade 3. Steers showed younger maturity, more marbling and higher USDA Quality grades than bulls (P<.05), with all bull treatments being similar.

Carcass masculinity was determined by evaluating crestiness, jump muscle and pizzle eye size of the carcasses. Steers were the least (P<.05) masculine with BI-BS being less (P<.05) masculine than the other bull treatments. NIB had the heaviest (P<.05) testicles of any of the bull groups.

Taste panel evaluations of ribeye steaks indicated that steers were generally superior in all traits (Table 4.3). BI-BS, however, were similar (P>.05) to steers for connective tissue amount, myofibrillar and overall tenderness. BI-BS tended (P<.10) to have higher taste panel scores and lower Warner-Bratzler shear values than NIB and BI-WS.

Repeated implanting of young bulls from birth with Ralgro®, although depressing gains compared to non-implanted bulls, yields carcasses with meat palatability traits similar to steers.

Table 4.1. Effects of Ralgro® Implant Periods on Live Weights and Development of Young Bulls and Steers.

	Treatment Groups				
Item	ST	BI-BS	BI-BW	BI-WS	NIB
Weaning					
Weight (lbs.)	465	516	523	506	528
Hip Ht. (in)	41.5	42.4	43.3	42.1	43
Scrotal Circum. (cm)	-	18.4[b]	19.8[b]	26.4[c]	26.5[c]
Slaughter					
Weight (lb.)	1104[b]	1224[c]	1233[c]	1270[c]	1280[c]
ADG (lb.)	2.49[b]	2.75[c]	2.76[c]	2.97[d]	2.92[d]
Hip Ht. (in)	49.2[b]	50.3[c]	51.9[de]	50.9[cd]	52.7[e]
Scrotal Circum. (cm)	-	34.5[b]	35.0[b]	37.6[c]	39.3[c]
Live Masculinity[a]	4.42[b]	3.00[c]	2.35[d]	2.13[d]	2.11[d]

[a]1 = very masculine, 5 = steer

[b,c,d,e](P<.05)

Table 4.2. Effects of Ralgro® Implant Periods on Carcass Characteristics of Young Bulls and Steers.

Item	Treatment Groups				
	ST	BI-BS	BI-BW	BI-WS	NIB
Yield					
Hot carcass wt. (lb)	687^{c}	756^{d}	767^{d}	774^{d}	803^{d}
Dressing percent	62.0	61.8	62.2	60.9	62.8
Fat thickness (in^{2})	0.36^{c}	0.34^{cd}	0.28^{d}	0.34^{cd}	0.26^{d}
Rib eye area (in^{2})	12.4^{c}	14.2^{d}	14.7^{d}	13.6^{d}	14.6^{d}
% Kidney Knob	2.14^{c}	1.64^{d}	1.64^{d}	1.73^{d}	1.64^{d}
Yield Grade	2.54^{c}	2.02^{de}	1.77^{e}	2.31^{cd}	1.92^{de}
Quality					
Maturity	A^{61c}	A^{74d}	A^{83d}	A^{74d}	A^{77d}
Marbling	Sm^{33c}	Sl^{75d}	Sl^{78d}	Sl^{63d}	Sl^{92d}
Quality Grade	Ch^{08c}	G^{70d}	G^{76d}	G^{60d}	G^{80d}
Masculinity					
Testicle wt. (gm)	-	377^{c}	449^{c}	488^{cd}	595^{d}
Crest[a]	5.18^{c}	4.14^{d}	3.59^{de}	3.59^{de}	3.45^{e}
Overall[d]	5.10^{c}	4.26^{d}	3.71^{e}	4.07^{e}	3.57^{e}

[a] 1 = extensive development, 6 = little development
[b] 1 = very bully; 5 = steer
[b,d,e] (P<.05)

Table 4.3. Effects of Ralgro® Implant Periods on Traits of Ribeye Steaks From Young Bulls and Steers Evaluated by a Taste Panel.

Item	Treatment Groups				
	ST	BI-BS	BI-BW	BI-WS	NIB
Juiciness[a]	6.33^{d}	5.91^{c}	5.86^{c}	5.83^{c}	5.73^{c}
Connective tissue[b]	7.02^{e}	6.82^{de}	6.61^{cd}	6.43^{c}	6.61^{cd}
Myofibrillar tenderness[a]	6.54^{e}	6.30^{de}	5.76^{c}	5.69^{c}	5.87^{cd}
Overall tenderness[a]	6.68^{e}	6.46^{de}	5.96^{c}	5.86^{c}	6.03^{cd}
W.B. shear values	2.71^{e}	3.32^{d}	3.27^{d}	3.48^{cd}	3.87^{c}

[a] 1 = extremely dry, tough; 8 = extremely juicy, tender
[b] 1 = extremely abundant; 8 = none
[c,d,e] (P<.05)

Consumer Preference of Beef Rib Steaks from Implanted Steers, Implanted and Non-implanted Bulls.

C.D. Pelton, D.M. Allen, L.R. Corah
and G.A. Milliken

Summary

Our research showed that implanting bulls from birth to slaughter made steaks from bulls as acceptable as steers to consumer panels. Implanting bulls from weaning to slaughter resulted in the least desirable consumer panel ratings for all palatability traits measured.

Introduction

Recent interest in feeding bulls has stimulated attempts to improve their carcass acceptability. One potential method of improving meat palatability in intact males is through the use of growth promotant implants. If successful, a major impediment to bull feeding might be removed. We examined the effect of implanting on consumer acceptability of beef from bulls.

Procedure

Rib steaks were obtained from 55 fall-born Simmental crossbred male calves, randomly allotted at birth to the following treatments: steers, implanted birth to slaughter (S); bulls, implanted birth to weaning (IBW); bulls, implanted birth to slaughter (IBS); bulls, implanted weaning to slaughter (IWS); and non-implanted bulls (B).

Implanted calves were given 36 mg zeranol (Ralgro) implants every 100 days. Steers were castrated at 5 months and all calves were weaned from their dams at an average of 250 days. After weaning, calves were fed a high concentrate corn-based diet until slaughtered at 17 months of age.

Animals were slaughtered at a commercial kill plant, electrically stimulated after evisceration, chilled 24 hours and graded by USDA personnel. Left primal ribs were removed and delivered to the Kansas State meats laboratory. Ribs were aged 7 days at 39° F and cut into steaks 1 in. thick.

Fifty-five households with 129 adult panel members were selected randomly from KSU academic and non-academic personnel. Steaks were distributed based on random designs. Response sheets were given to each household, requesting demographic information, visual preference prior to cooking, definition of cookery method, approximate degree of doneness, after cooking household preference, and data on buying and pricing decisions. Individual participants were asked to evaluate steaks for tenderness, juiciness, flavor and overall acceptability on an 8-point scale.

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

Results and Discussion

Mean values for consumer panel scores of palatability are shown in Table 5.1. Implanting bulls from weaning to slaughter resulted in the least desirable steaks in all areas rated by consumers. Steers and bulls implanted from birth to slaughter produced the most acceptable steaks. In conclusion, implanting of bulls from birth to slaughter was the only system involving intact males that enhanced palatability.

Table 5.1. Consumer Panel Results[a]

Palatability Trait	Treatments				
		Implant Treatment Groups			
	Steers	Birth to slaughter	Birth to weaning	Weaning to slaughter	Bulls
Juiciness	6.94^{b}	6.60^{b}	6.24^{c}	6.06^{bc}	6.39^{d}
Flavor	6.90^{b}	6.61^{b}	6.61^{b}	6.22^{bc}	6.45^{c}
Tenderness	7.03^{b}	6.78^{b}	6.23^{c}	5.96^{c}	6.12^{d}
Overall	7.10^{b}	6.69^{b}	6.25^{c}	6.13^{bc}	6.34^{d}

[a]Panel ratings are based on an 8-point hedonic scale, with 8=most preferred and 1=least preferred.

[b,c,d]Means within rows with different superscripts differ (P<.05).

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

Rosalie Held, Jack Riley, Clenton Owensby[1] and Ed Smith

Summary

Native bluestem pastures were grazed from May 16 to July 14, 1983 by steers with an average beginning weight of 545 lbs., at stocking rates of 1.82, 1.5, and 1.25 acres per steer. Daily gains for the high and low stocking rates were higher (P<.01) than for the medium stocking rate (2.22, 2.24 vs. 1.92 lb/day). Gains per acre were similar for the low and medium stocking rates, but was higher for the highest stocking rate (73, 75 vs 105 lb/acre).

Half of the steers in each stocking rate were self-fed a salt-limiting sorghum grain - Rumensin® mixture at an average intake of 1.84 lb per head per day. Supplementation increased daily gain (P<.01) over non-supplemented (2.39 vs. 1.86 lb/day). Gain per acre was increased 22 lbs by supplementation. Herbage remaining following grazing declined with increased stocking rate. No regrowth occurred following livestock removal in mid July. Warm-season perennial grass composition and basal cover have not changed differentially in relation to stocking rate during the 3-year study period.

Introduction

Early season intensive stocking (May 1 - July 15) of native bluestem pastures has been shown to produce daily gains similar to those made during the same period at normal stocking rates season long. This trial continued to evaluate different intensive stocking rates and the value of self-fed Rumensin® in a salt-limiting sorghum grain mixture.

Experimental Procedure

One 63 acre and five 60-acre pastures were assigned randomly to one of three stocking rates: 1.82, 1.5, or 1.25 acres per steer from May 16 to July 14, 1983 with two pastures per rate. Steers in one pasture of each stocking rate received a Rumensin sorghum grain supplement (Table 6.2) while steers in the other pastures received only salt. The steers, primarily British breeding, averaged 545 lbs initially.

Results

Results are shown in Tables 6.1 and 6.2. Steers at the low and high stocking rates gained more (P<.01) than those grazing at the medium rate. Herbage yield on the medium rate, nonsupplemental pasture was significantly lower than that of other treatments which was likely responsible for the reduced animal performance. Economic returns from grain look excellent; supplemented steers gained more (P<.01) than nonsupplemented steers. Gains per acre were increased with both the highest stocking rate and with supplementation.

[1] Department of Agronomy.

Herbage remaining from mid July on was greater at the lowest stocking rate and decreased with increased rates (Table 6.3 and 6.4). The 1.5 acre, nonsupplemented pasture apparently has inherently lower production than the other units. For the first time during the 3-year period of this study, regrowth during the latter half of the season did not occur due to hot, dry weather. Next year's production may be reduced due to lack of regrowth and food storage.

No stocking rate has significantly changed botanical composition or basal cover of the major warm-season grasses (Table 6.5).

Table 6.1. Effect of Stocking Rate on Performance of Steers Grazing Intensive Early Stocked Bluestem May 16 - July 14, 1983 (59 days).

	Stocking rate (acres per steer)		
Item	1.82	1.5	1.25
Steers per treatment	60	76	90
Avg. beginning wt., lb	546	542	547
Avg. gain per steer, lb	132[a]	113[b]	131[a]
Daily gain per steer, lb	2.24[a]	1.92[b]	2.22[a]
Gain per acre, lb	73	75	105

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

Table 6.2. Effect of Grain Supplementation on Performance of Steers Grazing Intensive, Early Stocked Bluestem.

	Supplemented			Nonsupplemented		
Stocking rate (acres/steer)	1.82	1.5	1.25	1.82	1.5	1.25
Steers per treatment	31	38	46	29	38	44
Supplement consumed Per head daily (self-fed)						
Ground sorghum grain, lb	1.79	1.74	1.49	0	0	0
Salt, lb	.20	.19	.17	0	0	0
Rumensin, mg	197	191	163	0	0	0
Avg gain per steer, lb	144	131	150	119	103	111
Daily gain per steer, lb	2.44	2.22	2.54	2.02	1.75	1.88
Gain per acre, lb	79	87	120	65	69	89
Supplemented vs. Nonsupplemented						
Avg gain per steer, lb		141[a]			110[b]	
Daily gain per steer, lb		2.39[a]			1.86[b]	
Gain per acre, lb		98			76	

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

Table 6.3. Grass (lb/A) Remaining in Mid July and Early October Following Grazing at Indicated Stocking Rates From May 16 to July 14, 1984.

	Grass Yield					
	Supplemented			Nonsupplemented		
Stocking rate (acres/steer)	1.82	1.50	1.25	1.82	1.50	1.25
Range Site				Mid July		
Loamy Upland	1809	1161	670	1476	567	1054
Breaks	1513	1154	727	1077	631	892
				Early October		
Loamy Upland	1844	948	981	950	609	832
Breaks	1308	971	763	865	524	741

Table 6.4. Forbs (lb/A) Remaining in Mid July and Early October Following Grazing at Indicated Rates From May 16 to July 14, 1984.

	Forb Yield					
	Supplemented			Nonsupplemented		
Stocking rate (acres/steer)	1.82	1.50	1.25	1.82	1.50	1.25
Range Site				Mid July		
Loamy Upland	282	182	150	139	161	52
Breaks	155	73	80	107	30	107
				Early October		
Loamy Upland	332	259	311	83	193	154
Breaks	100	77	174	76	41	70

Table 6.5. Botanical Composition (%) and Basal Cover (%) of Big Bluestem (Andropogon Gerardi), Indiangrass (Sorghastrum Nutans) and Little Bluestem (A. Scoparius) on Pastures Stocked at Indicated Rates From 1981-83; 1980 Data Represent Pretreatment Levels.

	Stocking Rate (acres/steer)											
	1.82				1.50				1.25			
Species	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
Big Bluestem												
% Comp.	28.4	23.6	29.4	28.2	28.7	27.0	30.6	28.1	22.1	22.7	25.1	24.4
% Basal Cover	2.27	1.18	2.10	2.16	3.40	1.32	2.02	2.07	2.23	1.26	1.78	1.40
Indiangrass												
% Comp.	15.9	13.5	19.2	19.4	20.3	17.0	21.6	18.8	21.8	16.3	21.0	21.7
% Basal Cover	1.32	0.70	1.37	1.50	2.38	0.78	1.43	1.4	2.20	0.88	1.50	1.26
Little Bluestem												
% Comp.	8.8	12.0	11.4	12.1	13.2	11.7	13.8	17.4	7.8	7.6	8.4	10.2
% Basal Cover	0.72	0.59	0.82	0.92	1.59	0.64	0.92	1.17	0.78	0.38	0.6	0.6

Silage Additive Update: 1984

Keith Bolsen, Mark Hinds, and John Brethour[1]

Summary

Numerous commercial silage additives, whose manufacturers claim will improve silage quality, are available to Kansas farmers and ranchers. We believe that these claims must ultimately be documented with farm-scale research. To date, Manhattan and Ft. Hays farm-scale silo results clearly indicate that a few silage additives do improve silage quality and are cost-effective. Several of them have consistently reduced "in silo" losses. But results probably will not be favorable with all additives under every farm condition. Nor will research results obtained with one commercial product in our trials also apply to other products on the market, however similar in ingredient formulation.

Introduction

With few exceptions, all crops grown can be harvested and fed as silage. A fact that has been recognized in Kansas for nearly a century (Shelton, 1889). Since silage is a product of anaerobic fermentation, the primary objectives in making it are to achieve and maintain oxygen-free conditions and to produce enough lactic acid to conserve the crop. When made by suitable techniques, silage should be well-preserved and lose a minimum of nutrients. That has been the goal since silage making was introduced in the U.S. over a century ago.

Both the chemistry and microbiology of silage fermentation are known. McDonald (1980) attributed the changes that occur during ensiling to the following activities: plant enzymes, lactic acid bacteria, clostridial bacteria, enterobacteriaceae, and yeasts. Only lactic acid bacteria have a "positive" effect on silage quality and their development must be encouraged. The other four activities are "negative" and their effects must be minimized and/or eliminated.

The dominance of lactic acid bacteria during the ensiling can only be achieved by controlling: (1) the moisture content of the crop; (2) the buffering capacity of the silage; (3) the availability of water-soluble carbohydrates; (4) the type of bacteria present; and (5) the speed of the fermentation (ie. rate of pH decline). The control of silage fermentation also involves proper harvesting, storing, and feeding techniques. These include: selecting a suitable crop; harvesting at the correct stage of maturity; ensiling at the right moisture content; cutting or chopping the crop finely; filling of the silo rapidly and sealing it to maintain anaerobic conditions; selecting a suitable silo structure; feeding the silage rapidly so that surface exposure is minimized; and using an effective silage additive.

[1]Beef Research Scientist, Ft. Hays Branch Experiment Station, Hays.

It is generally recognized that the "unavoidable" changes in nutritional value of the ensiled crop are small and the "unavoidable" losses in silage DM are low. These are presented in Table 7.1. Although the technology necessary to make high quality silage with a minimum loss is well established, on-farm practices and conditions often produce less than ideal silage.

The idea of using an "additive" to increase silage quality or to improve silage preservation is not new. Early in this century, Kansas farmers were using molasses and other carbohydrates (Hunter and Bushnell, 1916). In the 1960's and 70's, urea and other forms of NPN were used to increase the protein content of corn silage. Today, lactic acid bacteria and enzyme additives have been promoted widely with the expressed claim of "a more rapid and efficient production of lactic acid."

Silage fermentation aids may include lactic acid-producing micro-organisms, nutrients required by these lactic acid producers, and enzymes and/or micro-organisms that increase the availability of fermentable carbohydrates and other nutrients. Hundreds of products are commercially available that meet the "fermentation aid" definition.

Silage Additive Results

Do commercial fermentation aids improve silage quality in farm silos? There is not a clear consenus of opinion. Why? First, most of the commercial products have never been tested adequately either in laboratory or farm silos. Second, many evaluations are based on individual bias or on results from laboratory silos which can be misleading. When conducting additive research in farm silos, all silages must be harvested, stored, and fed using similar techniques. In theory, each silo should contain the same homogeneous material. In practice, this is difficult to achieve. Silage is complex and the factors that affect its quality are interactive (ie. crop suitability x chop length x silo structure).

The importance of reducing the loss of nutrients in the silo is universally accepted. It is our opinion that DM recovery is the most important criteria by which to evaluate commercial fermentation aids. It includes total losses from respiration, fermentation, effluent, surface waste, and aerobic deterioration prior to and during feeding.

At Manhattan and Ft. Hays, 19 farm-scale silo trials with either fermentation aid additives (microbial inoculants or enzymes) or non-protein nitrogen (NPN) additives were conducted from 1975 to 1983 using corn, alfalfa, or forage sorghum. Silages were evaluated using five response criteria: (1) ensiling temperature; (2) DM recovery; (3) aerobic deterioration; (4) nutritional value (digestibility or cattle performance); and (5) beef gain per ton of crop ensiled. Only DM recoveries for control and additive-treated silages are presented here (Table 7.2). We interpret these data as being generally positive for the inoculant or enzyme additives tested but less positive for NPN's, particularly with "wetter" forage sorghum silages.

Ensiling temperature and cattle performance results for several fermentation aid additives are presented in articles beginning on page 27 of this report.

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McDonald, P. 1980. Silage fermentation. Forage Conservation in the 80's, Brighton, England. Occas. Symp. No. 11, British Grassland Soc.

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Table 7.1. Nutrient Losses in Silage Making and Their Causing Factors.[1]

Process	Classified as	Approximate losses (%)	Causing factors
Residual respiration	unavoidable	1-4	Plant enzymes.
Fermentation	unavoidable	3-8	Micro-organisms.
Effluent	mutual	3->7	DM content.
or		or	
Field losses by wilting	unavoidable	3->7	Crop, weather, and technique.
Secondary fermentation	avoidable	0->5	Crop DM content and environment in silo.
Aerobic deterioration during storage	avoidable	0->6	Crop, filling time, silo, and sealing.
Aerobic deterioration after unloading (heating)	avoidable	0->10	As above plus unloading technique and season
		Total 7- >40	

[1]Data adapted from Zimmer, E. 1980. Efficient silage systems. Forage Conservation in the 80's. Occas. Symp. No. 11, British Grassland Soc.

Table 7.2. Feedable Dry Matter Recovery for Control and Additive-treated Corn, Alfalfa, and Forage Sorghum Silages in 19 Farm-scale Trials Conducted From 1975 to 1983 at Manhattan and Ft. Hays.[1]

Year and silage DM (%)	Additive treatment	Recovery of feedable DM[2]
corn		
1975 (38)	control	80.9
	Silo-Best®	87.5
1976 (35)	control	87.4
	Silo Guard®	93.7
1978 (44)	control	88.7
	Cold-flo®	91.5
	Sila-bac®	91.7
	Silo-Best	91.3
1979 (37)	control	93.3
	Cold-flo	88.5
	Ensila Plus®	94.1
1980 (33)	control	87.3
	Silo-Best	88.7
	Sila-ferm®	87.4
1981 (36)	control	89.0
	1177®	91.4
6-trial corn avg:	all 16 silages	89.5
	control	87.8
	inoculant or enzyme	90.7
	NPN	89.5
alfalfa		
1979 (36)	control	84.6
	Ensila Plus	90.0
	Silo Guard	89.7
	Sila-lator®	90.4
1980 (33)	control	82.0
	Sila-bac	82.0
	Silo Guard	86.2
forage sorghum		
1977 (29)	control	84.1
	Silo Guard	92.0
1979 (33)	control	91.0
	Cold-flo®	84.9
	Sila-bac	90.7
1981 (43)	control	84.4
	LSA-100	76.2
	1177	87.0
1982 (30)	control	85.6
	Fermentrol®	87.8
	urea	83.6
1982 (25)	control	77.2
	Silo Guard II®	84.0
1982 (25)	control	77.2
	Silo-Best	82.3
1982 (25)	control	77.2
	1177	79.1
*1979 (30)	control	82.1
	Sila-bac	85.0
*1979 (32)	control	87.3
	Sila-bac	90.2
*1980 (30)	control	78.1
	LSA-100	77.2
	Sila-bac	81.1
*1981 (29)	control	80.0
	LSA-100	76.0
11-trial sorghum avg:	all 26 silages	83.0
	control	82.2
	inoculant or enzyme	85.9
	NPN	79.6

[1] All corn and alfalfa silage trials were conducted in 10 x 50 ft concrete stave silos at Manhattan.

All forage sorghum trials were conducted in the silos at Manhattan except trials with one asterisk (*) which were conducted in 10 x 40 ft concrete stave silos at the Ft. Hays Branch Expt. Sta. under the supervision of John Brethour.

[2] Percent of the DM ensiled.

KSU

Silo Guard II® for Alfalfa, Corn, and Forage Sorghum Silages[1]

Keith Bolsen, Harvey Ilg, and Mark Hinds

Summary

In the first trial, calves fed Silo Guard II®-treated forage sorghum silage were 4.2% more efficient than those fed the control silage. Silo Guard II reduced the amount of heat produced during the ensiling process, and increased the dry matter recovered from the silo by nearly 7 percentage units (84.1 vs. 77.2%). The more efficient gain and reduced shrink loss for the treated silage gave 8.3 extra pounds of calf gain per ton of crop ensiled when compared with the control silage.

In the second trial, laboratory silos were used to evaluate three levels of Silo Guard II (.5, 1.0, and 2.0 lb per ton), with each of the following crops: direct-cut alfalfa, wilted alfalfa, corn, and forage sorghum. All levels of Silo Guard II improved dry matter recoveries and treated silages underwent more efficient fermentations. Adding Silo Guard II at .5 lb was as effective as the higher application rates.

Experimental Procedures

Trial 1. Two whole-plant forage sorghum silages were compared: control (no additive) and Silo Guard II applied at 1.0 lb per ton of fresh crop. The silages were made in 10 x 50 ft concrete stave silos on September 28 and 29, 1982 from Asgrow Titan R forage sorghum, harvested in the dough stage at 25 to 26% dry matter (DM). Ensiling temperatures were monitored for the first 42 days and nylon bags (6 per silo) were buried in each silo for additional observations of silage DM recoveries. The silos were opened on December 20 and 21.

Each silage was fed to 18 steer and heifer calves in three pens of six calves per silage. The calves were Hereford, Simmental, and Hereford x Angus and weighed 435 lb initially. The 94-day feeding trial began December 21, 1982 and ended March 25, 1983. Silages were full-fed and all calves received 2.0 lb of supplement 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.

All calves 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. Intermediate weights were taken before the a.m. feeding on days 28 and 56.

[1]Silo Guard II contains an enzyme and its co-factors and is manufactured by International Stock Foods, Inc., Waverly, NY 14892. Partial financial assistance was provided by International Stock Foods.

Silage samples were taken twice weekly from each silo. Feed offered was recorded daily for each of the six pens and the quantity of silage fed was adjusted daily to assure that feed was always in the bunks. Feed not consumed was removed, weighed, and discarded every 7 days.

Three aerobic stability (bunk life) measurements were made on each silage. 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. These 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. Silages were made in 1982 from: third-cutting 1/4-bloom alfalfa that was (1) direct-harvested at 75% moisture (low DM) or (2) heavily wilted to 50% moisture (high DM); (3) whole-plant corn, harvested in the dent stage at 67% moisture; and (4) whole-plant forage sorghum, harvested in the dough stage at 73% moisture. Four treatments were compared: control (no additive) and Silo Guard II applied at .5, 1.0, or 2.0 lb per ton of fresh crop.

For each treatment an appropriate amount of crop was placed in a Harsh Mobile Mixer® and the additive applied. After mixing, about 28 to 34 lb of crop was packed tightly into the laboratory silos (five per treatment) and the filled silos weighed. Samples of pre-treated and post-treated, pre-ensiled crop were taken and frozen immediately in liquid nitrogen. For all crops, less than 2 hours elapsed from the time the harvested material left the field until the laboratory silos were sealed.

For each crop, at about 10 weeks post-ensiling, silos were weighed and the silage mixed in a cement mixer and sampled. Dry matter loss was determined for each silo. All silage samples were analyzed for DM, pH, lactic acid, volatile fatty acids, crude protein, ammonia-nitrogen, and hot water insoluble-nitrogen. All pre-ensiled crop samples were analyzed for DM, pH, crude protein, and hot water insoluble-nitrogen. Bunk life was measured by procedures similar to those described in Trial 1.

Results and Discussion

Trial 1. Visual appraisal indicated that both the control and Silo Guard II silages were well preserved. Chemical analyses are shown in Table 8.1. The DM content of the pre-ensiled forages and silages was rather low: 25.9 and 24.3% for the control; 25.4 and 24.4% for the Silo Guard II. In the first 10 days to 2 weeks after the silos were filled, effluent was produced from the control silo; none came from the Silo Guard II silo. The DM content of the final 4 to 5 tons of silage in the bottom of the silos was 21.0% for the control and 25.5% Silo Guard II silages. The slightly higher lactic acid to acetic acid ratio in the Silo Guard II silage suggests that it underwent a more efficient fermentation.

Adjusted ensiling temperatures are shown in Figure 8.1. Control silage reached a maximum temperature of 14.5 F above its initial forage temperature on day 6; Silo Guard II silage reached 10.5 F above initial on day 4. Silo Guard II silage returned to its initial temperature on day 17 post-ensiling; control silage was 13.5 F above its initial temperature on day 17 and was still above initial by 3.0 F on day 42. Thus, the treated silage probably underwent a more efficient fermentation, which was completed much sooner than that of the control.

Silage recovery and loss data are shown in Table 8.2. In the concrete stave silos, DM lost during fermentation, storage, and feedout was 30.4% less for the Silo Guard II silage (14.5%) than for the control silage (20.8%). The data from the buried nylon bags gave similar results—treated bags had 27.4% less DM loss than control bags (8.1 vs. 11.2%). Results of four previous trials showed similar improvements in DM recovery for Silo Guard silages (see page 26 of this report).

Performance by the calves fed the two forage sorghum silage rations is shown in Table 8.3. Calves fed control silage consumed slightly more feed than those fed Silo Guard II silage, but since rates of gain for the calves were similar, feed efficiency was 4.2% better for the calves fed Silo Guard II silage.

Also shown in Table 8.3 are calf gains per ton of forage sorghum ensiled. These data combine silage recovery (Table 8.2) and calf performance. Silo Guard II produced 8.3 extra pounds of calf gain per ton of crop ensiled. For the cattleman or farmer-feeder, this is a logical way to determine the overall effectiveness of a silage additive, as it expresses both forage preservation efficency and silage nutritive value. Three previous trials with Silo Guard and Silo Guard II have indicated that gain produced per ton of whole-plant corn or sorghum ensiled was increased by an average of 6.5 pounds when compared with control silages (Reports of Progress 377 and 427).

Aerobic stabilities of silage from the top, middle, and bottom thirds of each silo are shown in Table 8.4. Both silages were unstable near the top of the silos, heating after only 1 or 2 days of air exposure. However, silages from the middle and bottom thirds of each silo were extremely stable, with no heating or deterioration during 21 days of air exposure.

Trial 2. All four low DM alfalfa silages were of extremely poor quality—they contained almost no lactic acid and very high amounts of volatile fatty acids (including butyric) and ammonia-nitrogen. Although each level of Silo Guard II improved DM recovery over the control (83.9 vs. 82.2% of the DM ensiled), none of the treated silages were of acceptable quality. Making alfalfa silage at a moisture content above 72% is not recommended.

Dry matter recoveries and chemical analyses of the high DM alfalfa silages are shown in Table 8.5. Silage made with .5 lb of Silo Guard II had numerically higher DM recovery and ratios of lactic to acetic acid and lactic to DM loss than control silage.

All eight corn and forage sorghum silages were of very acceptable quality—they had low DM losses and high lactic acids (Table 8.6). In both crops, each level of Silo Guard II significantly ($P<.05$) improved silage DM recoveries over the controls.

Summarized in Table 8.7 are results for the high DM alfalfa, corn, and sorghum silages. All levels of Silo Guard II improved DM recoveries and treated silages underwent more efficient fermentations as indicated by their higher ratios of lactic to acetic acid and lactic to DM loss. Adding Silo Guard II at .5 lb per ton was as effective as the higher application rates.

Table 8.1. Chemical Analyses for the Control and Silo Guard II Silages Made in the Concrete Stave Silos.[1]

Item	Silage treatment: Control	Silage treatment: Silo Guard II
Dry matter:		
pre-ensiled, %	25.9	25.4
silage, %	24.3	24.4
	% of the DM	
Lactic acid	6.30	6.50
Acetic acid	4.56	4.04
Propionic acid	.52	.33
Butyric acid	.06	.07
Total fermentation acids	11.11	10.60
Crude protein	7.24	7.63
Hot water insoluble-nitrogen	.75	.75
pH	3.77	3.89
Ratio:		
lactic:acetic	2.07	2.39

[1] Each value is the mean of 13 samples taken during the feeding trial.

Table 8.2. Forage Sorghum Silage Recoveries and Losses From the Concrete Stave Silos and Buried Bags for the Control and Silo Guard II Silages.

Item	DM recovery: Feedable	DM recovery: Non-feedable (spoilage)	DM lost during fermentation, storage, and feedout
	% of the DM ensiled		
Concrete stave silos			
control	77.2	2.0	20.8
Silo Guard II	84.1	1.4	14.5
Buried nylon bags[1]			
control	88.8	—	11.2
Silo Guard II	91.9	—	8.1

[1]Each value is the mean of six bags.

Table 8.3. Performance by Calves Fed the Control and Silo Guard II Treated Silages and Calf Gain Per Ton of Forage Sorghum Ensiled.

Item	Silage treatment: Control	Silage treatment: Silo Guard II
No. of calves	18	18
Avg. daily gain, lb	1.18	1.19
Daily feed intake, lb[1]		
silage	9.15	8.81
supplement	1.80	1.80
total	10.95[a]	10.61[b]
Feed/lb of gain, lb[1]	9.33	8.94
Silage fed, lb/ton[2]	1545	1682
Silage/lb of gain, lb[2]	25.83	24.67
Calf gain/ton of crop ensiled, lb[2]	59.8	68.1

[ab]P<.05).

[1]100% dry matter basis.

[2]All values are adjusted to the same silage DM content, 30 percent.

Table 8.4. Aerobic Stabilities of the Control and Silo Guard II Forage Sorghum Silages.

Replication and silage	Days of initial temp. rise above ambient (64F)	Maximum temp. (F)
Replication 1[a]		
Control	2.0	111
Silo Guard II	3.0	95
Replication 2[b]		
Control	*	*
Silo Guard II	*	*
Replication 3[c]		
Control	*	*
Silo Guard II	*	*

[a]Silage removed from the top one-third of the silos (January 4, 1983).

[b]Silage removed from the middle one-third of the silos (March 11, 1983).

[c]Silage removed from the bottom one-third of the silos (April 5, 1983).

*No rise in temperature or visible aerobic deterioration occurred during 21 days of exposure to air.

Table 8.5. Dry Matter Recoveries and Chemical Analyses for the Control and Silo Guard II High Dry Matter Alfalfa Silages Made in Laboratory Silos.

		Silo Guard II (lb/ton)		
Item	Control	.5	1.0	2 .0
Dry matter:				
pre-ensiled, %	50.2	50.1	50.6	50.6
silage, %	48.7	49.3	49.4	49.6
	% of the DM ensiled			
Dry matter recovery	96.1[b]	97.2[a]	96.5[ab]	96.8[ab]
	% of the silage DM			
Lactic acid	5.8	5.8	5.7	5.5
Acetic acid	2.4[b]	2.1[a]	2.1[a]	2.4[b]
Propionic acid	.01[b]	.07[a]	.03[b]	.02[b]
Butyric acid	ND	ND	ND	ND
Total fermentation acids	8.3[a]	7.9[ab]	7.8[b]	7.9[ab]
Crude protein	19.7[b]	20.7[a]	20.6[a]	20.6[a]
Hot water insol. N	1.3[b]	1.3[b]	1.3[b]	1.4[a]
Ammonia-N	.2	.2	.2	.2
pH	4.73	4.70	4 .76	4.74
Ratios:				
Lactic:acetic	2.4[ab]	2.8[a]	2.8[a]	2.3[b]
Lactic:DM loss	1.6	2.1	1.8	1.8

[ab]Values within a crop with different superscripts differ (P<.05).
ND means none detected.

Table 8.6. Dry Matter Recoveries and Chemical Analyses for the Control and Silo Guard II Corn and Forage Sorghum Silages Made in Laboratory Silos.

	Corn silage				Forage sorghum silage			
		Silo Guard II (lb/ton)				Silo Guard II (lb/ton)		
Item	Control	.5	1.0	2.0	Control	.5	1.0	2.0
Dry matter:								
pre-ensiled, %	33.4	33.2	33.1	32.8	27.5	27.2	27.2	27.7
silage, %	31.9	32.0	32.0	31.7	25.3	25.4	25.4	25.7
	% of the DM ensiled							
Dry matter recovery	94.5^{b}	95.7^{a}	95.8^{a}	95.4^{a}	90.6^{b}	91.8^{a}	91.7^{a}	91.2^{ab}
	% of the silage DM							
Lactic acid	8.1	7.2	7.6	7.5	10.4	10.7	10.5	11.4
Acetic acid	6.6	6.9	5.7	5.8	3.0^{b}	2.7^{ab}	2.4^{a}	2.6^{ab}
Propionic acid	.3	.4	.2	.2	ND	ND	ND	ND
Total fermentation acids	15.0	14.5	13.5	13.2	13.4	13.4	12.9	14.0
Crude protein	7.7	7.7	7.7	7.8	—	—	—	—
Hot water insol. N	.67	.65	.62	.62	—	—	—	—
pH	3.65^{a}	3.68^{b}	3.69^{b}	3.70^{b}	3.73^{a}	3.80^{b}	3.77^{ab}	3.75^{ab}
Ratios:								
Lactic:acetic	1.2	1.1	1.4	1.4	3.5^{b}	4.2^{a}	4.4^{a}	4.5^{a}
Lactic:DM loss	1.5	1.7	1.8	1.7	1.1	1.3	1.3	1.3

^{ab}Values within a crop with different superscripts differ ($P<.05$).
ND means none detected.

Table 8.7. Summary of the Dry Matter Recoveries and Chemical Analyses for the Control and Silo Guard II High Dry Matter Alfalfa, Corn, and Forage Sorghum Silages Made in Laboratory Silos.

		Silo Guard II (lb/ton)		
	Control	.5	1.0	2.0
No. of silages	3	3	3	3
Silage DM, %	35.3^{b}	35.6^{a}	35.6^{a}	35.7^{a}
	% of the DM ensiled			
Dry matter recovery	93.73^{b}	94.91^{a}	94.69^{a}	94.48^{a}
	% of the silage DM			
Lactic acid	8.1	7.9	7.9	8.1
Acetic acid	4.0^{c}	3.9^{bc}	3.4^{a}	3.6^{ab}
Propionic acid	.12	.16	.06	.06
Total fermentation acids	12.2	11.9	11.4	11.7
pH	4.04^{a}	4.06^{b}	4.07^{b}	4.06^{b}
Ratios:				
Lactic:acetic	2.4^{b}	2.7^{a}	2.8^{a}	2.7^{a}
Lactic:DM loss	1.4^{b}	1.7^{a}	1.6^{ab}	1.6^{ab}

^{abc}Values with different superscripts differ ($P<.05$).

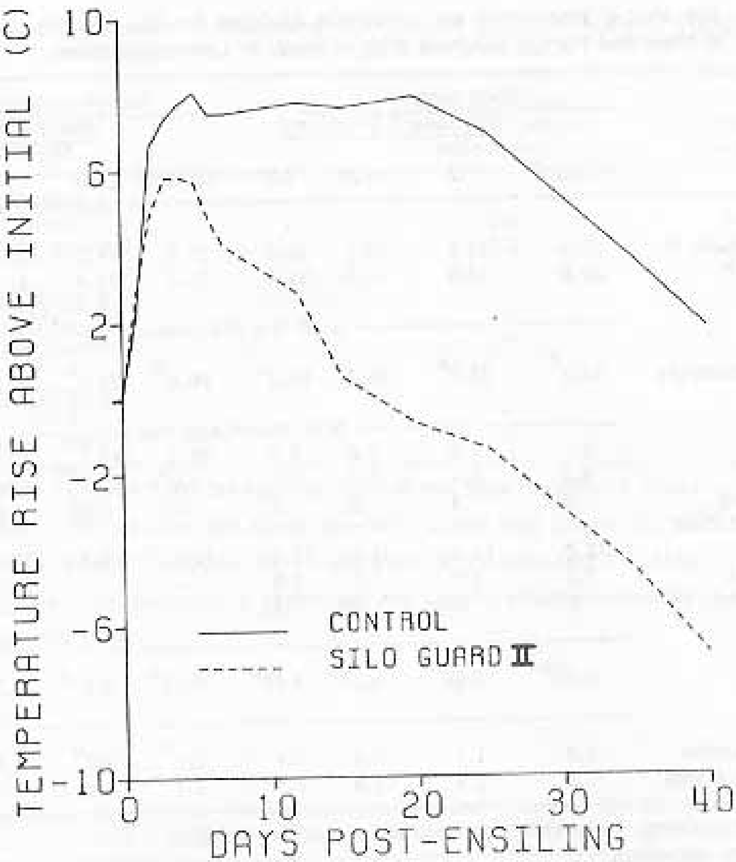
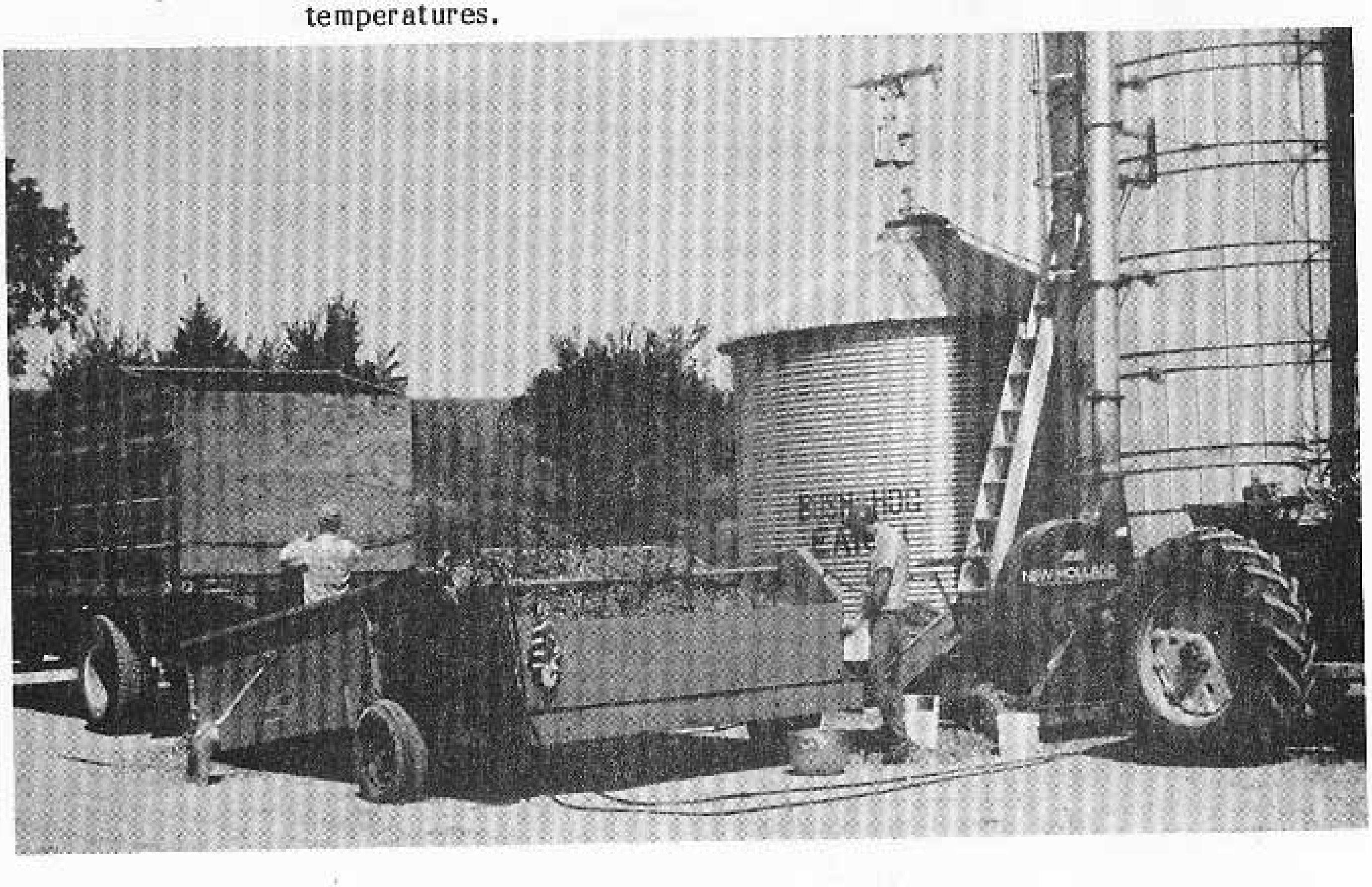


Figure 8.1. Adjusted ensiling temperature rise above the initial forage temperatures.



Silo-Best® for Sorghum Silages[1]

Keith Bolsen, Harvey Ilg, and Mark Hinds

Summary

Silo-Best lowered the ensiling temperature and increased the dry matter recovered from the silo by over 5 percentage units (82.3 vs. 77.2%). Calves fed the control silage gained faster and consumed more feed, but those fed treated silage were slightly more efficient. The more efficient gain and lowered shrink loss for Silo-Best silage gave 6.4 extra pounds of calf gain per ton of crop ensiled.

Experimental Procedures

Two whole-plant forage sorghum silages were compared: control (no additive) and Silo-Best applied at 1.0 lb per ton of fresh crop. The silages were made in 10 x 50 ft concrete stave silos on September 28 and 29, 1982 from Asgrow Titan R forage sorghum, harvested in the dough stage at 25 to 26% dry matter (DM). Ensiling temperatures were monitored for the first 42 days and nylon bags (6 per silo) were buried in each silo for additional observations of silage DM recoveries. The silos were opened on December 20 and 21.

Each silage was fed to 18 steer and heifer calves in three pens of six calves per silage. The calves were Hereford, Simmental, and Hereford x Angus and weighed 435 lb initially. The 94-day feeding trial began December 21, 1982 and ended March 25, 1983. Silages were full-fed and all calves received 2.0 lb of supplement 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.

All calves 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. Intermediate weights were taken before the a.m. feeding on days 28 and 56.

Silage samples were taken twice weekly from each silo. Feed offered was recorded daily for each of the six pens and the quantity of silage fed was adjusted daily to assure that feed was always in the bunks. Feed not consumed was removed, weighed, and discarded every 7 days.

Three aerobic stability (bunk life) measurements were made on each silage as described on page 28 of this report.

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[1]Silo-Best contains Lactobacillus plantarum, L. acidophilus, and dried Streptococcus faecium and Pediococcus fermentation products and is produced by Cadco, Inc., Des Moines, IA 50308. Partial financial assistance was provided by Cadco.

Results and Discussion

Both the control and Silo-Best silages appeared to be well preserved. Chemical analyses are shown in Table 9.1. The DM content of the pre-ensiled forages and silages was rather low: 25.9 and 24.3% for the control; 25.2 and 23.8% for the Silo-Best. In the first 10 days to 2 weeks after filling, effluent flowed from both silos, but less effluent appeared to come from the treated silage.

Adjusted ensiling temperatures are shown in Figure 9.1. Both silages reached a maximum temperature of 14.5 F above initial forage temperature on day 6. However, Silo-Best silage returned to its initial temperature on day 31 post-ensiling; control silage was 10.0 F above its initial temperature on day 31 and was still above initial by 3.0 F on day 42. These data indicate that the treated silage lost less energy during fermentation.

Silage recovery and loss data are shown in Table 9.2. In the concrete stave silos, DM lost during fermentation, storage, and feedout was 27.2% less for the Silo-Best silage (15.1%) than for the control silage (20.8%). The data from the buried nylon bags gave similar results—treated bags had 9.3% less DM loss than control bags (10.1 vs. 11.2%). Results of four previous trials have shown consistent improvements in DM recovery for Silo-Best silages (see page 26 of this report).

Performance by calves fed the two forage sorghum silages is shown in Table 9.3. Throughout the 94-day trial calves fed control silage consumed more feed than those fed Silo-Best silage. Although calves fed treated silage gained slightly less than calves fed control silage, they had a 2.1% better feed conversion.

Also shown in Table 9.3 are calf gains per ton of forage sorghum ensiled. These data combine silage recovery (Table 9.2) and calf performance. Silo Best produced 6.4 extra pounds of calf gain per ton of crop ensiled. In three of four previous trials, gain produced per ton of whole-plant corn, sorghum, or high-moisture corn ensiled with Silo-Best was increased by an average of over 6.0 pounds when compared with control silages (Reports of Progress 377 and 413).

Aerobic stabilities of silage from the top, middle, and bottom thirds of each silo are shown in Table 9.4. Both silages were unstable near the top of the silos, heating after only 1 or 2 days of air exposure. However, silages from the middle and bottom thirds of each silo were extremely stable. No heating or deterioration occurred during 21 days of air exposure.

Table 9.1. Chemical Analyses for the Control and Silo-Best Silages Made in the Concrete Stave Silos.[1]

Item	Silage treatment: Control	Silage treatment: Silo-Best
Dry matter:		
pre-ensiled, %	25.9	25.6
silage, %	24.3	23.7
	% of the DM	
Lactic acid	6.30	6.17
Acetic acid	4.56	5.80
Propionic acid	.52	.69
Butyric acid	.06	.01
Total fermentation acids	11.11	12.69
Crude protein	7.24	7.32
Hot water insoluble-nitrogen	.75	.74
pH	3.77	3.79
Ratio:		
lactic:acetic	2.07	1.14

[1] Each value is the mean of 13 samples taken during the feeding trial.

Table 9.2. Forage Sorghum Silage Recoveries and Losses From the Concrete Stave Silos and Buried Bags for the Control and Silo-Best Silages.

Item	DM recovery: Feedable	DM recovery: Non-feedable (spoilage)	DM lost during fermentation, storage, and feedout
	% of the DM ensiled		
Concrete stave silos			
Control	77.2	2.0	20.8
Silo-Best	82.3	2.6	15.1
Buried nylon bags[1]			
Control	88.8	—	11.2
Silo-Best	89.9	—	10.1

[1] Each value is the mean of six bags.

Table 9.3. Performance by Calves Fed the Control and Silo-Best Treated Sorghum Silages and Calf Gain Per Ton of Forage Sorghum Ensiled.

Item	Silage treatment	
	Control	Silo-Best
No. of calves	18	18
Avg. daily gain, lb	1.18	1.10
Daily feed intake, lb[1]		
silage	9.15	8.21
supplement	1.80	1.80
total	10.95[a]	10.01[b]
Feed/lb of gain, lb[1]	9.33	9.13
Silage fed, lb/ton[2]	1545	1646
Silage/lb of gain, lb[2]	25.83	24.88
Calf gain/ton of crop ensiled, lb[2]	59.8	66.2

[ab]P<.05.

[1]100% dry matter basis.

[2]All values are adjusted to the same silage DM content, 30 percent.

Table 9.4. Aerobic Stabilities of the Control and Silo-Best Forage Sorghum Silages.

Replication and silage	Days of initial temp. rise above ambient (64 F)	Maximum temp. (F)
Replication 1[a]		
Control	2.0	111
Silo-Best	<1.0	117
Replication 2[b]		
Control	*	*
Silo-Best	*	*
Replication 3[c]		
Control	*	*
Silo-Best	*	*

[a]Silage removed from the top one-third of the silos (January 4, 1983).

[b]Silage removed from the middle one-third of the silos (March 11, 1983).

[c]Silage removed from the bottom one-third of the silos (April 5, 1983).

*No rise in temperature or visible aerobic deterioration occurred during 21 days of air exposure.

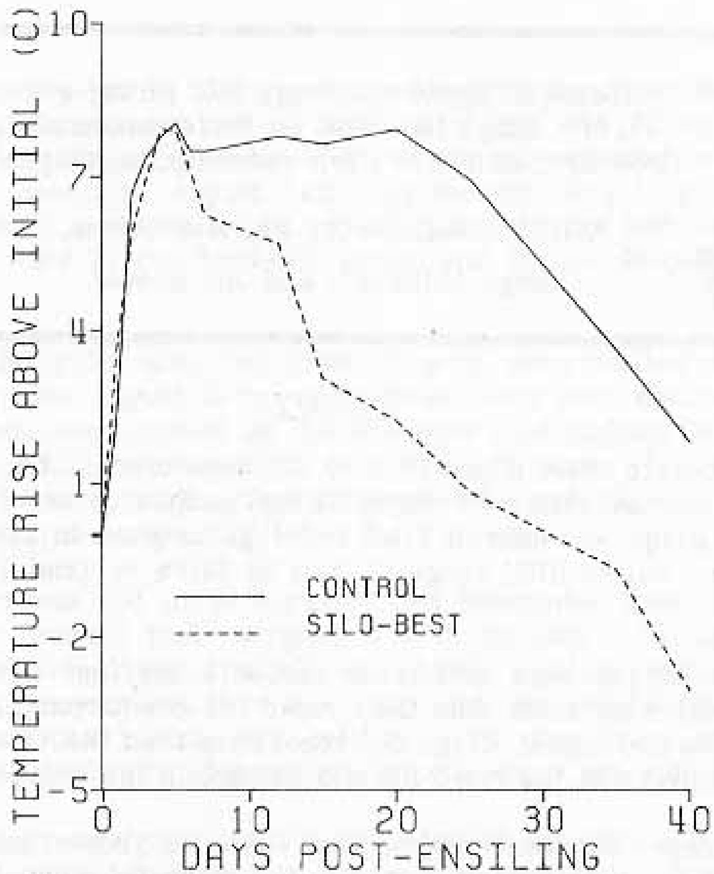

Figure 9.1. Adjusted ensiling temperature rise above the initial forage temperatures.

Effects of Rapid and Delay Silo Filling and 1177® Silage Inoculant on Performance of Growing Cattle Fed Corn and Sorghum Silages[1]

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

Summary

Eight concrete stave silos (10 x 50 ft) were used in two trials to evaluate rapid (24 to 36 hr) and delay (15 days) filling, each with or without 1177® silage inoculant. Corn silage was used in Trial 1; forage sorghum in Trial 2. The delay-fill silages had a dry matter (DM) range of 34.4 to 39.9% in Trial 1 and 24.2 to 29.6% in Trial 2.

All eight silages were well preserved with the four delay-fill silos having lower total fermenation acids than their rapid-fill counterparts. With corn silage, the rapid-fill silos had higher silage DM recoveries than the delay-fill silos. 1177® improved DM recovery in the rapid-fill silo but not in the delay-fill silo.

With forage sorghum silage, the rapid-fill silos lost effluent, which contributed to lower DM recoveries than in the delay-fill silos. 1177® improved DM recoveries with both fill procedures for the wetter sorghums. Steer performance was similar (P>.05) for all four treatments within each silage. When silage recovery and steer performance were combined, the 1177® treated silages produced more pounds of beef than their respective controls. When corn and forage sorghum silages were averaged, 1177® produced 3.3 lb more beef gain per ton of crop ensiled than uninoculated controls.

Experimental Procedures

Trial 1: Four concrete stave silos (10 x 50 ft) were filled with whole-plant corn in the late summer, 1981. The treatments were: (1) rapid-fill (filled during 24 to 36 hr) without inoculant (control-rapid); (2) delay-fill (filled over 15 days) without inoculant (control-delay); (3) rapid-fill with 1177® Silage Inoculant (1177-rapid); and (4) delay-fill with 1177® Silage Inoculant (1177-delay). The 1177®, 1.0 lb/ton of fresh crop, was applied by hand at the blower. Harvest and fill dates and crop dry matters (DM) are shown in Table 10.1.

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[1]Pioneer 1177® Silage Inoculant contains dried Lactobacillus plantarum and dried Streptococcus faecium fermentation products and is produced by Pioneer Hi-Bred International, Inc., Des Moines, IA 50308. 1177® and partial financial assistance were provided by Pioneer.

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

The corn, Ferry-Morse 3020, grown under irrigation near Manhattan, yielded approximately 153 bushels per acre. On each of the silo filling dates, a similar number of rows was harvested from each of two pre-selected areas in the field. When the harvest began on August 14th, the kernels were in the dent stage and the whole-plant corn averaged 34.3% dry matter. At the last harvest on August 27th, the kernels were in the hard-dent stage and the whole-plant was 39.9% dry matter.

For each delay-fill silo, two loads of crop were ensiled on each of the 4 filling days, except on August 24th, when three loads were ensiled. In each rapid fill silo, seven loads were ensiled by the alternate load method between 8 a.m. and 6 p.m. on August 17th; and the final two loads, between 11 a.m. and 2 p.m. on August 18th. Five thermocouple wires were spaced evenly in each of the four silos and ensiling temperatures were monitored for 8 weeks.

Each silage was fed to 24 Hereford and Simmental steer and heifer calves (four pens of six calves) that weighed 511 lb initially. All calves received a full-feed of silage and 2.0 lb of supplement daily. Rations were fed twice daily, with silage and supplement mixed in the bunk. Rations were formulated to contain 12.5% crude protein (DM basis), .50% calcium, .35% phosphorus, and to supply 150 mg of monensin and 30,000 IU of supplemental vitamin A per calf daily.

All calves were weighed individually after 16 hr without feed or water on 2 consecutive days at the start and at the end of the trial. Intermediate weights were taken before the a.m. feeding on days 28, 56, and 84. Silage samples were collected twice weekly from the silos. Feed intake was recorded daily for each of the 16 pens and silage not consumed was removed, weighed, and discarded every 7 days.

Twice during the feeding trial, silage from each silo was removed from three feet below the surface and aerobic stability measured by procedures described on page 28 of this report.

Trial 2: Four concrete stave silos (10 x 50 ft) were filled with whole-plant forage sorghum in the early autumn, 1982. The treatments were the same as for Trial 1. Harvest and fill dates and crop dry matters are shown in Table 10.1.

The forage sorghum, Asgrow Titan R, grown under dryland conditions near Manhattan, yielded approximately 60 bushels per acre. On each of the silo filling dates, a similar number of rows was harvested from a pre-selected area in the field. When the harvest began on September 20th, the grain sorghum grains were in the soft-dough stage and the whole-plant forage sorghum averaged 24.3% dry matter. At the last harvest on October 5th, the grain sorghum grains were in the hard-dough stage and the whole-plant was 29.5% dry matter.

For each delay-fill silo, two loads of crop were ensiled on each of the 4 filling days, except on September 24th and October 5th, when three loads were ensiled. In each rapid fill silo, six loads of crop were ensiled by the alternate load method between 1 p.m. and 6:30 p.m. on September 28th; and the final three loads between 11 a.m. and 1:30 p.m. on September 29th. Four thermocouple wires were evenly spaced in each of the four silos and ensiling temperatures were monitored for 40 days.

Each silage was fed to 18 Hereford and Simmental steer and heifer calves (three pens of six calves) that weighed 435 lb initially. All calves received a full-feed of silage and 2.0 lb of supplement daily. Rations were fed twice daily, with silage and supplement mixed in the bunk. Rations were formulated as in Trial 1. Calf weights, silage sampling, feed recording, and aerobic stability measures were similar to those in Trial 1.

Results and Discussion

Chemical analyses of the four corn silages are shown in Table 10.2 and for the four forage sorghum silages, in Table 10.3. The DM content of both crops entering the silos was increased by delay-filling over a 15-day period. The delay-fill silos had a DM range of 34.4 to 39.9% in Trial 1 and 24.2 to 29.6% in Trial 2. All eight silages were well preserved and had undergone predominantly lactic acid fermentations. In the first 10 days to 2 weeks after the rapid-fill sorghum silages were made, effluent was produced from both silos. As will be discussed later, the effluent had a detrimental effect on the quality of each silage.

For both corn and sorghum, the slightly higher DM content of the delay-fill forages gave silages with lower total fermentation acids than their rapid-fill counterparts. In Trial 1, the 1177 rapid-fill silage had the highest lactic acid content and the highest lactic to acetic acid ratio, which suggests this silage had the most efficient fermentation. The other three corn silages had similar chemical compositions. In Trial 2, the two delay-fill sorghum silages underwent more efficient fermentations than the two rapid-fill silages, as indicated by the higher lactic to acetic acid ratios. 1177 did not affect the chemical composition of either the rapid- or delay-fill sorghum silages.

Temperature rises above initial forage temperatures are shown in Figure 10.1 and 10.2. In both trials, the delay-fill silages had greater average temperature rises during the first week than the rapid-fill silages, peaking at 16 C vs 9 C in Trial 1 and 13 C vs. 8 C in Trial 2. This increased heat production was due, in part, to the prolonged surface exposure over the 15 days and less total compaction and density in the delay-fill silages.

The dry matter lost during fermentation, storage, and feedout from the concrete stave silos in Trial 1 was lowest for 1177-rapid (6.7%) but highest for 1177-delay (10.8%) while the control-rapid and control-delay had similar losses (Table 10.4). In Trial 2, both rapid-fill silos lost more dry matter than the two delay-fill silos. The lower DM content of the rapid-fill forages likely explains these higher losses; soluble nutrients needed for fermentation are lost in the effluent and the higher moisture allows a prolonged and less efficient fermentation. In both trials, approximately 1.5 to 3.0% of the recovered dry matter was discarded as non-feedable spoilage when the silos were opened. This spoilage was not influenced by silage treatment and was normal for silage surfaces sealed with black plastic.

Steer performances are shown in Table 10.5 and 10.6 for Trials 1 and 2, respectively. All four treatments within each silage produced statistically similar daily gains, feed intakes, and feed conversions. The two delay-fill corn silages, which were slightly drier, had numerically higher intakes than the two rapid-fill silages, however sorghum silage results were reversed, with delay-fill silages having lower intakes than rapid-fill silages.

Shown in Table 10.7 are steer gains per ton of crop ensiled. These data combine silage recovery from the concrete stave silos (Table 10.4) and feedlot performance (Tables 10.5 and 10.6) results. When averaged across fill procedures, the 1177 silages produced more steer gain than the control silages in both trials; 2.8 pounds per ton of corn ensiled and 3.8 pounds per ton of forage sorghum. When averaged for fill procedures, rapid-fill corn silages produced 5.7 pounds more gain than delay-fill silages, but the delay-fill sorghum silages produced 5.0 pounds more gain than rapid-fill silages. In both trials, the gain-producing potential of each silage was determined largely by its relative silage recovery.

Table 10.1. Harvest and Fill Dates for the Silages in Trial 1 and Trial 2.

Treatment	Corn harvest and fill dates (1981)	Forage sorghum harvest and fill dates (1982)
Control-rapid	August 17 and 18	September 28 and 29
Control-delay	August 14, 18, 24, and 27	September 20, 24, 30, October 5
1177®-rapid	August 17 and 18	September 28 and 29
1177®-delay	August 14, 18, 24, and 27	September 20, 24, 30, October 5

Table 10.2. Chemical Analyses of the Four Corn Silages in Trial 1[a].

Item	Silage treatment and fill procedure			
	Control		1177	
	Rapid	Delay	Rapid	Delay
Dry matter, %:				
pre-ensiled, avg.	35.8	37.2	35.3	37.6
pre-ensiled, range	—	34.1-40.3	—	34.7-39.4
silage	34.7	36.3	35.1	36.4
	% of the DM			
Lactic acid	4.94	4.40	6.33	4.88
Acetic acid	4.08	3.14	2.63	3.20
Propionic acid	.10	.10	.09	.14
Butyric acid	.03	.07	.06	.03
Total fermentation acids	9.42	7.92	9.33	8.57
Crude protein	7.62	7.47	7.45	7.56
Hot water insoluble - nitrogen	.53	.51	.44	.50
	% of total N			
Ammonia-N	10.1	8.1	10.6	8.8
pH	3.75	3.73	3.69	3.77
Ratio: lactic:acetic[b]	1.68	1.86	3.23	1.95

[a]Each value is the mean of 18 samples taken during the feeding trial.
[b]Lactic acid (% of the DM) to acetic acid (% of the DM).

Table 10.3. Chemical Analyses of the Four Forage Sorghum Silages in Trial 2[a].

Item	Silage treatment and fill procedure			
	Control		1177	
	Rapid	Delay	Rapid	Delay
Dry matter, %:				
pre-ensiled, avg.	25.9	26.5	25.5	26.0
pre-ensiled, range	—	24.3-29.8	—	24.1-29.5
silage	24.4	25.4	24.0	24.8
	% of the DM			
Lactic acid	6.30	5.19	5.76	6.12
Acetic acid	4.56	3.20	5.17	3.50
Propionic acid	.52	.20	.75	.32
Butyric acid	.06	.03	.05	.11
Total fermentation acids	11.11	8.34	11.76	9.54
Crude protein	7.24	7.06	7.38	7.13
Hot water insoluble - nitrogen	.75	.76	.79	.68
pH	3.77	3.99	3.85	3.88
Ratio:				
Lactic:acetic[b]	2.07	3.12	2.18	2.72

[a]Each value is the mean of 19 samples taken during the feeding trial.
[b]Lactic acid (% of the DM) to acetic acid (% of the DM).

Table 10.4. Silage Recoveries and Losses From the Concrete Stave Silos for the Four Corn Silages (Trial 1) and Four Forage Sorghum Silages (Trial 2).

Trial, silage treatment, and fill procedure	DM recovery		DM lost during fermentation, storage, and feedout
	Feedable	Non-feedable (spoilage)	
Trial 1: corn silage			
control-rapid	89.0	1.6	9.4
control-delay	88.0	2.7	9.3
1177 - rapid	91.9	1.4	6.7
1177 - delay	86.4	2.8	10.8
Trial 2: sorghum silage			
control-rapid	77.2	2.0	20.8
control-delay	81.1	1.9	17.0
1177-rapid	79.1	1.4	19.5
1177-delay	85.5	1.9	12.6

Table 10.5. Performance by Calves Fed the Four Corn Silages in Trial 1 (110 Days: December 9, 1981 to March 28, 1982).

	Silage treatment and fill procedure			
	Control		1177	
Item	Rapid	Delay	Rapid	Delay
No. of calves	24	24	24	24
Initial wt., lb	509	512	510	511
Avg. daily gain, lb	2.18	2.22	2.22	2.20
Avg. daily feed, lb[1]	14.67	15.24	14.57	14.84
Feed/lb of gain, lb[1]	6.75	6.86	6.56	6.73

[1]100% dry matter basis.

Table 10.6. Performance by Calves Fed the Four Sorghum Silages in Trial 2 (94 Days: December 22, 1982 to March 25, 1983).

	Silage treatment and fill procedure			
	Control		1177	
Item	Rapid	Delay	Rapid	Delay
No. of calves	18	18	18	18
Initial wt., lb	435	432	434	434
Avg. daily gain, lb	1.18	1.18	1.20	1.16
Avg. daily feed, lb[1]	10.96	10.67	10.76	10.61
Feed/lb of gain, lb[1]	9.33	9.02	9.02	9.16

[1]100% dry matter basis.

Table 10.7. Steer Gain Per Ton of Crop Ensiled in Trial 1 and Trial 2.*

	Silage treatment and fill procedure			
	Control		1177	
Item	Rapid	Delay	Rapid	Delay
Trial 1: corn silage				
Silage fed, lb/ton	1780	1760	1838	1728
Silage/lb of gain, lb	19.67	20.17	19.29	19.74
Steer gain/ton of corn crop ensiled, lb	90.5	87.3	95.8	87.5
Trial 2: sorghum silage				
Silage fed, lb/ton	1544	1622	1582	1710
Silage/lb of gain, lb	25.28	24.46	24.31	24.50
Steer gain/ton of sorghum crop ensiled, lb	61.1	66.3	65.1	69.8

*Values are adjusted to same dry matter content for each silage, 30 percent.

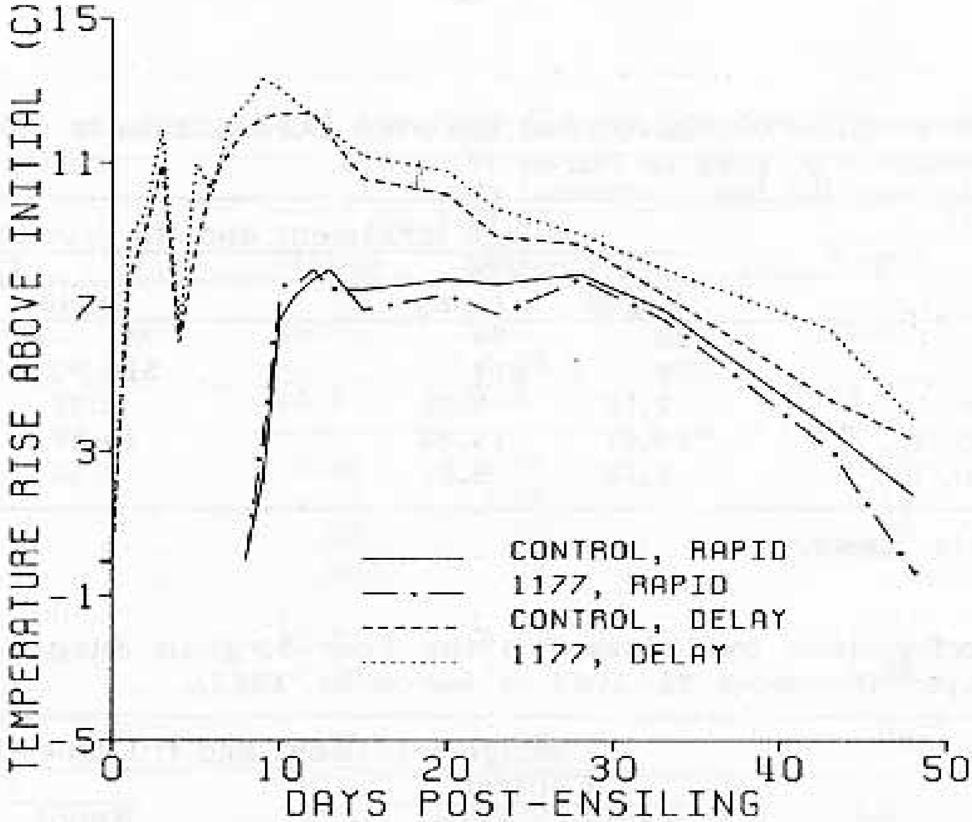

Figure 10.1. Adjusted ensiling temperature rise above the initial forage temperatures for the four corn silages in Trial 1.

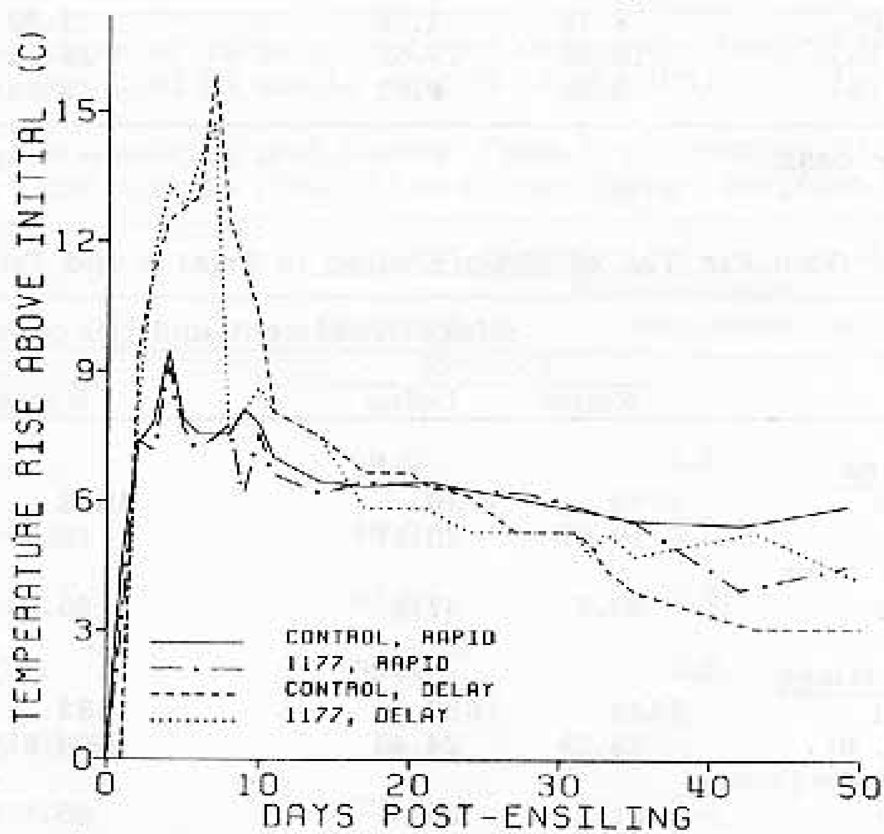

Figure 10.2. Adjusted ensiling temperature rise above the initial forage temperatures for the four forage sorghum silages in Trial 2.

Urea and Fermentrol® Additives for Forage Sorghum Silage[1]

Bogdan Janicki[2], Keith Bolsen, Mark Hinds, and Harvey Ilg

Summary

Adding urea to forage sorghum greatly increased the ensiling temperature, produced a more rapid and extensive fermentation, and resulted in more shrink loss in the silo. Fermentrol®, an enzyme-inoculant additive, had very little affect on the silage temperature or chemical composition, but it did reduce the shrink loss. Calves fed urea-treated silage had the poorest performance. Control and Fermentrol® silages each produced about 90 lb of calf gain per ton of crop ensiled, however urea silage produced only 60 lb. All three silages had short bunk lives throughout the trial.

Introduction

In three previous trials with corn and sorghum silages (Reports of Progress 377 and 394), non-protein nitrogen (ammonia) generally increased the crude protein content by 3 to 5 percentage units, increased the amount of fermentation acids, and extended the aerobic stability (bunk life). However, ammoniating silage usually decreased cattle performance, when compared to an all-natural supplement, and decreased silage dry matter recovery. Although ammonia is a cheaper source of NPN, urea is safer to handle. Urea was often added to corn silages in the 1960's and '70's, but has seldom been used with wetter forage sorghum silages.

Our objectives were: (1) to determine the effects of urea on the quality and feeding value of sorghum silage and (2) to continue our evaluations of other silage additives that are marketed in Kansas.

Experimental Procedures

Three whole-plant forage sorghum silages were compared: (1) control (no additive); (2) urea (10 lb/ton of fresh crop); and (3) Fermentrol® (2 ounces/ton of fresh crop). Urea was applied in a 50% water solution; Fermentrol, in dry form. The silages were made by the alternate load method in 10 x 50 ft concrete stave (farm-scale) silos on September 23, 1982 from Pioneer 947 forage sorghum harvested in the hard-dough stage at 31% dry matter (DM). Ensiling temperatures were monitored for the first 40 days. The silos were opened on November 18 and 19, 1982 and emptied at a uniform rate during the following 10 weeks.

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[1] Fermentrol®, an enzyme-inoculant silage additive, is produced by Agrimerica, Inc., Northbrook, Illinois 66002. Partial financial assistance provided by Agrimerica.

[2] Visiting research assistant in the Animal Sciences and Industry Department from the University of Agriculture, Bydgoszez, Poland (July 28, 1982 to July 26, 1983).

Each silage was fed to 16 Angus and crossbred steer calves in four pens of four calves per silage. The 56-day growing trial began November 20, 1982 and ended January 15, 1983. Silages were full-fed and all calves received 2.0 lb of supplement 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.

While the farm-scale silos were being filled, 18 laboratory-scale silos were filled for each silage treatment. These silos (three per treatment) were opened on days 1, 2, 4, 7, 21, and 64 post-ensiling.

Calf weights, silage samples, and silage bunk life procedures were similar to those described on page 41 of this report.

Results and Discussion

Visual appraisal indicated that the farm silo control and Fermentrol silages were well preserved; the urea silage was not. The urea silage was a dark brown color and reached much higher ensiling temperatures than the other two silages (Figure 11.1). Fermentrol reduced the ensiling temperature slightly when compared with the control.

Chemical analyses of the farm and lab silo silages are shown in Table 11.1 and Figures 11.2 and 11.3. In general, urea gave the most rapid and extensive fermentation, the highest pH's and total acids, and lowest lactic to acetic acid ratios. Although control and Fermentrol silages had similar compositions, the slightly higher lactic to acetic ratio in the farm silages and lower ensiling DM losses in the lab silos (Figure 11.4) suggest that the Fermentrol silage fermented more efficiently.

Silage recovery and loss results are shown in Table 11.2. In the farm silos, DM lost during fermentation, storage, and feedout was lowest for the Fermentrol silage (9.8%); highest for the urea silage (13.0%). The lab silos gave similar results, except the control and Fermentrol silages had nearly identical losses.

Performance by calves fed the three forage sorghum silage rations is shown in Table 11.3. Calves fed the urea silage had the slowest gain ($P<.05$), the lowest DM intake ($P<.05$), and the highest feed to gain ratio ($P<.05$). Calves fed Fermentrol silage had the highest intake ($P<.05$) and also had a 9.6% faster gain than those fed control silage.

Also shown in Table 11.3 are calf gains per ton of forage sorghum ensiled, which combine farm silo recovery (Table 11.2) and calf performance. Control and Fermentrol silages produced nearly identical gain (90.2 and 90.8 lb per ton, respectively); urea silage gave only 60.5 lb per ton. The low production of the urea silage was due primarily to its poor feed conversion.

Throughout the feeding trial, all three silages were highly unstable — heating after only 1 to 2 days of exposure to air. The 500 to 600 lb of silage removed daily from the surface of each silo (approximately a 2 to 3 inch layer) was not sufficient to prevent surface aerobic deterioration. As a result, an additional 400 to 500 lb of silage was removed from each silo as necessary (about every 4 or 5 days) so that animals were fed fresh, undeteriorated silage. This fast feeding rate of the silages shortened the trial from 84 days, as planned, to 56 days.

Table 11.1. Chemical Analyses for the Control, Urea, and Fermentrol Silages Made in the Concrete Stave (Farm) and Laboratory (Lab) Silos.[1,2]

	Silage treatment and silo					
	Control		Urea		Fermentrol	
Item	farm	lab	farm	lab	farm	lab
Dry matter:						
pre-ensiled, %	31.0	32.8	30.5	32.8	31.3	32.6
silage, %	30.7	30.6	29.8	29.5	30.0	30.4
	% of the silage DM					
Lactic acid	4.62	2.35	4.10	2.77	4 .83	2.71
Acetic acid	.75	3.81	3.08	6.05	.77	4.37
Total fermentation acids	5.37	6.67	7.20	9.69	5.60	7.67
Crude protein	8.6	8.2	11.5	11.8	9.0	8.4
	% of the total N					
Hot water insoluble-N	71.8	68.7	59.1	49.2	68 .2	61.2
Ammonia-N	1.1	2.6	10.3	14.4	1.4	2.6
pH	3.90	4.00	5.05	4.57	3.79	3.96
Ratio:						
lactic:acetic	6.1	.6	1.3	.45	6.3	.6

[1]Each farm silo value is the mean of 10 samples.

[2]Each lab silo value is the mean of three silos.

Table 11.2. Forage Sorghum Silage Recoveries and Losses From the Concrete Stave and Laboratory Silos for the Control, Urea, and Fermentrol Silages.

Silo and silage treatment	DM recovery: Feedable	DM recovery: Non-feedable (spoilage)	DM lost during fermentation, storage, and feedout
	% of the DM ensiled		
Concrete stave silos			
control	85.6	2.4	12.0
urea	83.6	3.4	13.0
Fermentrol	87.8	2.4	9.8
Laboratory-scale silos[1]			
control	92.2	—	7.8
urea	88.3	—	11.7
Fermentrol	92.3	—	7.7

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

Table 11.3. Performance by Calves Fed the Control, Urea, and Fermentrol Silages and Calf Gain Per Ton of Forage Sorghum Ensiled.

	Silage treatment		
Item	Control	Urea	Fermentrol
No. of calves	16	16	16
Initial wt., lb	453	452	454
Avg. daily gain, lb	1.77[a]	1.09[b]	1.94[a]
Daily feed intake, lb[1]			
silage	10.08	9.04	11.25
supplement	1.80	1.80	1.80
total	11.88[b]	10.84[c]	13.05[a]
Feed/lb of gain, lb[1]	6.82[a]	10.08[b]	6.78[a]
Silage fed, lb/ton[2]	1712	1672	1756
Silage/lb of gain, lb[2]	18.98	27.65	19.33
Calf gain/ton of crop ensiled, lb[2]	90.2	60.5	90.8

[abc] $P<.05$.

[1] 100% dry matter basis.

[2] All values are adjusted to the same silage DM content, 30 percent.

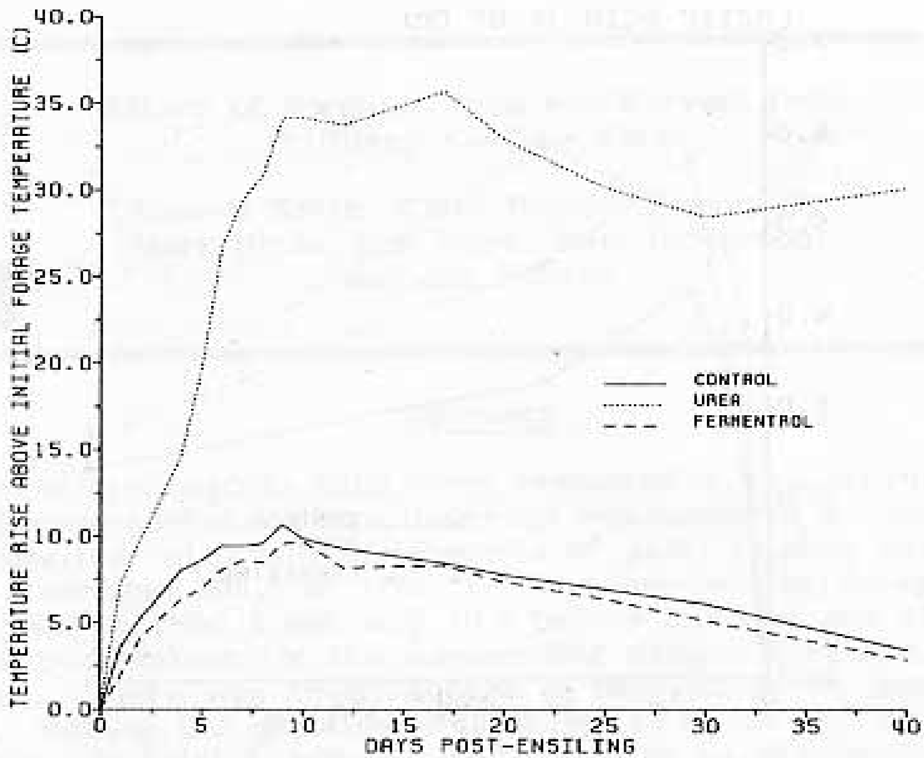

Figure 11.1. Adjusted ensiling temperature rise above the initial forage temperatures for three silages made in concrete stave silos.

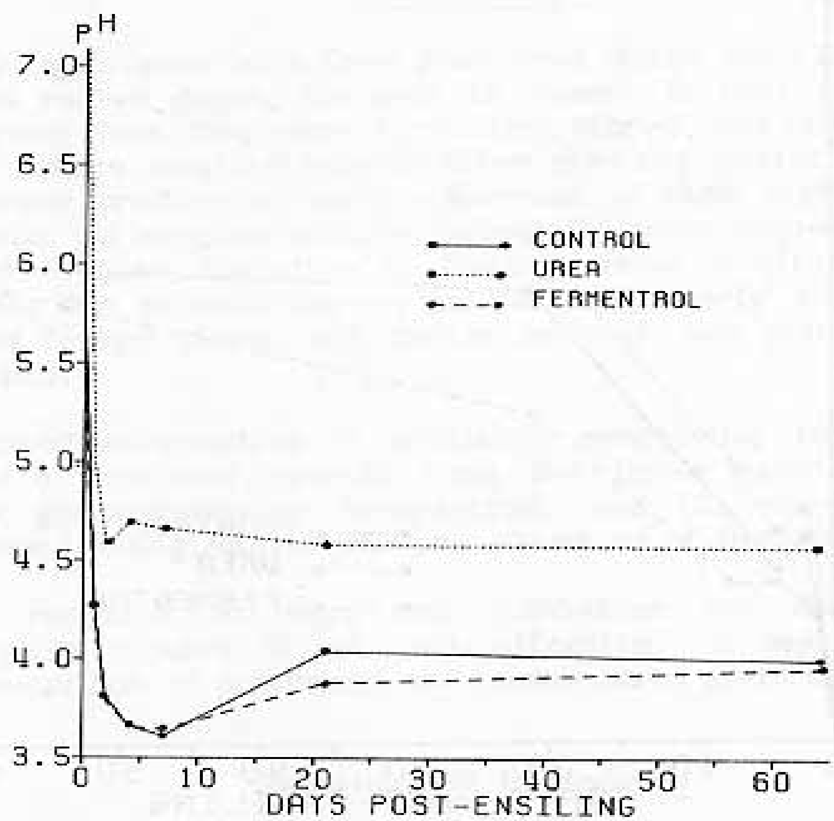

Figure 11.2. Changes in pH from 0 to 64 days for the three silages made in laboratory silos.

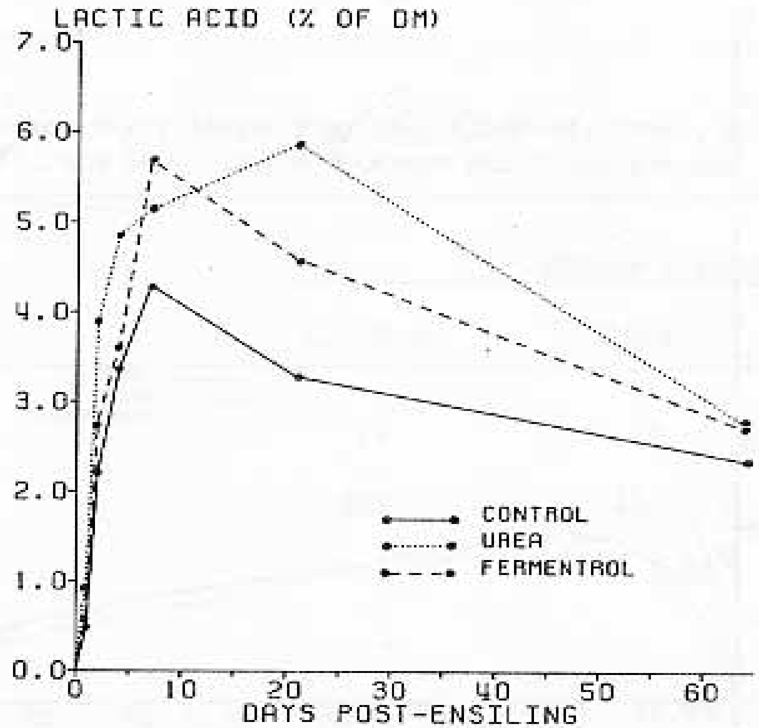

Figure 11.3. Changes in lactic acid from 0 to 64 days for the three silages made in laboratory silos.

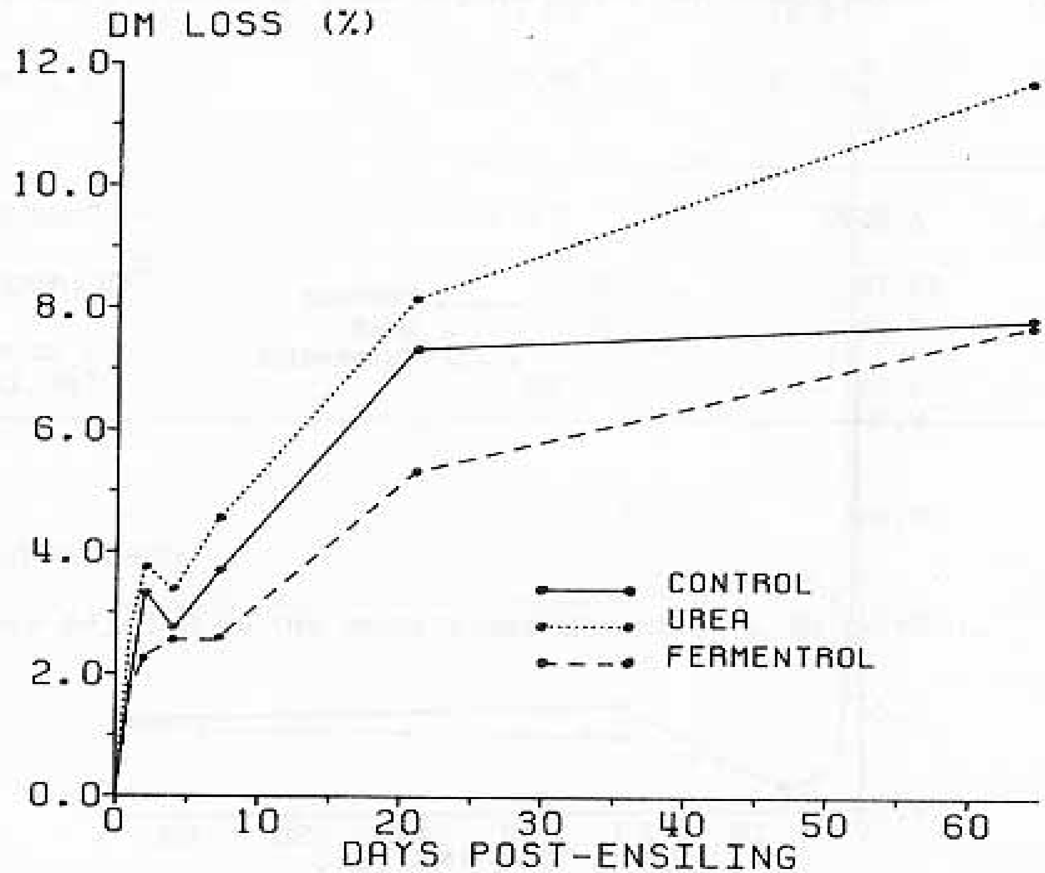

Figure 11.4. Dry matter losses from 0 to 64 days for the three silages made in laboratory silos.

Effect of Sorghum Type and Harvest Date on Silage Feeding Value

Russell Smith, Keith Bolsen, Harvey Ilg
Mark Hinds, Ron Pope, John Dickerson,
and Jim Hoover

Summary

Five silages produced in 1982 were evaluated in two growing trials using 96 steer calves. Forage sorghum silage (heading) was assigned a feeding value of 100. Based on comparative rates and efficiencies of gain, feeding value for the grain sorghum silage averaged 107.5 in Trial 1. The non-heading forage sorghum silage had a value of 64.6 in Trial 1 but only 40.2 before freezing and 31.4 after freezing in Trial 2. The poor values for the non-heading silages were due, in part, to very low feed intakes. There was no advantage in harvesting the non-heading sorghum after a freeze. Rolling the grain sorghum silage to break 95% of the grain did not improve its value. In Trial 2, adding alfalfa haylage to the non-heading silages did increase steer performance.

Introduction

Sorghum's importance as a feed grain and silage crop has increased steadily in the high-plains region during the past 25 years. In 1981 and 1982, more acres and tons of sorghum than corn were harvested, stored, and fed as silage in Kansas. Today, improved forage sorghum hybrids often give dry matter yields comparable to corn but with lower production costs. Because of their high grain content, corn silages are superior to sorghum silages, especially when high-silage rations are fed to growing cattle. Also, variation in feeding value is often large between the sorghum varieties, due to such factors as maturity (early and late season), plant height, grain and forage yields, dry matter content, and plant composition (crude protein, fiber, etc.).

Only limited information is available concerning the feeding values of silages made with improved hybrids from the three major sorghum types: (1) grain-type; (2) grain-producing forage-type; and (3) non-heading forage-type. Documenting these feeding values was one objective of these trials.

Previous research at Hays and Manhattan has shown that processing whole-plant sorghum silages is not cost effective. A second objective was to continue our comparison of processed and unprocessed grain sorghum silages.

Experimental Procedures

Trial 1. Three whole-plant silages were made in the fall of 1982: 1) Dekalb E 67 red grain sorghum (grain sorghum); 2) Pioneer 947 forage sorghum (heading); 3) Funks G 1990 hybrid forage sorghum (non-heading). The harvest dates and dry matter (DM) contents are shown in Table 12.1.

All crops were direct-cut using a Field Queen forage harvester equipped with a 2-inch recutter screen. The non-heading and heading forage sorghums 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.

Each of the three silages was fed without further processing. Grain sorghum silage also was fed after processing with a Roskamp® model K roller mill to break about 95% of the grain. 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). Each silage was full-fed with 1.8 lb (DM basis) of supplement per steer 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 56 days (November 20, 1982 to January 14, 1983).

For 3 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 day 28. The calves were implanted with 36 mg of Ralgro at the start of the trial.

Each silage was sampled twice weekly. Feed intake was recorded daily for each of the 16 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 silages were made in the fall of 1982: Cargill 200 forage sorghum (heading) and Funks G 1990 forage sorghum (non-heading), harvested either before or 1 week after freezing. The harvest dates and dry matter contents are shown in Table 12.1.

All crops were harvested as described in Trial 1. The non-heading, pre-freeze sorghum silage was the same silage used in Trial 1. The heading forage sorghum and the post-freeze non-heading sorghum were ensiled in 14 x 60 ft. concrete stave silos. For each silage, six nylon bags were filled with about 30 lb of crop and buried at two different depths.

Six rations were compared: each silage was fed with (50/50 mixture DM basis) and without alfalfa haylage (haylage) from a Harvestore®. The cattle were the same ones used in Trial 1; all received the appropriate forage plus 1.8 lb (DM basis) of supplement daily. All rations contained 12.5% crude protein. Haylage provided about 62, 61, and 64% of the total ration protein for the non-heading pre- and post-freeze and heading silage rations, respectively. Calves were allotted by weight and previous rate of gain to minimize any carry-over influence from Trial 1. Final weights from Trial 1 were used as starting weights for Trial 2 and final weights were taken as described in Trial 1. The growing trial was 54 days (January 14 to March 8, 1983).

Results and Discussion

The five silages fed in the two trials were well preserved and free of visable mold or spoilage. Chemical analyses and dry matter recoveries for silages are shown in Table 12.1. The wet, pre-freeze non-heading silage had the least efficient fermentation and the lowest DM recovery. The drier post-freeze silage had a more desirable lactic acid fermentation and a better DM recovery. The analyses of the heading and grain sorghum silages were typical.

Trial 1: Preformance by calves fed the four silages is shown in Table 12.2. The two grain sorghum silages gave the fastest gains and highest intakes ($P<.05$); non-heading sorghum silage, the slowest gain and lowest intake ($P<.05$). Performance by calves fed heading forage sorghum silage was intermediate, except they made 3.3% more efficient gains than steers fed grain sorghum silage.

Rolling the sorghum silage to crack the grain did not significantly improve its nutritional value. Although cattle feeders often express concern about how effectively the sorghum grain from whole-plant silages is digested, the good performance by calves in this trial and a similar trial in 1981 (Report of Progress 427) 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 of the gain may have been compensatory, since the pre-trial hay + grain ration was rather low in energy. But our weighing procedures should have prevented excessive fill from biasing the gains upward.

Trial 2: Performance by calves receiving the six rations is shown in Table 12.3. Heading sorghum silage rations produced faster gains ($P<.05$) and higher intakes ($P<.05$) than any of the non-heading silage rations. Steers fed the post-freeze non-heading silage alone gained significantly slower and were less efficient ($P<.05$), even though they had higher DM intakes ($P<.05$), than steers fed the pre-freeze non-heading silage. Haylage, when added to the pre- and post-freeze non-heading silages, significantly improved steer performance. However, when haylage was added to the heading silage, rate and efficiency of gain were slightly reduced. Cold weather adversely affected performance in this trial.

The growing season was favorable in Manhattan and produced a high grain content in the grain sorghum and heading forage sorghum silages. In Trial 1 grain made up 47.9% of the silage dry matter in the grain sorghum silage and 31.4% in forage sorghum silage.

Relative feeding values for the silages in both trials were compared by assigning a value of 100 to the heading forage sorghum silages. Based on comparative rates and efficiencies of gain, grain sorghum silage had a feeding value of 108 when unprocessed and 107 when processed. The pre-freeze non-heading forage sorghum had a feeding value of 64.6 in Trial 1 and 40.2 in Trial 2. Delaying harvest of the non-heading sorghum until after a freeze reduced its relative feeding value to 31.4. These disastrously low values for the non-heading silages reflect their high moisture content, absence of grain, low digestibility, and poor DM intake.

Table 12.1 Chemical Analyses and Dry Matter Recoveries for the Silages and Haylage in Trials 1 and 2.

Item	Trial 1		Trial 2			
			Non-heading			
	Grain sorghum	heading	pre-freeze*	post-freeze	heading	haylage
Harvest date (1982)	9/20	9/23	10/4	11/1	9/27	5/25
Dry matter:						
pre-ensiled, %	37	31	24	31	34	—
silage, %	36	30	22	30	33	58
	...% of the DM ensiled...					
Dry matter recoveries:						
concrete stave silo	90.6[c]	85.6	79.9	—	—	—
buried bag[a]	—	—	89.7	92.8	94.9	—
lab silo[b]	95.5	92.2	—	—	—	—
	...% of the silage DM...					
Lactic acid	5.10	4.62	2.77	4.15	4.70	.49
Acetic acid	1.61	.75	6.00	1.59	1.15	.64
Propionic acid	.02	.01	.83	.01	.01	.04
Butyric acid	.01	.01	.09	.03	.06	.01
Total fermentation acids	6.72	5.40	10.3	5.80	5.90	1.27
Crude protein	8.9	8.6	6.5	5.8	8.9	18.1
	...% of the total N...					
Hot water insoluble-nitrogen	62	72	36	45	54	45
	...					
pH	4.19	3.90	4.10	4.05	4.01	5.31

*This silage was fed in both trials.

[a]Mean of six nylon bags.

[b]Mean of six lab silos.

[c]Estimated recovery.

Table 12.2 Performance by Calves Fed the Four Silage Rations (Trial 1).

	Silage			
			Grain sorghum	
Item	non-heading	heading	unprocessed	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]	9.0[b]	6.8[a]	7.1[a]	7.0[a]
Relative feeding value[2]	64.6	100	108	107

[abc]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 heading forage sorghum silage assigned a value of 100.

Table 12.3 Performance by Calves Fed the Six Silage and Haylage Rations (Trial 2).

	Non-heading					
Item	pre-freeze	pre-freeze +haylage	post-freeze	post-freeze +haylage	Heading	Heading +haylage
No. of calves	16	16	16	16	16	16
Initial wt., lb	545	545	549	549	546	547
Final wt., lb	566	577	560	573	616	613
Avg. daily gain, lb	.39[c]	.57[b]	.19[d]	.42[c]	1.26[a]	1.16[a]
Avg. daily feed, lb[1]						
silage	5.86	4.73	8.72	5.23	14.01	7.38
haylage	—	4.91	—	5.18	—	7.34
supplement	1.8	1.8	1.8	1.8	1.8	1.8
total	7.66[c]	11.44[b]	10.52[b]	12.21[b]	15.81[a]	16.52[a]
Feed/lb of gain, lb[1]	25.54[ab]	20.11[ab]	56.26[c]	29.75[b]	12.58[a]	14.23[a]
Relative feeding value[2]	40.2	—	31.4	—	100	—

[abc]Values with different superscripts differ significantly (P<.05).
[1]100% dry matter basis.
[2]See Table 12.2.

High Moisture Corn Ensiled With Urea for Cattle Finishing Rations

Bruce Young, Russell Smith, Keith Bolsen, and Harvey Ilg

Summary

Dry rolled corn, ensiled high moisture corn, and high moisture corn that was rolled and ensiled with urea or left whole and ensiled with urea were compared in two cattle trials. Dry corn gave the poorest cattle performance; rolled, ensiled high moisture corn gave the best. When corn was left whole, adding urea prior to ensiling increased dry matter losses in the silo and produced a butyric acid fermentation. Urea increased the bunk life of the ensiled high moisture corn.

Introduction

High moisture grains are fed in large quantities to cattle on high energy finishing rations with supplemental nitrogen from urea. In our trials here, urea additions were made to whole and coarsely rolled high moisture corn prior to ensiling in concrete stave silos. These treatments were compared to coarsely rolled dry corn and ensiled high moisture corn fed with urea supplements to yearling steers and heifers. The ensiling and storage characteristics also were monitored.

Experimental Procedures

Thirteen hundred bushels of high moisture (HM) corn harvested at 74% dry matter (DM) were stored in three 10 x 50 ft concrete stave silos. Treatments were: 1) rolled with no additive (HMR), 2) rolled with 40 lb of a urea-water solution (50:50 wt./wt.) per ton added at ensiling (HMRU), and 3) whole (fed whole) with 40 lb of a urea-water solution (50:50 wt./wt.) per ton added at ensiling (HMWU). The urea-water solution was mixed with the high moisture corn in a Harsh Mobile Mixer® for 10 minutes before it was discharged to the silo. All corn was of the same variety and from the same field. Eleven hundred bushels of solar-dried corn were stored in an aerated bin and coarsely cracked by a roller mill prior to feeding (DR). It served as the control.

The three structures were opened after 220 days and complete mixed rations were full-fed for 112 days to 64 yearling mixed breed steers (16 pens of 4 steers per pen). Additionally, 20 Hereford heifers were individually fed each ration for 145 days (five heifers per ration).

Rations were formulated to contain 86% of the respective corn, 9% alfalfa, and 5% supplement (DM basis). Rumensin was included in the supplement (Table 13.1) at 550 g per ton and Tylan at 180 g per ton. Cattle were implanted at the beginning of the trial with 36 mg of Ralgro and received the final finishing ration on day 7.

Ingredient samples were collected weekly and feed consumed was recorded daily. The quantity of complete ration offered was adjusted according to the amount cattle consumed. Feed was always present in the feed 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 a.m. feeding at 28-day intervals. Final weights for cattle performance calculations were derived from hot-carcass weights adjusted by the average dressing percentage.

Aerobic stability of the HM corns were evaluated on June 18 and August 5 using 5.5 lb of corn per expanded polystyrene container as described on page 28 of this report. Twelve containers per corn treatment were monitored initially for temperature increases, with three containers per treatment removed on days 3, 5, 9 and 14 for DM loss determinations.

Dry matter losses from fermentation, storage, and feedout for each stave silo were calculated. In addition, nine nylon bags were filled with about 30 lb of corn for each silo and three bags were buried at each of three depths in the HM corn stored within the concrete silos. These bags were recovered during feedout but prior to any aerobic deterioration. Prior to ensiling, nine plastic container laboratory silos (5 gallon capacity) were filled with each treatment using a hydraulic press. The containers were sealed by lids fitted with rubber O-ring seals and Bunson valves and stored in a room at about 30 C. Dry matters were determined on all corns by oven drying at 55 C.

Results and Discussion

Steer performances are shown in Table 13.2. There were no statistically significant differences for average daily gain, feed intake, or feed conversion among corn treatments. Heifer performances are also shown in Table 13.2. Feed efficiency was significantly ($P<.05$) better for the HMR corn than DR corn. Average daily gain was similiar for heifers fed HMR, HMRU, HMWU corns and the lowest for those fed the DR corn. At each 28-day weigh period, DM intake was greatest for the HMWU corn treatment for both steers and heifers.

Ration crude proteins were lower for DR and HMR than HMRU and HMWU (Table 13.3) where urea additions were made prior to ensiling.

The DM lost from farm scale silos during fermentation, storage, and feedout was less for the HMR corn than the urea-treated HM corns (Table 13.4). Nylon bags and laboratory silos showed DM loss patterns similiar to the farm scale silos. HMR corn had the lowest DM loss and HMWU corn had the greatest DM loss.

Chemical analyses of the three ensiled corns from nylon bags are presented in Table 13.5. HMR and HMRU had undergone predominantly lactic acid fermentations whereas HMWU had significantly less lactic acid and a greater quantity of butyric acid. The most efficient fermentation would have occurred with the HMR and HMRU corns, as suggested by the high lactic to acetic acid ratio.

HMWU fermented inefficiently, with the production of butyric acid. That agrees with the high DM losses from silos and nylon bags for the HMWU. The buffering effect of ammonia from the urea allowed production of the most total fermentation acids in the HMRU corn; however, the HMR had the lowest pH. The high pH for HMWU most likely resulted from a buffered environment which was high in oxygen and had only limited access to water soluble carbohydrates from the whole kernel. Nitrogen recovery corrected for DM loss was lowest for HMR (93.8%) and highest for HMRU (85.4%) with HMWU being intermediate (91.4%).

All three ensiled HM corns in the farm scale silos were well preserved and free of mold or visible spoilage. However, the nylon bag chemical analyses reflects the composition of the ensiled corns more accurately than the weekly corn samples (Table 13.5). High ambient temperatures and slow surface removal rates from the silos caused some aerobic deterioration of the weekly samples. More free ammonia was apparent to workers around the HMWU silo than the HMRU silo.

Aerobic stability determinations with the ensiled HM corns showed that HMWU corn was the most stable in air and was the only ensiled corn that did not have a rapid and extensive rise in temperature over 14 days. It also had the highest % of total nitrogen as ammonia. HMR was the only unstable corn in the June 18 determination, heating on day 8 and reaching a maximum temperature of 102 F on day 13, with a 6.0% DM loss after day 14. HMR and HMRU corns were unstable after day 3 and 5, respectively, for the August 5 determination, and maximum temperatures of 113 F and 102 F were reached on day 6 and 14, respectively. Although HMRU corn was slightly unstable, the temperature rise occurred over an extented period of time and the DM loss was small. This is likely a result of ammonia production from urea breakdown.

Urea additions to ensiled HM corn increased the extent of fermentation and increased fermentation, storage, and feedout DM losses; however, urea-treated corn supported cattle performance equal to dry corn in this trial. Aerobic stability of whole HM corn stored with urea in a stave silo during the summer was equal to or better than HM corn stored without urea. Although urea may make it possible to store whole HM corn without oxygen-limiting structures, this practice is not currently recommended.

Table 13.1. Supplement Formulation for Cattle Rations Containing Dry Corn and High Moisture Corns.

Item	HM rolled urea and HM whole urea	Dry rolled and HM rolled
Corn	45.0	35.9
Fat	3.0	3.0
Urea	—	9.0
Limestone	20.7	0.8
Dicalcium phosphate	3.6	3.6
Potassium chloride	11.0	11.0
Ammonium sulfate	1.7	1.7
Salt	10.0	10.0
Premix[1]	5.0	5.0

[1] Included Rumensin, Tylan, trace minerals, and vitamins A, D, and E.

Table 13.2. Performance of Finishing Steers and Heifers Fed the Dry Corn or High Moisture Corn Rations.

Item	Dry rolled	HM rolled	HM rolled urea	HM whole urea
	Steers			
No. of pens	4	4	4	4
No. of steers/pen	4	4	4	4
Final weight, lb[1]	1053	1085	1072	1089
Initial weight, lb	674	673	674	679
Ave. daily gain, lb	3.38	3.68	3.55	3.66
Daily intake, lb[2]	20.08	19.51	20.23	21.76
Feed/gain	5.96	5.33	5.69	5.95
	Heifers			
No. of heifers	5	5	5	5
Final weight, lb[1]	933	999	975	1002
Initial weight, lb	569	573	568	568
Ave. daily gain, lb	2.51	2.94	2.80	3.00
Daily intake, lb[2]	15.23	15.33	15.23	17.31
Feed/gain	6.12[b]	5.27[a]	5.51[ab]	5.79[ab]

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

[2] 100% dry matter basis.

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

Table 13.3. Chemical Composition of the Four Complete Rations.

Item	Dry rolled	HM rolled	HM rolled urea	HM whole urea
Dry matter, %	86.4	76.7	75.4	74.9
	—— % of the DM ration ——			
Crude protein	11.6	11.3	13.5	13.1
	—— % of the total N ——			
HWIN as % TN[1]	60.0	46.5	43.4	48.8
NPN as % TN[2]	12.9	15.6	20.3	18.2

[1] Hot water insoluble-nitrogen.
[2] Non-protein nitrogen.

Table 13.4. Dry Matter Losses From Fermentation, Storage, and Feedout for the Ensiled High Moisture Corns.

Item	HM rolled	HM rolled urea	HM whole urea
	—— % of the DM ensiled ——		
<u>Concrete stave silos:</u>[1]			
Losses from fermentation, storage, and feedout.	4.8	5.8	6.1
<u>Nylon bags:</u>[2]			
Losses from fermentation, and storage	1.78	3.87	4.43
<u>Laboratory scale silos:</u>[3]			
Losses from fermentation, and storage	3.37	4.37	5.45

[1] Each value represents one silo.
[2] Each value is the mean of nine bags, except HM rolled urea which is the mean of seven bags.
[3] Each value is the mean of nine silos.

Table 13.5 Chemical Composition of the Dry Corn and Ensiled High Moisture Corn Weekly and Nylon Bag Samples.

Item	Weekly: Dry rolled	Weekly: HM rolled	Weekly: HM rolled urea	Weekly: HM whole urea	Nylon bag: HM rolled	Nylon bag: HM rolled urea	Nylon bag: HM whole urea
Pre-ensiling DM, %	—	73.8	73.4	74.0	74.6	73.7	73.8
Post-ensiling DM, %	88.3	75.8	75.8	75.1	75.1	74.3	72.2
pH	5.58	4.27	5.63	7.27	3.80	5.59	6.24
Nitrogen fractions:							
	DM basis						
Crude protein, %	9.1	10.3	12.6	12.8	9.6	13.7	13.1
NPN as % of TN[1]	3.15	12.5	21.4	20.0	4.7	26.1	22.9
NH4 as % of TN[2]	1.03	7.3	13.8	11.6	4.2	9.9	15.6
HWIN as % of TN[3]	80.8	52.6	39.5	48.6	46.6	48.7	55.9
Fermentation acids:							
	% of the corn DM						
Lactic acid	—	2.00	2.61	.56	1.86	3.92	.27
Acetic acid	—	.49	.56	.57	.43	.67	.73
Propionic acid	—	.03	.03	.02	.03	.02	.03
Butyric acid	—	.12	.06	.36	.07	.01	1.31
Total acids	—	2.65	3.27	1.54	2.40	4.62	2.45
Ethanol	—	.03	.02	.02	.05	.05	.05
WSC[4]	4.15	11.12	7.53	9.57	7.93	7.96	4.48

[1] Non-protein nitrogen as % of total nitrogen.
[2] Ammonia nitrogen as % of total nitrogen.
[3] Hot water insoluble-nitrogen as % of total nitrogen.
[4] Water soluble carbohydrates.

CULBAC® and ADD-F® (formic acid) Additives for Sudangrass and High Moisture Shelled Corn Silages[1]

Keith Bolsen, Mark Hinds, and Harvey Ilg

Summary

Laboratory silos were used in three trials to evaluate sudangrass (slightly or moderately wilted) and high moisture corn silages, each receiving the following treatments: (1) control (no additive); (2) CULBAC® dry; (3) CULBAC® liquid; and (4) ADD-F® (formic acid). Although the 12 silages were well preserved visually, there were differences in their chemical compositions. Silages treated with CULBAC dry had the highest DM recoveries and probably the most efficient fermentations. As expected, formic acid restricted the amount of fermentation, but surprisingly, it did not improve DM recovery.

Introduction

In two previous trials with alfalfa silages, CULBAC® reduced dry matter (DM) losses and lowered pH's. In a third trial with whole-plant corn, CULBAC reduced the DM loss and dramatically increased bunk life (Report of Progress 427). These trials were conducted using a laboratory-scale silo that we developed (see Report of Progress 394) and have used successfully to compare various silages, including additive-treated silages. In most of Northern Europe, formic acid has been used to improve the quality of hay-crop silages, particularly when wet, rainy weather makes field-wilting difficult or impossible.

Our objectives were to determine the efficacy of using CULBAC in dry or liquid form and formic acid on sudangrass and high moisture shelled corn.

Experimental Procedures

Silage was made in 1982 from: (1) first-cutting, hybrid sudangrass in the early-boot stage and slightly wilted to 77% moisture or moderately wilted to 64% moisture and (2) high moisture (HM) shelled corn containing 26% moisture. Sudangrass (Northrup King Trudan 6) was cut and swathed or 4 p.m. on July 27 and left to wilt until 1 p.m. on July 29 (slightly wilted, Trial 1) and at 4 p.m. on July 30 (moderately wilted, Trial 2); HM corn was harvested on September 16 (Trial 3). It was the same source of corn described on page 58 of this Progress Report. Four treatments were compared: (1) control (no additive); (2) CULBAC in dry form; (3) CULBAC in liquid form; and (4) formic acid (ADD-F®). CULBAC was applied at the manufacturer's recommended rate, and ADD-F was applied in an 80% liquid solution at 2.5 liters per ton of fresh crop.

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[1]CULBAC® is a non-viable lactobacillus product, manufactured by TransAgra Corporation, Memphis, TN 38138. ADD-F® is an 80% formic acid solution produced by British Petroleum. Partial financial assistance was provided by TransAgra.

For each treatment an appropriate amount of crop was placed in a Harsh Mobile Mixer® and the additive applied. After mixing, about 28 to 34 lb of crop was tightly packed into the laboratory silos (six per treatment) and the filled silos weighed. Samples of pre-treated and post-treated, pre-ensiled crop were taken and frozen immediately in liquid nitrogen. In all cases, less than 2 hours elapsed from the time material left the field until laboratory silos were sealed.

In each trial, at about 105 days post-ensiling, silos were weighed and the silage mixed in a cement mixer and sampled. Dry matter loss was determined for each silo. All silage samples were analyzed for DM, pH, ammonia-nitrogen, lactic acid, volatile fatty acids, crude protein, and hot water insoluble-nitrogen. All pre-ensiled crop samples were analyzed for DM, pH, crude protein, and hot water insoluble-nitrogen. Bunk life was measured by procedures described on page 28 of this Progress Report.

Results and Discussion

Trial 1. All four silages were reasonably well preserved and there were no obvious visual differences. As shown in Table 14.1, ADD-F silage had the lowest ($P<.05$) DM recovery; CULBAC dry and liquid silages had numerically higher recoveries than the control. Although ADD-F restricted fermentation, as evidenced by lower lactic and total acids ($P<.05$), its higher DM loss was inconsistent with its chemical analyses. Only the CULBAC dry silage had more lactic acid (8.04 vs. 7.48%) and a lower pH (4.15 vs. 4.27) than the control silage, but those differences were not statistically significant.

The ratios of lactic to acetic acid and lactic to DM loss were numerically highest for CULBAC dry silage. These ratios suggest that CULBAC dry gave a slightly more efficient fermentation than the control. The ratios are likely not appropriate for evaluating ADD-F silage, since its mode of action is to restrict acid production. As expected, the two silages that had the highest ammonia-nitrogen's, also had the highest pH's (CULBAC liquid and ADD-F). Aerobic stability results showed that all four silages were extremely stable and did not heat until days 18 to 21.

Trial 2. Visually all four silages were of similar and acceptable quality. As shown in Table 14.2, CULBAC dry silage had numerically higher DM recovery, lactic acid, and ratios of lactic to acetic and lactic to DM loss than the control silage. Although differences ($P<.05$) among silages occurred for total acids, ammonia-nitrogen, and hot water insoluble-nitrogen, these may have little, if any, practical significance. ADD-F restricted fermentation in Trial 2, but to a lesser extent than in the wetter sudangrass in Trial 1. Control and CULBAC dry and liquid silages were moderately stable in air and ADD-F silage was highly stable.

The slightly wilted and much wetter silages in Trial 1 had higher total fermentation acids, higher ammonia-nitrogen's, higher pH's, and lower lactic to acetic ratios than the moderately wilted, drier silages in Trial 2. These data indicate that the wetter silages should have lost more DM than the drier silages. They did not. The silages in Trial 1 had an average DM loss of 4.0%; silages in Trial 2, 4.2 percent.

The control silages in both sudangrass trials were of very acceptable quality: high lactic acids, no butyric acid, low ammonia-nitrogen's and low pH's. Thus one would expect any improvement in silage quality due to the three additives to be rather small. Only CULBAC dry improved DM recovery over the control in both trials and it likely improved fermentation efficiencies, as judged by lactic acid, lactic to acetic ratios, and lactic to DM loss ratios. All eight sudangrass silages had similar ammonia-nitrogen and hot water insoluble-nitrogen levels.

Trial 3. As was observed for the sudangrass silages, all HM corns were well preserved and there were no obvious visual differences among them. Data are shown in Table 14.3. The CULBAC dry HM corn had the highest DM recovery (P<.05) and both CULBAC treatments contained lower (P<.05) total and individual acids, including butyric, than the control. Although the ADD-F HM corn had a much lower acid content than the other treatments, it had a similar DM loss. The control and CULBAC dry corns were highly stable in air, but the CULBAC liquid and ADD-F corns were only moderately stable and heated after 4 days.

Table 14.1. Dry Matter Recoveries and Chemical Analyses of the Slightly Wilted Sudangrass Silages (Trial 1).[1]

Item	Control	CULBAC dry	CULBAC liquid	ADD-F
Dry matter:				
pre-ensiled, %	22.7	22.9	22.1	22.0
silage, %	22.0	22.4	21.6	20.8
	% of the DM ensiled			
Dry matter recovery	96.1^{a}	97.0^{a}	96.8^{a}	94.1^{b}
	% of the silage DM			
Lactic acid	7.48^{a}	8.04^{a}	7.18^{a}	2.76^{b}
Acetic acid	4.28	4.08	4.99	4.46
Propionic acid	.12^{ab}	.06^{a}	.20^{b}	.06^{a}
Total fermentation acids	11.9^{a}	12.2^{a}	12.4^{a}	7.3^{b}
Crude protein:				
pre-ensiled, %	13.6	13.6	13.8	13.3
silage, %	14.6	14.7	14.6	14.5
	% of the total N			
Ammonia-N	9.5^{a}	9.2^{a}	14.6^{b}	13.6^{ab}
Hot water insol. N				
pre-ensiled, %	58.5	58.5	57.4	57.9
silage, %	35.9^{b}	36.4^{b}	36.6^{b}	40.7^{a}
pH	4.27^{a}	4.15^{a}	4.33^{ab}	4.60^{b}
Ratios:				
lactic:acetic	1.9^{a}	2.1^{a}	1.8^{a}	.7^{b}
lactic:DM loss	1.9^{a}	2.7^{a}	2.3^{a}	.4^{b}

[1]Each silage value is the mean of six silos.

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

Table 14.2. Dry Matter Recoveries and Chemical Analyses of the Moderately Wilted Sudangrass Silages (Trial 2).[1]

Item	Control	CULBAC dry	CULBAC liquid	ADD-F
Dry matter:				
pre-ensiled, %	36.2	36.3	36.5	36.9
silage, %	34.8	35.1	34.7	35.2
	% of the DM ensiled			
Dry matter recovery	95.6	96.2	95.6	95.8
	% of the silage DM			
Lactic acid	5.08[ab]	5.53[a]	5.39[a]	4.38[b]
Acetic acid	1.73[ab]	1.95[a]	1.95[a]	1.25[b]
Propionic acid	.02	.02	.02	.03
Total fermentation acids	6.84[a]	7.51[a]	7.36[a]	5.66[b]
Crude protein:				
pre-ensiled, %	12.8	13.2	13.2	13.1
silage, %	14.3	13.4	13.6	13.8
	% of the total N			
Ammonia-N	6.8[a]	7.7[ab]	7.7[ab]	8.4[b]
Hot water insol.-N				
pre-ensiled, %	48.8	47.7	48.7	50.4
silage, %	40.4	40.4	41.7	41.7
pH	4.14	4.17	4.16	4.15
Ratios:				
lactic:acetic	3.0	3.1	3.0	3.8
lactic:DM loss	1.1[ab]	1.4[a]	1.1[ab]	.8[b]

[1]Each silage value is the mean of six silos.

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

Table 14.3. Dry Matter Recoveries and Chemical Analyses of High Moisture Corn Silages (Trial 3).[1]

Item	Control	CULBAC dry	CULBAC liquid	ADD-F
Dry matter:				
pre-ensiled, %	74.1	74.0	74.8	74.8
silage, %	72.3	72.5	72.7	72.3
	% of the DM ensiled			
Dry matter recovery	96.5^{b}	97.3^{a}	96.3^{b}	96.7^{b}
	% of the silage DM			
Lactic acid	1.26^{a}	.84^{c}	1.06^{b}	.35^{d}
Acetic acid	.19^{c}	.12^{b}	.13^{b}	.09^{a}
Butyric acid	.19^{b}	.12^{ab}	.13^{ab}	.01^{a}
Total fermentation acids	1.63^{a}	1.08^{b}	1.32^{b}	.44^{c}
Ethanol	.06^{c}	.06^{b}	.05^{b}	.02^{a}
Crude protein:				
pre-ensiled, %	8.53	8.67	9.08	8.85
silage, %	9.14	8.45	8.12	8.60
	% of the total N			
Hot water insol.-N				
pre-ensiled, %	94.4	85.1	86.2	95.0
silage, %	64.1	65.9	69.6	70.5
pH	3.95^{a}	3.97^{a}	3.99^{b}	3.97^{a}
Ratios:				
lactic:acetic	6.7^{a}	7.3^{a}	8.7^{a}	4.1^{b}
lactic:DM loss	.4^{a}	.3^{b}	.3^{b}	.2^{c}

[1] Each silage value is the mean of six silos.

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

Sodium Bicarbonate and Feed Flavor Supplements for Calves Fed Forage Sorghum Silage[1]

Keith Bolsen and Dirk Axe

Summary

High-moisture forage sorghum silage was fed to 108 steer calves to measure the effect of sodium bicarbonate and feed flavor (Omniflavor®) on calf performance. Overall performance was similar for all three rations by the end of the 94-day trial, but at days 29 to 56, when weather conditions were extremely cold, bicarbonate and Omniflavor each gave improved rate and efficiency of gains.

Introduction

Researchers and cattlemen alike have experienced low dry matter (DM) intakes and poor conversions for calves fed forage sorghum silages that have high moisture contents (less than 30% DM).

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 DM and gained 8% faster than steers not receiving bicarbonate. Similar results were reported by South Dakota researchers.

Flavoring compounds are sometimes used in the feed industry to improve palatability or acceptability of a feed. In previous trials at Manhattan (Report of Progress 427) flavors did not increase silage intakes but improved both rate and efficiency of gains.

Our objective was to measure the effect of $NaHCO_3$ and a feed flavor on intake and utilization of high-moisture forage sorghum silage.

Experimental Procedures

The silage was Asgrow Titan R forage sorghum, harvested in the dough stage at about 25% DM during the last week of September in 1982. It was fed to 108 steer and heifer calves in a 94-day growing trial that began on December 21, 1982 and ended on March 25, 1983. Six pens of six calves received each of the following supplements: (1) sodium bicarbonate, at 112 gm per calf daily; (2) Omniflavor, at 2.0 lb per ton of ration (air-dry basis); and (3) control (no bicarbonate or flavor).

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[1] The feed flavor, Livestock Omniflavor Cream®, is produced by Agrimerica, Inc., Northbrook, IL 60032. Partial financial assistance was provided by Agrimerica.

The silage was full-fed and all calves received 2.0 lb of supplement daily. The supplements were top-dressed onto, and partially mixed with, the silages in the bunk. Composition of the supplement is shown in Table 15.1. The rations were formulated to provide 12.5% crude protein, .5% calcium, and .35% phosphorus (DM basis) and 150 mg of monensin and 25,000 I.U. of vitamin A per calf daily.

Feed offered was recorded daily for each pen and the feed not consumed was removed, weighed, and discarded every 2 days for the first 2 weeks of the trial; every 3 days for the next 2 weeks; and every 7 days thereafter.

Results and Discussion

Overall performance by the steers is shown in Table 15.2. Although $NaHCO_3$ and Omniflavor each improved rate and efficiency of gains by about 2.5%, these differences were not statistically significant. Dry matter intakes were similar for the three rations.

Calves were weighed at 28 and 56 days to determine if $NaHCO_3$ and Omniflavor influenced interim performance. Shown in Figure 15.1 are gains vs. days on feed. During days 0 to 28, calves fed the three rations made nearly identical gains. Days 29 to 56 were a period of extremely cold weather and $NaHCO_3$ and Omniflavor both improved gains by 23 and 18%, respectively. During days 57 to 94, calves fed the control ration compensated, and made the fastest gains.

Shown in Figure 15.2 are DM intakes vs. days on feed. When compared to the control, Omniflavor increased DM intakes during days 0 to 28 but decreased intakes during days 57 to 94. Dry matter intake was not affected by $NaHCO_3$ at any time during the feeding trial.

In previous sorghum silage trials (Report of Progress 427), feed flavor improved calf performance (rate and efficiency of gain) by only 1.1% in the first trial but by 7.7% in the second trial. The flavor used was Ultra Sweet Livestock Omniflavor, fed at higher rates than in the current trial.

The response to $NaHCO_3$ was considerably less than the 8.4% improvement obtained last year using yearling steers fed corn silage (Report of Progress 427).

Table 15.1. Composition of the Control, Sodium Bicarbonate, and Omniflavor Supplements Fed With the Forage Sorghum Silage.

Ingredient	Supplement		
	Control	$NaHCO_3$	Omniflavor
	lb/ton		
Soybean meal	1265	1310	1271
Rolled sorghum grain	414	94	392
Sodium bicarbonate[1]	—	275	—
Omniflavor[2]	—	—	16
Urea	125	125	125
Salt	42	42	42
Dicalcium phosphate	85	85	85
Limestone	35	35	35
Tallow	20	20	20
Trace mineral premix	5	5	5
Vitamin A[3]	+	+	+
Rumensin-60[4]	+	+	+

[1] Added to provide 112 gm/calf daily.
[2] Added to provide 2.0 lb/ton of air-dry ration.
[3] Added to provide 30,000 IU/calf daily.
[4] Added to provide 150/mg calf daily.

Table 15.2. Performance by Calves Fed the Control, Sodium Bicarbonate, and Omniflavor Supplements (94 Days).

Item	Supplement		
	Control	$NaHCO_3$	Omniflavor
No. of calves	36	36	36
Initial wt., lb	437	430	433
Avg. daily gain, lb	1.15	1.18	1.18
Avg. daily feed, lb[1]	10.61	10.57	10.61
Feed/lb of gain, lb[1]	9.25	9.00	9.04

[1] 100% dry matter basis.

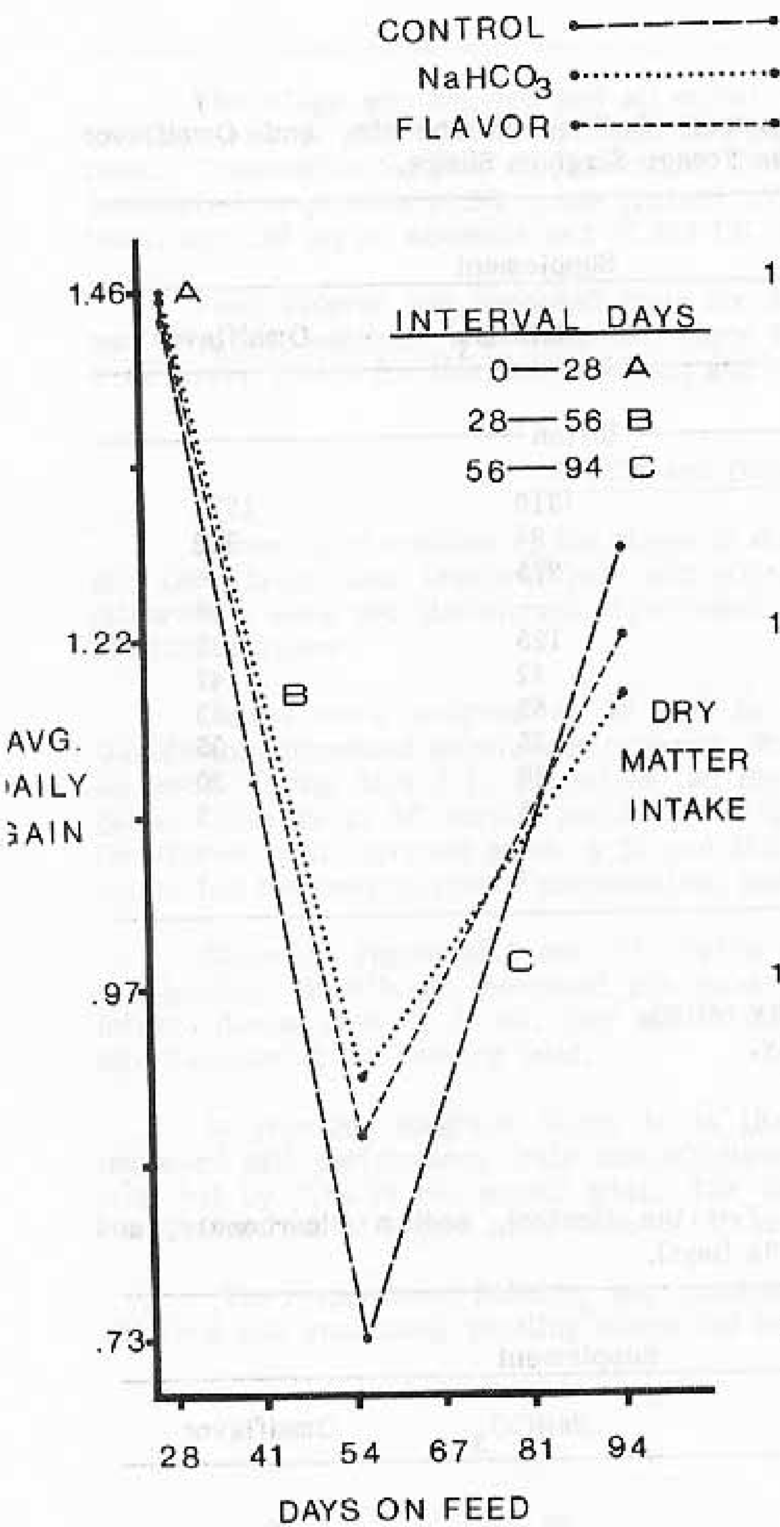

Figure 15.1. Average daily gain vs. days on feed for the calves fed the three rations.

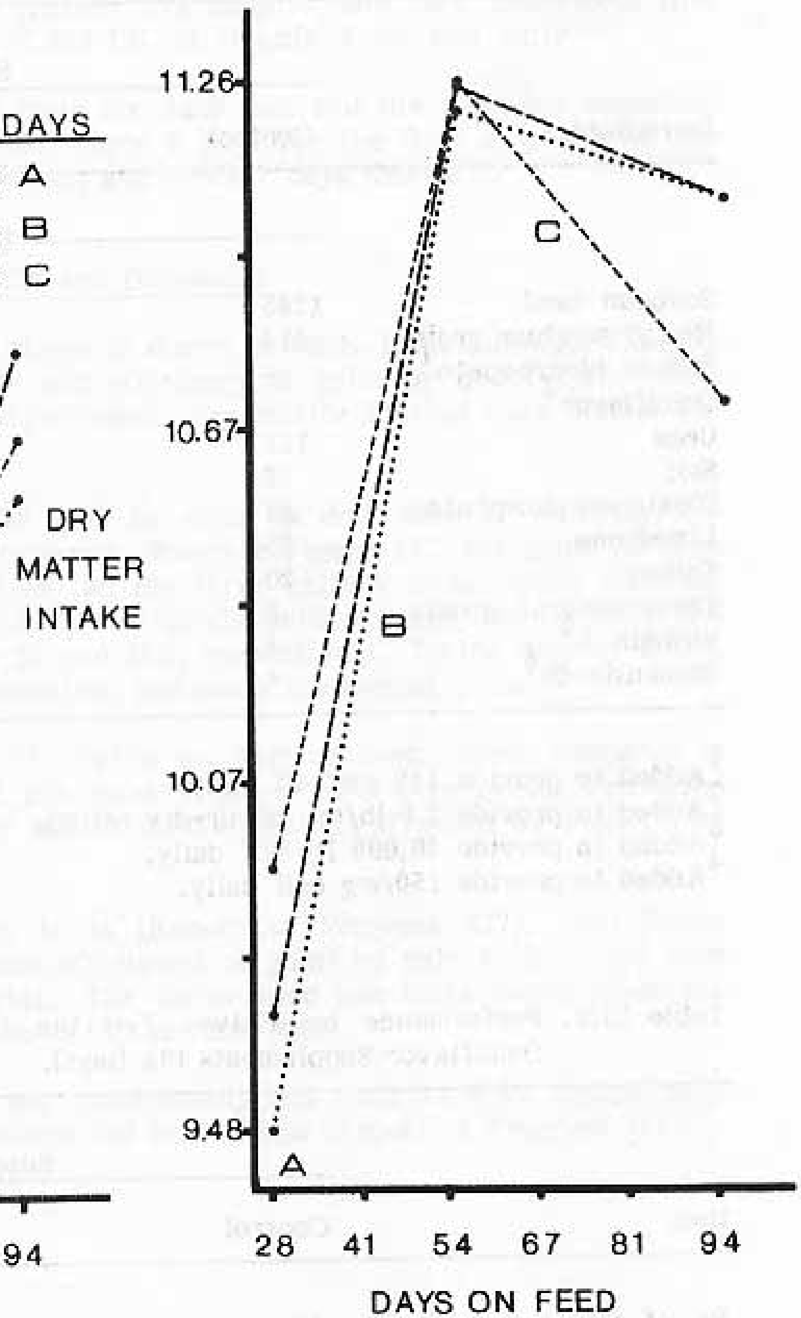

Figure 15.2. Dry matter intake vs. days on feed for the calves fed the three rations.

Effect of Ammonia Level and Treatment Temperature on Intake and Digestibility of Wheat Straw by Lambs

Ahmed Laytimi, Keith Bolsen, and Bogdan Janicki[1]

Summary

Replicate, covered wheat straw (WS) stacks were treated with 1.5 or 3.0% anhydrous ammonia in three environmental chambers at 37, 68, or 95 F, for 23 days. Then digestibility was measured (wethers). Rations were 88% wheat straw and 12% supplement. The control wheat straw was non-ammoniated but contained 5% urea in the supplement. Stack temperatures increased rapidly within 2.5 hours post-ammoniation, and equilibrated at chamber temperatures for the rest of the treatment period. Both crude protein (CP) and in vitro dry matter digestibility of the WS increased with ammonia level and treatment temperature. Percent of the ammonia recovered increased with temperature and was always higher with the low ammonia level treatment. Ammoniation improved ration intakes and dry matter digestibility, but did not increase CP digestibility which decreased as temperature increased. Ammoniation solubilized the hemicellulose, cellulose, and lignin and increased the digestibility of the fiber components.

Introduction

Increased cost of production has forced cattle and sheep producers to minimize costs wherever possible. Consequently, feeding crop residues has received considerable attention. Kansas produces millions of tons of wheat straw, corn stalks, grain sorghum stover, and soybean residue each year. These residues are low in digestible energy and crude protein, so treatment methods are needed that will improve their nutritive value. Recently, research with anhydrous ammonia treatment has received much attention in the popular press and its use is growing markedly among Kansas farmers and ranchers. Since residues can be treated during the hot summer months, under moderate temperatures of the spring, or during the cold winter months, we evaluated the effects of treatment temperature and ammonia level on nutritive value of wheat straw.

Experimental Procedures

Twelve stacks, each with nine rectangular bales (68 lb avg. wt.) of wheat straw, were probed with thermocouple wires, covered with plastic, and sealed. Replicate stacks then were treated with 1.5 or 3.0% anhydrous ammonia (NH_3) (air dry basis) in three environmental chambers of 3 C (37 F), 20 C (68 F) or 35 C (95 F). The appropriate amount of NH_3 was applied to each stack from an ammonia tank using a John-blue applicator to regulate the flow rate. The applicator was connected to 1 inch x 4 ft pipe that was inserted into the center of the stacks. Temperature was monitored within each stack at 15 minutes before, at 15 minutes after, and at 2.5 hours after treatment and then once a day for 22 days. On day 23, stacks were uncovered, removed from environmental chambers, and aerated for 5 days. Each stack then was tub-ground through a one-inch screen.

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[1]Visiting research assistant in the Animal Sciences and Industry Department from the University of Agriculture, Bydgoszez, Poland (July 28, 1982 to July 26, 1983).

Seven rations, 88% wheat straw and 12% supplement, were formulated to 9.3% crude protein (CP) and to meet NRC requirements of mature wether sheep for calcium, phosphorus, and Vitamin A (Table 16.1). Soybean meal (44% CP) was used as the protein source and grain sorghum (9% CP) was the carrier in the six ammoniated straw supplements. The untreated wheat straw supplement also contained 4.95% urea.

Twenty one mature wether sheep (110 lb avg. wt.), that were fitted with fecal collection bags and housed in individual digestion crates, were used to compare the seven straw rations (3 wethers per ration) in a two-period digestion trial. Each period consisted of a 14-day adaptation period, during which voluntary intake were measured, followed by a 7-days total collection at 90% of voluntary intake.

Results and Discussion

Figure 16.1 shows temperature changes during ammonia treatment. At 15 minutes after application, the temperature had increased rapidly in all stacks. After 2.5 hours, it started to decrease and at 24 hours after treatment, all stacks had returned to the chamber temperatures and remained there for the rest of the 23-day period.

Table 16.2 shows CP content of the straws fed to the wethers, the percent of the applied ammonia that was actually recovered in the straws, and the in vitro dry matter digestibilities (IVDMD) of the straws. Both CP and IVDMD increased with ammonia level and with treatment temperature. The amount of ammonia incorporated in the straws (percent NH_3 recovery) increased with temperature and it was always higher for the low level ammonia treatment at each temperature.

Table 16.3 shows the effects of treatment temperature and ammonia level on ration intakes and their apparent CP and dry matter (DM) digestibilities. Except for the low-temperature and low-ammonia level wheat straw ration, intake was lowest for the untreated straw ration. The highest intake was for the high-temperature and low-ammonia level straw ration. The CP digestibility was not increased by ammoniation and it decreased as temperature increased, indicating that the high temperatures made some of the incorporated nitrogen from the ammonia unavailable to the wethers. Ammoniation increased the DM digestibilities of the rations by an average of 7.0 percentage units (45.6 to 52.6%).

Table 16.2 shows the effects of ammoniation on the fiber components of the straws. When compared with the untreated straw, ammoniation solubilized an average of 7% of the hemicellulose, 3% of the cellulose, and 29% of the lignin.

Ammoniation increased digestibilities of hemicellulose by 24%, cellulose by 15%, acid detergent fiber (ADF) by 10%, and cell walls by 15% (Table 16.3).

Table 16.1. Ingredient Composition (%) of the Supplements Fed With the Straws.

Item	Temperature and NH_3 level (%)						
	37 F		68 F		95 F		
	1.5	3	1.5	3	1.5	3	Untreated
Grain sorghum	27.9	48.0	48.0	64.7	64.7	85.8	21.6
Soybean meal	62.0	41.0	41.0	24.4	24.4	4.0	63.3
Dicalcium phosphate	4.5	5.0	5.0	5.4	5.4	5.9	4.5
Limestone	2.3	2.3	2.3	1.9	1.9	1.8	2.3
Urea	-	-	-	-	-	-	5.0

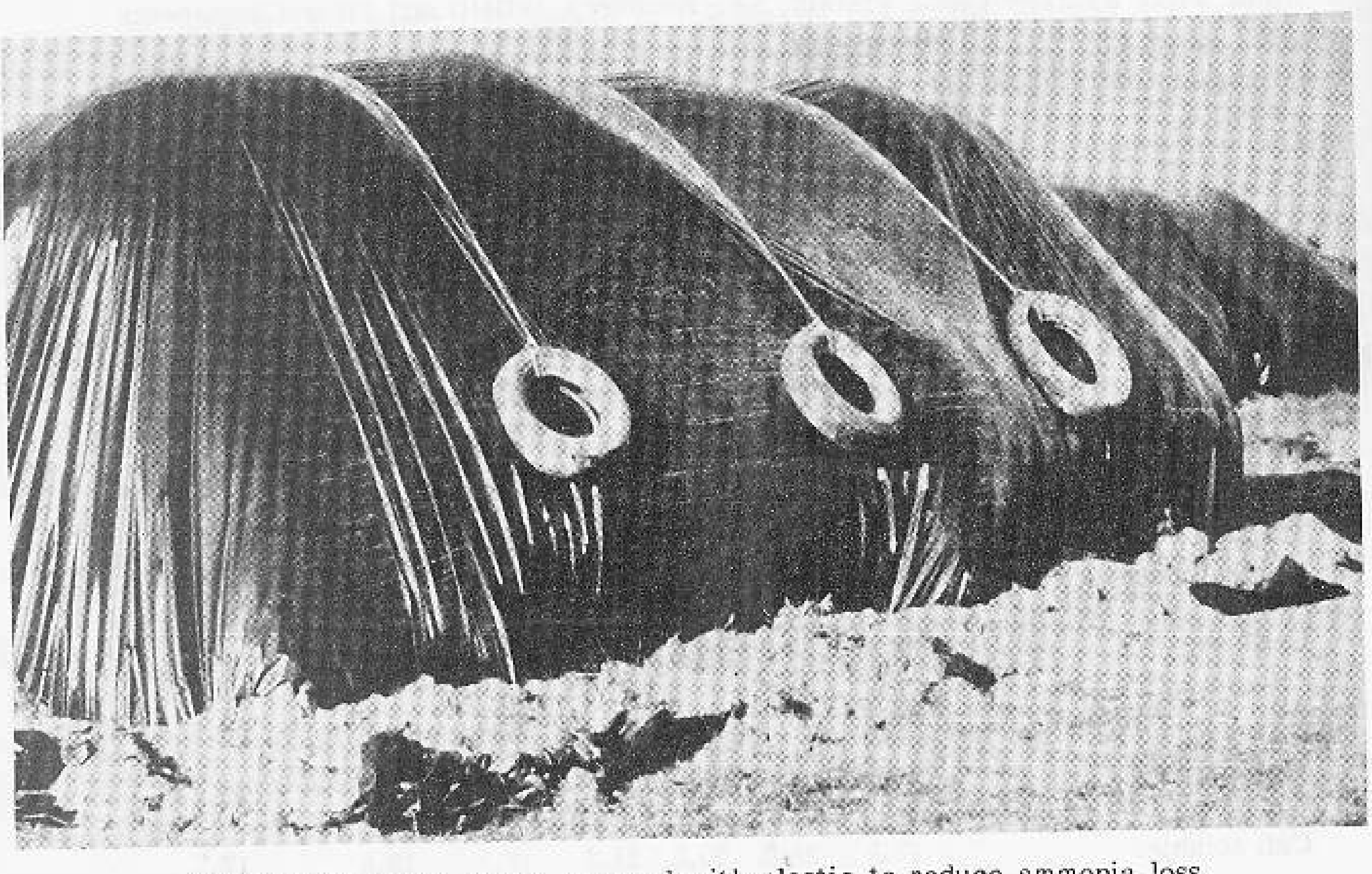
All supplements had the following ingredients: 2% salt, 1.0% tallow, 32 g vitamin A, 3 g vitamin D, 22 g vitamin E, and 227 g of trace mineral mix Z-10.

Table 16.2. Average Crude Protein, NH_3 Recovery, IVDMD and Fiber Components of the Straws.

Item	Temperature and NH_3 level (%)						
	37 F		68 F		95 F		
	1.5	3	1.5	3	1.5	3	Untreated
CP, %	5.8	6.7	7.1	7.8	7.7	8.8	3.9
NH_3 recovery, % of applied	24.7	18.2	41.6	25.3	46.4	31.8	-
IVDMD, %	54.1	55.2	55.7	56.1	57.3	56.7	47.2
Hemicellulose	26.8	24.0	24.8	23.9	24.5	24.8	26.7
Cellulose	38.6	38.8	38.6	39.1	39.9	38.0	39.9
ADF	55.4	56.1	55.2	54.5	56.5	56.3	55.6
Cell wall	82.2	80.0	80.0	78.8	81.0	81.1	82.4
Cell solubles	17.8	20.0	20.0	21.2	19.1	19.0	17.7
Lignin	10.5	10.8	10.2	10.4	10.3	10.8	14.8

Table 16.3. Intakes and Digestibilities of the Straw Rations.

	Temperature and NH_3 level (%)						
	37 F		68 F		95 F		
Item	1.5	3	1.5	3	1.5	3	Untreated
DM intake, gm/day	715	746	776	801	1030	858	717
	digestibility, %						
DM	51.4	52.3	52.1	53.5	53.8	52.7	45.6
CP	65.0	61.6	62.0	60.3	58.6	56.6	66.2
Hemicellulose	61.6	63.3	61.7	66.7	63.3	61.4	43.9
Cellulose	56.9	56.4	56.6	59.7	64.5	55.0	50.6
ADF	47.0	45.3	46.9	48.3	53.2	49.2	43.7
Cell wall	50.8	49.1	49.9	54.0	54.7	46.0	43.5



Ammoniated wheat straw, covered with plastic to reduce ammonia loss.

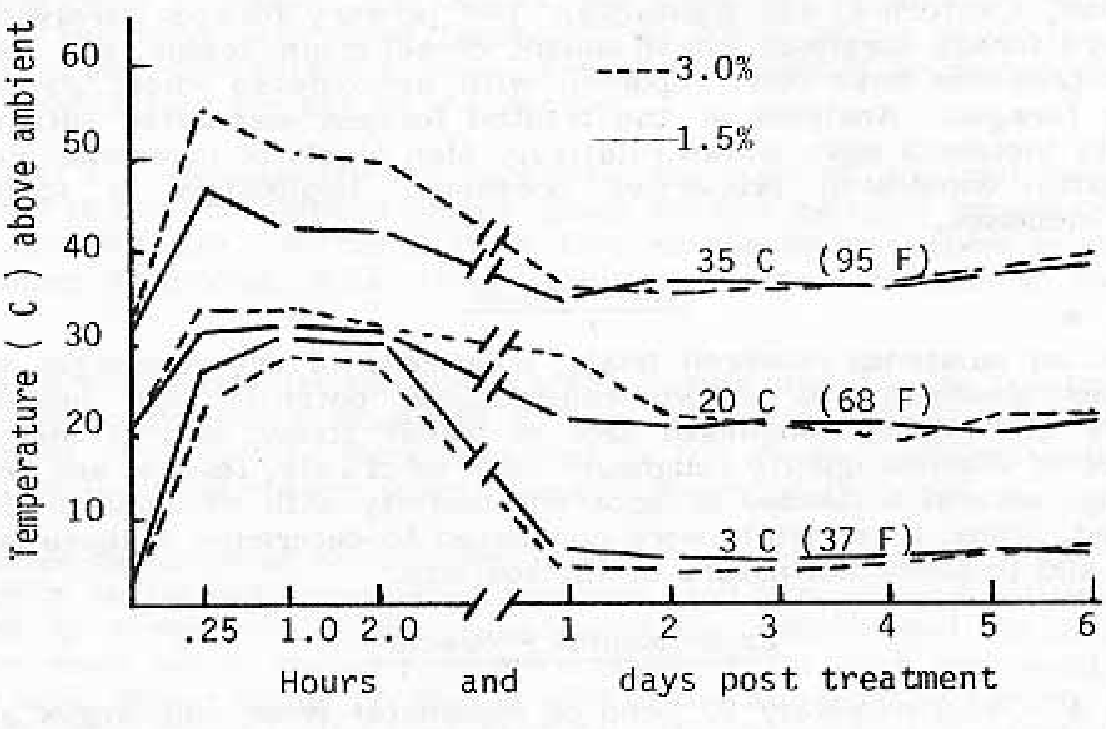


Figure 16.1. Temperature changes within the wheat straw stacks during ammonia treatment.

Toxicity Problems with Ammoniated Dry Roughages

Danny Simms[1], Gerry Kuhl, and John Brethour[2]

Summary

In two trials conducted at the Fort Hays Experiment Station, symptoms of toxicity (hyperexcitability, circling, convulsions, death) were observed in several newborn calves (1 to 14 days of age) nursing cows consuming ammoniated forage sorghum hay. None of these symptoms was observed in calves nursing cows consuming untreated hay. No toxicity symptoms were observed in the cows on any treatment. However, several instances of similar symptoms in cattle consuming ammoniated forages have been reported in growing calves and adult cattle in Kansas, Texas, California, and Kentucky. The primary forages involved in these incidents were forage sorghum, hybrid sudan, cereal grain, brome, and fescue hays. To date, no problems have been reported with ammoniated wheat straw or other poor quality forages. Analyses of the treated forages associated with several of these toxicity incidents have shown relatively high levels of imidazole compounds - chemicals with convulsive properties previously implicated in toxicity with ammoniated molasses.

Introduction

Based on numerous research trials, treatment of dry roughages with about 3% anhydrous ammonia has shown considerable potential for increasing the usefulness of low quality roughages such as wheat straw, and of increasing the feeding value of medium quality roughages such as prairie, fescue, and brome hays. Unfortunately, several instances of apparent toxicity with ammoniated feeds have been reported. Thus, these trials were conducted to determine if there is potential for toxicity and to study the nature of the toxicity.

Experimental Procedure

Trial 1 - Approximately 90 head of Simmental cross and Angus x Hereford cows were assigned randomly to two treatments: 1) Control - untreated hybrid forage sorghum hay and 2) Ammoniated hybrid forage sorghum hay (treated 12/82). Cattle on both treatments were fed untreated forage sorghum prior to February 28, 1983, at which time one-half of the cows were switched to the ammoniated sorghum hay.

Trial 2 - Thirty-six head of Simmental cross and Angus x Hereford cows were assigned randomly to three treatments: 1) Control - untreated hybrid forage sorghum (same hay as in Trial 1), 2) Ammoniated hybrid forage sorghum (surplus hay from Trial 1 treated 12/82), and 3) Ammoniated hybrid forage sorghum (control hay from Trial 1 freshly treated 9/83). At the time the cows were placed on trial, approximately 5 head of each group of 12 cows were nursing calves 1 to 7 days old.

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[1]Extension Livestock Specialist, Northwest Kansas.
[2]Beef Cattle Scientist, Fort Hays Experiment Station.

Treatment of Forage

In both trials, hybrid forage sorghum from the same 1982 crop was used. The ammoniated forage was treated by stacking numerous large round bales of the forage together, covering with black plastic and sealing the edges with dirt. About 4% (79-80 lbs/ton of forage, as fed) anhydrous ammonia was applied at one location in the stack through a hose under the plastic. In both trials, the stacks were uncovered approximately 10 days prior to feeding. Bales were self-fed in bale racks.

Results and Discussion

Trial 1 - During the first 14 days of the trial, five calves nursing cows consuming ammoniated forage sorghum died, while no deaths occurred in the control group. Two of these calves were observed exhibiting hyperexcitability and convulsions prior to death. On day 14, the trial was terminated, with both groups thereafter receiving untreated forage. Two more calves from the ammoniation treatment group died within 2 days. Necropsy indicated no pathological organisms or other explanation for any of the deaths.

Trial 2 - Approximately 5 days after the start of the trial, several calves in the freshly (9/83) ammoniated forage group showed extreme hyperexcitability (wild running and circling). Within 2 days, five of the seven calves in this group had shown these symptoms, with two exhibiting severe convulsions and subsequent death.

With the cattle on the old (12/82) ammoniated forage treatment, the first sign of hyperexcitability occurred 8 days following initiation of the trial. No symptoms of any toxicity were observed in the group receiving untreated forage sorghum. Also, no symptoms were observed in any of the cows.

Since research at several locations in the 1950's and 60's had shown similar symptoms in cattle fed ammoniated molasses, and the primary active chemical was identified as 4-methylimidazole, samples of the ammoniated forage sorghum and milk from cows whose calves died were analyzed for that compound. Preliminary analyses have shown levels of 40-120 ppm in the ammoniated forage. No imidazole compounds were found in the untreated hay. It appears that a metabolite is present in the milk instead of 4-methylimidazole itself. Thus, this chemical or closely related compounds, which have been shown to be convulsive agents in laboratory animals, are likely the cause of the toxicity in these trials. However, much more research is required before a complete answer is available.

Several sporadic cases of symptoms similar to those observed in these trials have been reported in several states with cattle being fed ammoniated sorghum-sudans (sweet-stemmed cultivars), fescue, brome, and cereal grain hays. In these cases, it seems that higher-quality hays are particularly predisposed to develop toxicity since they have more soluble carbohydrates, which appear to be necessary for 4-methylimidazole formation during ammoniation. In several cases, these incidents have involved growing cattle as well as adult animals. To date, no cases of toxicity have been reported with cattle being fed ammoniated low-quality roughages such as wheat, barley, oat or milo straw. Thus, based on the information available at this time, producers should refrain from ammoniating forage sorghum, sudan, brome, fescue, or cereal grain hays.

Comparison of Compudose®, Ralgro® and Synovex-C®[1] for Suckling Steer Calves[2]

Danny D. Simms[3] and Robert Schalles

Summary

The comparative growth-promoting value of Compudose, Ralgro, Ralgro + Ralgro reimplant, and Synovex-C + Synovex-C reimplant was evaluated on five Kansas ranches with 674 suckling steer calves in seven trials conducted during 1982 and 1983. The Ralgro + Ralgro reimplant program increased gain significantly ($P<.05$) over controls, with an average improvement of 3.9%. Either a single Ralgro or Compudose implant at branding increased gain about 2.6%. Implanting with Synovex-C produced 1% improvement in gain.

Introduction

Implanting during the suckling period is a very economical management practice. However, the introduction of Compudose, and the anticipated introduction of Synovex-C, makes determining their relative effectiveness important.

Experimental Procedures

In trials 1 through 5, suckling, Simmental-sired steer calves on five Kansas ranches were assigned randomly at branding (2-3 mo. old) to four treatments: 1) Control - no implant, 2) Single Ralgro at branding, 3) Ralgro at branding and again mid-way through the suckling period, and 4) Compudose at branding. Individual, non-shrunk weights were taken at branding and weaning. All trials were started in late April or early May, re-implanting in August, and weaning in October. In trials 6 and 7, suckling, Simmenatal-cross steer calves on two Kansas ranches were assigned randomly to three treatments: 1) Control - no implant, 2) Ralgro at branding and reimplanted, and 3) Synovex-C at branding and reimplanted. Individual, non-shrunk weights were taken at branding, reimplanting and weaning. These trials were started in May, with reimplanting in August, and weaning in October (Table 1).

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[1]Synovex-C is a suckling calf implant being developed by Syntex Agribusiness. It contains 100 mg. Progesterone and 10 mg. Estradiol Benzoate.

[2]Appreciation is expressed to Norman Rohleder, Russell; Roger Wilson, Oberlin; Charles Griffith, Hill City; Vernon Isaac, Edson; and Gano Farms, Hill City for providing cattle and assistance with data collection and to County Extension Agricultural Agents Allen Dinkel, Decatur; Del Jepsen, Russell; and Todd Willman, Sherman, for their assistance with data collection.

[3]Extension Livestock Specialist, Northwest Area.

Table 18.1. Trial Length, Re-implant Day, and Number of Calves Per Treatment in Suckling Calf Implant Trials

Trial No.	Trial Length In Days	Day of Reimplant	Number of Calves Per Treatment: Control	Ralgro	Ralgro + Ralgro	Compudose	Synovex-C+ Synovex-C
1	153	92	13	19	20	42	—
2	175	115	13	50	19	42	—
3	175	—	9	36	—	14	—
4	182	98	13	18	31	26	—
5	187	103	9	15	43	18	—
6	151	88	40	—	42	—	42
7	174	97	32	—	36	—	32
			129	138	191	142	74

Least squares procedures were utilized to combine all seven trials and compare all five treatments. All calves were included in the analysis, including the small percent that lost their implant.

Results

Since the results of trials 1 and 2 were discussed in the 1983 Cattlemen's Day Report, Table 18.2 shows only the results of trials 3 through 5.

Table 18.2. Results of Three Trials Conducted in 1983 Comparing Ralgro and Compudose for Suckling Steer Calves

Item	Control	Ralgro	Ralgro + Ralgro	Compudose
No. Calves	31	69	74	58
Avg. Initial Wt., Lbs.	135.6	132.2	140.0	135.4
Avg. Daily Gain, Lbs.	2.06[a]	2.12[ab]	2.19[b]	2.14[ab]
Improvement Over Control	—	2.9%	6.3%	3.9%

[ab]Values with different superscripts differ significantly (P<.01).

Although all three implant systems improved gain over control, the increase was statistically significant only with the Ralgro reimplant program.

In trials 6 and 7, both Ralgro and Synovex-C increased (P<.05) gain from branding to reimplanting; however, neither implant improved gains from reimplanting to weaning (Table 18.3). Over the entire pre-weaning period, Ralgro increased (P<.05) gain over both control and Synovex-C.

Table 18.3. Results of two Trials Comparing Ralgro and Synovex-C with Suckling Calves.

Item	Control	Ralgro + Ralgro	Synovex-C + Synovex-C
No. Calves	72	78	74
Avg. Initial Wt., Lbs.	188.0	191.5	188.8
ADG, Branding to Reimplanting, Lbs.	2.26^{a}	2.39^{b}	2.34^{b}
ADG, Re-implant to Weaning, Lbs.	1.81_{a}	1.81_{b}	1.74_{a}
ADG, Branding to Weaning, Lbs.	2.07^{a}	2.14^{b}	2.08^{a}
Improvement over Control	—	3.0%	.5%

[ab]Values with different superscripts differ significantly (P<.01)

When all seven trials were combined (Table 18.4), all products increased gain over controls. However, the improvement was significant (P<.05) only in the case of the Ralgro reimplant treatment. It should be noted that this treatment was included only in two of the seven trials and more trials may be necessary to accurately determine its value as a growth promotant. While the implant growth responses were less than commonly found in previous trials, they were still economical.

Compudose retention was monitored in these trials and about 6.9% of the implants were missing at weaning time.

Table 18.4. Results of Suckling Calf Implant Trials Evaluating Compudose, Ralgro, and Synovex-C.

Implant Treatment	No. Calves	Least Square Means ADG, Lbs.	Increase Over Control %	Increase Over Control lbs
Control	129	2.07^{b}	—	—
Ralgro	138	2.13^{ab}	2.9	10.2
Ralgro + Ralgro	191	2.15^{a}	3.9	13.6
Compudose	142	2.12^{ab}	2.4	8.5
Synovex-C + Synovex-C	74	2.09^{b}	1.0	3.4

[a]Values with different superscipts are statistically different (P<.05).

Effect of Oxytetracycline Hydrochloride Coating Added to Compudose Implants in Grazing Steers[1]

Lyle W. Lomas[2]

Summary

Adding an oxytetracycline coating to Compudose implants did not change their effectiveness. Implanting with Compudose significantly increased gain of grazing steers an average of 17% compared to non-implanted controls.

Introduction

Compudose is a long lasting silicone rubber implant that contains estradiol-17ß. Its payout activity is about two times longer than other growth promoting implants. Previous research has shown that Compudose increases rate of gain in grazing stocker cattle by 9 to 16%.

Retention of the Compudose implant in the ear has been a problem when the implant was administered improperly. Failure to properly cleanse the implant site and disinfect the implanter needle has resulted in infection around the implant, which has been found to be the major factor causing implant loss. Research has shown that cleansing the implant site, disinfecting the implanter needle, and dipping it in a tylosin-neomycin powder reduced infection and thereby improved retention of the implants. This study evaluated the effects of adding an oxytetracycline antibiotic coating to Compudose implants on grazing steer performance.

Procedure

Eighty-one Brangus steers with an average weight of 551 lbs were divided into three weight blocks, with steers in each block assigned randomly to three implant treatments: 1) control - no implants, 2) non-coated Compudose implants, or 3) Compudose implant coated with at least 0.7 mg oxytetracycline hydrochloride powder. The implant needle was disinfected prior to each use with both types of implants and dipped in a tylosin-neomycin powder prior to implanting non-coated Compudose.

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[1]Implants and partial financial assistance provided by Eli Lilly and Co., Indianapolis, IN.

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

All treatments were represented equally in each of the three weight blocks. Each block was assigned to three 10-acre smooth bromegrass pastures. Cattle within each block were rotated among the three pastures assigned to that block at two week intervals. Steers in each block has access to an automatic waterer and a mineral feeder containing a mixture of equal parts steamed bone meal and trace mineral salt. Supplemental feed was provided uniformly as needed to maintain an average daily gain of at least one pound. Implants were palpated on days 28 and 56 and steers with missing implants were reimplanted. Implants were palpated again at the end of the study. Sexual behavior (mounting activity) of the steers was monitored daily during the first 28 days of the study. Initial and final weights were taken following a 16 hour shrink from feed and water. The 169 day study ran from May 11 to October 28, 1983.

Results

Results of this study are presented in Table 19.1. Steers implanted with non-coated and oxytetracycline coated Compudose gained 20.3% (51 lb) and 13.7% (33 lb) more ($P<.01$), respectively, than controls. There was no significant ($P>.05$) difference between the two types of Compudose, with an average increase in gain of 17% compared to non-implanted steers.

On day 28 of the study, one oxytetracycline coated Compudose implant was missing and the steer was reimplanted. All implants were present on day 56 and at the end of the study. Two non-coated Compudose implanted steers and one oxytetracycline coated Compudose implanted steer exhibited mounting activity during the first 28 days of the study. No other sexual activity was observed.

Table 19.1. Effect of Oxytetracycline-Coated Compudose on Gains of Grazing Steers (168 days)

Item	Control	Uncoated Compudose	Oxytetracycline Coated Compudose
No. of steers	27	27	27
Initial wt., lb	547	552	554
Final wt., lb	805	861	845
Total gain, lb	258	309	291
Average daily gain, lb	1.53^a	1.84^b	1.74^b

^{a,b}Means with different superscripts differ significantly ($P<.01$).

Comparison of Compudose, Ralgro and Synovex-S Implants for Growing Steer Calves[1]

Dannys Simms[2], Gerry Kuhl
and Robert Schalles

Summary

Four field trials were conducted to compare Ralgro, Synovex-S and Compudose implants for growing steer calves. All implant programs signficantly increased (P<.01) average daily gain. Reimplanting with Ralgro or Synovex-S improved gain an additional 5.6% compared to the average of these implants used singly and 4.8% compared to Compudose.

Introduction

The introduction of Compudose into the implant market has made the question of which implant to use more complicated. These trials were conducted to determine the best implant program for growing steer calves under common Kansas winter feeding programs.

Experimental Procedure

Steer calves entering wintering programs on four Kansas ranches were randomly allotted to six treatments: 1) control - no implant, 2) single Ralgro, 3) single Synovex-S, 4) Ralgro + Ralgro reimplant, 5) Synovex-S + Synovex-S reimplant, and 6) single Compudose. Individual, non-shrunk weights were taken at initial implanting and at the end of the trials. Animals which lost indentification tags were eliminated from the trial; however, steers which lost their implants were included in the results. One trial was dropped from the summary since the calves were not fed as planned and gains were very low. Table 20.1 illustrates the experimental details of the three trials included in the analysis.

[1] Appreciation is expressed to Mike Sramek, McDonald; Lewis Schneider, Logan; Norman Rohleder, Russell; and Mark Thomas, Wallace for supplying cattle, facilities and labor, and to International Minerals and Chemical Corporation, Syntex Agri-Business, Inc., and Elanco Products Co. for providing financial support and implants. Special thanks to Pat Burton, IMC; Kerry Bedell, Elanco; and to County Extension Agricultural Agents Del Jepsen, Russell; Keith VanSkike, Wallace; and Allen Dinkel, Decatur for their assistance.

[2] Extension Livestock Specialist, Northwest Kansas.

Results

All implant treatments increased (P<.01) average daily gain over controls (Table 20.2). Reimplant treatments (Ralgro + Ralgro and Synovex-S + Synovex-S) increased gain by an average of 4.8% more than Compudose although the difference was not significant (P>.08). Reimplanting increased gain an average of 5.6% over single implanting with either Ralgro or. Synovex. Reimplanting was effective in feeding periods as short as 112 days (Trial 3), where the single Ralgro and Synovex-S treatments increased gain an average of 6.5% over controls, while the reimplant treatments increased gain 22.3% over controls. Retention of Compudose was not a major problem, with only 6 of 133 implants (4.5%) lost in the four trials.

Daily gains of calves in the trial which was not included in the analysis averaged only .38 lbs. There was no response to any implant treatment at this low rate of gain. This supports the common recommendation that cattle gains on growing programs must be at least .75 lbs/hd/day to obtain a response from implanting.

Table 20.1. Experimental Design of Trials 1, 2, and 3

Item	Trial 1	Trial 2	Trial 3
No. Steers	144	192	127
Breeding of calves	Simmental-cross	Hereford-Angus	Simmental-cross
Length of trial	185	137	112
Reimplant day	96	74	70
Initial Wt., lb	489	433	541
Daily Gain, lb	1.37	2.09	1.56
Ration	Wheat Pasture Plus Grain and Dry Forage Suppl.	Sorghum Silage Plus Milo at 1.5% Body Wt. and Protein Suppl.	Sorghum Silage Plus Milo at 1% Body Wt. and Protein Suppl.

Table 20.2. Effect of Implant Program on Daily Gains of Growing Steers - 3 Trial Summary

Implant Treatment	No. Calves	Least Square Means for Daily Gain, lb ± S.E.		% Improvement Over Control
Control	41	1.45^{a}	± .08	----
Ralgro	45	1.67^{b}	± .08	15.2
Synovex-S	49	1.71^{bc}	± .08	17.9
Ralgro + Ralgro	105	1.78^{bc}	± .07	22.8
Synovex-S + Synovex-S	102	1.79^{c}	± .07	23.4
Compudose	100	1.70^{bc}	± .07	17.2

^{abc}Means with different superscripts differ significantly (P<.05).

Comparison of Synovex-S and STEER-oid Implants for Feedlot Steers[1]

Bob Lee[2] and Scott Laudert[3]

Summary

Synovex-S and STEER-oid were compared in a 133-day finishing trial to evaluate their effects on growth and carcass traits of yearling steers. No significant differences in average daily gain, feed intake, feed to gain ratio, carcass weight, ribeye area, fat thickness, quality grade or yield grade were detected between the two implants at the end of the trial. However, significant differences in feed efficiency were detected during days 0-35 and 36-63, possibly due to different release rates of the implants.

Introduction

Both STEER-oid and Synovex-S implants contain 200 mg progesterone and 20 mg estradiol benzoate. They are used in steers to improve growth and feed efficiency. Although both implants contain the same mixture of synthetic hormones, pellet differences such as hardness and release time could cause them to perform differently.

Experimental Procedure

One hundred and sixty Charolais-Angus yearling steers were allocated by initial weight to 20 feeding pens. Cattle in one-half the pens were implanted with Synovex-S while the other half received STEER-oid. All steers were reimplanted with their respective implants on day 63 of the trial. All cattle were eartagged, vaccinated for IBR, BVD, leptospirosis and 7-way clostridium, and wormed with injectable Tramisol. Individual full beginning weights were shrunk 4% and final weights were calculated using carcass weights adjusted to a 64% dressing percent. All steers were full-fed a diet that contained 56% rolled high moisture corn, 26.5% dry rolled milo, 6.2% corn silage, 2.2% ground alfalfa hay, 4.1% blended feeding fat and 5.0% supplement (dry basis). The diet contained 13.5% crude protein and 72.35% dry matter. The implant study was superimposed on an ionophore study where Rumensin was fed at 25 g/ton or Bovatec at 30 g/ton.

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[1]Study was conducted at the Garden City Experiment Station. Partial financial assistance for this trial was provided by Anchor Labs, Inc., St. Joseph, MO.

[2]Animal Research Scientist, Garden City Experiment Station.

[3]Extension Livestock Specialist, Southwest Kansas.

Results and Discussion

The results of the trial are shown in Table 21.1. STEER-oid implanted steers had a better feed to gain ratio than Synovex-S steers during the first 35 days on trial. However, this effect was reversed during days 36 to 63, so that no difference was detected when day 0 to 63 values were compared. A possible explanation could be that, although both implants are the same chemically, they have different release rates. There were no signficant differences in average feedlot performance over the 133-day trial nor in carcass characteristics between the two implants.

Table 21.1. Effect of STEER-oid or Synovex-S on Steer Feedlot Performance and Carcass Characteristics

Item	Synovex-S	STEER-oid
Initial wt., lb	699	707
Final wt., lb	1155	1163
	Day 0-35	
Daily Gain, lb	3.69	3.89
Dry Matter Intake, lb	21.47	20.95
Feed/Gain, lb	5.82[a]	5.39[b]
	Day 36-63	
Daily Gain, lb	3.85	3.41
Dry Matter Intake, lb	20.21	20.33
Feed/Gain, lb	5.25[c]	5.96[d]
	Day 0-63	
Daily Gain, lb	3.76	3.68
Dry Matter Intake, lb	20.91	20.79
Feed/Gain, lb	5.56	5.65
	Day 0-133	
Daily Gain, lb	3.43	3.43
Dry Matter Intake, lb	21.86	21.56
Feed/Gain, lb	6.37	6.29
Carcass data:		
Dressing percent	64.0	64.0
Quality grade	Good+	Good+
Yield Grade	2.1	2.1

[ab]Values in the same row with different superscripts differ significantly (P<.05).
[cd]Values in the same row with different superscripts differ signifcantly (P<.07).

Single vs. Reimplant Programs for Finishing Steers[1]

Jack Riley and Ron Pope[2]

Summary

Finishing yearling beef steers were used to compare various implant programs in a 167-day trial. All implant programs increased daily gain ranging from 6.6 to 25.4% over non-implanted controls and improved feed efficiency ranging from .5 to 13.9%. Steers implanted with Ralgro® initially and reimplanted 75 days later with Synovex-S® gained the fastest and most efficiently.

Introduction

The availability of Compudose® and its apparent 200-day period of effectiveness has generated several research trials comparing single Ralgro®, Synovex-S®, or Compudose implants to reimplanting programs. This project was designed to compare six implant treatments.

Experimental Procedure

One hundred sixty-eight Angus, Hereford and Angus x Hereford yearling steers averaging 654 lbs were allotted to six treatments: (1) non implanted control; (2) Ralgro® implant initially; (3) Ralgro® initially and Synovex-S® at day 75; (4) Synovex-S® initially; (5) Synovex-S® initially and at day 75; and (6) Compudose®. Treatments 1 and 6 were replicated 6 times with 6 steers per replicate. Treatments 2, 3, 4, and 5 had 4 replicates of 6 steers each.

Steers were purchased from one ranch in Nebraska and had not been previously implanted. A growing ration (DM basis) of 55% forage sorghum silage, 37.5% rolled milo and 7.5% supplement was fed the first 56 days and the finishing diet (DM basis) was 10% forage sorghum silage, 84% rolled milo and 6% supplement. Rumensin was added to the diet to provide 30 g per ton and Tylan, 10 g per ton. (air-dry basis).

Individual weights were taken on two consecutive days at the beginning and end of the trial. Single intermediate weights were recorded at 28-day intervals. All weights were non shrunk and taken prior to the a.m. feeding. Each steer was checked for implant retention at 28 and 56 days. Steers with lost implants were not reimplanted. Daily observations were made for abnormal behavior such as riding activity. Routine carcass and liver abscess data was collected.

[1]Compudose® implants and partial financial assistance provided by Lilly Research Laboratories, Greenfield, Indiana. Special recognition is given to Dr. Herman Grueter for his assistance as trial monitor.

Results and Discussion

Steers in all implant treatments gained faster than the controls at all stages of the trial. Table 22.1. summarizes the data collected for the first half (84 days) and the entire 167 day feeding period. The two groups reimplanted with Synovex on day 75 gained the fastest, consumed the most daily dry matter and were the most efficient. The efficacy of a single Ralgro or Synovex, as measured by an advantage over non-implanted steers, appeared to disappear between day 85 and 112 after implantation. A single Compudose implant maintained a consistent growth level and efficiency rate during the entire trial.

No abnormal behavior activities were observed. Seven of the 36 Compudose implants could not be palpated at the end of the study and were assumed lost. There were 3 Synovex implants lost from the 72 steers implanted initially. The deep site implant location was used for the Ralgro treatments and palpation was not possible. Carcass quality traits were not affected by implant treatments.

Table 22.1. Single vs. Reimplant Programs for Finishing Steers. (April 28-October 12, 1982)

	Implant Treatment					
Item	Control	Ralgro	Ralgro/ Synovex[1]	Synovex	Synovex/ Synovex[1]	Compudose
Initial wt, lb	655	654	654	652	653	653
Daily gain:						
0-84 days	2.06[a]	2.46[b]	2.53[bc]	2.51[bc]	2.57[bc]	2.63[c]
0-167 days	2.28[a]	2.60[c]	2.86[e]	2.43[b]	2.76[de]	2.67[cd]
Feed Intake (DM):						
0-84 days	19.36[a]	19.75[a]	20.31[b]	20.47[b]	20.43[b]	20.50[b]
0-167 days	19.70[a]	20.33[a]	21.36[c]	20.98[b]	21.32[c]	20.94[b]
Efficiency (DM):						
0-84 days	9.44[a]	8.08[b]	8.02[b]	8.15[b]	7.96[bc]	7.81[c]
0-167 days	8.66[a]	7.84[b]	7.46[c]	8.62[a]	7.73[b]	7.86[b]
Final wt, lb	1035	1088	1132	1059	1115	1098
Carcass data:						
Weight, lb	633	660	686	645	681	669
Dressing %	61.1	60.7	60.6	61.0	61.2	60.9
Rib eye area, sq in	11.93	12.01	12.41	11.56	11.69	11.78
Fat thickness, in	.57	.55	.51	.53	.58	.54
Cutability %	49.46	49.4	49.76	49.36	48.75	49.24
Quality grade[2]	13	12	12	13	12	13

a,b,c,d,e Means on same row with different superscripts differ($P<.05$)

1 Reimplanted on day 75

2 High good = 11, Low choice = 12

Comparison of Compudose with Ralgro or Synovex-S Reimplant Programs for Finishing Steers[1]

Scott B. Laudert[2] and George V. Davis Jr.[3]

Summary

Finishing yearling steers reimplanted with Synovex-S or Ralgro gained 6.8 and 4.2% faster, respectively, than those implanted with Compudose. However, feed efficiency was not significantly different among treatments. Steers implanted with Compudose gained 5.1% faster and more efficiently than those implanted with a single Ralgro.

Introduction

Implanting cattle when they enter the feedyard has been a common management practice for the past 15 to 20 years. Numerous research trials have shown a positive response to single Ralgro or Synovex implants at the beginning of the finishing period. Since the major response to implanting occurs during the first 60 to 90 days, reimplanting with either Synovex or Ralgro has been shown to produce favorable results.

The recent clearance of Compudose has stimulated a great deal of interest in comparing the standard Ralgro and Synovex reimplanting programs with a single Compudose implant.

Experimental Procedure

Two hundred yearling steers averaging 627 lbs were allotted to five implant treatments: (1) control; (2) initial Ralgro; (3) initial Ralgro, Ralgro reimplant; (4) initial Synovex-S, Synovex-S reimplant; and (5) initial Compudose. The steers in groups 3 and 4 were reimplanted on day 73 of the 146 day trial. The other groups of steers were not disturbed at reimplanting time.

Each treatment group consisted of 4 pens of 10 head each. All groups were fed the same throughout the trial (June 8-Nov. 1, 1982). The final ration contained 90% concentrate with 24 grams Rumensin and 9 grams Tylan per ton.

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[1]This trial was conducted at the Garden City Experiment Station. Appreciation is expressed to International Minerals and Chemical Corporation for financial assistance and Iowa Beef Processors, Holcomb, KS for carcass data assistance.

[2]Extension Livestock Specialist, Southwest Kansas.

[3]Animal Research Scientist, Garden City Experiment Station.

Results

All implant treatments improved overall performance compared to controls (Table 23.1). Steers implanted with Compudose converted feed to gain as efficiently as those reimplanted with either Ralgro or Synovex. Reimplanting with Ralgro improved ($P<.05$) feed efficiency over that of the single Ralgro group.

Rate of gain was highest for the reimplanted groups. Steers reimplanted with Synovex-S gained 6.8% faster ($P<.05$) than those implanted with Compudose. Ralgro reimplanted steers tended to gain faster ($P=.07$) than those implanted with Compudose. Compudose produced faster ($P<.05$) gains than a single Ralgro. Compudose implant loss was 2.5%. Carcass quality was not affected by implanting.

It's interesting to note that the single Ralgro and control groups performed similarly from day 84 to 146. This observation would tend to confirm the theory that Ralgro loses its ability to stimulate performance after about 90 days. It is also noteworthy that the gain and efficiency advantage obtained during the early portion of the feeding period with a single Ralgro was maintained even though the cattle were not reimplanted.

Table 23.1. Response of Finishing Steers to Various Implant Programs

Item	Control	Ralgro	Ralgro/Ralgro[1]	Synovex/Synovex[1]	Compudose
Initial Weight, lbs	628	630	627	629	626
Daily Gain, lbs:					
Day 0-56	2.80^{a}	3.06^{c}	3.16^{c}	3.45^{b}	3.07^{c}
Day 84-146	2.88^{a}	2.95^{a}	3.48^{b}	3.41^{bc}	3.23^{c}
Day 0-146	2.75^{a}	2.93^{b}	3.21^{cd}	3.29^{d}	3.08^{c}
Feed Intake, lbs:					
Day 0-56	18.13^{a}	18.28^{a}	18.00^{a}	19.73^{b}	18.11^{a}
Day 84-146	20.58^{a}	21.49^{ab}	22.76^{c}	23.08^{c}	22.09^{bc}
Day 0-146	19.35^{a}	20.00^{ab}	20.34^{b}	21.38^{c}	19.97^{ab}
Feed Efficiency:					
Day 0-56	6.48^{a}	5.97^{b}	5.70^{b}	5.72^{b}	5.90^{b}
Day 84-146	7.15	7.28	6.54	6.77	6.84
Day 0-146	7.04^{a}	6.83^{ab}	6.34^{c}	6.50^{bc}	6.48^{bc}
Carcass Parameters:					
Carcass weight, lbs	645^{a}	662^{d}	684^{c}	697^{b}	671^{cd}
Ribeye area, sq. in.	11.4	11.6	11.8	11.9	11.6
Backfat, in.	.51	.52	.55	.60	.52
Quality grade[2]	13.1	13.2	12.9	12.9	13.0
Yield grade	2.4	2.3	2.6	2.6	2.4

[abcd] Means in the same row with different superscripts differ significantly ($P<.05$).

[1] Reimplanted on day 73.

[2] High good = 12, Low choice = 13.

Implant Comparisons for Finishing Steers[1]

Scott Laudert[2], Gerry Kuhl, and Marshall Walker[3]

Summary

A one hundred and forty day field trial was conducted to evaluate the relative performance of steers implanted with Compudose, Ralgro and Synovex-S. Daily gains of cattle receiving a single initial implant were increased 8.0% with Compudose, 12.7% with Ralgro and 21.5% with Synovex-S compared to non-implanted controls. Steers on a reimplant program with Ralgro and/or Synovex-S gained 23.6 to 24.9% faster than controls, with no significant differences due to implant brand or sequence.

Introduction

Research has consistently shown that implanting incoming feedlot steers increases weight gain about 10% and feed utilization by 5 to 8%, while reimplanting midway through the finishing period improves gain and efficiency an additional 4 to 5%. Little research has been reported comparing the long acting Compudose implant with other implant programs. This trial was conducted to evaluate Compudose with traditional single and reimplant programs for finishing steers fed under commercial feedlot conditions.

Experimental Procedure

One hundred and seventy-two crossbred beef steers averaging 665 lbs were allotted randomly to eight implant treatments: 1) control - no implant; 2) initial Ralgro, no reimplant; 3) initial Ralgro, Ralgro reimplant; 4) initial Ralgro, Synovex-S reimplant; 5) initial Synovex-S, no reimplant; 6) initial Synovex-S, Ralgro reimplant; 7) initial Synovex-S, Synovex-S reimplant; and 8) Compudose, no reimplant. All steers were individually identified and weighed at the beginning of the 140 day trial.

Steers in the reimplant treatment groups were reimplanted on day 51. All steers were fed in the same pen in a commercial southwest Kansas feedlot and handled according to standard feedlot procedures. Final weights were calculated from individual hot carcass weights and the average dressing percentage (61.8%) of the entire group. All data were analyzed by Least Squares Analysis of Covariance to remove effects of variation in initial weight.

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[1]Appreciation is expressed to Grant County Feeders, Ulysses, KS for supplying cattle and facilities; Excel Corporation, Dodge City, KS for slaughter assistance and International Minerals and Chemical Corporation for financial assistance.

[2]Extension Livestock Specialist, Southwest Kansas.

[3]Grant County Extension Agricultural Agent.

Results

The trial results are presented in Table 24.1. All traditional implant treatments greatly increased (P<.05) gain over controls, with less (P<.10) improvement from Compudose. The single Synovex-S group gained slightly faster (P<0.4) than the single Ralgro cattle and did not differ significantly from the reimplant treatment groups. There was no difference among the reimplant treatment groups (P>.50).

Compudose-implanted steers showed gains similar to steers implanted with a single Ralgro but gained slower (P<.05) than steers implanted with a single Synovex-S or reimplanted steers. None of the steers in the Compudose group lost their implants.

Table 24.1. Comparison of Implants on Performance of Finishing Steers

Treatment			Least squares means, lbs			
Initial	Reimplant	No. steers	Final weight	Total gain	Daily gain	Gain over controls
None	None	23	996	332	2.37[a]	—
Ralgro	None	21	1037	374	2.67[bc]	42
Ralgro	Ralgro	22	1079	414	2.96[d]	82
Ralgro	Synovex-S	20	1079	414	2.96[d]	82
Synovex-S	None	19	1074	410	2.93[d]	78
Synovex-S	Ralgro	22	1067	403	2.88[cd]	71
Synovex-S	Synovex-S	22	1079	414	2.96[d]	82
Compudose	None	23	1023	358	2.56[ab]	26

[abcd] Means with different superscripts differ significantly (P<.05).

Effect of a Single Ralgro Implant on Conception Rates and Calving Difficulty in First Calf Beef Heifers[1]

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

Summary

Three hundred and seventy four heifers from two Kansas ranches were used to determine if a single Ralgro implant given either at two months of age or at weaning would influence pelvic development and subsequent calving difficulty or conception rates. The study involved two herds of Simmental (spring and fall calving) and one herd of fall calving Angus cattle. Ralgro did not influence conception rates as yearlings, or percentages of heifers requiring assistance with their first calf. Implanted heifers had larger pelvic areas as yearlings, but the advantage disappeared by two years of age. Pelvic area in assisted vs unassisted two year old heifers did not differ.

Introduction

Pelvic area is a key factor associated with calving difficulty, especially with first calf heifers. A single Ralgro implant has been shown to increase daily gain of beef heifers but some studies have shown a depression in yearling conception rates of implanted heifers kept as replacements. The objective of this study was to determine if a single Ralgro implant could increase pelvic area and facilitate easier calving without reducing conception.

Experimental Procedure

One hundred forty seven spring-born and 92 fall-born Simmental, and 135 fall-born Angus heifers were allotted to three treatments: 1) control, 2) single Ralgro implant at weaning, and 3) one-third of the fall calving Simmental heifers implanted once with Ralgro at 2 months of age. Data collected included birth, weaning and yearling weights; yearling and 2-year frame scores; pelvic areas measured with a Rice pelvimeter at weaning, yearling and precalving and precalving body condition scores. Yearling conception rates and degree of assistance required at first calving were recorded. Calving data was collected on 187 heifers (64 fall calving Simmental, 64 spring calving Simmental and 59 fall calving Angus heifers). Comparisons between herds and breeds is not intended.

[1] Appreciation is expressed to Henry Gardiner, Gardiner Angus Ranch, Ashland, KS and Roy Parsons, Ecco Simmental Ranch, Buffalo, KS.

Results and Discussion

Implanting at 2 months improved preweaning daily gains of fall-calving Simmental heifers compared to controls. But, implanting at weaning did not increase average daily gain from weaning to yearling in any herd. Fall calving Simmental heifers implanted at weaning were taller as yearlings and as 2-year olds than heifers implanted at 2 months of age. Non-implanted fall calving Simmental heifers were in better condition at calving time than heifers implanted at weaning (Table 25.1).

Implanting at weaning increased yearling pelvic size in all herds. But control spring and fall-calving Simmental heifers had larger pelvic areas at 2 years of age than implanted heifers. Therefore, the advantage in yearling pelvic area due to implanting was reduced by two years of age. Pelvic areas were similar in calving assisted and unassisted two year old heifers (Table 25.2).

Ralgro implants did not influence overall yearling conception rate during the 63-day breeding season, or average conception date, percentage of heifers requiring assistance with their first calf, calf birth weight or gestation length (Table 25.3).

In summary, a single Ralgro implant increased pelvic area as yearlings, but this advantage disappeared by calving. Ralgro had no effect on conception rates or calving difficulty.

Table 25.1. Effect of Ralgro on Heifer Weight, Height and Condition

	Simmental					Angus	
	Fall Calving			Spring Calving		Fall Calving	
Item	Implanted at 2 months	Implanted at weaning	Controls	Implanted at weaning	Controls	Implanted at weaning	Controls
Weaning wt., lbs	575	591	566	471	475	431	448
Daily Gain, lbs birth-weaning	2.45^{b}	2.17^{a}	2.25^{a}	.98	1.01	1.60	1.68
Yearling wt., lbs.	822^{ab}	831^{b}	796^{a}	752	745	650	654
Daily Gain, lbs weaning-yearling	1.61	1.56	1.50	1.85	1.75	1.42	1.34
2 year wt., lbs	927	951	943	956	978	963	985
Yearling ht., in.	48.4^{a}	49.3^{b}	48.8^{ab}	---	---	46.0	46
2 year ht., in.	50.4^{a}	51.5^{b}	51.2^{ab}	50.7	51.2	47.8	48.2
Condition score^{c}	5.0^{ab}	4.9^{b}	5.3^{a}	4.9	5.1	5.2	5.2

^{ab}Values with different superscripts differ significantly (P<.05) within a trait and herd.
^{c}1 = thin, 10 = fat

Table 25.2. Effect of Ralgro on Heifer Pelvic Area

	Simmental					Angus	
	Fall Calving			Spring Calving		Fall Calving	
Item	Implanted at 2 months	Implanted at weaning	Controls	Implanted at weaning	Controls	Implanted at weaning	Controls
Weaning pelvic area, cm^2	144.5	138.6	139.1	124.5	124.0	102.8	106.3
Yearling pelvic area, cm^2	196.0[a]	206.9[b]	194.5[a]	194.9[a]	187.8[b]	175.1[a]	168[b]
Precalving pelvic area, cm^2	261.0[b]	268.5[ab]	272.4[a]	233.4[a]	245.8[b]	236.3	231.9
Precalving pelvic area, cm^2							
assisted at calving		262.4		242.9		234.4	
unassisted		269.41		239.1		233.9	

[ab]Values with different superscripts differ significantly (P<.05) within a trait and herd.

Table 25.3. Effect of Ralgro on Heifer Reproductive Perforance

	Simmental					Angus	
	Fall Calving			Spring Calving		Fall Calving	
Item	Implanted at 2 months	Implanted at weaning	Controls	Implanted at weaning	Controls	Implanted at weaning	Controls
Conception rate, %	89.5	90.9	85.7	97.3	94.5	82.7	74.4
Avg. calving date	Sept. 4	Aug. 23	Aug. 24	Feb. 23	Feb. 16	Sept. 5	Sept. 7
Calving assistance, %							
unassisted	79	86.4	81	55.6	59.5	64.5	57.1
hand pull	15.8	4.5	14.3	14.8	16.2	35.5	42.9
calf jack	5.2	9.1	—	25.9	21.6	—	—
cesaerean	—	—	4.7	3.70	2.70	—	—
Calf birth wt., lbs	69.7	67.6	70.9	79.1	78	67	71.8
Gestation length, days	283.6	282.0	285.3	286.0	287.1	279.9	281.3

Effect of Lasalocid on the Sexual Development of Beef Heifers

Larry Corah and Jack Riley

Summary

Lasalocid (Bovatec®) improved daily gain of replacement heifers by .20 lb per day and reduced the time to first heat in heifers fed on a lower level of energy, but had no significant affect in the higher energy group. Feeding Lasalocid did not affect conception rates.

Introduction

Use of Lasalocid in stocker and feedlot cattle diets has improved daily gain and feed efficiency. No research data are available on the effect of Lasalocid fed to replacement heifers from weaning until breeding as yearlings. This study was conducted to determine the effect of Lasalocid fed in two energy levels on sexual development of replacement heifers.

Experimental Procedure

One hundred twenty Angus and Angus X Hereford heifers, born February to April, 1981, were allotted randomly by weight to the following four treatments:

1. Control - fed to gain approximately .75 pound/day (low energy)
2. Control - fed to gain approximately 1.25 pound/day (high energy)
3. Lasalocid - fed same rations as control (projected gain of approximately .75 pound per day) plus 200 mg/head/day lasalocid
4. Lasalocid - fed same rations as control (projected gain of approximately 1.25 pound per day) plus 200 mg/head/day lasalocid

Lasalocid was added to the protein supplement to provide 200 mg per head per day for treatments 3 and 4.

Rations used in the 168-day trial consisted of silage and grain, with extra grain fed to those heifers where the projected daily gain was 1.25 pounds per day. Rations for the control and Lasalocid treatments were identical except for the inclusion of Lasalocid. To determine the onset of puberty, heifers were checked twice daily for estrus activity. Heifers were artificially inseminated for a 60-day period utilizing one inseminator and semen from a single ejaculate. Pregnancy was determined by rectal palpation approximately 60 days after the end of breeding.

Weight, frame and pelvic measurements were monitored. Daily health observations were made, with individual records of treatment or post-mortem examinations, if necessary.

Results and Discussion

As shown in Table 26.1, the observed daily gain for the control heifers was close to that desired. Feeding Lasalocid improved the daily gain by approximately .20 pounds per head per day in both the low energy and high energy group.

Feeding Lasalocid to the low energy group hastened the onset of puberty but had no significant effect in the higher energy group. Lasalocid did not affect conception rates during the 60-day breeding season, and did not affect animal health.

The results of this trial indicate that Lasalocid will cause a significant improvement in the onset of puberty in heifers on a low level of nutrition.

Table 26.1. Effect of Lasalocid on Sexual Delevloment of Beef Heifers

Treatment	No. of Heifers	Projected Daily Gain, lb.	Actual Daily Gain, lb.	Days from start of trial to where following % were cycling 50%	75%	Starting Weight lb.	Final Weight lb.	Pregnant %
Lasalocid	30	.75	1.02	94	108	478	649	96.7
Lasalocid	30	1.25	1.44	106	125	480	722	86.2
Control	30	.75	.81	115	140	475	612	86.7
Control	30	1.25	1.24	99	115	476	685	86.7

Effect of Actaplanin[1] on Performance of Grazing Steers

Lyle W. Lomas[2]

Summary

Feeding actaplanin in a loose mineral mix or twice weekly in a supplement significantly improved gains of grazing steers. The greatest improvement in performance was found with average daily actaplanin intakes of 255 or 257 mg per head in the two trials.

Introduction

Actaplanin, an experimental feed additive, is a complex of glycopeptide compounds produced by Actinoplanes missouriensis. It enhances propionic acid production without reducing total volatile fatty acid production. Two studies were conducted to determine the most effective dosage for promoting increased weight gain by grazing steers.

Procedure

Experiment A

In experiment A, 32 yearling Hereford steers with an initial weight of 506 lbs were used to evaluate the effect of free choice feeding a loose mineral mixture containing 0, 2, 3 and 4 mg of actaplanin per gm. Steers were blocked by weight and assigned randomly to the four actaplanin treatments. Eight steers were assigned to each of four 10-acre brome pastures. Cattle were rotated between pastures every seven days. Mineral was fed free choice in wind vane mineral feeders and weighed weekly to determine mineral and actaplanin intake. The mineral mixture was the only source of supplemental mineral offered. All animals were fed 2 lb of corn per head daily during the entire 119 day trial (April 8 - August 5, 1981). Initial and final weights were the average of two nonshrunk weights taken on consecutive days.

Experiment B

In experiment B, 81 yearling Angus steers with an initial weight of 533 lbs were used to evaluate actaplanin at levels of 0, 600, 900 and 1200 mg in one pound of corn supplement per head fed twice weekly (average mg/head/day dosages of 0, 171, 257 and 343, respectively). Steers were blocked by weight, assigned

[1] Actaplanin is an experimental feed additive produced by Eli Lilly and Co., Indianapolis, IN which provided the feed additive and partial financial assistance.

[2] Research Animal Scientist, Southeast Kansas Branch Experiment Station, Parsons, KS.

randomly to one of the four treatments and allotted to nine 10-acre smooth bromegrass pastures with nine steers per pasture. The block of light-weight cattle contained two control groups and one group for each level of actaplanin. The heavy-weight block had one group assigned to each treatment. Steers were rotated between pastures within a block at 14-day intervals and fed the supplements on Mondays and Thursdays. Supplemental feed was provided uniformly to all cattle when availability of high quality forage declined. Initial and final steer weights were the average of two nonshrunk weights taken on consecutive days. The 112 day trial was initiated on April 7, 1982 and terminated on July 28, 1982.

Results

Experiment A

Results of experiment A are presented in Table 27.1. All levels of actaplanin improved performance over the controls. Largest gain increases were with 3 and 4 mg of actaplanin per g of mineral. Actaplanin intake of 144 mg daily resulted in a 13.1% (26 lb) increase ($P<.10$) in gain over the control group; intakes of 255 mg and 353 mg increased ($P<.01$) gain 23.2% (46 lb) and 19.6% (39 lb), respectively. There was no significant difference ($P>.10$) in performance among the three actaplanin levels. In this study, 255 mg of actaplanin per head daily appeared most effective.

Table 27.1. Effect of Actaplanin in Loose Mineral on Grazing Steer Performance (119 days)

	Actaplanin Concentration (mg/g of mineral)			
Item	0	2	3	4
No. of steers	8	8	8	8
Initial wt., lb	506	510	506	503
Final wt., lb	706	736	752	742
Total gain, lb	200	226	246	239
Avg. daily gain, lb	1.68^{ac}	1.90^{b}	2.07^{bd}	2.01^{bd}
Avg. mineral intake, g/hd/day	66.8	72.0	84.9	88.2
Avg. actaplanin intake, mg/hd/day	0	144	255	353

^{a,b}Means with different superscripts differ significantly ($P<.10$).

^{c,d}Means with different superscripts differ significantly ($P<.01$).

Experiment B

Results of experiment B are shown in Table 27.2. Average daily actaplanin intakes were 0, 171, 257 and 343 mg per head daily. Cattle receiving actaplanin gained faster than controls. Actaplanin intakes of 171 mg and 257 mg resulted in 12.6% (25 lb) and 12.0% (24 lb) improvements (P<.01) in gain, respectively, over controls. Consumption of 343 mg of actaplanin per head daily improved (P<.10) gain 5.7% (11 lb) over the control group, but resulted in lower gain than the 171 mg (P<.10) and 257 mg (P<.05) per day treatments. The most effective doses of actaplanin were 171 and 257 mg per head daily.

Table 27.2. Effect of Feeding Actaplanin Twice Weekly on Grazing Steer Performance (112 days)

	Actaplanin Concentration (mg/lb of supplement)			
Item	0	600	900	1200
No. of steers	27	18	18	18
Initial wt., lb	526	538	537	535
Final wt., lb	722	759	757	742
Total gain, lb	196	221	220	207
Avg. daily gain, lb	1.75[ac]	1.97[d]	1.96[f]	1.85[eg]
Avg. actaplanin intake, mg/hd/day	0	171	257	343

[a,b]Means with different superscripts differ significantly (P<.01).

[c,d,e]Means with different superscripts differ significantly (P<.10).

[f,g]Means with different superscripts differ significantly (P<.05).

Effects of Bovatec, Oxytetracycline (OTC), Bovatec Plus OTC and Rumensin-Tylan Combination on Feedlot Performance and Liver Abscess Control in Finishing Steers[1]

Bob Lee[2] and Scott Laudert[3]

Summary

Adding Bovatec, OTC, Bovatec plus OTC or Rumensin-Tylan to finishing steer diets did not significantly improve average daily gain in the 133 day feeding period, but did improve ($P<.05$) feed to gain ratios. The Rumensin-Tylan combination was the only treatment that reduced ($P<.05$) liver abscess incidence.

Introduction

Currently, Rumensin-Tylan is the only ionophore/antibiotic combination cleared by the FDA for use in beef feedlot diets. The FDA restriction on combination drug use has caused some producers to discontinue antibiotic feeding for liver abscess reduction. This study was designed to see if feeding an antibiotic (OTC) alone or alternately with Bovatec would reduce liver abscesses and what effect alternating these drugs would have on live animal performance.

Experimental Procedure

One hundred and sixty Charolais-Angus crossbred steers were allocated by initial weight to five treatments: 1) Control; 2) Bovatec (30 g/ton, 90% dry matter basis); 3) Oxytetracycline (OTC, 1g/hd/day, 3 days out of 28 days); 4) Bovatec plus OTC; and 5) Rumensin-Tylan (25g and 10g/ton, respectively, 90% dry matter basis). In the Bovatec plus OTC treatment, Bovatec was removed from the feed for the three days per month that OTC was fed. Treatments were replicated, with four pens of eight steers per treatment.

Cattle were vaccinated with IBR, BVD, leptospirosis and 7-way clostridium, wormed with injectable Tramisol and implanted. Individual full beginning weights were shrunk 4% and 133 day ending weights were calculated from carcass weights adjusted to a 64% dressing percent. All steers were full fed a diet which contained the following ingredients on a dry matter basis: 56% rolled high moisture corn, 26.5% dry rolled milo, 6.2% corn silage, 2.2% ground alfalfa hay, 4.1% blended feeding fat and 5% supplement that contained minerals, vitamins, protein and the appropriate treatment drug. Carcass characteristics and liver abscess incidence and severity were evaluated at slaughter.

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[1] Study conducted at the Garden City Experiment Station. Bovatec and partial financial assistance were provided by Hoffman-LaRoche, Inc., Nutley, NJ. Rumensin-Tylan was provided by Elanco Products Co., Indianapolis, IN.

[2] Animal Research Scientist, Garden City Experiment Station.

[3] Extension Livestock Specialist, Southwest Kansas.

Results and Discussion

Performance and carcass data are presented in Table 28.1. All feed additives except OTC alone reduced ($P<.05$) dry matter intake over the entire trial. All treatments improved ($P<.05$) feed to gain ratios as compared to controls. No differences in rate of gain were detected during any time period among the treatments.

Table 28.2 shows the liver abscess data. Only the treatment containing Tylan showed a significant reduction in liver abscesses. Both the Bovatec and Bovatec + OTC treatments had a higher ($P<.05$) liver abscess incidence than controls.

Daily gain was not significantly ($P>.05$) affected by liver abscess condition, averaging 3.24 lb with no abscesses, 3.17 lb with small abscesses, 3.16 lb with large abscesses, 3.13 lb. with open abscesses.

Table 28.1. Feedlot Performance of Steers on Five Feed Additive Treatments

Item	Control	Bovatec	OTC	Bovatec+ OTC	Rumensin+ Tylan
Initial wt., lb	700	700	703	690	704
Final wt., lb	1164	1172	1172	1130	1154
Quality grade	Gd+	Gd+	Gd+	Gd+	Gd+
Yield grade	2.16	2.12	2.10	2.04	2.12
			Day 0-35		
Daily gain, lb[d]	3.83	3.68	3.79	3.76	3.90
Dry matter intake, lb	22.91^{a}	20.93^{b}	21.19^{b}	20.78^{b}	20.23^{b}
Feed/gain	5.98^{a}	5.69^{ab}	5.59^{b}	5.53^{b}	5.19^{b}
			Day 0-63		
Daily gain, lb[d]	3.83	3.77	3.70	3.54	3.75
Dry matter intake, lb	22.56^{a}	20.48^{b}	20.47^{b}	20.36^{b}	20.10^{b}
Feed/gain	5.89^{a}	5.43^{ab}	5.53^{ab}	5.75^{a}	5.36^{b}
			Day 63-133		
Daily gain, lb[d]	3.06	3.05	3.53	3.17	3.04
Dry matter intake, lb	24.00^{a}	22.63^{ab}	23.48^{a}	21.47^{b}	21.12^{b}
Feed/gain	7.84^{a}	7.42^{ab}	6.65^{b}	6.67^{b}	6.95^{b}
			Day 0-133		
Daily gain, lb[d]	3.42	3.49	3.53	3.31	3.39
Dry matter intake, lb	23.32^{a}	21.61^{bc}	22.06^{ab}	20.94^{c}	20.63^{c}
Feed/gain	6.82^{a}	6.19^{b}	6.25^{b}	6.33^{b}	6.09^{b}

[abc]Means in the same row with different superscripts differ significantly ($P<.05$).
[d]No significant differences ($P>.10$).

Table 28.2. Liver Data of Cattle on Five Feed Additive Treatments

Liver scores	Control	Bovatec	OTC	Bovatec+ OTC	Rumensin+ Tylan
	Number of head/treatment				
0 = Normal	26	18	24	20	30
1 = Small abscess	2	0	1	1	0
2 = Large abscess	1	9	2	4	1
3 = Open abscess	2	5	4	7	1
4 = Other condemnation	1[d]	0	1[e]	0	0
% Condemned livers	19%[b]	44%[a]	25%[b]	38%[a]	6%[c]

[abc] Means with different superscripts differ significantly ($P<.05$).
[d] Condemned because offal dropped onto slaughter floor.
[e] Condemned because of telang (parasite).

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Proper Implanting Technique

Implanting is one of the most profitable management tools available to cattlemen, typically returning $10 to $15 for each $1 invested. While implanting is easy, proper technique - especially implant site and cleanliness - is important to assure maximum implant performance and retention.

Proper implant site depends on the product used. Ralgro should be implanted into the small pocket of fat and muscle at the base of the ear. In contrast, Synovex, STEER-oid and Compudose should be deposited between the skin and underlying cartilage in the middle third of the back of the ear between the grooves.

Cleanliness is important to prevent infection with all types of implants. While washing ears isn't practical, simply wiping off the implant needle between animals with a sponge dampened with disinfectant, and rubbing off extremely dirty ears with a wet rag will minimize the risk of infection. Keeping the needle sharp and free of burrs will also help prevent hair and dirt from contaminating the wound site.

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KSU

Relationship of Cow Weight, Cow Condition and Dosage of Prostaglandin on Synchronized Heat[1]

Danny Simms[2] and Larry Corah

Summary

Simmental cows on two Kansas ranches received either 2 or 3 ml injections of the prostaglandin cloprostenol (Estrumate)[3]. Dose level had little effect on response rate in either small or large cows. However, for each unit increase in body condition score, 12% more cows expressed heat.

Introduction

Since the introduction of prostaglandin synchronization products, many cattlemen have expressed concern that the recommended dosage of these products is inadequate for large cows. This experiment was conducted to find if increasing the dose to 1.5 times the recommended level would increase the percentage of cows synchronized.

Experimental Procedure

High percentage Simmental cows, approximately 60 days postpartum, on two Kansas ranches were weighed at the start of the breeding season and assigned to either 2 ml (500 mcg) or 3 ml (750 mcg) of the prostaglandin cloprostenol (Estrumate). At the start of each trial, the cows were also condition scored using a 9 point scale, where 1=extremely thin, 5=average, and 9=extremely fat.

In Trial 1, a 2-injection synchronization system was employed, with only those cows failing to exhibit heat after the first injection receiving the 2nd injection. In Trial 2, all cows were palpated rectally for ovarian activity. Only cows with a corpus luteum were injected. However, 12 days later, the remaining non-responding cows were started on the same 2-injection program used in Trial 1. Exhibition of heat within 5 days of treatment was considered a positive response.

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[1]Appreciation is expressed to Cliff and Leon Houghton, Tipton, KS and Allen Worcester, Hill City, KS for providing cattle and collecting data; to Kenneth Fromm, Mitchell County Extension Agricultural Agent for his assistance; to Dr. Ken Odde, Colorado State University for assistance with palpation and to Bayvet Division of Cutter Laboratories for providing Estrumate for this trial.

[2]Extension Livestock Specialist, Northwest Kansas.

[3]Estrumate is a brand name for cloprostenol sodium at 250 mcg/ml.

Results and Discussion

Table 29.1 shows the number of cows in each weight group, and the percent exhibiting heat following treatment. The 3 ml dose was only slightly more effective than 2 ml. The heavy cows had slightly higher percentage showing heat. Thus, the recommended dosage appears adequate even for large cows.

Table 29.2 shows the number exhibiting heat within each weight and body condition group. On the average, for each unit increase in condition score, 12% more cows showed heat. This agrees with other research and confirms that cows should be condition score 5 or better for satisfactory reproduction.

Table 29.1. Percent of Cow Showing Heat by Weight and Estrumate Dosage Level

Cow Weight, lb	2 ml Dose		3 ml Dose	
	No. Cows	% Heat	No. Cows	% Heat
1285 to 1560	18	80.3	21	82.1
1175 to 1280	40	66.9	35	69.4
1060 to 1165	38	54.4	38	61.3
940 to 1055	20	67.4	21	73.8
Average	116	65.5	115	69.6

Table 29.2. Percent of Cows Showing Heat by Weight and Condition Score

Cow weight, lb	Condition Score			
	4	5	6	7
1285 to 1560	(0) -	(25) 84.0	(14) 85.6	(0) -
1175 to 1280	(7) 71.0	(49) 65.2	(17) 77.1	(1) 100.0
1060 to 1165	(11) 28.4	(55) 59.6	(10) 70.0	(0) -
940 to 1055	(7) 43.4	(31) 74.2	(3) 65.6	(0) -
Average	(25) 44.5	(160) 67.9	(44) 77.4	

Numbers in parentheses indicate the number of animals in each group.

Effect of Insecticide Impregnated Ear Tags on Horn Fly Populations and Suckling Calf Performance[1]

Danny Simms[2], Todd Willman[3]
and Robert Schalles

Summary

Three trials were conducted to determine the effect of insecticide impregnated ear tags on horn fly counts and weight gain of suckling calves. In trials 1 and 2, cow calf pairs on two Kansas ranches were assigned to these treatments: 1) Control - no tag, 2) Cows Only - 1 tag per cow, 3) Calf Only - 1 tag per calf, and 4) Cow and Calf - 1 tag each. Each tag treatment was in a separate pasture.

All insecticide tag treatments reduced ($P<.05$) horn flies on cows and calves in July and August; however, by September the tags were only reducing ($P<.05$) flies on cows. While the weight gain response to tags was variable, when trials were combined, all tag treatments increased ($P<.05$) calf gains over controls. Using a single tag per cow was better ($P<.05$) than a single tag per calf, while tagging both the cow and calf was no better than either single tag treatment. Average fly counts for each pasture were negatively correlated with calf weight gains indicating a strong relationship between fly populations and calf performance.

In trial 3, apparent horn fly resistance to the insecticide in the tags resulted in terminating the trial mid-summer. Research in Kansas and other states indicates that horn fly resistance to pyrethroid insecticides is becoming a common problem which means that producers may need to revert to previously used methods of horn fly control.

Introduction

Insecticide impregnated ear tags have been widely adopted in the beef cattle industry for horn fly control; however, many producers still question whether it is better to apply the tag to the cow, the calf, or to both. Furthermore, most ear tag research has measured the reduction in horn fly numbers without monitoring calf weight gain responses. Our trials were initiated to determine the effect of various insecticide tag treatments on horn fly numbers as well as pre-weaning daily gain in calves.

[1]Appreciation is expressed to Vernon Isaac, Edson; Gano Farms, Hill City and Bob Dickinson, Gorham for their cooperation in providing cattle and assisting with data collection, and to Diamond Shamrock Corporation, Cleveland, OH and Anchor Laboratories, St. Joseph, MO for providing ear tags for these trials.
[2]Extension Livestock Specialist, Northwest Kansas.
[3]Sherman County Extension Agricultural Agent.

Experimental Procedure

In trials 1 and 2, cow/calf pairs on two Kansas ranches were assigned randomly to the following treatments in separate pastures: 1) Control - no tag, 2) Cows Only - one tag per cow, 3) Calves only - one tag per calf, and 4) Cows and Calves - one tag each. Pastures were of similar type (upland, short grass) and stocked at a similar rate. Individual, non-shrunk calf weights were taken at the start of each trial (April 18 and May 2, 1983 for trials 1 and 2, respectively) and at weaning. Fenvalerate (Ectrin®) impregnated tags were used in trial 1 and permethrin (Permectrin Ear Tag®) impregnated tags were used in trial 2. Horn flies were counted monthly on 10 cows and 10 calves in each treatment, starting in July. Least Squares Means procedures were used to analyze the fly count and calf gain data, with adjustment for effect of calf sex on average daily gain.

In trial 3, cow/calf pairs were assigned randomly to either one fenvalerate (Ectrin®) impregnated tag per cow, or one permethrin (Permectrin Ear Tag®) tag per cow. The trial was initiated on May 21, 1983.

Results and Discussion

Table 30.1 shows the average horn fly counts per month on both cows and calves in trials 1 and 2. All treatments gave almost total horn fly control on cows and calves in the middle of July; however, by the middle of August control had dropped to about 78% on both cows and calves in the single tag treatments. By mid-September, hornfly control dropped even further on all treatments, with the Cows Only tag treatment giving the best control (about 50%) of horn flies on the calves.

Applying a single tag to the cow gave slightly better horn fly control than placing the tag on the calf. Two tags per pair (Cow + Calf) gave only slightly better horn fly control than either single tag treatment. Based on these data, a single fly tag in either the cow or calf, or tagging both cow and calf, will give good fly control for most of the grazing season.

All tag treatments increased ($P<.05$) average daily gain over control (Table 30.2). In addition, tagging cows only increased ($P<.05$) calf gains 5.1% over simply tagging calves. Thus, even though cows are harder to tag, the extra calf gain may pay for the extra effort.

Trial 3, which was initially designed to compare 2 brands of tags, was dropped in mid-July since it appeared that neither tag was giving adequate fly control. Unfortunately, a control group wasn't included in this trial to serve as a baseline. However, research at the Ft. Hays Experiment Station located in the same area as this trial has indicated that horn flies have developed resistance to the pyrethroid insecticides. Confirmed cases of resistance to pyrethroid insecticides have been reported from several areas nation wide. If widespread horn fly insecticide resistance develops, much of the benefit shown in Trials 1 and 2 will be negated.

The data in Table 30.3 show a strong negative relationship between average fly counts and calf performance.

Table 30.1. Effect of Insecticide Impregnated Ear Tag Treatments on Monthly Horn Fly Populations - Average of Trials 1 and 2.

Ear tag treatment	Least Squares Means, avg. no. horn flies					
	July		August		September	
	No.	% control	No.	% control	No.	% control
Per Cow						
Control	147^{a}	—	422^{a}	—	489^{a}	—
Cows Only	3^{b}	98	44^{b}	90	210^{b}	57
Calves Only	12^{b}	92	91^{c}	78	200^{b}	59
Cows + Calves	1^{b}	99	2^{b}	100	236^{b}	52
Per Calf						
Control	25^{a}	—	98^{a}	—	156^{a}	—
Cows Only	0^{b}	100	18^{b}	79	52^{b}	67
Calves Only	2^{b}	92	21^{b}	79	116^{a}	26
Cows + Calves	0^{b}	100	0^{b}	100	147^{a}	6

[abc]Values in the same column and data set with different superscripts differ significantly (P<.05).

Table 30.2. Effect of Horn Fly Control on Performance of Calves in Trials 1 and 2

Ear tag treatment	No. pastures	No. calves	Least Squares Means: Daily gain, lb	Least Squares Means: % Improvement over control
Control-no tags	2	46	1.98^{c}	—
Cows Only	3	72	2.17^{a}	9.6%
Calves Only	4	99	2.07^{b}	4.5%
Cows + Calves	2	44	2.12^{ab}	7.1%

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

Table 30.3. Relationship Between Monthly Cow and Calf Horn Fly Counts and Calf Performance

Month-Animal	Simple Correlations Between Calf Average Daily Gain and Average Horn Fly Counts
July-Cow	-.45
July-Calf	-.11
August-Cow	-.69*
August-Calf	-.72*
September-Cow	-.73*
September-Calf	-.81

*Values are statistically significant (P<.05).

Kansas Steer Futurities - The Record on Retained Ownership 1974-1983[1]

Chuck Lambert, Danny Simms,[2] Bob Schalles, Larry Corah,
Gerry Kuhl and Mike Sands

Summary

Spring born steer calves, weaned and delivered to custom feedlots by Kansas producers, were fed to slaughter weight. Gain and carcass information was gathered on over 5,000 head fed in 53 separate tests since the fall of 1974.

Retaining ownership of steers through the feedlot phase has been profitable for producers in six of the last nine years, and in only two years have losses been large. Those same calves, if sold at weaning, would have been profitable in only three of the last nine years, using Kansas Farm Management Association average costs of production.

The cattle averaged 59 percent USDA Choice and 98.3 percent USDA Yield Grade 3 or trimmer carcasses. Death loss averaged 1.2 percent over the nine years.

Breed groups with the ability to gain rapidly and grade USDA Choice were most profitable. There was an $86.63 difference in profit and a .7 lb per day difference in gain from the low to high gaining breed groups.

Profit increased as yearling hip height and rib eye area increased while carcass quality grade and fat thickness decreased. Profitability leveled out when yearling hip height exceeded 47 inches, rib eye area exceeded 13.5 sq. in. and quality grade went below 50 percent Choice.

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[1]Sincere appreciation is expressed to all County Extension Agriculture Agents and packing plant personnel who have helped gather performance and carcass information and to the Kansas Livestock Association for co-sponsoring the Kansas Steer Futurity. Special thanks are extended to the following coordinators and feedlots who have conducted these tests over the past nine years:

Kansas Steer Futurity - Gene Francis - Ottawa County Feeders, Minneapolis; Pratt Feedlot, Pratt; S & H Feedlot, Ellinwood and Oswalt/Arnett Feedlot, Garden City.

Northwest Futurities - Danny Simms - Ellis County Feeders, Hays; Riverside, Penokee; Tri-State Feeders, St. Francis and Pioneer Feedlot, Oakley.

Southwest Futurity - Scott Laudert - Clark County Feedyard, Ashland.

Smith/Jewell County Futurities - Bill Wood and Wilbur Dunavan - Headrick Feedyard, Jewell and Lehmann Feedyard, Gaylord.

Lincoln County and Guaranty State Bank Futurities - Milton Krainbill and Doug Johnson - Solomon Valley Feedlot, Beloit.

[2]Extension Livestock Specialist, Northwest Kansas.

Introduction

The Kansas steer futurity program is a concept where producers can test calves for gain and profitability through the feedlot phase. It was implemented at two Kansas locations in the fall of 1974. Since then, the Extension-sponsored program has been expanded to several test sites throughout Kansas.

The goal is to give producers an opportunity to evaluate cattle for post-weaning gain and carcass characteristics. Purebred cattle breeders can identify superior lines by testing sire progeny groups, and commercial cattlemen can compare different breeds and crosses. Both purebred and commercial producers can also test, on a limited basis, the profitability of retaining ownership from birth through the feedlot.

Procedure

Fifty-three futurities involving over 5,000 spring-born steer calves have been held since 1974. Calves were weaned and delivered to futurity test sites, usually during November. Nearly all tests were held at commercial custom feedlots, with consignors' cattle fed together in one or two pens. Cattle were weighed on arrival and processed according to the individual feedlot's management program.

Most futurities allowed a two- or three-week warm-up period to equalize predelivery management effects. Cattle were then individually weighed for an official test starting weight and fed to slaughter weight on typical rations used by the feedlot. At some tests, after about 100 days on feed, cattle were weighed and hip height measured.

Producers consigning cattle received rate of gain and carcass information at the end of the test. Producers were billed directly by the feedlot for feed, medical and yardage costs and were paid directly by the packer on a carcass value basis. With those figures, producers could tabulate cost per pound of gain and profit per head, based on their individual costs of producing calves to feedlot delivery time.

Futurity cattle were marketed when management of the test felt they were of acceptable weight and fat thickness. To allow for differences in maturity patterns of various breeds and types of cattle, there were normally two or three slaughter dates for each test. Normal selling time was May through June when cattle were approximately 15 months old.

For this summarization, individual breeds were grouped using the U.S. Meat Animal Research Center classification for mature size and growth rate. Breeds classified into each grouping were:

Large Continentals (LC) - Beef Friesian, Charolais, Chianina, Maine Anjou, Marchigiana and Simmental.

Medium Continentals (MC) - Gelbvieh, Blonde D-Aquitaine and Beef Brown Swiss.

Small Continentals (SC) - Limousin, Pinzgauer, Salers, South Devon and Tarentaise.

British - Angus, Red Angus, Hereford, Polled Hereford and Shorthorn.

Cattle with 75 percent or more of any one breed were considered purebred. Crosses of breeds within each group were considered to be of that same grouping (for instance, Angus X Hereford were British, Simmental X Charolais were LC). Crosses of breeds from different groups were given separate classifications (for instance, Charolais X Angus were LC X British). Cattle with Brahman breeding were grouped into a separate catagory called Brahman crosses. This group included Santa Gertrudis, Brangus, Beef Master and Brahman sires crossed on Charolais, Simmental, British and crossbred cows. Longhorn crosses were left as a separate category.

Cattle also were divided by frame score without regard to breed designation. Frame scores were calculated from hip height measurements. Frame 1 cattle were 37 to 39 in. tall at one year of age and each increment in frame score was equal to an increase of 2 in. in hip height.

Differences due to test location and year were eliminated statistically.

Results

Table 31.1. shows the "typical" steer fed through the Kansas futurity program during the last nine years. Overall average daily gain including the warm-up period was very near to the average daily gain on test. Compensatory gain was not a large factor in cattle of this age and weight. There may be large differences in performance in the early stages of the feeding period, but they did not have a large impact on overall growth rates.

When these tests were started, there was some concern that cattle fed to slaughter weight at a relatively young age would not have sufficient marbling to grade USDA Choice. Quality grade was recorded on 4,411 steers. Of those, 2,593 (59 percent) graded USDA Choice, and 13 (.2 percent) graded USDA Prime. Percent Choice ranged from 41.6 percent in 1975 to 69.4 percent in 1977. In three of the four years that futurity cattle did not grade 60 percent Choice (1975, 1978 and 1979), per head profits were $85 or more. While cattle of this type have potential to grade 60 percent Choice, 98.3 percent also produced Yield Grade 3 or trimmer carcasses.

Another producer concern during the early years of these tests was death loss from feeding calves in commercial feedlots. In the nine years of these tests, 52 calves (1.15%) died and another 24 head (0.5%) were removed and salvaged. The total removal rate of 1.65% compares with rates normally experienced by custom feedlots.

Table 31.2 shows large fluctuations in cattle prices, interest rates and cow carrying costs over the nine years Kansas futurities have been held. Values for steer calves at feedlot delivery time have ranged from less than $150 per head in the "wreck of '74" to over $500 per head in the fall of 1979. Records from the Kansas Farm Management Association are used to average the cost of producing the calf to feedlot delivery time.

In 1978-79 and 1979-80 steer calf values were over $400 per head at delivery time, and annual cow costs were less than $300; net returns at weaning were $100 per head or more. In 1980-81 steer calf values were nearly $450 per head, but annual cow costs had jumped tto $350, and net return dropped to $21 per head. The cow-calf producer has shown positive returns at weaning time in only three of the last nine years.

Interest rates on feeder cattle loans have nearly tripled over the last nine years. In 1974-75, with steer calf values of less than $150 per head and interest rates at 6.5 percent, the interest cost of owning the calf was 2.2 cents per day. In 1979 to 1981, with calf prices at $450 to $500 per head and interest rates in the 15 to 16 percent range, the per head interest cost was approximately 22 cents per head per day.

Economic data from the feedlot phase are incorporated with calf production costs in Table 31.3. In 1974-75, 1977-78 and 1981-82 positive returns from finishing steer calves more than made up for negative returns at weaning. In 1976-77 and 1982-83 small positive returns from finishing helped reduce larger negative returns at weaning. In 1975-76 a small loss during finishing increased an already large negative return at weaning. Large positive returns from retained ownership in 1978-79 increased the even larger positive returns at weaning. Only in 1979-80 and 1980-81 did retaining ownership actually cause a large decrease in positive returns available at weaning.

Producers selling calves at weaning would have lost money in six out of the last nine years. Those retaining ownership of steer calves through the feedlot phase in Kansas Steer futurities experienced positive returns in six of the last nine years. Only in two years (1979-80 and 1980-81) were losses large due to retained ownership.

BREED COMPARISONS

This was not a scientifically designed test to determine the value of various breeds. Rather, the results represent the averages for selected cattle consigned by various producers over the nine years of the steer futurity program. A performance summary of the 26 breeds and crosses evaluated can be obtained by contacting Animal Science Extension, Weber Hall, KSU, Manhattan, KS 66502.

More important than ranking individual breeds is identifying the traits making some breeds more profitable. The more profitable cattle were generally crossbreds, and cattle with relatively heavier starting weights — an indication of pre-weaning gain ability of the calf and milking ability of its dam. A combination of heavy starting weight, continued gain after arrival at the feedlot, and relatively high dressing percentage was reflected as heavier carcass weights. A 20 pound increase in carcass weight produced $17 more in profit per head.

The ability of breeds to grade USDA Choice and gain rapidly was economically important. Premiums for USDA Choice over Good grade cattle were reflected in the profitability formula because actual carcass grade prices were used in determining the final values.

Five traits separated the five most profitable beef breeds from the five least profitable ones: 1) The top five had starting weights of 625 lbs or more; the bottom five weighed 585 lbs or less. 2) Average daily gain for the five most profitable was 3.0 lbs or more; the five least profitable averaged less than 3.0 lbs per day. Profit increased an average of $2.80 per head for each .1 lb increase in average daily gain. 3) Carcass weights for the five most profitable breeds were 708 lbs or more and for the bottom five were 649 lbs or less. 4) Quality grades were similar for the top and bottom five breeds in profitability. 5) Four of the five least profitable breeds had over .4 inch backfat while only one out of five of the most profitable breeds exceeded .4 inch. Profit differed $86.63 and average daily gain over .7 lb/day from the low to high beef breed.

Because futurity cattle were sold on a carcass basis, dressing percentage was an important profitability factor. A 1 lb increase in carcass weight resulted in a $.85 increase in profit. A 1.5 percent increase in dressing percent from a steer weighing 1,150 lbs would yield 17.25 lbs more carcass or an increase of $14.66 profit per head.

Table 31.4 compares breed groups combined using the MARC classification of breeds by mature size and growth rate. Larger frame breed groups had heavier starting and carcass weights, larger ribeye areas, faster average daily gains and were more profitable. As frame size increased, fat thickness and quality grade decreased. All breed groups averaged USDA Yield Grade 2 — an indication that cattle were being marketed at a common end point by test managers. British cattle showed more external fat in spite of the shortest time on feed.

Faster gaining cattle were generally more profitable. However, other factors combine to influence profitability. Small Continentals (SC) posted a 3 lb average daily gain, and had the largest ribeye areas and trimmest yield grade. But they also had the lowest quality grade, which resulted in the lowest profitability. A combination of 3.17 lb gain per day and an average quality grade of 6.9 (90% USDA Choice - or better) in the MC X British cattle was the most profitable among breed groups.

Cattle also were divided by frame score without regard to breed designation as shown in Table 31.5. As frame score increased from 1 to 8, starting weight increased from 496 to 752 pounds, average daily gain increased from 2.58 lbs to 3.50 lbs per day, ribeye area increased from 11.9 sq. in. to 14.3 sq. in. and carcass weight increased from 571 to 801 pounds. Increased hip height or frame score also is associated with decreased fat thickness, a leaner USDA yield grade, and a corresponding decrease in USDA quality grade.

Differences in dressing percentage among individual breeds were not reflected by frame score categories. However, the fatter, smaller-framed cattle showed slightly higher dressing percentages than the larger-framed, trimmer cattle.

There appears to be a diminishing return for frame sizes above 6 (yearling hip heights above 47 to 49 inches). Average daily gain and ribeye area increase as frame size increases above 6, but profit does not increase accordingly. Quality grade also decreased below 50% USDA Choice as frame size increased above 6, and increased gain did not compensate for the decreased quality grade.

Muscling of the cattle as indicated by ribeye area was nearly 3 times (r = .32) more highly correlated to average daily gain than to frame score (r = .13). Based on steers fed through the Kansas Futurities, profit potential reaches a plateau when cattle reach 47 inches tall at the hip at one year of age or when rib-eye reaches 13.5 sq. in.

Table 31.1: Average Results of the Steer Futurities in Kansas

Birth date	Feedlot delivery date	Delivery weight	Warmup period	Weight on feed	Days on feed	Daily gain on test	Selling date
Feb. 23	Nov. 7	585 lbs	17 days	636 lbs	167	3.08 lbs	June 1

Selling weight	Dressing percent	Carcass weight	Overall daily gain	Rib eye area	Percent kidney knob	Yield grade	Quality grade[1]
1148 lbs	61.0	699 lbs	3.06 lbs	12.78 sq. in.	2.7	2.48	6.53

[1] 6 = high Good; 7 = low Choice.

Table 31.2. Annual Economic Data Pertaining to Retained Ownership vs. Sale of Calves at Weaning

Year	Actual weight at delivery	Price/cwt. at delivery (November)	Value at delivery	Estimated[1] annual cash costs of cow ownership	Estimated[2] returns for calves sold at delivery Date	Returns minus annual cow costs	Interest[3] Rate	Interest Cost (feeder)
1974-75	524	$27.70	$145.15	$221.67	$124.10	-$97.57	6.5%	$4.83
1975-76	552	37.44	206.67	223.96	168.32	-55.65	8.0	8.88
1976-77	583	37.37	217.87	228.85	176.93	-51.92	8.8	9.72
1977-78	589	40.95	241.20	221.52	201.20	-20.32	8.9	11.29
1978-79	590	69.45	409.76	244.21	342.35	98.14	10.1	21.77
1979-80	573	88.18	505.27	296.07	416.57	120.50	14.7	39.00
1980-81	576	77.14	444.33	348.93	370.70	21.77	16.6	37.18
1981-82	605	64.35	389.32	345.27	327.04	-18.23	17.2	31.00
1982-83	598	64.85	387.80	345.31	321.58	-23.73	14.3	27.35

[1]Based on average costs from Kansas Farm Management Association records. Feed costs were calculated at market rates. Interest charges assumed a 60 percent debt on operating expenses and livestock. Interest on breeding stock was calculated on the estimated cow value + 16 percent of replacement heifer value + 4 percent of estimated bull value. Costs did not include a charge for operator labor, depreciation on buildings or equipment or a return on the 40 percent investment equity.

[2]Returns were based on a 92 percent calf crop. Therefore, sales included 46 percent of a steer calf; 30 percent of a heifer calf (16 percent held for replacement), cull cow sales of 14 percent per year and a 2 percent death loss.

[3]From Federal Reserve Bank of Kansas City, average interest rates on feeder calf loans, first two quarters of each year, Kansas City area.

Table 31.3. Average Annual Costs and Returns From Retained Ownership of Futurity Steers

Year	Feedlot costs	Feedlot costs plus interest	On farm[1] weaning period	Total feeding costs	Return[2] at slaughter	Returns minus annual cow costs	Return[3] from feeding	Total lifetime return
1974-75	237.59	242.42	9.22	251.64	525.75	-97.57	128.96	31.39
1975-76	215.56	224.44	8.15	232.59	432.35	-55.65	-6.91	-62.55
1976-77	208.16	217.88	8.40	226.28	450.15	-51.92	6.00	-45.92
1977-78	213.21	224.50	8.35	232.85	591.58	-20.32	117.53	97.21
1978-79	224.34	246.11	9.15	255.26	753.74	98.14	88.72	186.86
1979-80	239.08	278.08	10.45	288.53	710.96	120.50	-82.85	37.66
1980-81	320.86	358.04	14.12	372.16	737.80	21.77	-78.69	-56.92
1981-82	255.33	286.33	12.43	298.76	808.95	-18.23	120.87	102.64
1982-83	301.59	328.94	13.22	342.16	739.24	-23.73	9.28	-14.45
				Weighted means		- 3.00	33.66	30.66

[1]Costs for on-farm weaning expenses calculated at one half the average daily feedlot cost of cattle on feed, for 14 days.

[2]Return at slaughter = Carcass price x Carcass weight, adjusted for death loss (average 1.15 percent).

[3]Return from feeding = Return at slaughter - Total feeding cost - Value at delivery.

Table 31.4. Peformance of Futurity Steers Catagorized by Breed Groups

Item	British	Small Continentals X British	Smaller Continentals	Medium Continentals X British	Large Continentals X British	Large Continentals	Brahman X's	Longhorn X's
No. steers	969	268	32	70	1748	921	159	79
Profit, $	54.67	67.68	37.86	87.59	69.12	71.45	59.82	49.58
Starting weight, lb	594	595	561	631	633	647	633	541
Frame score	3.9	3.9	4.7	4.2	4.9	5.4	5.1	3.3
Average daily gain, lb	2.82	3.03	3.00	3.17	3.10	3.17	2.97	2.47
Quality grade[1]	6.8	6.8	6.0	6.9	6.6	6.2	6.5	7.0
Carcass weight, lb	646	677	659	723	709	731	696	603
Dressing percent	61.2	61.2	61.3	61.9	61.3	61.2	61.0	61.4
Fat thickness, in.	.50	.36	.30	.41	.36	.30	.39	.32
Ribeye area, sq. in.	11.9	13.0	13.6	13.2	12.9	13.4	12.6	11.7
Yield grade	2.82	2.31	2.02	2.44	2.38	2.17	2.61	2.35
Days fed	164	171	173	172	171	174	172	176

[1]6 = USDA high Good; 7 = USDA low Choice.

Table 31.5. Effect of Frame Score on Steer Performance in Kansas Futurities

Item	FRAME SCORE 1	2	3	4	5	6	7	8
No. steers	22	127	305	526	593	483	203	56
Yearling hip height, in.	37-39	39-41	41-43	43-45	45-47	47-49	49-51	51-53
Profit, $	$53.29	61.50	61.46	65.43	75.73	82.51	85.57	84.86
Starting weight, lb	496	536	576	602	641	683	706	752
Average daily gain, lb	2.58	2.75	2.84	3.08	3.24	3.37	3.43	3.50
Quality grade[1]	7.3	7.2	7.0	6.8	6.7	6.5	6.4	6.1
Carcass weight, lb	571	605	634	672	716	757	777	801
Dressing percent	61.3	61.3	61.1	6.1	61.2	61.2	61.1	61.0
Fat thickness, in.	.42	.44	.44	.42	.39	.37	.32	.31
Ribeye area, sq. in.	11.9	11.9	12.1	12.8	13.4	13.7	13.9	14.3
Yield grade	2.5	2.6	2.6	2.5	2.4	2.4	2.2	2.2
Days fed	172	166	165	162	163	165	167	162

[1]6 = USDA high Good; 7 = USDA low Choice.

Performance and Profitability of Calves and Yearlings in Southeast Kansas Steer Futurities (Seven Year Summary)[1]

Chuck Lambert, Frank Brazle[2], Larry Corah, and Robert Schalles

Summary

Since the fall of 1976, 370 calves and 330 yearlings have been fed through the Southeast Kansas Steer Futurities. In four of the last seven years, both age categories have shown profits through the feedlot phase, using incoming market values assigned by professional market managers, actual feedlot performance and expenses, and slaughter value based on grade and yield data. Calves have been more profitable than yearlings in each of the seven years.

Yearlings averaged 123 pounds heavier and about 155 days older than calves at feedlot delivery time. The yearlings required 42 fewer days on feed, and gained .27 pounds per day faster through the feeding period with 8 percent more grading USDA Choice than calves. On the other hand, calves required 1.2 pounds less feed per pound of gain, were ready for market nearer the seasonal high prices and netted $29 per head more than yearlings. When the cost of ownership for an additional 155 days and cost of gain for an extra 123 pounds of weight is considered with the yearling cattle prior to the feedlot phase, calves become even more profitable. Larger framed cattle were more profitable within both calf and yearling divisions.

Introduction

Calving cows in the fall and growing cattle on summer pasture are common practices in Southeast Kansas. Thus, the steer futurity program in that area was expanded to include a division for yearling cattle, in addition to the spring-born calf feeding program practiced in other Kansas futurities.

Procedure

Producers enrolled in the Southeast Kansas Steer Futurity (Expo) delivered groups of five head of yearlings or weaned calves to a commercial feedlot in November of each year. Each group of five normally was sired by the same sire or breed of sire, and cattle within a group were in the same age category. An experienced cattle buyer or livestock auction manager placed an initial value on the cattle, based on current market price levels and cattle condition. Cattle were

[1]Appreciation is expressed to the Kansas Livestock Association for cosponsorship of the futurities, to Flint Hills Beef Feeders, Potwin, Circle E Feedlot, Potwin and Black Jack Cattle Co., Yates Center for feeding and management of the cattle, to Tom Orwig, Extension Livestock Specialist, South Central Kansas and area County Extension Agriculture Agents for assistance in organizing and collecting live and carcass data.

[2]Extension Livestock Specialist, Southeast Kansas.

processed using routine feedlot procedures. Extension personnel group weighed each consignment group for an official starting weight. Cattle were fed to slaughter on the feedlot's normal rations. When the lot management felt the cattle were of acceptable weight and fat thickness, they were sold to a packer on a grade and weight basis, and carcass traits measured. Feed, medical, yardage, and interest costs were recorded for each five-head group. A summary of growth rate, profitability, and carcass traits was provided to cooperating producers.

For this report, breeds and their crosses were combined using the Meat Animal Research Center classifications for mature frame size and growth rate. Cattle with 75 percent or more of any one breed were considered to be purebred. Hereford, Angus, Shorthorn, and all crosses between those breeds were classified as British. Purebred Limousin, South Devon, Tarentaise and Pinzgauer were classified as Smaller Continentals (SC). Purebred Gelbvieh and Brown Swiss were classified as medium Continentals (MC). Charolais, Marchigiana, Chianina, Simmental, Maine Anjou, and crosses among these breeds (Simmental x Charolais, for instance) were classified as Larger Continentals (LC).

All crossbred cattle containing any Brahman blood were grouped together for this report, including combinations of Brangus, Beefmaster, and Santa Gertrudis sires with British, Simmental, and crossbred cows. Two pens of MC x British calves were combined with the SC x British calves because frame sizes and average daily gains were similar. There were no MC X British yearlings.

Results

Since the first test began in the fall of 1976, 370 calves and 330 yearlings have been fed through the Southeast Kansas program. Using prices assigned at feedlot delivery time, actual feed, medicine, yardage and interest expenses, and actual grade and yield selling prices, feeding both yearlings and calves has been profitable in four of the last seven years. However, in every year, feeding calves has been a more profitable alternative than feeding yearlings (Table 32.1).

The price per hundredweight at delivery time has ranged from a low in 1977 around the mid $30's to a 1980 high of nearly $85 for calves and $75 for yearlings. The price spread between calves and yearlings has averaged $2 per cwt., except in 1980.

Calves averaged 123 pounds lighter than yearlings at delivery time. In recent years, weights have been heavier for both age categories than in earlier years. Average age of calves at delivery time was 235 days, while average age of yearlings was 390 days. Ownership and maintenance costs for an additional 155 days and cost of gain for an additional 123 pounds would need to be added to the lifetime cost of producing yearling cattle to slaughter, as compared to feeding calves to slaughter.

Eight percent more yearling cattle than calves graded USDA Choice. Part of this difference can be explained by the fact that yearling cattle averaged 17.6 months of age at slaughter while calves averaged 13.9 months. Even with a higher percentage grading Choice, average selling price for yearlings was $2.64 per hundredweight less. Actual selling prices were used, so any premium for USDA

Choice cattle over USDA Good cattle was reflected in the selling price. Part of this difference can be explained by seasonal price trends. Slaughter prices show a strong tendency to set yearly highs in May or June. Average time on feed from mid-November delivery for yearlings was 140 days, this placing slaughter time in late March or early April — before seasonal price peaks were reached. Average time on feed for calves was 182 days, placing their slaughter time in mid-May near the normal price peak.

Slaughter weights and carcass characteristics might have been influenced by the subjective visual assessment used to determine when cattle were ready for market. Yearling cattle were 52 pounds heavier at slaughter and 33 pounds heavier on the rail. Dressing percent, yield grade, and fat thickness over the ribeye were nearly the same for both age categories. Yearlings had .4 square inch larger ribeyes, while the younger cattle were 1.6 inches taller at the hip at 12 months of age (1 unit differences in frame score equals 2 inches).

Average daily gain of yearling cattle was .27 pounds per day faster than calves. However, calves required 1.2 pounds less feed per pound of gain. Heavier starting weight and greater weight to maintain through the feeding period were factors in the poorer feed conversion of yearlings. Likewise, a 42-day shorter yearling feeding period was a factor in their higher average daily gain, because growth of cattle tends to slow as they fatten. Average medical costs were similar for the two age categories.

Table 32.2 shows the performance of various breed groups combined according to the MARC classification for frame size and growth rate.

Many of the relationships between calves and yearlings discussed earlier held true when cattle were divided by size based on breeding. Calves were approximately 2 inches taller at one year of age, were valued higher per cwt., and required less feed per pound of gain than yearlings within each breed group designation. Yearlings weighed more at delivery time, required fewer days on feed to slaughter, and gained more per day than calves. British, Smaller frame Continental, and Brahman-cross yearlings graded a higher percentage Choice than calves. This trend did not exist with the Larger framed Continental cattle.

For breed categories other than the Smaller Continentals x British, calves were more profitable than yearlings. When Brahman cattle are excluded, average daily gain of yearling cattle appears to be more consistent regardless of frame designation than calves.

Larger framed yearlings returned $8.23 more per head through the feeding period than British yearlings. Larger framed calves were valued $20-50 more at the start of the feeding period, they grew faster, yielded trimmer carcasses, and netted about $20 more profit per head than British calves.

Table 32.1. Annual Comparisons - Southeast Kansas Steer Futurities

Year	Price/Cwt at Feedlot Delivery		Feedlot Delivery Weight		Feeding Period Profit	
	Calves	Yearlings	Calves	Yearlings	Calves	Yearling
1977	$35.67	$33.59	512	663	-10.86	$-31.78
1978	40.52	38.35	504	681	129.69	34.39
1979	67.02	65.41	549	607	104.62	89.89
1980	84.87	74.73	518	667	-84.71	-44.82
1981	72.97	70.90	570	645	-59.97	-61.87
1982	62.56	61.29	580	701	125.71	64.25
1983	63.86	61.00	594	729	66.56	19.29

Year	Selling Price/cwt.		Percent USDA Choice		Final Live Weight	
	Calves	Yearlings	Calves	Yearlings	Calves	Yearlings
1977	$37.93	36.02	59.4	64.6	951	1053
1978	53.48	45.65	47.4	50.7	1031	1030
1979	67.30	65.53	63.0	57.8	1013	1046
1980	63.85	64.88	41.6	55.7	957	1058
1981	63.68	62.78	38.5	77.1	991	1057
1982	71.08	66.80	33.2	34.3	1088	1073
1983	68.40	65.56	52.0	50.2	1034	1113

*Interest costs on delivery value included.

Table 32.2. Group Breed Comparisons—Southeast Kansas Steer Futurities

Item	British	Smaller Continentals x British	Larger Continentals x British	Large Continentals	All Brahman Crosses
			Calves		
Number of cattle	80	35	105	65	60
Frame size	3.6	4.7	5.3	5.4	4.4
Delivery weight	499	575	575	607	533
Delivery price/cwt	$63.77	61.52	60.65	61.13	61.86
Delivery value	$318.21	353.74	348.75	371.06	329.71
Final weight	926	1009	1056	1117	1005
Final price/cwt	$61.11	60.17	60.85	61.12	61.09
Carcass weight	579	639	659	691	626
Dressing percent	62.4	63.3	62.3	61.8	62.2
Days fed	177	179	174	179	183
Feed/lb, gain	9.2	10.3	9.5	9.6	9.1
Avg. daily gain	2.42	2.42	2.79	2.85	2.59
Percent Choice	59	22	60.4	47.3	50.3
Ribeye area	10.5	12.7	12.3	12.4	11.5
Fat thickness	.45	.33	.32	.27	.41
Yield grade	2.47	2.25	2.09	2.08	2.41
Medical Expense	$7.85	21.59	3.39	7.07	5.80
Feeding period profit	$53.73	19.65	72.63	76.44	71.79
			Yearlings		
Number of cattle	80	30	85	55	35
Frame size	2.6	3.8	4.2	4.8	3.8
Delivery weight	634	686	704	736	701
Delivery price/cwt	$59.13	58.62	56.91	56.95	57.74
Delivery value	$374.88	402.13	400.65	419.15	404.76
Final weight	1006	1032	1083	1170	1026
Final price/cwt	$57.59	58.41	58.10	58.47	59.02
Carcass weight	623	648	676	723	638
Dressing percent	61.9	62.8	62.4	61.8	62.1
Days fed	132	127	136	145	128
Feed/lb. gain	10.1	11.1	10.8	10.8	11.3
Avg. daily gain	2.81	2.75	2.79	3.00	2.56
Percent Choice	77	48	57.6	43.9	60.4
Ribeye area	11.6	12.8	12.3	12.8	11.3
Fat thickness	.45	.30	.32	.28	.38
Yield grade	2.54	2.42	2.11	1.99	2.39
Medical Expense	$5.73	3.89	3.62	2.92	5.01
Feeding period profit	26.49	26.83	32.33	34.72	25.41

KSU

Medication Programs for Newly Received Calves

Dirk Axe, Jack Riley and Mark Spire[1]

Summary

Three medication programs for newly purchased feeder calves were compared and found to be similar in effectiveness. There was considerable variation in cost between the three medication programs which indicates a potential cost saving opportunity. Twenty-three percent of the calves received were diagnosed as sick at least once during the 56-day trial.

Introduction

Stress associated with marketing and shipping often results in newly received calves requiring intensive animal health programs to reduce mortality and morbidity. In this trial, we compared the effectiveness and relative costs of three medication programs.

Procedures

A fifty-six day trial with 250 steer calves was conducted (October 13, 1983 to December 8, 1983) to evaluate three medication programs. Calves averaged 455 lbs when purchased from one auction in South Dakota and were received at KSU Beef Research Unit with an in-transit shrink of 4.2%.

Upon arrival, all calves had temperatures recorded, were ear tagged, wormed, vaccinated for IBR, PI_3 BVD, and clostridial (7-way), injected with Vitamin A & D, and poured with Warbex®. Calves were assigned randomly to either treatment schedule A, B, C or a non-treated control (Table 33.1). Each treatment represented a three day medication program to be administered after a calf was observed as sick and had a temperature of 104°F or above. Calves that did not respond to the initial treatment were placed on schedule D (Table 33.1) for three additional days. A control group of calves was not treated during the 14 day period following arrival and was not included in the comparative cost figures.

Results

Table 33.2 shows an economic comparison of processing and medication costs. Twenty-three percent of the calves received were diagnosed as sick at least once during the 56-day trial. Treatment schedule A was the most economical with schedule C being the most expensive. All three medication programs were considered effective when compared to untreated controls. Schedule A had a slightly higher number of treatment days per calf diagnosed as sick.

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[1]Department of Surgery and Medicine

Table 33.3 compares arrival temperature and its relationship to subsequent sickness. Although based on limited numbers of sick calves, there was a trend toward more sickness as body temperature at arrival increased. Arrival temperatures also were plotted against processing order. Temperature increased 1° F during the 5 hour processing period whether or not steers were sick. This agrees with other research, and supports the need to adjust the minimum temperature required for medication, depending on how long cattle have been held in the working area.

Table 33.1. Treatment Schedules (Medications were given at labeled dosages).

Schedule A

Day 1 - Oxytetracycline (LA 200®)
Triple sulfa boluses
Dexamethasone
B-complex vitamins
Day 2 - Triple sulfa boluses
Day 3 - Triple sulfa boluses

Schedule B

Day 1 - Tylan®
Triple sulfa boluses
Dexamethasone
B-complex vitamins
Day 2 - Tylan®
Day 3 - Triple sulfa boluses

Schedule C

Day 1 - Amoxicillin
Triple sulfa boluses
Dexamethasone
B-complex vitamins
Day 2 - Amoxicillin
Triple sulfa boluses
Day 3 - Amoxicillin
Triple sulfa boluses

Schedule D

Day 4 - Erythromycin
Day 5 - Erythromycin
Day 6 - Erythromycin

Table 33.2. Cost Comparison of Three Medication Programs.[1]

	Treatment Schedule		
Item	A	B	C
No. steers treated	9	10	14
Daily medication cost/steer[2] diagnosed as sick	$1.63	$2.69	$3.02
Days treated/steer diagnosed as sick[3]	3.7	3.3	3.3

[1]Product costs at processing were $1.47 per steer.

[2]Costs based upon current local prices and subject to change.

[3]Schedule D was used for non responsive steers after the initial 3 day treatment.

Table 33.3. Relationship of Arrival Temperature and Incidence of Sickness.

Item	Arrival Temperature					
	<101°F		101-102.9°F		>103°F	
	No.	%	No.	%	No.	%
Calves arriving within temperature range	77	30.8[1]	152	60.8[1]	21	8.4[1]
Calves which became sick	16	20.8[2]	34	22.[2]	9	42.9[2]

[1]Represents percentage of total steers purchased.

[2]Represents percentage of calves within that temperature range that became sick.

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Nutrition and Management for New Cattle

No plan for handling newly arrived cattle is complete without adequate facilities and a good feeding program to get cattle off to a good start. Minimizing stress is critical, and includes working the cattle quietly and gently, and providing a good pen environment relatively free of dust or mud. Keep the receiving pens rather small, with plenty of bunk space and running water to incourage intake. Hold fresh cattle off water for 2 to 4 hours, however, and provide a familiar feed such as high quality grass hay so they will eat rather than tank up on water. Limit the amount of fermented feeds used until cattle become accustomed to them. Increase the ration energy level over the first week with grain and/or silage. Supplement the ration with ample amounts of protein, vitamins and minerals. An "all natural" protein source (no urea) works best. Recent research has also shown that potassium supplementation (1 to 1.5% of the ration dry matter) will increase performance and reduce sickness.

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Feeding Bulls - A Practical Evaluation[1]

Danny Simms[2], Larry Corah, Gerry Kuhl
and Robert Schalles

Summary

Bull calves on nine Kansas ranches were either castrated and implanted with Ralgro, left intact and not implanted, or left intact and implanted with Ralgro, with performance evaluated through slaughter. Bulls produced leaner carcasses and gained slightly faster and more efficiently than steers. However, based on actual prices received, bulls returned $16.09 less to their owners than steers. Implanting with Ralgro during the suckling phase did not influence any of the traits measured. It is evident that marketing is a major problem which makes bull feeding risky.

Introduction

Feeding intact males takes advantage of their faster gain and greater efficiency compared to steers. This field trial was conducted to evaluate bull feeding as a practical option for commercial cattlemen. Since implanting during the suckling phase retards sexual development in bulls, a Ralgro treatment was included to determine its effect on bull performance and carcass desirability.

Experimental Procedure

Fifteen bull calves from each of nine ranches were assigned randomly at branding (2-3 mo of age) to three treatments: 1) castrated and implanted with 36 mg Ralgro, 2) left intact and not implanted, and 3) left intact and implanted with 36 mg Ralgro. Most of the calves were Simmental crossbreds with a few Charolais and Limousin crosses. Individual, non-shrunk weights were taken at branding and weaning. Following weaning, the calves were entered in the Ellis County Steer Futurity in late November. On arrival at the feedlot, all steers and bulls were implanted with 36 mg Ralgro and weighed. All bulls, regardless of initial treatment, were penned together. Steer calves were assigned to one of two pens based on weight. Both bulls and steers were re-implanted with 36 mg Ralgro mid-way through the feeding period. The feeding program was the same for both the steers and bulls; both groups were on full feed approximately 7 weeks after arrival in the feedlot.

[1]Appreciation is expressed to Ruthven, Inc., Russell; David Popp, Hoxie; O'Brien Ranch, St. Francis; Joe Thielen, Dorrance; Arden Cronn, Wakeeney; Gano Farms, Hill City; Taylor Bemis, Hays; Tom Keller, St. Francis and Bill Greving, Prairie View for their cooperation in providing cattle and collecting pre-weaning data, and to County Extension Agricultural Agents Ross Nelson, Ellis; Del Jepsen, Russell; Jack Stroade, Rooks; John Robison, Ness and Tox Maxwell, Trego for their help in weighing cattle and collecting carcass data.

[2]Extension Livestock Specialist, Northwest Kansas.

The steers were slaughtered in two groups (170 and 184 days on feed) and the bulls in one group (194 days on feed) with the goal of attaining the same carcass backfat in all treatments. All animals were sold on a grade and yield basis. Carcass data were collected in a commercial packing plant following a 24-hr chill. Steer feedlot costs and feed conversion values were based on an average of the two steer pens. Since both the steers and bulls in this study were fed in pens with animals not involved in the experiment, the feed conversion data is subject to some error.

Results and Discussion

Table 34.1 shows the performance of the treatment groups from birth through slaughter.

Table 34.1. Comparative Performance of Bulls vs. Steers

Item	Steers Implanted from Branding to Slaughter	Bulls Implanted from Weaning to Slaughter	Bulls Implanted from Branding to Slaughter
No. head, branding to weaning	47	32	44
Wt. per day of age to weaning, lbs	2.13	2.13	2.12
No. head delivered to feedlot	37	26	39
Feedlot ADG (arrival to slaughter), lbs	3.28	3.32	3.36
On test ADG, lbs	3.24	3.30	3.36
ADG from branding to slaughter, lbs	2.42	2.54	2.52
Average days on feed	177	194	194
Feed/gain, lb[a]	7.10	6.85	6.85
Vet. and hospital charges, $/head	28.28	7.46	7.46
Death loss, %[a]	1.3	1.1	1.1

[a]Based on all 153 steers and 87 bulls on test.

Weight per day of age at weaning was the same for both steers and bulls. Bulls gained only slightly faster in the feedlot than steers. Consequently, from branding to slaughter, gain per day was only .09 lbs greater for the bulls. Preweaning implants had no influence on bull performance. Death losses were the same for bulls and steers; however, the veterinary and hospital charges were over $20 more for the steers. The bulls had a 3.5% better feed conversion.

Table 2 shows a comparison of the carcass traits for the bulls and steers.

Table 34.2. Comparison of Carcass Traits of Bulls vs. Steers

Item	Steers Implanted from Branding to Slaughter	Bulls Implanted from Weaning to Slaughter	Bulls Implanted from Branding to Slaughter
No. head	37	26	38
Quality grade:			
No. Choice (%)	25 (68)	2 (8)	6 (16)
No. Good (%)	12 (32)	20 (77)	26 (68)
No. Stag (%)	-	4 (15)	6 (16)
Avg. carcass wt., lbs	681[a]	737[b]	726[b]
Avg. rib fat, in.	.36[a]	.22[b]	.26[b]
Avg. rib eye area, sq. in.	13.4[a]	14.7[b]	14.6[b]
Avg. REA/cwt of carcass, sq. in.	1.97	1.99	2.01
Avg. yield grade	2.2[a]	1.4[b]	1.6[b]

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

Only 8 out of 64 (12.5%) bulls graded USDA Choice compared to 25 out of 37 (68%) steers. There was a tendency for a higher percentage of the bulls implanted during the suckling phase to grade Choice; however, about 16% of all bulls graded Stag. Bulls produced heavier carcasses as a result of an average 17 days longer on feed. Even with this longer feeding period, bull carcasses carried less backfat and had lower yield grades than steer carcasses. Rib eye areas were larger in bull carcasses; however, rib eye area per hundred lbs of carcass was the same in bulls and steers. No differences in any of the carcass traits existed between the two bull treatments.

Table 34.3 shows an economic analysis of this trial. Gross and net returns were calculated using the actual prices received at slaughter and also an average of the prices for the three slaughter dates, since the market dropped considerably following the first slaughter date. This drop in the market greatly reduced the profitability of the bulls since they were slaughtered last. Furthermore, the spread between Choice and Good grade carcasses widened following the first slaughter date.

Table 34.3. Economic Comparison of Bulls vs. Steers

Item	Steers Implanted from Branding to Slaughter	Bulls Implanted from Weaning to Slaughter	Bulls Implanted from Branding to Slaughter
Gross returns per head (actual market),[a] $/head	731.40	721.70	712.63
Gross return per head (average market),[b] $/head	723.85	752.02	742.46
Average feedlot cost, $/head	273.76	313.24	313.24
Net return (actual market),[a] $/head	457.64	408.46	399.39
Net return (average market),[b] $/head	450.09	438.78	429.22

[a] Returns based on actual prices received at slaughter.

[b] Returns based on average prices for the three slaughter dates.

Net return per head averaged $53.71 more for steers than bulls using the actual prices received; however, using average market prices, the advantage was only $16.09. Two major factors contributed to the lower profitability of the bulls. While most research has shown that bulls will gain substantially faster and more efficiently, the advantage to bulls in this trial was only 3 to 4%. Secondly, at the time of slaughter, the discounts from Choice grade for Good grade carcasses ($6/cwt) and for stags ($15/cwt) were relatively large.

In this trial, the primary difficulty in feeding intact males was marketing. The bulls were 15 to 17 months old at slaughter and had been fed a high energy ration for almost 200 days - a commonly recommended program for feeding intact males. Yet 16% still graded Stag. Packers would only purchase the bulls on a grade and yield basis, greatly increasing the marketing risk. Furthermore, packing plant personnel displayed bias against bulls. Thus, unless a market is arranged prior to feeding, or the packing industry demonstrates a willingness to accept young bull beef and pay a competitive price, it appears that the traditional program of feeding steers offers the greatest profit potential.

Feedlot Performance of Angus and Brahman x Angus Steers During Cold Weather

Stephen Boyles, Jack Riley and Ron Pope

Summary

Straightbred Angus steers gained .21 lb/day faster than Brahman x Angus steers during a 184-day winter feeding trial. Angus steers had a higher yield grade, more fat thickness at 12th rib, and graded 90% Choice. Brahman x Angus steers were 40 days younger at slaughter, had more carcass weight/day of age and larger loin eyes, but only graded 10% choice. There was no difference in feed efficiency.

Introduction

Previous research at other institutions has shown that using Brahman in a crossbreeding program may increase performance. However, before crossbreeding that includes Brahman can be recommended for cold regions, more research must be done to measure that cross' performance during winter. We also need to know the maximum acceptable level of Brahman breeding to withstand cold stress.

Procedure

Ten purebred Angus and 10 Brahman x Angus steers were purchased from the Kerr Foundation Ranch, Poteau, Oklahoma, for use in this trial. Angus averaged 502 lb (279 days of age) and Brahman x Angus 546 lb (239 days of age) when started on test. Steers were allotted by breed to alternate individual feeding pens in an open front building and fed an 85% concentrate finishing diet for 184 days (December 14, 1982 to June 15, 1983). Daily feed records were maintained and individual weights taken at 14-day intervals. Carcass weights, grades and measurements also were obtained for each steer.

Results

Results of the trial are summarized in Table 35.1. Brahman x Angus steers were 44 pound heavier and 40 days younger at the beginning of the trial but both groups weighed the same after 184 days on feed. Angus steers gained .21 lb/day faster. There was no differnce in feed efficiency. Angus steers had poorer yield grades, more fat at the 12th rib and graded 90% choice. Brahman x Angus steers had more carcass weight per day of age and larger loin eyes but only graded 10% choice.

Brahman x Angus carcasses were longer than Angus but the same depth at the first and fifth rib. Hair weight and diameter and hide thickness from the neck, side and rump were similar for both groups. Thus, the Brahman cross' poorer performance during winter was not due to differences in insulation.

Table 35.1. Feedlot Performance of Angus and Brahman x Angus Steers During Cold Weather.

Item	Angus	Brahman x Angus	
No.	10	10	
Initial wt, lb	502	546	
Final wt, lb	1112	1116	
Days on feed	184	184	
ADG, lb	3.32	3.11	(P=.15)
Feed to gain	6.3	6.2	(P=.76)
Hip height, in	46.0	50.9	(P=.0001)
Carcass wt lb	701	713	(P=.71)
Carcass wt/day of age, lb	1.43	1.58	(P=.16)
Dressing %	63.0	63.8	(P=.18)
Yield grade	4.03	2.98	(P=.02)
Fat thicknes, in	.67	.46	(P=.01)
Loin eye area, sq in	12.1	12.8	(P=.14)
No Choice	9	1	(P<.01)

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Weather Stress

The "Thermoneutral Zone" is a range of temperatures within which cattle are most efficient. Below the thermoneutral zone, they must spend energy to warm the body through shivering or changing their metabolic rate. Above the thermoneutral zone they must spend energy in an attempt to cool the body. But the thermoneutral zone changes with animal and weather conditions. A coat of winter hair acts as an insulator, and moves the bottom of the thermoneutral zone downward. Cattle fed in winter are more comfortable at a lower temperature than if they had their summer coat.

Wind effects cattle just like it does humans. Cattle have their own "wind chill index." A cold rain is especially rough on cattle because it destroys the insulation properties of hair. Combine cold rain with wind, and cattle may not be able to eat enough to meet their maintenance requirements.

Experiment Station scientists are studying weather and the way it influences cattle. Weather graphs, prepared by the Station climatologist, are shown in the final paper of this progress report.

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The Weather in 1982 and 1983

L. Dean Bark[1]

The 1983 weather in Kansas upset carefully laid plans and confounded the best management techniques. Yet the averages for 1982 and 1983 appear very similar. In Manhattan, the average temperatures were 54.04 F for 1982 and 54.06 F for 1983. Precipitation totals were 32.88 in. for 1982 and 35.74 in. for 1983. However, those who watched their crops dry up in the summer of 1983 after a delayed planting because of wet fields, and suffered with their livestock through heat stress in July and August and cold stress during December know differently. Neither our crops nor our livestock ever experience "average" weather. They experience the extremes of weather, and growth and gain are at the mercy of the variability. We can get a better picture of the last two years' weather by looking at the actual daily values and comparing them to the normal—or average—for that time of year. Figure 36.1 and 36.2 shows the 1982 and 1983 data for Manhattan.

Let's start by explaining the charts, drawn by the KSU computer using data from the extensive files of the Agricultural Experiment Station's Weather Data Library. First, notice the three smooth curves in each diagram. They represent the average conditions, based on 70 years of data. The top two curves show the average maximum and minimum temperatures. They reach a low point in mid-January and peak in mid-July. The lower smooth curve is the average accumulated precipitation. It starts at zero on January 1st and increases throughout the year. It climps slowly at first because little precipitation is received from January through March. The larger amounts of rain received from April through September (75-80% of our annual total) are shown by the steeply climbining curve. The curve levels out again as the winter dry season returns in October.

Using the average curves for comparison, we now can look at the actual daily temperatures. Note the low temperatures in January and early February of 1982 were followed by relatively warm temperatures from late February through April. Most of the rapidly fluctuating ups and downs are the usual day-to-day temperature variations that occur in a continental climate. In 1983, the 100 F temperatures in July and August are evident, as are the record breaking lows in December that almost drop off the chart.

The cumulative precipitation curves are even more interesting. Although both years end with about the same total, the way it was received was quite different. A horizontal line is a dry period and a vertical jump means precipitation on that day. The many small rains in 1982 kept the accumulated total near average all year. In 1983, the heavy rains through June and again in October and November were separated by a devastating dry period.

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[1]Climatologist, Kansas Agricultural Experiment Station

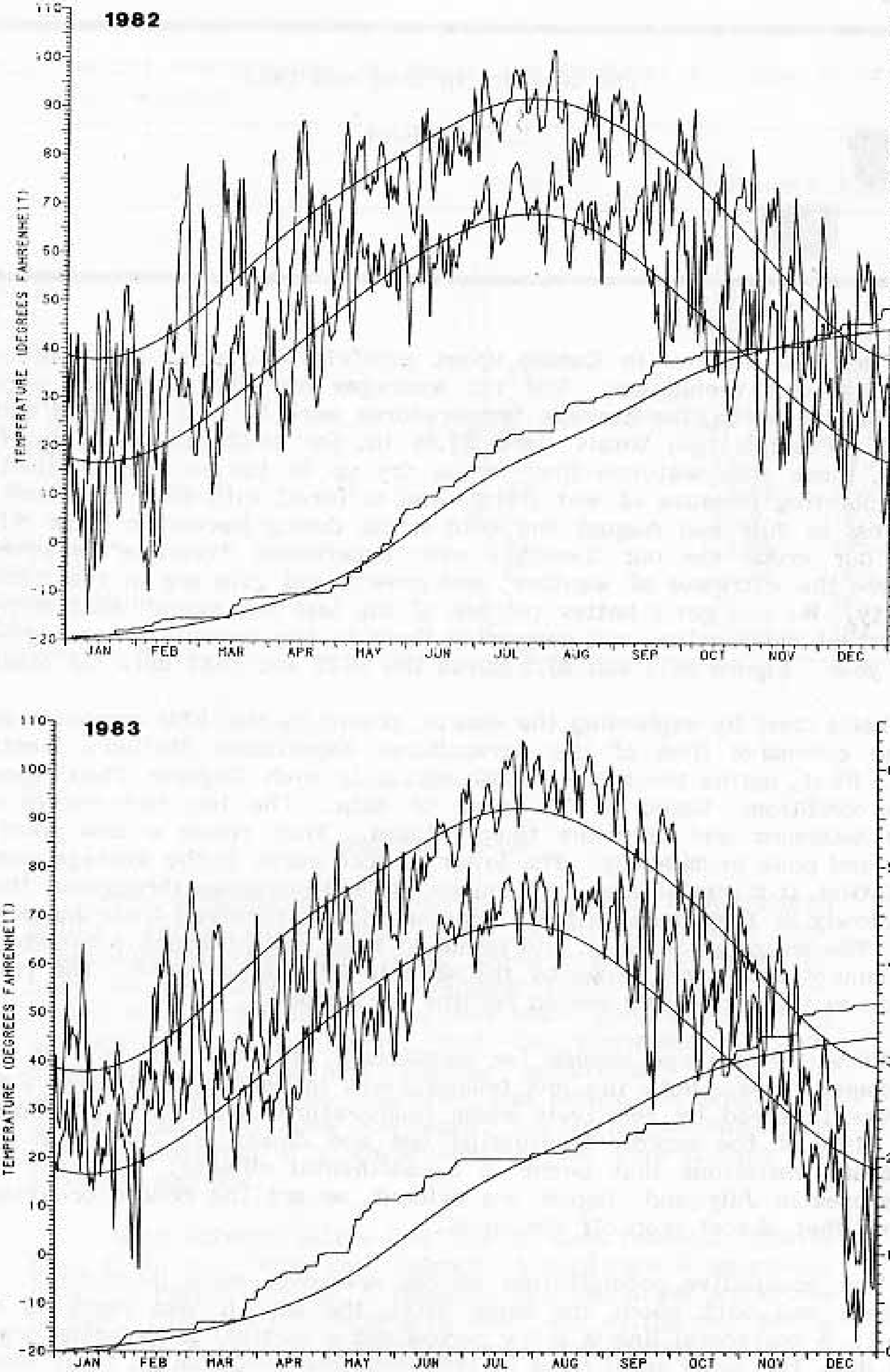

Figure 36.1. 1982 and 1983 temperature and precipitation for Manhattan, Kansas. Kansas Agricultural Experiment Station Weather Data Library.

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Agrimerica Inc.	Northbrook, Illinois
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American Cyanamid Company	Princeton, New Jersey
A.O. Smith harvestore Products, Inc.	Arlington Heights, Illinois
Bayvet Div., Cutler Labs, Inc.	Shawnee, Kansas
Cadco, Inc.	Des Moines, Iowa
Church & Dwight Company, Inc.	Piscataway, New Jersey
Diamond Shamrock	Cleveland, Ohio
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Excel Corporation	Wichita, Kansas
Fourth National Bank	Wichita, Kansas
Harneds	Wichita, Kansas
Hoffman-LaRoche	Nutley, New Jersey
Roman L. Hruska U.S. Meat Animal Research Center	Clay Center, Nebraska
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International Stock Food, Inc.	Waverly, New York
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The Upjohn Company	Kalamazoo, Michigan

The Livestock and Meat Industry Council

Dear Friends:

The Livestock and Meat Industry Council, Inc., is a unique way to promote the growth and development of the livestock and meat industry. The ultimate objective of the Council is to establish an endowment fund of several million dollars, the income from which will be allocated annually to help support animal and meat science research and related activities. Support will be unrestricted as to project location. Interdisciplinary research will be encouraged.

Everyone has a stake in the growth and improvement of the livestock and meat industry. That is a message Kansans and concerned citizens throughout the United States should heed and do something about. Here are some reasons why:

1. Animal products are important for adequate human nutrition.

2. The livestock and meat industry is NUMBER ONE in Kansas and every dollar of its sales generates at least five dollars of economic activity elsewhere. Thus, our industry is the largest single contributor to the strength and the development of the total Kansas economy.

3. Kansas resources—climate, soil, crops and people—are superbly suited to make livestock and meat even more dominant.

4. Animal and meat science research, teaching and extension programs are the principle means by which we can assure the future of our industry. Current and prospective state and federal funds have to be supplemented with substantial voluntary contributions to insure adequate support for the programs we need.

5. The Livestock and Meat Industry Council, Inc., provides a unique way to pool voluntary, tax deductible contributions, large and small, to support animal and meat science research and realted educational activities.

For 1983-84, President of the LMIC is Scott Chandler, Vice President is Linton Lull, Fred Germann is Secretary, Orville Burtis, Jr. is Treasurer and Gene Watson is the Immediate Past President. Other directors are Earl C. Brookover, Charles N. Cooley, Henry Gardiner, Walter M. Lewis, W. C. Oltjen, A. G. Pickett and Wayne Rogler.

The LMIC needs your help to make sure research and teaching can continue at the level your industry deserves. Every contributor is a member and every gift to the LMIC also counts as a gift to the KSU Foundation.

Sincerely,

Calvin L. Drake

Calvin L. Drake, Executive Vice President
Livestock and Meat Industry Council
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Report of Progress 448 March 1984

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