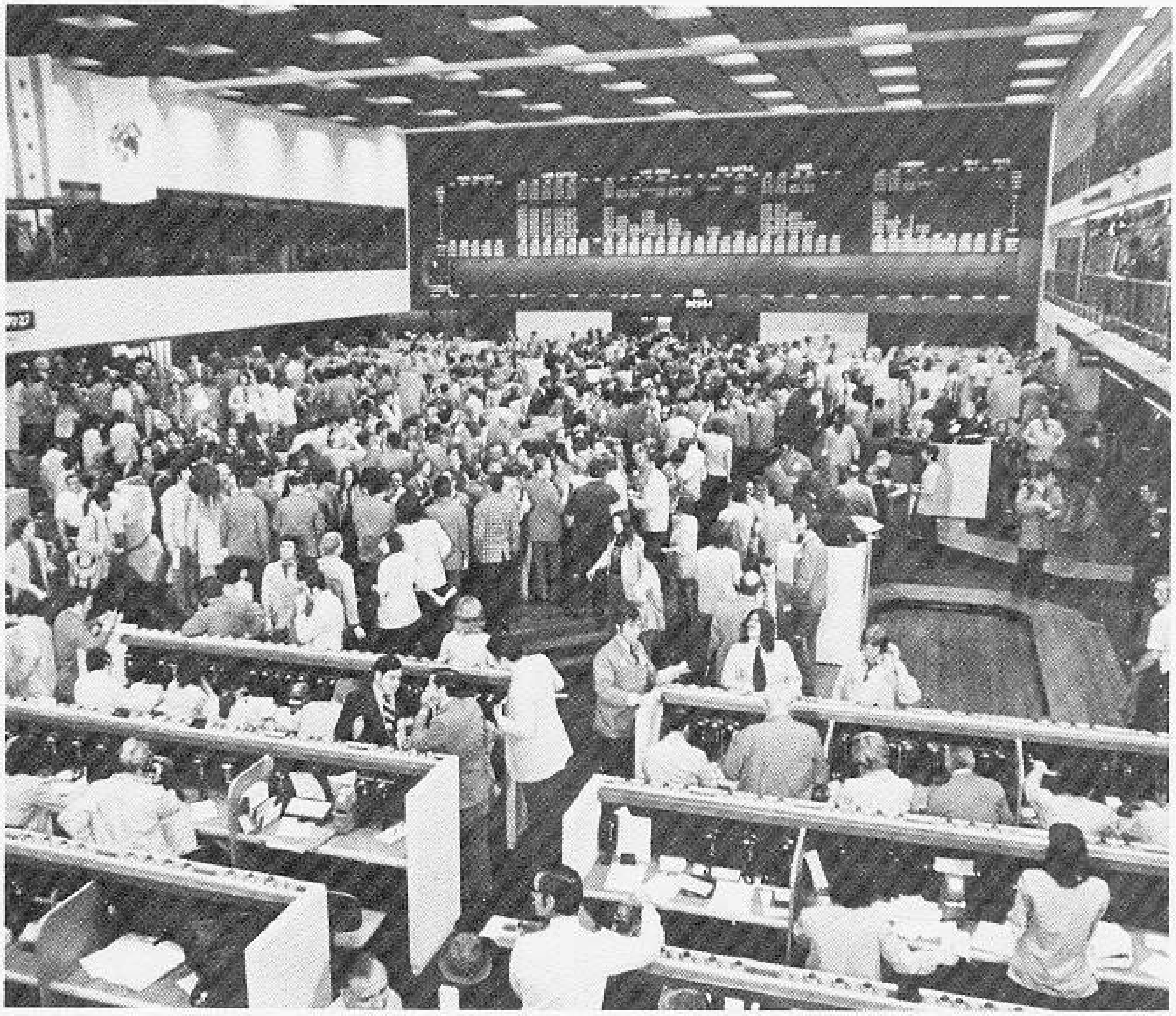
Report of Progress 413

March 5, 1982



CATTLEMEN'S DAY '82

Agricultural Experiment Station

Kansas State University, Manhattan

John O. Dunbar, Director

C O N T E N T S

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 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 will report a correlation between two traits. Correlations are a measure of the relationship between traits. The relationship may be positive (both traits tend to get bigger or small together) or negative (as one trait gets bigger, the other gets smaller). A perfect correlation is one (+1 or -1). If there is no relationship, the correlation is zero.

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

Many animals per treatment, replicating treatments several times, and using uniform animals increases the probability of showing the real differences resulting from treatments. The 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.

KSU

Fed Cattle Market Is Guardedly Optimistic, Says K-State's Sands

Returns to cattle feeders should move back into the profit column during most of 1982, but feeding margins will remain narrow, says Mike Sands, extension economist specializing in livestock marketing at K-State.

"Most of the improvement in profitability compared with last year will result from lower feed and feeder prices, rather than a dramatic rise in fed cattle prices," he points out.

With Choice steer prices expected to average in the $64-66 cwt. range during January-June, feeding returns should average on the positive side, in sharp contrast to the average $95-per-head losses suffered during the first half of 1981, Sands believes.

Total commercial cattle slaughter reached 34.9 million head in 1981, about 3% larger than a year earlier. Although fed cattle marketings dropped about 1% from 1980 levels, the decline was more than offset by a 14% rise in nonfed steer and heifer and cow slaughter.

"Certainly, the lack of growth in consumers' inflation-adjusted incomes during the past year has contributed to the dismal economic performance of the cattle industry," Sands comments. "But, perhaps more importantly, total red meat and poultry supplies climbed to a record 53.1 billion lbs. in 1981, about 1.5% more than the year-earlier record.

Cattle Inventory Down

The inventory of cattle on feed in the 23 major feeding states on Jan. 1 totaled 10.1 million head, down 9% from a year earlier and the lowest for that date since 1975. Most of the decline came on both lighter-weight steers and heifers, which reflected a large drop in summer and fall placements.

Sands expects first-quarter fed cattle marketings to be down 1% from a year earlier, as indicated by Jan. 1 marketing intentions. "Considering the severe winter weather, marketings could turn out somewhat smaller than intentions," he adds. However, larger nonfed cattle slaughter is likely to push total slaughter slightly above last year.

April-June marketings of fed cattle will probably be down 4-6% from 1981 levels, a substantially smaller decline than suggested by the inventory of lighter weight cattle on feed on Jan. 1. Sands says nonfed cattle slaughter will probably total about the same as a year ago.

Editor's Note: This series of articles is from the "Spring Insight '82" program conducted by Extension Economists at KSU.

"After dipping below year-earlier levels in the April-June quarter, commercial beef output will probably resume its upward trend in the second half of the year. Total beef production is expected to rise about 1% during 1982, following a 3% rise in 1981," the economist observes.

After breaking below the $60 cwt. mark in December, Choice steer prices in Southwest Kansas rebounded to around $63 by late January. Further declines in both beef and pork supplies during April-June should provide further support for fed cattle prices.

"On a quarterly basis, expect Choice steers to average $65-68 cwt. during the second quarter," the livestock marketing specialist says.

Cyclically declining pork production and a stronger economy are likely to offset part of the negative impact of larger beef supplies during the last half of 1982. Still, he says, Choice steer prices are likely to trade mainly in the lower $60's during the third quarter and even lower during the fourth quarter of this year.

"For the year, Choice steer prices should average around $63-65, but will trade in a range from the upper $50's to the upper $60's," Sands concludes.

Feeder Cattle Prices Will Depend On What Happens in Market for Feds

Several factors will continue to influence feeder cattle prices in the year ahead. Bearing on these prices will be: (1) the profitability of cattle feeding, (2) feed and interest costs; and (3) the available supply of feeder cattle, says Sands.

"In spite of sharp declines in feed costs during the last half of 1981, more rapid declines in fed cattle prices resulted in continued losses for most cattle feeders," he observes. "Consequently, many cattle feeders have been increasingly reluctant bidders on feedlot replacements and feeder prices have weakened relative to fed cattle prices."

Feeder steers weighing 600-700 lbs. have trended lower at Kansas City since late last summer, declining to around $57 cwt. in early January, compared with the upper $60's last summer and the lower $70's a year earlier.

Sands points out that an increasing cow inventory and larger feeder supplies have put additional pressure on feeder prices. Choice yearling steer prices have traded at or below fed steer prices during much of 1981.

"A return to positive feeding margins will be necessary to provide support for feeder prices," he adds.

At the same time, total feeder cattle supplies on Jan. 1 were estimated at about 2% larger than a year earlier. This increase in feeder numbers, particularly the 5% larger yearlings supplies outside feedlots on Jan. 1, coupled with high interest rates, will partially offset the positive price impacts of lower feed costs and improved feeding margins this spring, the specialist notes.

Sands forecasts Choice 600-700-lb. feeder steer prices will move into the mid-$60's cwt. this spring as fed cattle prices strengthen. He believes feeder prices may move into the upper $60's for short periods in the late spring before slipping to the lower $60's cwt. in the second half of 1982.

"Prices for 400-500-lb. steer calves should follow a similar pattern," he observes, "rising from the lower $60's this winter to the lower $70's this spring. Grass demand, interest rates and feed prices will heavily influence price direction this summer."

He adds that current conditions suggest stocker prices could retreat into the upper $60's this summer and to the mid-$60's this fall.

"Steer calves have continued to sell at prices above fed cattle, but the premium has narrowed to about $2-4, compared with $13-15 a year ago," he says.

Abundant feed grain and protein supplies will probably prevent any dramatic rise in feeding costs during the year ahead, he adds. Corn and milo prices this winter were nearly $1 a bu. lower than a year ago in many areas.

High Interest Hurts

"Historically high interest rates will continue to have negative effects on feeder prices, with backgrounders and cow-calf operators feeling the major impact because they have capital tied up for longer times."

Although interest rates will probably resume their modest downtrend this spring from current levels of 17-18%, no major drop is likely, Sands believes. Consequently, continued high interest rates will keep on dampening feeders' enthusiasm and at least partially offset the effect of lower feed costs on cattle feeding breakeven prices.

Recent declines in feeder prices and falling feed costs have pushed projected average breakevens to the lower $60's cwt. for the first time in more than two years, making profit prospects for cattle feeders appear more favorable for the late winter and spring months, the economist says.

KSU

Little Things Mean a Lot In Managing Beef Cattle

Survival in the beef cattle business for the next year or so will depend on doing little things well, says Don Pretzer, extension farm management specialist at Kansas State.

"Doing enough little things right will add up to big differences in profitability, no matter whether you're a cow-calf operator, a backgrounder or a cattle finisher." He offers some interesting ideas for cattle ranchers.

Cow-calf Operations

The economist says cow herd costs are running around $375 per cow-calf unit per year. This includes $178 for feed, including pasture for 15% replacements, 15% interest on the value of the cow ($450) and $32 a year for labor.

"A 92% calf crop with steer sale weights averaging 475 lbs. and heifers at 425 lbs. indicates the producer needs $98 cwt. for his steers and $92 cwt. for heifers to cover all of his costs," the economist notes. Current prices of $67 and $61, respectively, show a full-cost loss of $101 per cow-calf unit."

The specialist says survival strategy warrants looking only at cash costs, including rented grass. On a cash cost budget, the breakevens are at $70 and $64 cwt., resulting in a $9-per-unit loss per year.

"How can we improve on the above?" Pretzer asks. "For average and below-average quality herds, selling all calves and buying replacement heifers or mature cows should help."

The cost of a 425-lb. heifer at weaning is $350. Adding another $290 for pasture and winter feed during the growing phase pushes production costs for replacement heifers up to $640 apiece. Cash costs alone for producing replacement heifers average $518.

"Retaining ownership of calves is another possibility for increasing gross income," says the economist. "Tax considerations become important when shifting income from one year to the next. Retained ownership also entails longer-term financing, but does allow flexibility for using grass, allows better timing of sales, permits selling roughages, labor and use of facilities."

He notes that spring feeder cattle prices are usually higher than fall prices. Still, he doesn't expect average prices to be much higher in 1983 than in 1982.

Other strategies Pretzer suggests include managing for higher percentage calf crops--a 90% calf crop versus an 80% crop translates into a $27-per unit boost in returns. Implanting calves usually nets a $10 to $15 increase per unit while good fly control (where flies are a problem) is worth an added $5 per unit.

Combining all of these practices can add $41 to $46 to the bottom line of the average cow-calf unit, he points out.

"Longer run practices still dictate using superior bulls and cross-breeding, according to research findings," Pretzer notes. "Weaning weight is so important that 125 lbs. added per cow can eliminate that full cost loss of $101 per cow."

Wintering and/or Grazing Calves

Full cost budgets for wintering and/or grazing, using purchase prices in the mid-$60's cwt., grain at $2.40 a bu., 15% interest and pasture costs of $55 for beginning weights of 550 to 575 lbs. show that breakeven prices are $1 to $2 below purchase prices, the economist observes.

"But we can live with slight negative margins like these, providing we keep death loss to 1-2% and have healthy, good-doing cattle."

Prices for calves, feeders and finished beef cattle have been nearly equal in recent months. With present grain prices and expectations for them to remain near present levels, producers can expect some narrow profits in the finishing phase, the specialist believes.

"When starting with low fed cattle prices, some segment of the beef industry is bound to suffer. With current sideways prices, the cowman is taking the major brunt of losses," he observes.

"Meanwhile, giving attention to the little things can mean the difference between an operation's surviving or failing."

Silo-Best and Sila-ferm Additives for Corn Silage and Drought-stressed Corn Silage for Yearling Steers[1,2]

Keith Bolsen and Harvey Ilg

Summary

Normal corn silage, with and without additives, and drought-stressed corn silage were evaluated in a 77-day growing trial using 64 steers. Steers fed drought silage had slowest and least efficient gains. Additive-treated silages were used more efficiently than the control silage. Dry matter recovery from the silos was consistently improved by the enzyme additive but not by the microbial inoculant additive. Steer gain per ton of corn crop ensiled was increased by 7.2 and 4.4 lb for enzyme and inoculant silages, respectively, compared with that for the control silage.

Introduction

In two previous trials, Silo-Best (an enzyme additive) improved dry matter recovery of corn silage; however, silage feeding value was variable (Progress Report 377, Kansas Agriculture Expt. Station). Commercial silage inoculants generally improved silage dry matter recovery and feeding value in our previous trials (Progress Reports 377 and 394, Kansas Agriculture Expt. Station).

This trial continued evaluation of commercial additives for corn silage.

Experimental Procedure

Three concrete stave silos (10 ft x 50 ft) were filled with whole-plant corn (dent stage) containing 31 to 33% dry matter (DM). Treatments were: 1) no additive (control); 2) Silo-Best applied as dry powder at 1.0 lb/ton of fresh crop; 3) Sila-ferm applied in a water solution at 1.0 liter of mixture/ton of fresh crop. Harvest was August 13 and 14, 1980. Corn was grown under irrigation near Manhattan and grain yield was approximately 80 bushels/acre. A fourth whole-plant corn containing 27 to 29% DM was ensiled August 1 and 2, 1980, in a 14 ft x 60 ft concrete stave silo. It was severely drought-stressed, yielding about 2 bushels/acre.

Silos were opened on October 13. Each silage was full-fed to 16 yearling Hereford steers (four pens of four steers) during a 77-day growing trial (October 14 to December 30, 1980). All steers received 2.0 lb of supplement daily[3]. Rations were formulated to provide 11.5% crude protein (DM basis), 200 mg of monensin/steer daily, and equal amounts of calcium, phosphorus, and vitamin A.

---

[1]Silo-Best is an enzyme product of Cadco, Inc., Des Moines, Iowa.

[2]Sila-ferm is a microbial inoculant product of Medipharm, Engelholm, Sweden.

[3]lb/ton: soybean meal, 1630; rolled milo 185; dicalcium phosphate, 100; salt, 50; trace minerals, 10; tallow, 20; Rumensin-60, 3.3; and Vitamin A premix, 1.7

All steers were weighed individually, after 16 hr without feed or water, at the start and at the end of the trial. Intermediate weights were taken before the a.m. feeding on days 28 and 56.

Silage samples were collected weekly from the silos. Feed intake was recorded daily for each of the 16 pens. Corn silage was full-fed and silage not consumed was removed, weighed, and discarded every 7 days.

Dry matter losses during fermentation, storage, and feedout were measured for each of the first three silages by accurately weighing and sampling all loads of fresh crop ensiled and later by weighing and sampling all silage removed from the silos. Thermocouple wires, soldered to 1/4-inch x 12-inch copper tubing, were evenly spaced in the center of these silos, and ensiling temperatures were monitored for the first 8 weeks.

About 1,600 lb of fresh crop was taken from each of the three 10 ft x 50 ft stave silos after loads 3 and 7 and used to fill 48 experimental silos. For each silage treatment, corn-plant material was tightly packed in four metal drums (55-gallon capacity) lined with polytheylene; six plastic containers (5-gallon capacity); and six nylon bags (30-lb capacity). Three nylon bags were buried in the fresh crop at two depths in each stave silo. The plastic containers were made air-tight with lids fitted with rubber O-ring seals and Bunson valves and the drums and containers were stored in a room at 25 C.

For aerobic stability (bunk life) measurement, 60 lb of fresh silage was obtained at a 3 ft depth below the surface in each silo on December 16, 1980. The samples were divided into 12 equal lots of 4.0 lb, and each lot was placed in an expanded polystyrene container lined with plastic. A thermocouple was placed in the center of each container and cheese cloth stretched across the top. Containers were stored at 18.3 C and temperature was recorded twice daily. After 2, 4, 7, and 14 days of air exposure, triplicate containers of each silage were weighed, mixed, and sampled, and dry matter loss was determined.

Results and Discussion

Ensiling temperatures are shown in Figure 3.1. Treated silages were slightly warmer than the control during the first week; but treated silages were consistantly cooler from weeks 2 to 8. This may indicate that Silo-Best and Sila-ferm supported faster fermentation during initial ensiling.

Steer performances are shown in Table 3.1. Gain and efficiency were exceptionally good for all four silage rations, reflecting the high dry matter consumptions and mild weather. Silo-Best and Sila-ferm silages were utilized more efficiently ($P<.05$) than was control silage, and required an average of 5.4% less dry matter/lb of gain. Drought-stressed silage supported slower ($P<.01$) and less efficient ($P<.05$) gains than the three normal silages. The high fiber content (Table 3.3) and low grain yield indicated that drought silage was low in total digestible nutrients (TDN).

Presented in Table 3.2 are dry matter recoveries from the concrete stave and experimental silos for the normal corn silages. The dry matter lost during fermentation, storage, and feedout from the concrete staves was similar for the control, Silo-Best, and Sila-ferm (an average of 10.25%). In the experimental silos, Silo-Best and Sila-ferm appeared to reduce these losses, with Silo-Best giving the greater improvement: 5.5% loss for Silo-Best and 7.8% for Sila-ferm, compared with 9.3% for control. When dry matter recoveries are compared by averaging the values for the four types of silos, both silage additives increased DM recovery over that of the control (3.6 percentage units increase for Silo-Best; 1.3 percentage units for Sila-ferm).

For each of the three silages, losses from the buried bags were 9 to 34% less than losses from the concrete stave silos. We believe there are at least two reasons for that: 1) The bags were buried in the center of the silage, where density and compaction were greatest, while in the stave silos, a considerable amount of silage was in contact with the silo walls and doors; and 2) the silage surface of the stave silos was continuously exposed to air for the entire time of silage feeding, while the silage in the buried bags had not been exposed to air until removed from the silos.

Losses from the 5-gallon containers were 45 to 73% less than losses from the concrete stave silos, indicating that ensiling conditions are very favorable in this type of experimental silo.

In both the stave silos and the 55-gallon drums, a small percentage of the dry matter ensiled was removed from the surface and discarded as nonfeedable spoilage when the silos were opened. We believe these spoilage losses were not related to the corn silage treatments but rather to poor compaction near the top of the silos, where air penetrated the silage surface.

All four silages appeared well preserved. Chemical analyses are shown in Table 3.3. The pH values were relatively low and all silages had undergone normal lactic acid fermentations. Although there were no clostridial fermentations, as evidenced by low NH_3-N and butyric acid values, acetic acid was relatively high in all four silages. Silage composition was affected little by either of the additive treatments. Three types of experimental silos (buried bag, 5-gallon, and 55-gallon) all produced silages of exceptionally good quality. Compared with the stave silos, experimental silos resulted in higher lactic acid contents and, except for the buried bags, lower acetic acid values.

Aerobic stabilities of the four corn silages are shown in Table 3.4. Control and Silo-Best silages showed no spoilage during the 14 days; Sila-ferm silage heated on the 11th and 12th days; and drought-stressed silage was the least stable in air. Two additional aerobic stability determinations started January 16 and February 3, 1981, gave similar results.

Shown in Table 3.5 are steer gains per ton of corn crop ensiled for the normal corn silages. These data combine feedlot performance (Table 3.1) and silage recovery from the concrete stave silos (Table 3.2). Compared with the control, Silo-Best corn silage produced 7.2 extra pounds, and Sila-ferm 4.4 extra pounds, of steer gain/ton of silage.

Table 3.1. Performance by steers fed the four corn silages (77-day trial: October 14 to December 30, 1980).*

	Control	Silo-Best	Sila-ferm	Drought-stressed
Initial wt., lb	742	749	750	746
Final wt., lb	968	980	986	932
Avg. daily gain, lb	2.94[a]	3.00[a]	3.06[a]	2.42[b]
Avg. daily feed, lb**				
corn silage	19.29	18.48	19.13	16.93
supplement	1.80	1.80	1.80	1.80
total	21.09[a]	20.28[a]	20.93[a]	18.73[b]
Feed/lb of gain, lb**	7.17[d]	6.77[c]	6.80[c]	7.77[e]

*Each value is the mean of 4 pens of steers (4 steers/pen).

**100% dry matter basis.

a,bValues with different superscripts differ significantly (P<.01).

c,d,eValues with different superscripts differ significantly (P<.05).

Table 3.2. Corn silage fermentation, storage, spoilage, and feedout losses from the concrete stave and experimental silos.

Silo and silage treatment	DM recovered: Feedable	DM recovered: Non-feedable (spoilage)	DM lost during fermentation, storage, and feedout
	% of the DM put into the silo		
Concrete staves			
Control	87.34	2.14	10.52
Silo-Best	88.73	1.65	9.62
Sila-ferm	87.42	1.96	10.62
			x̄ = 10.25
Buried bags[1]			
Control	90.44	--	9.56
Silo-Best	93.62	--	6.38
Sila-ferm	92.04	--	7.96
			x̄ = 7.97
5-gallon containers[2]			
Control	94.02	--	5.98
Silo-Best	97.42	--	2.58
Sila-ferm	96.07	--	3.93
			x̄ = 4.16
55-gallon drums[3]			
Control	82.58	4.91	12.51
Silo-Best	87.51	4.89	7.60
Sila-ferm	83.33	5.15	11.52
			x̄ = 10.54
All silos			
Control	88.60	--	9.64
Silo-Best	91.82	--	6.54
Sila-ferm	89.72	--	8.51

1Each value is the mean of 6 bags buried within the stave silos.

2Each value is the mean of 6 containers.

3Each value is the mean of 6 drums.

Table 3.3. Chemical analyses of control, Silo-Best, Sila-ferm and drought-stressed corn silages in the concrete stave and experimental silos.

	Dry matter pre-ensiled	Dry matter silage	pH	Crude protein	Crude fiber	Lactic acid	Acetic acid	Butyric acid	NH_3-N*
	%	%		% of the DM					
Concrete staves[a]									
Control	32.7	31.6	3.65	8.9	20.5	4.37	2.73	trace	--
Silo-Best	32.0	30.1	3.65	8.9	19.1	4.36	3.08	trace	--
Sila-ferm	31.0	30.8	3.68	9.6	18.7	4.29	3.20	trace	--
Drought	31.5	29.8	3.93	10.2	24.1	5.17	3.34	.05	--
Buried bags[b]									
Control	33.2	30.9	3.75	9.1	--	6.94	3.97	trace	4.44
Silo-Best	32.7	31.1	3.76	9.3	--	6.71	3.57	trace	4.14
Sila-ferm	30.7	28.2	3.75	9.5	--	5.84	3.80	trace	4.83
5-gallon containers[c]									
Control	33.1	31.7	3.73	--	--	6.83	1.93	trace	4.17
Silo-Best	32.6	32.0	3.74	--	--	6.32	1.87	trace	4.49
Sila-ferm	30.4	30.0	3.78	--	--	6.81	1.97	trace	5.68
55-gallon drums[d]									
Control	33.7	30.6	3.55	--	--	10.07	2.24	.08	5.61
Silo-best	34.5	30.7	3.47	--	--	7.49	2.05	.22	3.89
Sila-ferm	29.6	27.0	3.55	--	--	8.55	2.51	.24	3.70

*NH_3-N expressed as a percent of total N.

a,b,c,dEach value is the mean of 10, 6, 6, and 4 samples, respectively.

Table 3.4. Changes in temperature and losses of dry matter during air exposure by the four corn silages.

Corn silage	Day of initial rise above ambient temp.*	Maximum temp.	days exposed to air: 2	4	7	14
		C	loss of DM[1]			
Control	**	**	2.25	.84	1.88	3.15
Silo-Best	**	**	.48	2.00	1.78	1.57
Sila-ferm	11.7	38.9	1.10	5.46	4.88	10.59
Drought-stressed	5.4	51.5	3.10	2.94	7.22	32.57

*1.5 C rise above ambient temperature (18.3 C).

**No rise in temperature

1% of the DM exposed to air.

Table 3.5. Steer gain per ton of corn crop ensiled*

Item	Control	Silo-Best	Sila-ferm
Silage fed, lb/ton of crop ensiled	1747	1775	1748
Silage/lb of gain, lb	19.88	18.67	18.94
Steer gain/ton of corn crop ensiled ensiled, lb	87.9	95.1	92.3

*Values are adjusted to the same DM content for each silage, 33%.

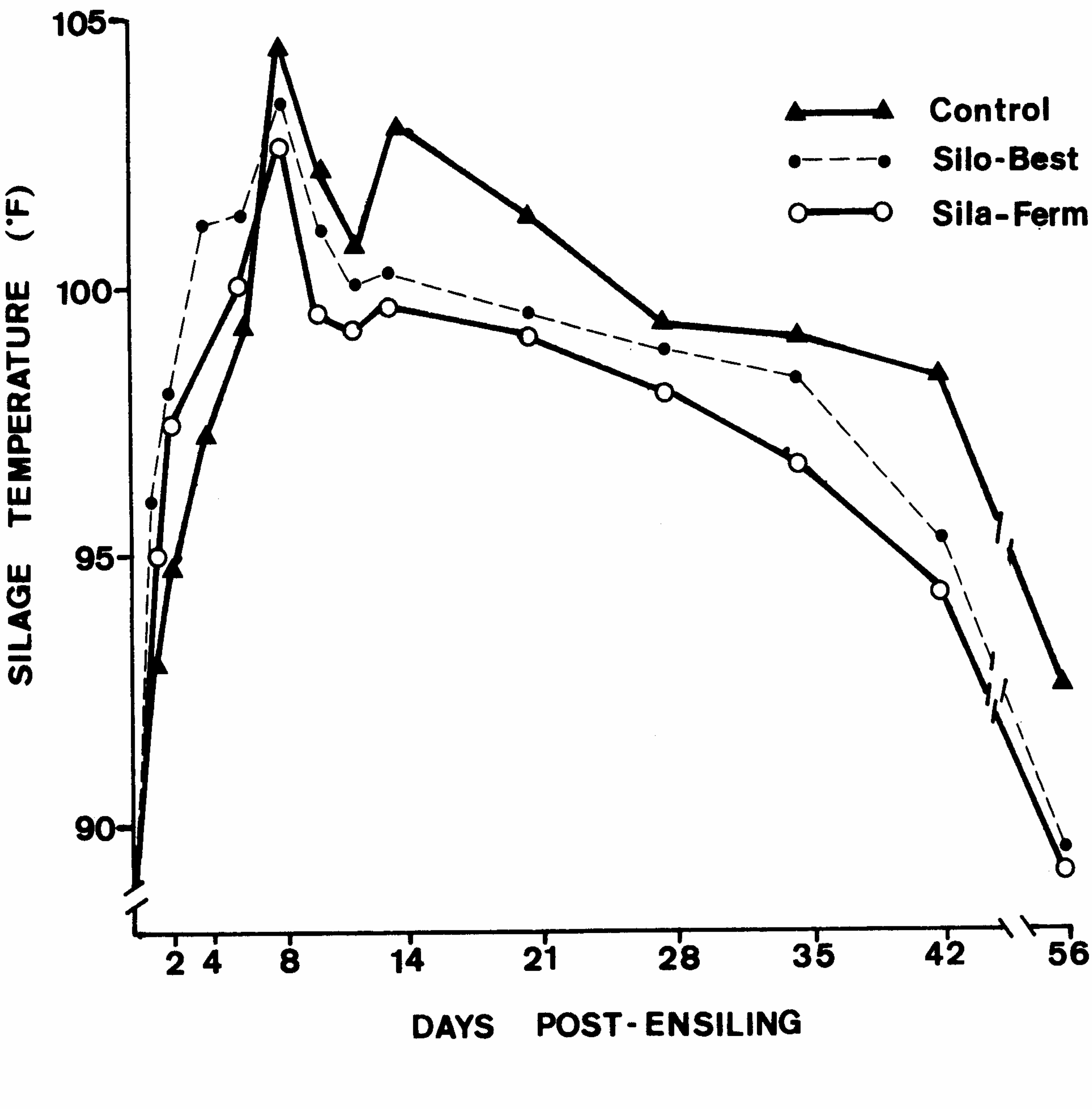


Figure 3.1. Ensiling temperatures for control, Silo-Best, and Sila-ferm corn silages (August 14 to October 9, 1980)

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

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

Summary

An inoculant (Sila-bac) and a non-protein nitrogen (LSA-100) silage additive were evaluated with whole-plant, forage sorghum silage. Sila-bac silage had the fastest temperature rise and peaked at 10 C above its initial temperature. LSA-100 silage had a slow, steady temperature rise and reached a maximum of 22 C above its initial. Control silage peaked at 15 C above its initial. Steers fed LSA-100 silage gained 7 to 9% faster than did those fed control or Sila-bac silages. LSA-100 silage was consumed in greatest amount; Sila-bac silage, in the least. The two additives improved feed efficiency by 3% over the control.

Both additives improved aerobic stability; control silage heated after 3 days; Sila-bac and LSA-100 after 7. Dry matter recovery from the stave silos was similar for control (78.1%) and LSA-100 silages (77.3%), but higher for Sila-bac silage (81.2%). When fermentation, storage, and feedout losses were combined with steer performance, pounds of gain per ton of ensiled forage were 88.8 for Sila-bac, 84.5 for LSA-100, and 82.6 for control silages.

Introduction

In Kansas, forage sorghum silage is commonly the main component in cattle growing rations. Previous research (Hays and Manhattan) has shown that non-protein nitrogen (NPN) applied to corn and forage sorghum at ensiling will produce silages of variable feeding value. Commercial silage inoculants generally have improved silage dry matter recovery; however, feeding value of the silages has been less consistant.

This trial continued our evaluation of NPN and inoculants for forage sorghum silage.

Experimental Procedure

Forage sorghum silages were made at the Hays Branch Experiment Station in October of 1980, using Asgrow's Titan E hybrid direct-cut at

---

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

[2] Inoculant (Sila-bac[R]) was provided by Pioneer Hi-Bred International, Inc., Microbial Genetics Division, Portland, Oregon.

[3] Urea-Molasses (LSA-100[R]) was provided by Namolco, Inc., Willow Grove, PA.

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

the hard-dough stage (29 to 32% dry matter). Treatments were: 1) control (no additive); 2) Sila-bac applied at 1.0 lb/ton of fresh crop; and 3) LSA-100 applied at 34.5 lb/ton of fresh crop. Additives were applied by hand at the silo blower, and silages were made in concrete stave silos (10 ft x 30 ft). Control silage was made during the morning of October 2; Sila-bac silage, during the afternoon; and LSA-100, during the morning of October 3.

Dry matter losses during fermentation, storage, and feedout were measured by accurately weighing and sampling all loads of fresh crop ensiled and later weighing and sampling all silage removed from the silos. Ensiling temperatures were monitored for the first 7 weeks.

About 450 lb of fresh crop was removed from each silo during filling. For each silage treatment, 12 plastic containers (5-gallon capacity) and six nylon bags (5-gallon capacity) were tightly filled with forage sorghum. The containers were made air tight with lids fitted with rubber O-ring seals and Bunson valves, then transported immediately to Manhattan and stored in a room at 20 to 25 C. Three nylon bags were buried in the fresh crop at two depths in each stave silo.

Stave silos were opened after 50 days and the silage was fed at a uniform rate for the following 10 weeks. Silages were sampled weekly and composited to form a biweekly sample for chemical analyses. The plastic containers were opened in duplicate for each silage treatment on days 1, 2, 3, 4, 12, and 122 post-ensiling. The nylon bags (three/silo) were recovered at approximately 25 and 60 days after the stave silos were opened.

Seventy-five crossbred steers were fed at the Hays Station in an 81-day growth trial (December 22, 1980 to March 12, 1981). The steers, native to Nebraska and averaging 508 lb, were randomly allotted by weight, breeding, and previous gains to the three silage rations (one pen of 15 steers per ration). Rations were the appropriate silage fed *ad libitum* plus 1.52 lb of supplemental ingredients that included 1.12 lb of soybean meal, .20 lb of premix , .10 lb of limestone, and .09 lb of ammonium sulfate. In the LSA-100 silage ration, .67 lb of grain sorghum replaced an equal amount of soybean meal. Rations were mixed and fed once daily and salt was available free-choice. Steers were implanted with 36 mg of Ralgro at the start of the trial.

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

To measure aerobic stability, approximately 60 lb of fresh silage was obtained from a 3-ft depth below the surface in the center of each stave silo on February 26, 1981. The silages then were transported immediately to Manhattan and stability determined as described on page 7 of this Progress Report.

---

[5] Premix supplied 30,000 IU vitamin A, 300 mg monensin, 90 mg Tylan, 5 mg cobalt, 30 mg copper, 7 mg iodine, 150 mg iron, 100 mg manganese, and 272 mg zinc per steer daily.

Results

Chemical analyses of the three silages are shown in Table 4.1. All three silages were well preserved and had undergone normal fermentations. Compositions of control and Sila-bac silages were similar; but LSA-100 silage had a higher pH and more ammonia-nitrogen. The LSA-100 silage contained 12.0% crude protein (CP). The pre-ensiled crop was 7.19% CP. Adding 34.5 lb of LSA-100 per ton should have raised the CP to 12.62%, so 95.4% of the added nitrogen from LSA-100 was recovered in the silage.

Ensiling temperatures above initial temperatures are shown in Figure 4.1. The graph represents daily mean readings of four thermocouples per silo. Sila-bac silage had the fastest temperature rise, peaking in 5 days at 10 C above its initial temperature. LSA-100 silage showed a slow, steady increase in temperature over the 50-day ensiling period, reaching a maximum of 22 C above its initial temperature; while the control silage peaked at 15 C above its initial temperature in 12 days.

Steer performances are shown in Table 4.2. LSA-100 silage supported 7% faster gains than the control and 9% faster gains than Sila-bac silage ($P<.05$). This increase in gains by LSA-100 could have been due to the difference in ration CP level: control and Sila-bac, 10.1%, LSA-100, 12.9%. Feed intake was highest for LSA-100 silage; lowest for Sila-bac silage. Both LSA-100 and Sila-bac silages were utilized 3% more efficiently than was the control.

The dry matter lost during fermentation, storage, and feedout from the concrete staves was similar for the control and LSA-100 silages (16.9 and 17.5%, respectively) and lowest (14.0%) for Sila-bac (Table 4.3). In the stave silos, about 5% of the dry matter ensiled was discarded as non-feedable spoilage when the silos were opened. This surface loss was probably due to poor compaction and air penetration and not to the treatments.

Dry matter losses from the buried bags were less ($P<.05$) for Sila-bac and LSA-100 silages (11.0 and 10.9%, respectively) than for the control (13.4%). Both additives increased ($P<.05$) dry matter recovered in the 5-gallon containers, which was 5 to 6 percentage units over the control silage. These represent the lowest possible dry matter losses that could be expected in large farm-scale silos.

Shown in Table 4.4 are steer gains per ton of forage sorghum crop ensiled. These data combine feedlot performance (Table 4.2) and silage recovery from the concrete stave silos (Table 4.3). Compared with the control, Sila-bac sorghum silage produced 6.2 extra pounds and LSA-100 1.9 extra pounds of steer gain/ton of ensiled crop.

The control silage was less stable in air than were the additive silages (Table 4.5). It heated on day 3; Sila-bac and LSA-100 silages showed no signs of spoilage until day 7. When exposed to air, the control silage had lost 8.8% of its dry matter at first notice of temperature rise.

By the time both additive silages had heated and started to lose dry matter, the control had lost more than 16% of its dry matter. After 1 week of air exposure (i.e., silage surfaces or silage piles), the control would have lost 15% of its available dry matter, while the additive silages would have lost only 3%.

Table 4.1. Chemical analyses of control, Sila-bac, and LSA-100 forage sorghum silages[1]

Silage	Dry matter	pH	Crude protein	Crude fiber	Ether extract	Ash	Lactic acid	Acetic acid	Butyric acid*	NH_3-N**
	%		% of the DM							
Control	29.08	3.92	7.2	23.2	2.0	8.0	3.58	1.82	TR	3.39
Sila-bac	30.13	3.92	7.1	23.1	2.9	7.9	3.85	1.58	ND	4.46
LSA-100	30.53	4.05	12.0	22.4	3.0	7.9	3.52	1.88	TR	17.45

[1] Each value is the mean of five samples.

*ND means none detected; TR means traces detected.

** NH_3 is ammonia-nitrogen expressed as percent of total nitrogen.

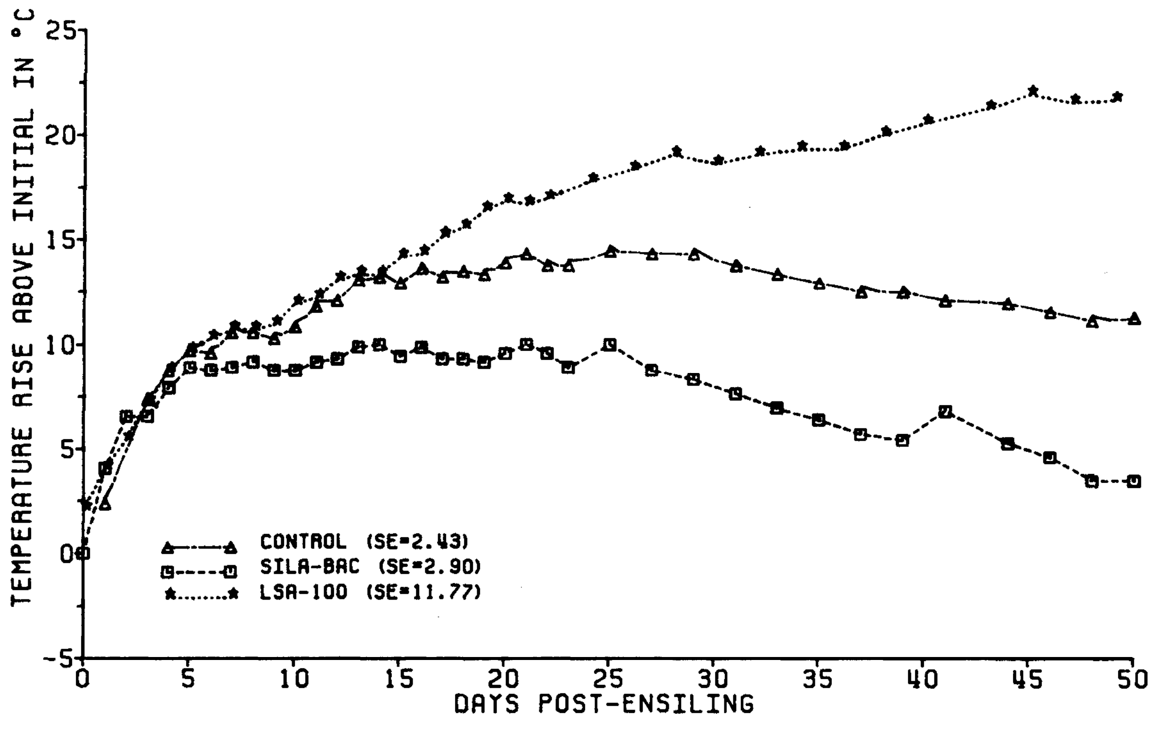


Figure 4 .l. Ensiling temperature (degrees above initial temperature) for the three forage sorghum silages. Initial temperatures were 15, 22, and 8 C for control, Sila-bac, and LSA-100 silages, respectively.

Table 4.2. Performance by steers fed the three forage sorghum silage rations

Item	Control	Sila-bac	LSA-100
No. of steers	15	15	15
Avg. initial wt., lb	512	505	506
Avg. final wt., lb	720	709	729
Avg. total gain, lb	208	203	222
Avg. daily gain, lb	2.56[a,b]	2.52[a]	2.75[b]
Avg. daily feed intake, lb[1]			
sorghum silage	13.00	12.28	13.58
soybean meal	1.12	1.12	.45
milo	- -	- -	.67
premix	.21	.21	.21
ammonium sulfate	.09	.09	.09
ground limestone	.10	.10	.10
total	14.52	13.80	15.10
Feed/lb of gain, lb[1]	5.67	5.48	5.49

[1]100% dry matter basis.

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

Table 4.3. Forage sorghum silage fermentation, storage, and feedout losses from the concrete stave and experimental silos.

Silo and silage treatment	DM recovered: Feedable	DM recovered: non-feedable (spoilage)	DM lost during fermentation, storage, and feedout
	% of the DM put into the silo		
Concrete staves			
Control	78.05	5.03	16.92
Sila-bac	81.16	4.85	13.99
LSA-100	77.28	5.23	17.49
Nylon bags[1]			
Control	86.65	--	13.35
Sila-bac	88.97	--	11.03
LSA-100	89.11	--	10.89
5-gallon containers[2]			
Control	86.55[a]	--	13.45
Sila-bac	91.03[b]	--	8.97
LSA-100	92.08[b]	--	7.92

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

[2]Each value is the mean of two containers at 122 day post-ensiling.

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

Table 4.4. Steer gain per ton of sorghum crop ensiled*

Item	Control	Sila-bac	LSA-100
Silage fed, lb/ton	1561	1623	1546
Silage/lb of gain, lb	18.90	18.27	18.30
Steer gain/ton of sorghum crop ensiled, lb	82.6	88.8	84.5

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

Table 4.5. Changes in temperature and losses of dry matter during air exposure for the three forage sorghum silages.

Silage	Day of initial rise above ambient temperature*	Maximum temperature	Accumulated temperature above ambient, Days exposed to air: 3	5	9	13	Loss of DM, Days exposed to air: 3	5	9	13
		C	C				% of DM exposed to air			
Control	3	35.0	9.6	33.9	56.9	81.1	8.7[a]	13.4[a]	16.4[a]	21.7[a]
Sila-bac	7	35.6	**	**	14.1	70.5	<1.0[b]	<1.0[b]	6.6[b]	14.9[b]
LSA-100	7	40.0	**	**	18.3	97.5	<1.0[b]	<1.0[b]	3.9[b]	22.2[a]

*1.7 C rise or higher.

**No rise in temperature.

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

Trials on Commercial Silage Additives[1]

Keith Bolsen

Introduction

Numerous commercial silage additives, manufacturers of which make various claims for their improving silage quality, are available to Kansas farmers and ranchers. In 2 previous years (1980 and 1981), we reported on nine trials involving six additives (Progress Reports 377 and 394). Each additive improved the silage in at least one of the four criteria we evaluated: 1) ensiling temperature, 2) dry matter recovery, 3) feeding value, and 4) aerobic stability. Two more trials with additives are reported on in this Progress Report (pages 6 and 11).

Summary

Summarized in Table 5.1 are dry matter recoveries for 20 additive silages and their 11 controls in trials conducted from 1975 to 1981. Recovery of feedable dry matter averaged 85.0% for controls and 87.9% for additives. Fifteen additive silages had higher DM recoveries than did controls; only five silages, the same or lower recoveries.

Table 5.1. Dry matter recovery for control and additive silages in 11 trials conducted from 1975 to 1981.*

Silage and dry matter	Additive treatment	Recovery of feedable DM**
		%
Corn (38%)	control	80.9
	Silo Best[R]	87.5
Corn (35%)	control	87.4
	Silo Guard[R]	93.7
Corn (44%)	control	88.7
	Cold-flo[R]	91.5
	Sila-bac[R]	91.7
	Silo-Best	91.3
Corn (37%)	control	93.3
	Cold-flo	88.5
	Ensila Plus[R]	94.1
Wheat (42%)	control	77.6
	Ensila Plus	79.4
Sorghum (29%)	control	84.1
	Silo Guard	92.0
Sorghum (33%)	control	91.0
	Cold-flo	84.9
	Sila-bac	90.7
Alfalfa (36%)	control	84.6
	Ensila Plus	90.0
	Silo Guard[R]	89.7
	Sila-lator[R]	90.4
Alfalfa (33%)	control	82.0
	Sila-bac	82.0
	Silo Guard	86.2
	1981 trials	
Corn (32%)	control	87.3
	Silo-Best[R]	88.7
	Sila-ferm[R]	87.4
Sorghum (30%)	control	78.1
	Sila-bac	81.1
	LSA-100[R]	77.2
11 -Trial avg.	control	85.0
	additive	87.9

*All silages were made in 10 ft x 50 ft concrete stave silos.

**Percent of the dry matter ensiled.

[1] Mention of products and companies is made with the understanding that no discrimination or endorsement is intended. Also, no criticism is implied of products and companies not mentioned.

Alfalfa Silages and Hay and Corn Supplementation for Yearling Steers

Keith Bolsen, Harvey Ilg, Mark Hinds, and Jim Hoover

Summary

Four alfalfa forages were evaluated: 1) hay; 2) low-dry matter (DM) silage; 3) medium-DM silage; and 4) high-DM silage. All forages were full-fed along with 2 lb of supplement or supplement plus 2 or 4 lb of cracked corn. Calves fed hay or medium-DM silage had the fastest and most efficient gains. Hay had the highest intake; low-DM silage, the lowest. Adding corn to the ration improved calf performance slightly, but feed costs per lb of gain were similar for all three levels of corn supplementation.

Low- and medium-DM silages were better preserved than high-DM silage, which contained considerable spoilage due to yeasts and molds. High-DM silage also had the highest ensiling temperatures and it was slightly less stable in air on feedout than was either of the other two silages. Dry matter recovery from the stave silos, however, was about 3 percentage units greater for the high-DM silage than for the low- or medium-DM silages.

Introduction

In our previous trials, we found properly managed alfalfa silage or haylage to be economical and efficient sources of nutrients for growing calves. Adding corn grain to alfalfa rations can greatly improve cattle performance. But how does ensiling alfalfa that is exceedingly wet or exceedingly dry affect its quality? And what level of corn is best with alfalfa? In this trial we compared well-made alfalfa silage with hay and poorly-made silages and evaluated three levels of corn supplementation for growing calves.

Experimental Procedures

In May, 1981, first-cutting alfalfa was obtained from a single field when at 1/10 to 1/4 bloom. The four harvest treatments were: 1) low-dry matter (DM) silage; 2) medium-DM silage; 3) high-DM silage; and 4) field-dried hay. After the alfalfa had been swathed with a mower-conditioner on May 6, low-DM silage was harvested after approximately 1 hr of field wilting; medium-DM silage after 3 to 5 hr of wilting; and high-DM silage after 24 to 30 hr of wilting. Hay was baled into 60 to 80 lb bales on May 11, after the swaths had received about 1.0 inch of rainfall on May 8. Windrows were turned once before baling.

Dry matter of the 12 loads of alfalfa (four loads/silo) is shown in Table 6.1. Low-DM material contained less moisture than expected, probably because of the unusually warm, dry weather several days before harvest and because of slight infestation of alfalfa weevil which resulted in some loss of lower leaves.

Dry matter losses during fermentation, storage, and feedout were measured for the three alfalfa silages by weighing and sampling all loads of material before it was ensiled in concrete stave silos (10 ft x 50 ft) and later weighing and sampling all silage removed. Ensiling temperatures during the first 7 weeks were monitored with six thermocouples evenly spaced in each silo.

About 500 lb of fresh material was removed from each silo during filling and tightly packed into nylon bags (20 to 25 lb/bag) and plastic containers (20 to 25 lb/container). Experimental silo details appear on page 7 of this Progress Report.

Silos were opened after 90 days and silages and hay were each full-fed to 12 Hereford steers averaging 748 lb. All steers received 2 lb of supplement[1] daily; four steers fed each alfalfa also received 2 lb of cracked shelled corn and four received 4 lb of corn. Rations were fed twice daily; the silage and concentrates mixed in the feed bunk. Steers were housed in individual pens for the 49-day trial (August 6 to September 24, 1981).

All steers were weighed individually after 16 hr without feed or water on two consecutive days at the start and again at the end of the trial. Two days before the final weighings, all steers were fed the same amount of feed (14 lb of ration dry matter). An intermediate weight was taken before the a.m. feeding on day 28.

Aerobic stability (bunk life) of each silage was measured as described on page 7 of this Progress Report.

Results

Ensiling temperatures are shown in Figure 6.1. All silages had rather low temperatures for the first 2 weeks. During the next 5 weeks, the low- and medium-DM silages stayed between 25 and 28 C; however, temperature of the high-DM silage increased gradually and reached a maximum of 43 C at 43 days.

Chemical analyses are presented in Table 6.2. Low- and medium-DM silages were better preserved than was high-DM silage, which was dark brown and contained considerable spoilage due to yeasts and molds. In the low- and medium-DM treatments, fermentations were extensive and produced silages that were high in lactic, acetic, and total acids. The high-DM treatment had undergone a minimum fermentation as evidenced by its high pH (5.05) and low total acids (3.69%). In all three silages, the very low butyric acid and NH_3-N levels confirmed the absence of any clostridial fermentation.

Performance of steers for the four alfalfa and three corn treatments is shown in Table 6.3. None of the numerical differences in performance were statistically significant, and there were no interactions between the alfalfa forage treatments and cracked corn additions.

---

[1]Lbs./ton of supplement: rolled milo, 1789.7; salt 90;trace minerals, 10; monosodium phosphate, 107; and Rumensin-60, 3.3.

Hay and medium-DM silage gave faster gains (13.7 and 15.3%, respectively) and more efficient gains (8.0 and 10.5%, respectively) than low-DM silage. Steers fed high-DM silage had intermediate rate and efficiency of gains. Hay was consumed in the greatest amount; low-DM silage in the least.

Adding cracked corn to the alfalfa rations improved steer performance only slightly. The extra gain from 1.75 lb of cracked corn dry matter added to the ration was .13 lb; from 3.5 lb of corn dry matter, .19 lb. Adding corn, however, resulted in less alfalfa being consumed by the steers --- 1.59 lb less with the 1.75 lb of corn and 2.82 lb less with the 3.5 lb of corn. At today's feed prices, the feed cost per lb of gain was nearly the same for the three levels of corn supplementation.

The response to corn was less than expected in that results of our previous trial with alfalfa silage showed .37 lb of extra gain from 1.75 lb of corn dry matter added to the ration. Reasons for the differences between trials are not apparent; however, steers fed in last year's trial had a 140 lb lighter initial weight, and in both trials steers were being fed excess protein. The lighter steers, which had a higher protein requirement, were able to use the extra protein (from alfalfa) and energy (from corn) more efficiently.

Presented in Table .4 are silage dry matter recoveries from the concrete stave and experimental silos. In the stave silos, about 3 percentage units more dry matter was fed from the high-DM silage than from the low- or medium-DM silages. This, along with results of silage chemical analyses, indicated that the high-DM silage underwent a less extensive fermentation than did either of the two other silages. Nearly twice as much of the high-DM silage, however, was discarded as non-feedable spoilage when the silos were opened, probably because its compaction was poorer than that of low- or medium-DM silages.

For each of the three silages, losses from the buried bags and 5-gallon containers were only 58 and 42%, respectively, of the losses from the concrete stave silos. These results agreed with those of several of our trials and indicated that losses from the bags and containers were about half the losses from the concrete stave silos.

All three alfalfa silages were highly stable in air on feedout (Table .5). High-DM silage heated on the 10th and 11th days; low- and medium-DM silages showed no signs of spoilage during the entire 14 days of air exposure.

Table 6.1. Dry matter content of the alfalfa at ensiling.

	Silage dry matter treatment		
Load number	Low	Medium	High
	Dry matter, %		
1	28.4	35.6	54.3
2	31.3	37.0	56.4
3	30.2	37.1	54.6
4	32.2	36.2	58.2
Avg. dry matter*	30.5	36.5	56.0

*Weighted averages that are adjusted for diferences in load size.

Table 6.2. Chemical analyses of the four alfalfa forages fed in the steer trial.[1]

Item	Silage Low-DM	Silage Medium-DM	Silage High-DM	Hay
Dry matter, %	29.7	34.5	56.0	92.1
pH	4.23	4.30	5.05	--
	% of the dry matter			
Lactic acid	9.59	8.09	1.65	--
Acetic acid	4.79	4.40	1.92	--
Propionic acid	.30	.19	.06	--
Butyric acid	.01	.06	.01	--
Total fermentation acids	14.83	12.80	3.69	--
Crude protein	20.3	20.0	20.2	19.8
	% of the total nitrogen			
Hot-water insoluble-N	33.4	34.3	41.5	76.3
NH_3-N	7.9	6.8	5.9	--

[1]Each value is the mean of five samples.

Table 6.3. Performance by steers fed each of the four alfalfa and three corn treatments.

	Alfalfa hay	Alfalfa silage Low	Alfalfa silage Medium	Alfalfa silage High	Corn (lb/day) 0	Corn (lb/day) 2	Corn (lb/day) 4
No. of steers	12	12	12	12	16	16	16
Initial wt., lb	749	749	748	747	750	748	747
Final wt., lb	822	813	822	817	815	820	821
Avg. daily gain, lb	1.49	1.31	1.51	1.43	1.33	1.46	1.52
Avg. daily feed, lb[1]							
alfalfa	14.53	13.60	14.34	14.01	15.59	14.00	12.77
supplement	1.80	1.80	1.80	1.80	1.80	1.80	1.80
corn	1.75	1.75	1.75	1.75	--	1.75	3.50
total	18.08	17.15	17.89	17.56	17.39	17.55	18.07
Feed/lb of gain[1]	12.56	13.65	12.21	12.78	13.57	12.69	12.14

[1]100% dry matter basis.

Table 6.4. Alfalfa silage fermentation, storage, spoilage, and feedout losses from the concrete stave and experimental silos.

Silo and silage DM treatments	DM recovered Feedable	DM recovered Non-feedable (spoilage)	DM lost during fermentation, storage and feedout
	% of the DM put into the silo		
Concrete staves			
low	85.54	2.57	11.89
medium	85.17	3.34	11.49
high	88.31	5.56	6.13
Buried bags[1]			
low	94.08	--	5.92
medium	93.75	--	6.25
high	95.77	--	4.23
5-gallon containers[2]			
low	94.81	--	5.19
medium	95.42	--	4.58
high	97.32	--	2.68

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

[2]Each value is the mean of six containers.

Table 6.5. Changes in alfalfa silage temperature and losses of dry matter during air exposure.

Silage	Day of initial rise above ambient temp.*	Maximum temp.	Accumulated temp. above ambient, °C		Loss of dry matter (% of DM exposed to air)	
			day 7	day 14	day 7	day 14
		°C				
Low DM	**	**	**	**	<1.0	<1.0
Medium DM	**	**	**	**	<1.0	<1.0
High DM	10.9	40	**	35.7	<1.0	4.1

*1.5 C rise or higher.

**No rise in temperature.

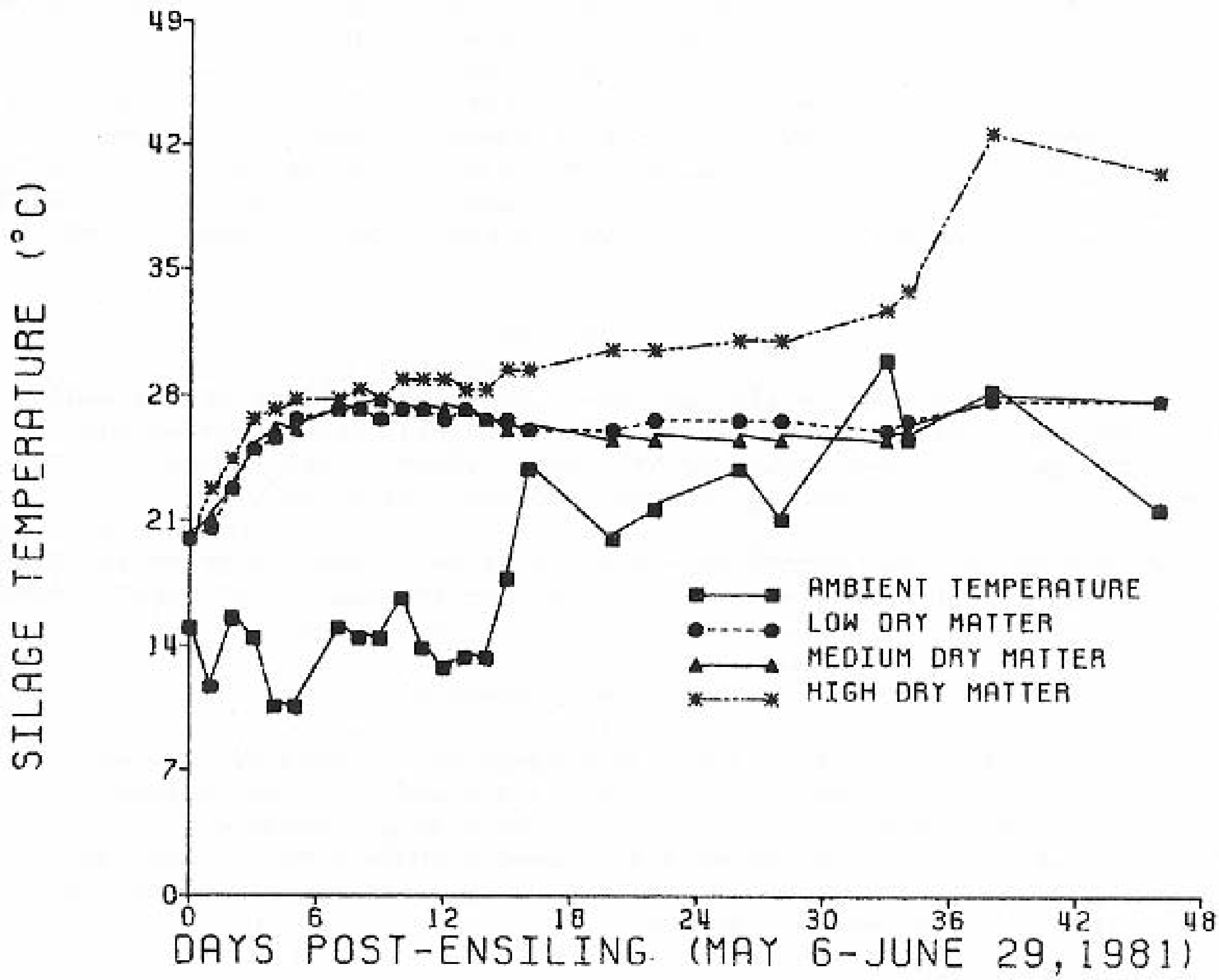


Figure 6.1. Ensiling temperatures for three alfalfa silages.

NaOH Wheat Silage and Alfalfa Haylage for Growing Steers and Heifers

Keith Bolsen, Harvey Ilg, Mopoi Nuwanyakpa, and Jim Hoover

Summary

Wheat silage, with and without sodium hydroxide (NaOH), was fed, with or without alfalfa haylage, in an 80-day growing trial. Calves fed NaOH-silage consumed 18% more feed and gained 16% faster than those fed control silage, but feed efficiencies were similar. When 50% of the wheat silage was replaced with alfalfa haylage (DM basis), gains decreased 3.1 and 3.7%, feed intake increased 12.3 and 9.7%, and feed efficiency decreased 23.7 and 14.4% for calves fed control and NaOH silages, respectively. NaOH increased ensiling temperatures by 9 to 12° C during the first 6 weeks. Dry matter recovery from the concrete stave silos was similar for both silages (82.1% for control and 83.9% for NaOH); recoveries from buried bags were 92.3 and 89.5%. NaOH wheat silage was more stable in air than was either control wheat silage or alfalfa haylage.

Introduction

In several previous trials, we showed that wheat silage can be used effectively in cattle growing rations (Bulletin 613, Kansas Agriculture Expt. Station). However, compared with corn silage, wheat silage is less digestible, has a lower intake, and deteriorates faster in air.

This trial was our second one in which we evaluated the potential of sodium hydroxide and alfalfa haylage to improve the quality of wheat silage rations.

Experimental Procedure

Two whole-plant wheat silages (late dough, 57% moisture) were made in 10 ft x 50 ft concrete stave silos on June 9 and 10, 1980, without (control) or with NaOH applied at 3.8% of the crop dry matter. NaOH was applied as dry prills, metered with a hydraulic applicator attached to the silage blower. Silage was direct-cut using a Field Queen forage harvestor with a 2-inch recutter screen.

Silos were opened after 7 months. Each silage was fed to 30 Hereford and Simmental steer and heifer calves (six pens of five calves) during an 80-day growing trial (January 5 to March 26, 1981). For three pens receiving each wheat silage, alfalfa haylage replaced half the silage (dry matter basis). Wheat silages and haylage were full-fed along with supplement fed at 2.0 lb of supplement per calf daily (air-dry basis). Supplements were formulated to bring the total rations (dry basis) to 12.0% crude protein (all natural), .45% calcium, .35% phosphorus and to provide 30,000 I.U. of vitamin A and 70 mg of aureomycin per calf daily. The two NaOH wheat silage rations contained 1.4% potassium, supplied by either potassium chloride or alfalfa haylage. Rations were fed twice daily, with forage and supplement mixed in the bunks.

The haylage (ensiled at 40 to 44% moisture in a 14 ft x 40 ft Harvestore) was from 4th-cut alfalfa harvested in September, 1979.

All calves were weighed individually, after 16 hr without feed or water, at the start and at the end of the trial. Intermediate weights were taken before the a.m. feeding on days 28 and 56.

Dry matter losses during fermentation, storage, and feedout were measured for both wheat silages by weighing and sampling all loads of fresh crop ensiled and, later, weighing and sampling all silage removed. About 125 lb of fresh crop was removed from each silo twice during filling, packed into three nylon bags (30 lb/bag), and buried in each silo. As silage was fed, bags were removed from the silos, weighed, mixed, and sampled for chemical analysis, and dry matter loss was determined. Ensiling temperatures during the first 6 weeks were monitored with four thermocouples evenly spaced in each silo.

Aerobic stability (bunk life) of the wheat silages and haylage was determined as described on page 7 of this Progress Report.

Results

Chemical analyses of the two silages and haylage are shown in Table 7.l. Control silage fermented normally, as evidenced by low pH, predominance of lactic acid, and little butyric acid. However, NaOH silage underwent a clostridial fermentation, characterized by high pH, excessive butyric acid, and little lactic acid.

Ensiling temperatures (Figure 7.l) averaged 9° to 12° C warmer for NaOH silage than the control throughout the 6 weeks.

Cattle performances are shown in Table 7.2. Calves fed NaOH silage alone gained faster ($P<.05$) and consumed more feed ($P<.05$) than those fed control silage alone. Adding alfalfa haylage to either wheat silage increased feed intake by about 11%, but decreased rate and efficiency of gains. Our previous trial (Progress Report 394) also showed that NaOH increased intake but not use of wheat silage and that haylage had less net energy than wheat silage. In both trials, the high sodium content of the NaOH silage rations caused high water intake, excessive urination, and extremely wet pen conditions.

Dry matter losses in the stave silos (Table 7.3) were similar for control and NaOH wheat silages and 2 to 6 percentage units higher than those generally obtained with corn or sorghum silages. Dry matter loss from the buried bags represented slightly less than the minimal loss obtainable in a farm-scale silo.

Aerobic stability results in Table 7.4 show that NaOH silage was highly stable in air (heating on the 10th day), control silage moderately stable (heating on the 4th and 5th days), and haylage unstable (heating on the 2nd day).

Table 7.1. Chemical analyses of control and NaOH wheat silages and alfalfa haylage.

Forage	Dry matter	pH	Ash	Crude protein	Crude fiber	Lactic acid	Acetic acid	Propionic acid	Butyric acid	NH_3-N*
	%		% of the DM							
Control	41.95	4.24	7.17	11.11	24.40	4.29	1.40	.19	.17	6.76
NaOH	41.75	7.16	10.37	9.67	25.46	.82	1.23	.95	5.82	9.67
Alfalfa haylage	60.43	5.61	11.23	23.71	24.78	1.24	.86	.16	.03	4.20

*NH_3-N expressed as a % of total N.

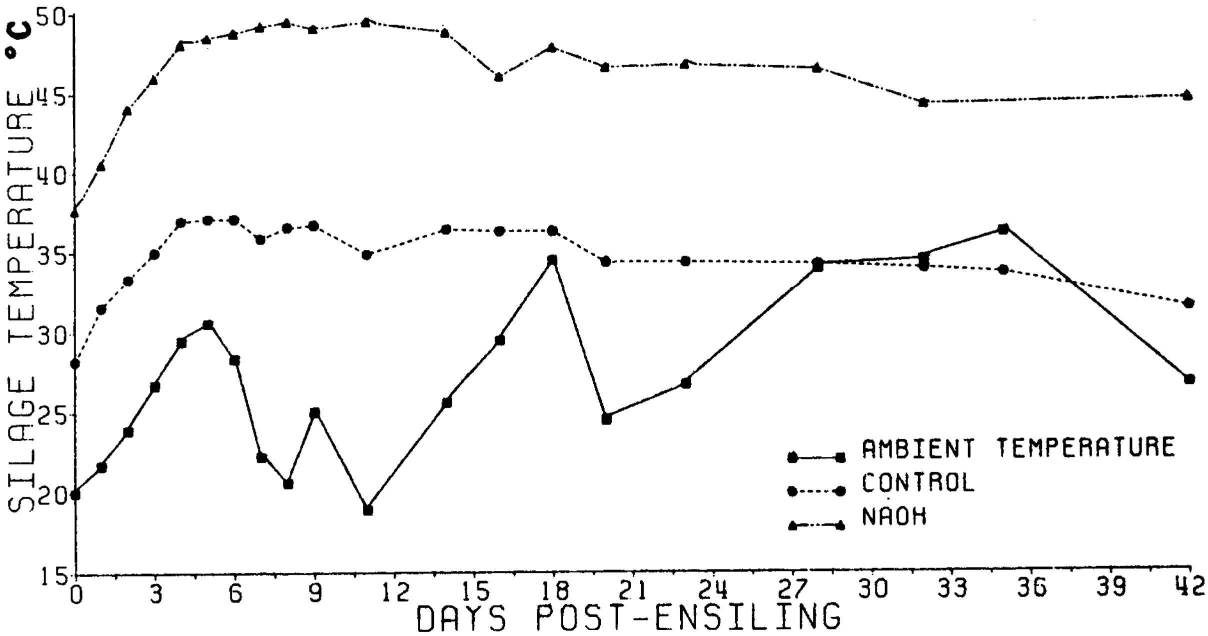


Figure 7.1. Ensiling temperatures for control and NaOH wheat silages.

Table 7.2. Performance by steers and heifers fed the four wheat silage and alfalfa haylage rations.

	Control wheat silage		NaOH wheat silage	
	alone	+ haylage	alone	+ haylage
No. of calves	15	15	15	15
Initial wt., lbs.	479	481	482	474
Final wt., lbs.	608	607	632	619
Avg. daily gain, lbs.	1.62[c]	1.57[d]	1.88[a]	1.81[b]
Avg. daily feed intake, lbs.[2]				
wheat silage	10.23	6.36	12.47	6.89
haylage	---	6.35	---	6.96
supplement	1.80	1.80	1.80	1.80
total	12.03[c]	14.51[b]	14.27[b]	15.65[a]
Feed/lb. of gain, lbs.[2]	7.51[a]	9.29[b]	7.58[a]	8.67[a,b]

[1] 80-day trial: January 5 to March 26, 1981.

[2] 100% dry matter basis.

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

Table 7.3. Wheat silage fermentation, storage, spoilage, and feedout losses

Silo and silage treatment	DM recovered: Feedable	DM recovered: Non-feedable (spoilage)*	DM lost during fermentation, storage and feedout
Concrete staves	% of the DM put into the silo		
Control	82.06	6.00	11.94
NaOH	83.86	5.00	11.14
Buried bags			
Control	92.26	--	7.74
NaOH	89.48	--	10.52

* Removed from the silage surface when the silos were opened January 4, 1981.

Table 7.4. Changes in temperature and losses of dry matter by the two wheat silages and alfalfa haylage during air exposure

Silage	Day of initial rise above ambient temp.*	Maximum temp.	Accumulated temp. above ambient, C: day 3	day 6	day 10	Loss of DM (% of DM exposed to air): day 3	day 6	day 10
		C						
Control	4.9	53.9	**	27.4	121.1	<1.0	1.1	9.8
NaOH	10.0	29.4	**	**	6.5	<1.0	<1.0	1.7
Alfalfa haylage	2.0	40.0	28.0	52.4	76.4	2.1	5.4	17.9

*1.5 C rise above ambient (18.3 C).

**No rise in temperature.

Forage Sorghum Silage and Summer Annual Silage and Hays for Growing Steers and Heifers

Keith Bolsen, Harvey Ilg, Mopoi Nuwanyakpa and Gerry Posler[1]

Summary

Sorghum-Sudan hay and silage and sudangrass hay were compared with forage sorghum silage in an 80-day growing trial involving 60 calves. Calves fed forage sorghum gained 14% faster than those fed sudangrass hay (P<.05). Calves fed either of the two silages consumed less feed (P<.05) but were more efficient (P<.05) than those fed either of the two hays.

This and two previous trials indicate that early-harvested summer annual silages and hays produce similar rates of gain but that silages are used 10 to 20% more efficiently by growing cattle. These forages have 75 to 90% of the relative feeding value of average-quality forage sorghum silage. With crude protein content of 12 to 15%, our summer annuals required little, if any, supplemental protein.

Introduction

In four previous trials, summer annuals produced high-yielding, high-quality forages when harvested early. (Progress Reports 320, 350, and 377, Kansas Agricultural Expt. Station).

We continued evaluating those forages by comparing an early-harvested summer annual silage and two early-harvested summer annual hays with forage sorghum silage in growing rations.

Experimental Procedure

Four forages harvested in the summer and fall, 1980, were compared: 1) forage sorghum (Dekalb FS-25a+) was direct-cut in the soft dough stage at 28 to 30% dry matter and ensiled between October 6 and 9 in a 14 ft x 60 ft concrete stave silo; 2) Sorghum-sudan (Dekalb 7a+) was swathed with a mower-conditioner in a late-vegetative growth (July 10) before heads emerged. Alternate windrows were harvested after a 24-hr wilt and ensiled at 35% DM (range, 29.0 to 44.7%) in a 10 ft x 50 ft concrete stave silo; 3) remaining windrows were turned twice, allowed to field-wilt over a weekend, and baled; and 4) sudangrass (Northrup King Trudan-6) was harvested for hay at the same time and by the same methods as was sorghum-sudan. Both hays were made into 70 to 80 lb bales, stored under cover, and chopped with a tub grinder with a 2-inch screen before being fed.

---

[1]Department of Agronomy, Kansas State University, Manhattan, KS.

For the sorghum-sudan forage treatment, six nylon bag and six plastic container silages were made from wilted material obtained from load 4 (29.0% DM) and load 8 (42.9% DM) (see page 7, this Progress Report).

Each of the four forages was fed to 15 Hereford and Simmental steer and heifer calves (three pens of five calves) during an 80-day growing trial. Silages and hays were full-fed along with 2.0 lb of supplement per calf daily (air-dry basis). Supplements were formulated to bring the rations (dry basis) to 12.0% crude protein (all natural), .45% calcium, and .35% phosphorus and to provide 30,000 IU of vitamin A and 70 mg of aureomycin per calf daily. Rations were fed twice daily, with forage and supplement mixed in the bunk.

All calves were weighed individually, after 16 hr without feed or water, at the start and at the end of the trial. Intermediate weights were taken before the a.m. feeding on days 28 and 56.

Silage aerobic stability (bunk life) was determined as described on page 7 of this Progress Report.

Results

Chemical analyses and silage aerobic stabilities are shown in Table 8.1. Silages were well preserved and were relatively high in lactic acid. Crude fiber values were similar for all forages, but the three summer annuals averaged 3.6 percentage units higher crude protein than did the forage sorghum. Both silages were highly stable in air. Forage sorghum silage heated on day 9; sorghum-sudan silage, on day 13.

Table 8.2 shows that calves fed forage sorghum silage outperformed those fed sorghum-sudan silage or hay and calves fed sudangrass hay had the poorest performance. Dry matter consumption averaged 25% higher for the two hays than for the two silages; however, hays were used far less efficiently.

Table 8.1. Chemical analyses of the four forages and aerobic stability of the two silages.

Item	Forage sorghum silage	Sorghum-sudan silage	Sorghum-sudan hay	Sudangrass hay
Dry matter, %	28.77	32.42	90.10	90.48
pH	3.78	4.26	--	--
NH_3-N*	3.75	5.37	--	--
	% of the DM			
Ash	9.03	10.91	9.50	9.62
Crude protein	9.42	14.68	12.49	11.98
Crude fiber	25.25	27.77	25.90	24.99
Lactic acid	5.03	4.86	--	--
Acetic acid	2.01	2.30	--	--
Propionic acid	.37	.38	--	--
Butyric acid	.34	.03	--	--
Day of initial rise above ambient temp.**	9.0	13.3	--	--
Maximum temp., C	37.2	26.7	--	--
Loss of DM after 14 days, % of DM exposed to air	10.1	1.8	--	--

*NH_3-N expressed as a percent of total nitrogen.

**1.5 C rise above ambient (18.3 C).

Table 8.2. Performance by steers and heifers fed the four silage and hay rations.

	Silage: forage sorghum	Silage: sorghum-sudan	Hay: sorghum-sudan	Hay: sudangrass
No. of calves	15	15	15	15
Initial wt., lb	482	480	477	475
Final wt., lb	625	606	602	576
Avg. daily gain, lb	1.78[a]	1.57[a]	1.56[a]	1.26[b]
Avg. daily feed intake, lb[2]				
silage	11.93	11.47	--	--
hay	--	--	15.47	14.62
supplement	1.80	1.80	1.80	1.80
total	13.73[b]	13.27[b]	17.27[a]	16.42[a]
Feed/lb of gain, lb2	7.73[a]	8.47[b]	11.01[c]	13.00[d]

[1] 80-day trial: January 5 to March 26, 1981.

[2] 100% dry matter basis.

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

Stocking Rate and Supplementation for Steers Grazing Intensively on Early-stocked Bluestem Pasture

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

Summary

Native bluestem pastures were grazed by 520-lb steers from April 30 to July 14 at stocking rates of 1.7, 1.3 and 1.1 acres per steer. Daily gain of the steers was about the same for the two heavier stocking rates, but was slightly lower for the lightest rate (1.7 acres/steer). The gain per acre increased with each increase in stocking rate.

Half of the steers were self-fed a salt-limited sorghum grain-rumensin mixture. Each steer consuming approximately 1.5 pounds per day of this mixture gained about a half a pound more per day ($P<.05$) than did each steer not fed the supplement (1.77 vs 1.27 lbs.). Gain per acre was increased by 33 lbs. with the supplementation.

Introduction

Our previous experiments have shown that grazing cattle on bluestem pasture from May 1 to July 15 at twice the normal stocking rate (Early-season, intensive stocking) will produce about the same or better daily gains during this period than will grazing them on pastures all season at a normal stocking rate (about 3.3 acre per 500-lb steer). We designated this trial to study even higher stocking rates.

Rumensin generally has given positive results with grazing cattle. We designed this trial to determine if daily gain would be increased when sorghum grain and rumensin were self-fed in a salt-limiting mixture.

Experimental Procedure

Six 60-acre pastures were randomly assigned to the following stocking rates: 1.7, 1.3, and 1.1 acres per steer from April 30 to July 14, 1981, two pastures per stocking rate. Steers in one pasture received the supplement (Table 9.2); steers in the other received only salt. The steers, originated in Arkansas, were in moderate flesh, and averaged 520 lbs.

Results and Discussion

The results are shown in Tables 9.1 and 9.2. Steers on pastures stocked at the heavier rates (1.3 and 1.1 acres per steer) gained about the same; those at the lightest rate (1.7 acres) gained slightly less, even though they had more grass available. We cannot explain that difference. Gain per acre increased as the stocking rate increased.

Consuming approximately 10 to 15% salt limited a steer's daily grain intake to about 1.5 lb or less. The supplement significantly increased daily gain per steer (1.77 vs 1.27 lbs) and gain per acre (100 vs 67 lbs).

Table 9.1. Effect of different stocking rates for steers on intensive, early-stocked pasture (April 30-July 14, 1981)

	Stocking rate (acres/steer)		
	1.67	1.33	1.11
Steers per treatment	52	75	81
Avg. beginning wt., lb	517	521	523
Avg. gain per steer, lb	106[a]	115[b]	118[b]
Daily gain per steer, lb	1.41[a]	1.53[b]	1.57[b]
Gain per acre, lb	64[a]	86[b]	107[c]

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

Table 9.2. Effect of grain supplementation on performance of steers on intensive, early-stocked bluestem pasture

	Supplemented			Nonsupplemented		
	1.67	1.33	1.11	1.67	1.33	1.11
Steers per treatment	29	37	41	23	38	40
Supplement consumed (self-fed) per head daily						
Ground sorghum grain, lb	1.50	1.50	1.26	0	0	0
Salt, lb	.17	.17	.14	0	0	0
Rumensin, mg	167	167	140	0	0	0
Avg. gain per steer, lb	128	132	135	69	97	101
Daily gain per steer, lb	1.71	1.76	1.80	1.05	1.29	1.35
Gain per acre, lb	77	99	122	47	73	76
Supplement vs nonsupplemented						
Avg. gain/steer, lb		133[a]			95[b]	
Daily gain/steer		1.77[a]			1.27[b]	
Gain per acre, lb		100[a]			67[b]	

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

High-moisture Corn With Additives for Finishing Rations[1,2,3]

Bruce Young, Harvey Ilg, and Keith Bolsen

Summary

Dry corn (dry), Harvestore ensiled high-moisture corn, stave silo ensiled high-moisture corn (stave H.M.C.) and stave H.M.C. ensiled with NaOH, Cold-flo ammonia, or Silo-Best additives were evaluated in steer and heifer finishing trials. Cold-flo and NaOH H.M.C. gave slowest gains; NaOH had the highest intake and Harvestore H.M.C. the lowest, efficiency of gain favored the Harvestore H.M.C.

All H.M.C. corn except NaOH was unstable in air because of high dry matter at ensiling, slow corn use, and warm temperatures. Dry matter losses and temperature rises during air exposure were highest for Cold-flo and Harvestore H.M.C.

Experimental Procedure

Four concrete stave silos (10 ft x 50 ft) and one oxygen-limiting Harvestore were used to store about 1,000 bushels per structure of high-moisture corn (H.M.C.) at 77.7% to 82.1% dry matter, harvested September ll-13, 1979.

Stave silo H.M.C. treatments were: 1) no additive (stave), 2) 80 lb of NaOH, 3) 2.0 lb of Silo-Best,[1] and 4) 19.3 lb of Cold-flo[2] ammonia. For treatment 5, H.M.C. corn ensiled in a Harvestore was used and for 6, artificially dried corn (dry). Additive rates were per ton of wet corn harvested of the same variety and from the same field. NaOH and Harvestore H.M.C. were ensiled whole; others were coarsely cracked by a roller mill before ensiling. Harvestore and dry corns were coarsely rolled before feeding; NaOH H.M.C. was fed whole.

---

[1] Silo-Best® is an enzyme product of Cadco, Inc., Des Moines, Iowa. Partial financial assistance provided by Cadco, Inc.

[2] Cold-flo ® is a non-protein nitrogen product of USS Agri-Chemicals, Division of United States Steel, Atlanta, Georgia. Partial financial assistance provided by United States Steel.

[3] Mention of products and companies is made with the understanding that no discrimination is intended and no endorsement implied.

Silos were opened after 210 days and a complete mixed ration of each corn was full-fed for 93 days (April 9 to July II, 1979) to 78 cattle (five individually fed steers/ration and two pens of four heifers/ration). The rations contained 83.2% corn, 4.5% forage sorghum silage, 4.5% alfalfa hay and 7.8% supplement (dry basis) (Table. 10.1). All rations were formulated to 12% crude protein, .80% calcium and .32% phosphorus. Cattle were adjusted to full feed over 24 days, implanted with 36 mg of Ralgro, and wormed with an oral paste.

At the start and again at the end of the feeding trial, all cattle were weighed individually after 16 hr without feed or water. Intermediate full weights were taken before the a.m. feeding on days 28, 56, and 84. Steer performance was based on beginning and ending live weights. Heifer final weights were derived from hot-carcass weights and a dressing percentage of 62.

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

Aerobic stability (bunk life) of each H.M.C. was measured with samples taken on May 13 and July 1, 1980 (details are described on page 7 of this report).

Results

The Cold-flo H.M.C. was 9.36% crude protein (CP) before treatment and 9.95% CP when fed. The 19.3 lb of Cold-flo added per ton should have raised the CP to 14.32%, so only 12% of the Cold-flo nitrogen added was retained. Ammonia loss at the silo blower and during silo filling were enhanced by the low moisture of the ensiled corn.

Adding NaOH to whole H.M.C. quickly turned the corn a carmel yellow and the mixture was very difficult to blow into the silo. NaOH-treated corn at feeding was dark brown to black; it caked and was extremely difficult to remove from the silo.

Chemical analyses of the corn treatments are shown in Table 10.2. The pH values for ensiled H.M.C.'s were higher than expected. NaOH (pH, 8.8) and Cold-flo (pH, 7.8) remained basic due to the alkaline nature of the additives. High pH's for the other H.M.C.'s indicated minimum fermentation because of high dry matter of the pre-ensiled corn. Volatile fatty acid and lactic acid levels confirmed the pH measurements. Acid detergent nitrogen, which represents bound and undigestible nitrogen (probably due to heating), was highest for the NaOH treatment.

Aerobic deterioration of H.M.C., which can occur in the silo (at the surface) or in the feed bunk, results from aerobic organism growth (yeasts, molds, or bacteria). In this experiment the structures were open for feeding April 8 through July 15, 1980. NaOH-treated corn did not heat extensively at the feeding surface, but some spoilage occurred near the inside wall of the silo. Stave, Silo-Best, Cold-flo, and Harvestore H.M.C.'s heated at the feedout surface, in addition to showing organism growth. Mold and yeast growth were apparent. Slow corn use and warm ambient temperature undoubtedly contributed to the aerobic deterioration at the surface. Instability in the Harvestore could have been increased because only 20% of the structure was filled originally.

Aerobic stability measurements (Table 10.3) confirmed the unstable nature of all H.M.C.'s except NaOH. Cold-flo and Harvestore H.M.C. heated nearly as soon as they were exposed to air, and they reached the highest temperatures and had the greatest accumulated temperatures in each measurement. Stave and Silo-Best H.M.C. heated at an intermediate rate. Dry matter and lactic acid disappeared and pH values increased during exposure to air; changes were most pronounced in Harvestore and Cold-flo H.M.C. Ammonia accumulation, particularly in Harvestore H.M.C., indicated protein breakdown.

Performance of all steers and heifers are shown in Table 10.4. Individually fed steers: Intakes were similar among treatments, but rates of gain for Cold-flo and NaOH H.M.C. were less ($P<.05$) than for other corns. NaOH H.M.C. was used the least efficiently ($P<.05$).
Heifer groups: Daily feed consumption was higher for Silo-Best and NaOH H.M.C. ($P<.05$) than for Harvestore; consumption was similar for other corns. Rates of gain were all statistically similar, but gains were lowest for Cold-flo and NaOH H.M.C. Harvestore H.M.C. was used the most efficiently; NaOH, the least ($P<.05$).

For both steers and heifers, NaOH addition increased intake but performance was reduced. The high sodium content of NaOH rations caused high water intake and urine excretion, which could explain the lowered performance. Although the stave, Silo-Best, and Harvestore H.M.C.'s were unstable in air, cattle performance for these rations was similar to that for dry corn.

Table 10.1. Composition of the supplements fed in the six rations.

Ingredient	Dry, stave, Harvestore, and Silo-Best	NaOH	Cold-flo
	lb per ton		
Corn, rolled	---	---	1042.0
Soybean meal, 44% CP	900.00	900.00	---
Tallow	20.00	20.00	20.00
Urea, 281% CP	178.00	178.0	---
Limestone	520.00	520.0	520.0
Dicalcium phosphate	60.00	60.0	60.00
Salt	120.00	---	120.00
Potassium chloride	110.00	230.00	146.00
Ammonium sulfate	40.00	40.00	40.00
Vitamin A (10,000 IU/gm)	17.80	17.80	17.80
Vitamin D (15,000 IU/gm)	1.20	1.20	1.20
Rumensin 60	5.00	5.00	5.00
Tylan 10	18.00	18.00	18.00
Trace mineral (CCC-Z10)	10.0	10.0	10.0

Table 10.2. Chemical analyses of the corn treatments.[1]

Corn treatment	Dry matter	pH	NH_3-N[2]	Crude protein	ADN[3]	Lactic acid	Acetic acid	Valeric acid
	%			% of the DM				
Dry	89.6	5.5	.47	9.49	.046	.194	.014	.030
Stave	82.0	6.4	5.14	8.96	.110	.433	.096	.021
NaOH	82.1	8.8	1.81	8.68	.177	.264	.379	.087
Silo-Best	81.4	6.4	4.19	9.15	.070	.350	.140	.015
Cold-flo	79.0	7.8	18.66	9.95	.092	.754	.117	.027
Harvestore	77.7	7.6	11.96	9.04	.047	.579	.121	.015

[1]Each value is the mean of a composite sample.

[2]NH_3-N means amnonia-nitrogen expressed as a % of total nitrogen.

[3]Acid-detergent nitrogen

Table 10.3. Changes in temperature, and pH and losses of dry matter and lactic acid during air exposure by five high-moisture grains.

Samples taken May 13.

Corn treatment	Day of initial rise above ambient temp.*	Maximum temp.	Days exposed to air: 0	2	5	7	16
		°F	Accumulated temp. above ambient °F				
Stave	5.7	88.9		29.9	50.7	84.6	136.2
Silo-Best	7.2	88.3		28.5	42.3	49.3	96.9
NaOH	Stable	69.0		**	4.8	9.3	35.3
Cold-flo	1.4	111.5		43.8	204.6	329.3	633.9
Harvestore	1.0	104.3		67	155.7	207.3	493.0
Dry	Stable	66.7		**	**	**	**
			Loss of DM (% of DM exposed to air)				
Stave				.9	1.3	1.6	2.7
NaOH				.8	1.1	1.2	3.6
Silo-Best				1.2	1.6	1.8	2.1
Cold-flo				13.4	14.3	16.6	26.70
Harvestore				1.7	2.3	3.6	11.8
Dry				1.1	1.1	1.00	.9
			pH				
Stave			4.72	4.87	5.26	5.73	5.99
Silo-Best			4.87	4.95	5.09	5.32	5.88
NaOH			8.83	9.03	9.15	9.11	9.19
Cold-flo			5.61	5.92	6.80	6.67	6.59
Harvestore			5.14	5.78	6.39	6.39	6.19
Dry			5.53	5.55	5.97	5.50	5.66
			Lactic acid				
Stave			.32	.40	.34	.24	.13
Silo-Best			.23	.21	.26	.19	.08
NaOH			.06	.06	.07	.08	.06
Cold-flo			.85	.72	.43	.41	.15
Harvestore			.30	.27	.14	.13	.11
Dry			.12	.05	.06	.05	.04

Samples taken July 1.

Corn treatment	Day of initial rise above ambient temp.*	Maximum temp.	Days exposed to air: 0	2	5	7	16
		°F	Accumulated temp. above ambient °F				
Stave	5.5	84.8		5.0	30.8	41.3	56.9
Silo-Best	4.5	93.00		19.0	62.3	69.8	143.8
NaOH	Stable	71.3		**	**	**	**
Coldflow	2.0	116.9		91.7	262.7	338.1	475.1
Harvestore	1.0	118.4		163.3	284.2	340.7	459.1
Dry	Stable	71.2		**	**	**	**
			Loss of DM (% of DM exposed to air)				
Stave				2.69	3.05	3.17	2.77
Silo-Best				.84	1.70	2.19	4.04
NaOH				.30	0	0	0
Cold-flo				1.50	5.46	9.79	14.44
Harvestore				3.88	7.78	10.40	15.27
Dry				0	0	0	0
			pH				
Stave			5.08	5.01	5.63	6.03	6.07
Silo-Best			5.26	5.25	6.27	6.21	6.08
NaOH			8.35	8.67	8.76	8.52	8.87
Cold-flo			5.13	6.08	6.61	6.43	6.69
Harvestore			5.76	6.65	6.54	6.48	6.74
Dry			5.80	5.62	5.56	5.51	5.48
			Lactic acid				
Stave			.25	.39	.30	.13	.16
Silo-Best			.33	.39	.18	.16	.15
NaOH			.06	.13	.12	.14	.13
Cold-flo			1.31	.77	.30	.25	.26
Harvestore			.27	.14	.15	.14	.10
Dry			.09	.07	.09	.08	.08

*6.0 F rise above ambient temperature

** No rise in temperature.

Table 10.4. Performance by steers and heifers fed the six corn rations.

	Dry	Harvestore[1]	Stave	NaOH	Silo-Best	Cold-flo
No. of steers	5	4	5	5	5	5
Initial weight, lb	641	630	648	640	652	655
Final weight, lb	930	914	942	860	956	915
Avg. daily gain, lb	3.18^{a}	3.12^{a}	3.23^{a}	2.42^{b}	3.35^{a}	2.86^{ab}
Total daily feed, lb[2]	18.08	17.06	18.44	18.95	18.89	16.99
Feed/lb of gain, lb[2]	5.72^{a}	5.50^{a}	5.78^{a}	8.07^{b}	5.62^{a}	6.08^{a}
Number of heifers	8	8	8	8	8	8
Initial wt., lb	552	557	548	553	557	555
Final wt., lb	816	822	804	807	826	801
Avg. daily gain, lb	2.90	2.92	2.81	2.79	2.96	2.71
Total daily feed, lb[2]	17.20^{ab}	16.50^{b}	17.67^{ab}	18.76^{a}	18.19^{a}	17.29^{ab}
Feed/lb of gain, lb[2]	5.93^{bc}	5.66^{c}	6.29^{abc}	6.72^{a}	6.16^{abc}	6.40^{ab}

[1] One steer died.

[2] 100% dry matter basis.

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

Sila-bac and Molasses Additives for High Moisture Sorghum Grain[1]

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

Summary

Sila-bac, molasses, or both combined were evaluated as additives for ensiled high moisture sorghum grain. Control grain had the greatest increase in temperature during ensiling. Grain treated with Sila-bac had the highest lactobacilli count but control grain had the fastest drop in pH. Sila-bac grain was the most stable in air and remained stable for 30 days. Control grain was stable for 21 days; grain treated with molasses or molasses plus Sila-bac was stable until day 5.

Group-fed steers receiving Sila-bac grain gained faster and were more efficient than steers fed control or molasses-treated grain. Individually fed steers gained fastest when receiving molasses treated grain. Those receiving Sila-bac grain were the most efficient.

Introduction

Sorghum grain is increasingly used as an alternative to corn in cattle finishing rations. The production of sorghum grain requires less water and costs less per acre than corn. Mature sorghum grain, however, may need drying for safe storage and must be processed for efficient use by cattle. As energy costs increase, drying and processing become less desirable.

Previous Kansas research (Manhattan, Hays, and Garden City) has shown that although high moisture sorghum grain, rolled before ensiling, can be used efficiently by finishing cattle, the feeding value is not consistently equal or superior to dry rolled sorghum grain.

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

Experimental Procedure

Four concrete stave silos (10 ft x 50 ft) were filled with approximately 22,000 lb of high moisture sorghum grain harvested at 23 to 27% moisture.

---

[1]Sila-bac[R] is a lactobacillus inoculant product of Pioneer Hi-Bred International, Inc., Microbial Genetics Division, Portland, Oregon 97201.

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

Treatments were: 1) control (no additive); 2) 0.1% Sila-bac (2 lb/ton); 3) 1.0% dry cane molasses; and 4) 1.0% dry cane molasses plus 0.1% Sila-bac. Additives were applied to the grain on an as-received weight basis. All grain was passed through a roller mill to lightly crack the kernels; then treated, mixed, and augered into one of the four silos.

Samples were taken from each load as it was augered into the silo. Representative 800-g samples of the grain being ensiled were placed in air-tight plastic bags. Three bags for each treatment were placed in 5-gallon containers and covered with sand. The containers were stored in a chamber where the temperature was adjusted to correspond to the temperature recorded in the concrete stave silos. Bags were removed at intervals, mixed, and analyzed for lactobacilli, pH, and fermentation acids.

Silos were opened after 18 days, and 12 yearling Hereford steers (two pens of four steers each and four individually fed steers) were fed each grain. Rations contained 83% high moisture sorghum grain, 12% corn silage, and 5% supplement on a 100% dry matter basis. Rations were formulated to 11.5% crude protein, .64% calcium, .34% phosphorus, and .66% potassium. The supplement supplied 200 mg of monensin per steer daily. Rations were fed *ad libitum* twice daily. Refused feed was removed, weighed, and discarded every 7 days. Grain samples were collected weekly from the silos.

All steers were weighed individually, after 16 hr without feed or water, at the start and at the end of the feeding trial. Intermediate weights were taken on days 28 and 56. Final weights were calculated from the average dressing percentage of all steers.

Grain dry matter losses during fermentation, storage, and feedout were measured for each treatment by accurately weighing and sampling each load as it was augered into the silo and, later, weighing and sampling the material as it was removed from the silos. Ensiling temperature was monitored for the first 28 days by four thermocouples evenly spaced in each silo.

To measure aerobic stability (bunk life), fresh ensiled grain was taken from each silo and divided into 15 lots; each lot was placed in a plastic-lined polystyrene container. A thermocouple was embedded in the center of each container, cheesecloth was stretched over the top and the containers were placed in a 20°C room. Temperature for each container was recorded twice daily. Triplicate containers were removed, weighed, mixed, and sampled after 3, 6, 9, and 12 days of exposure to air. Temperature for the control and Sila-bac treated grains was monitored for 30 days.

Results

Lactobacilli counts at different times post-ensiling are shown in Table 11.1. Grain entering the silos was used for initial counts. Sila-bac treated grain had the highest initial lactobacilli count; however, at the end of 48 hr, counts were similar for all grain treatments. Control grain had the most rapid pH decrease; the molasses plus Sila-bac grain had the slowest (Figure 11.1). The rate of decrease in pH was similar for Sila-bac and molasses grains. After 58 days, Sila-bac and molasses grains had the lowest pH; molasses plus Sila-bac, the highest.

Chemical analyses of the grains are shown in Table 11.2. Control, Sila-bac, and molasses grains all had similar pH values; molasses plus Sila-bac grain was slightly higher. Lactic acid was highest in the control and molasses grains. Acetic acid was highest in the Sila-bac grain and lowest in the molasses plus Sila-bac grain; the control and molasses grains were intermediate. Ammonia nitrogen was highest in the Sila-bac grain.

Actual ensiling temperatures are shown in Figure 11.2. Sila-bac grain had the highest ensiling temperature; control grain, the lowest. Grain treatments did not enter the silos at the same temperatures. For example Sila-bac grain was 5°C warmer than control grain. Shown in Figure 11.3 is ensiling temperature in degrees above initial temperature. The control had the highest rise (6.5 C); molasses grain, the lowest (4.5 C).

Steer performances are shown in Table 11.3. Gains and efficiencies were excellent for all treatments. Group-fed steers receiving Sila-bac grain gained faster and more efficiently ($P<.05$) than those receiving control or molasses grains. Individually fed steers receiving molasses grain gained faster ($P<.05$) than those receiving the control or molasses plus Sila-bac grains. Individual steers fed Sila-bac grain had the lowest ($P<.05$) daily feed intake but were the most efficient ($P<.05$).

Losses due to fermentation, storage, and feedout are presented in Table 11.4. The control and Sila-bac grains had similar losses (7.69 and 8.91%, respectively), which were higher than losses from the molasses and molasses plus Sila-bac grains (<1.0% and 1.8%, respectively). These differences may be due to a higher dry matter and therefore a less extensive fermentation in the molasses-treated grains.

Aerobic stabilities are presented in Table 11.5. Aerobic deterioration is characterized by increased temperature, increased pH, loss of dry matter, and loss of fermentation acids. The Sila-bac treated grain was very stable and showed no temperature rise during the 30 days. The control grain was stable until day 21, while the molasses and molasses plus Sila-bac grains were only stable until day 5.

Table 11.1. Lactobacilli concentration of the four high moisture sorghum grains at different intervals post-ensiling[1]

	Sorghum grain			
Time post-ensiling	Control	Sila-bac	Molasses	Molasses + Sila-bac
	lactobacilli/gram of grain			
0 hr	1.1×10^4	4.2×10^7	2.8×10^6	4.3×10^4
8 hr	2.1×10^7	2.5×10^7	5.2×10^6	4.3×10^5
16 hr	2.3×10^8	7.4×10^7	8.4×10^7	2.6×10^8
24 hr	2.6×10^8	1.6×10^8	1.8×10^8	1.7×10^7
48 hr	2.5×10^8	2.5×10^8	3.2×10^8	1.2×10^8
96 hr	3.0×10^8	2.9×10^8	3.9×10^8	8.0×10^8
7 days	1.8×10^8	2.1×10^8	1.9×10^8	2.3×10^8
14 days	7.8×10^7	8.6×10^7	1.3×10^8	1.3×10^8

[1]Concentrations are mean of three samples per interval for each grain.

Table 11.2. Chemical analyses of control, Sila-bac, molasses, and molasses + Sila-bac sorghum grain[1,2]

Sorghum grain	Dry matter	pH	Crude protein	Lactic acid	Acetic acid	Propionic acid	Butyric acid	Valeric acid	NH_3-N*
	%		% of the dry matter						
Control	73.33	4.42	10.77	.935	.280	.006	.058	<.001	3.529
Sila-bac	73.78	4.51	10.57	.838	.439	.018	.001	.001	3.941
Molasses	75.32	4.45	10.51	.885	.319	.012	.001	.001	2.983
Molasses + Sila-bac	77.14	4.69	10.46	.800	.178	.001	.000	.017	3.073

[1]Each value is the mean of 10 samples (except Sila-bac + molasses, which is the mean of 8).

[2]All analyses were determined by using wet samples.

*NH_3-N means ammonia-nitrogen expressed as % of total nitrogen.

Table 11.3. Performances by yearling steers fed the four sorghum grain rations[1]

Item	Sorghum grain: Control	Sila-bac	Molasses	Molasses + Sila-bac
Group-fed steers:				
Number	8	8	8	8
Initial wt., lb	799	790	792	794
Final wt., lb	1043	1078	1021	1065
Avg. total gain, lb	244	288	229	268
Avg. daily gain, lb	3.48[b,c]	4.09[a]	3.26[c]	3.87[a,b]
Avg. daily feed, lb[2]	23.1	24.2	23.3	24.6
Feed/lb of gain, lb[2]	6.16[b,c]	5.92[a]	7.15[c]	6.40[a,b]
Individually fed steers:				
Number	4	4	4	4
Initial wt., lb	838	840	838	843
Final wt., lb	1104	1140	1148	1102
Avg. total gain, lb	266	299	310	260
Avg. daily gain, lb	3.83[b]	4.29[a,b]	4.42[a]	3.74[b]
Avg. daily feed, lb[2]	23.5[a,b]	21.8[a]	25.1[b]	24.4[b]
Feed/lb of gain, lb[2]	6.16[b,c]	5.13[a]	5.72[a,b]	6.58[c]

[1]70-day trial: October 9, 1980 to December 19, 1980.

[2]100% DM basis

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

Table 11.4. Sorghum grain fermentation, storage and feedlot losses in the silos

Sorghum grain	Dry matter at ensiling	Dry matter at feeding	DM Loss
	%	%	%
Control	73.16	73.63	7.69
Sila-bac	73.94	73.73	8.91
Molasses	76.05	75.50	<1.0
Molasses + Sila-bac	77.11	77.11	1.8

Table 11.5. Change in temperature and pH and loss of dry matter and nutrients during air exposure by the four sorghum grains.

Sorghum grain	Day of initial rise above ambient temperature*	Days exposed to air 0	3	6	9	12
		DM loss (%)				
Control	21	--	<1.0	1.02	1.62	1.97
Sila-bac	--	--	<1.0	<1.0	<1.0	<1.0
Molasses	5	--	<1.0	<1.0	6.22	12.89
Molasses + Sila-bac	5	--	<1.0	<1.0	2.52	3.38
		pH				
Control		4.40	4.37	4.44	4.56	4.72
Sila-bac		4.46	4.46	4.52	4.62	4.62
Molasses		4.19	4.48	5.85	5.58	5.65
Molasses + Sila-bac		4.76	5.25	5.92	6.02	5.92
		Lactic acid (% of the DM)				
Control		1.054	.765	.938	1.000	.908
Sila-bac		.764	.636	.522	.697	.657
Molasses		1.258	1.098	.542	--	.405
Molasses + Sila-bac		.792	.643	.460	.472	.476
		Acetic acid (% of the DM)				
Control		.640	.302	.464	.394	.327
Sila-bac		.880	.678	.602	.538	.626
Molasses		.164	.029	.030	.030	.043
Molasses + Sila-bac		.070	.018	.021	.011	.014
		NH_3-N (% of total nitrogen)				
Control		4.85	5.68	4.78	5.82	4.34
Sila-bac		5.19	7.12	5.20	6.67	5.86
Molasses		2.73	2.64	2.77	1.89	2.29
Molasses + Sila-bac		.93	1.12	.65	.58	.55

*Ambient temperature, 20° C.

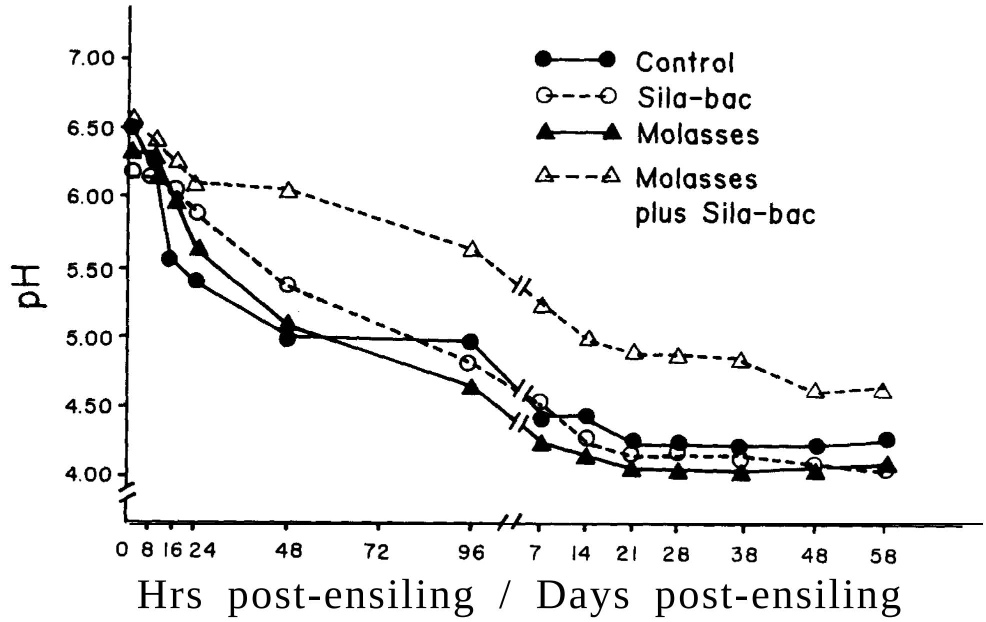


Figure 1. pH of the four sorghum grains at various time intervals post-ensiling. Each value represents the overage of triplicate samples.

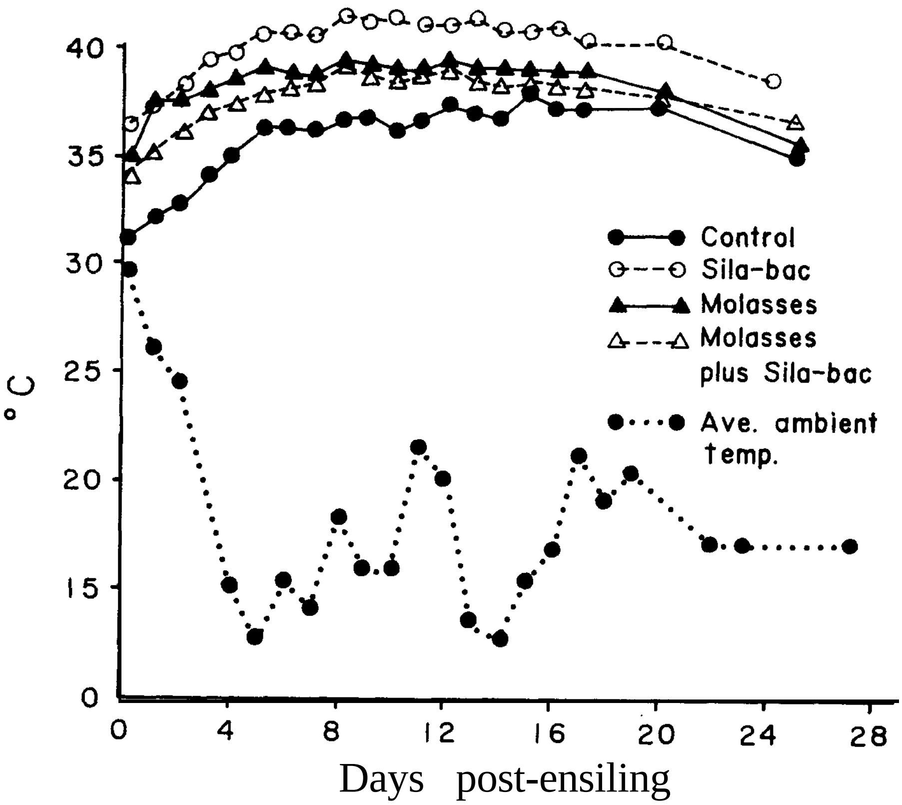


Figure 2. Ensiling temperature for the four sorghum grains at various days post-ensiling.

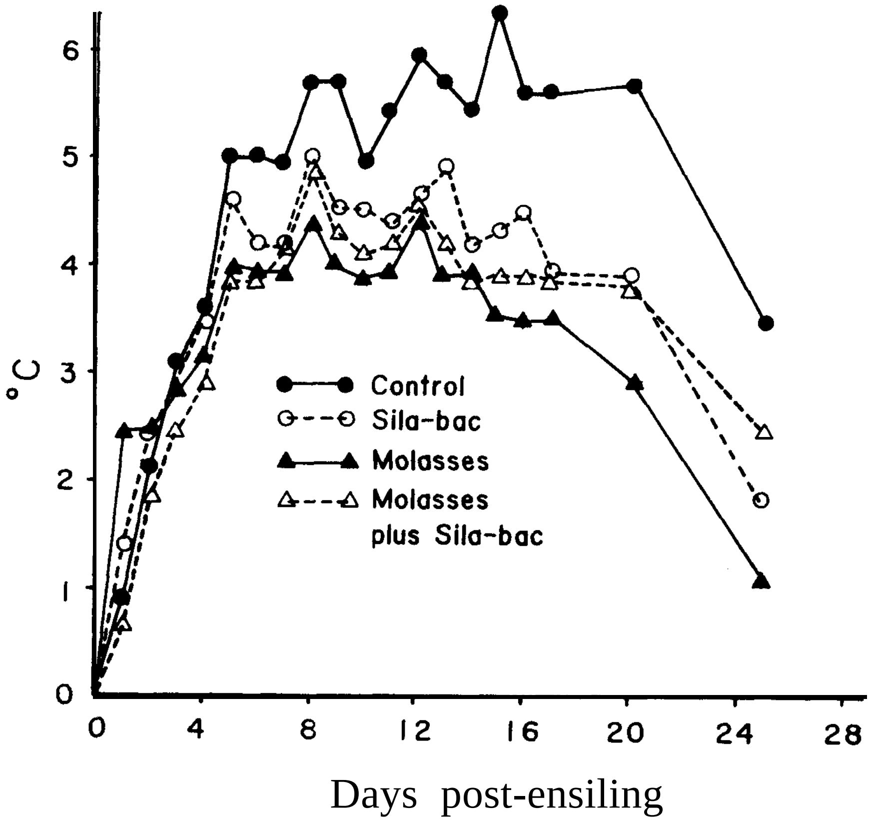


Figure 3. Ensiling temperature (degrees above initial temperature) for the four sorghum grains at various days post-ensiling.

Whole Sorghum Grain Stillage for Beef Cattle[1]

Steve Soderlund, Keith Bolsen, Ron Pope,
Jack Riley, and Ben Brent

Summary

Trials were conducted to evaluate the storing, handling, and feeding of whole sorghum grain stillage from a farm-scale still. Stillage varied in dry matter among batches and had to be agitated to keep solids suspended. Whole stillage kept for 10 days to 2 weeks, even during warm weather, with mold growth occurring only on the surface. However, when stillage was mixed with either grain or forage, it spoiled rapidly and required close bunk management.

Although whole stillage was still palatable to cattle after 2 weeks, intakes were best when it was less than 3 days old. When whole stillage was fed freechoice, cattle could not consume enough dry matter to maintain weight.

Steers fed whole stillage at 50% (as-fed basis) of a growing ration consumed more dry matter, gained faster, and were more efficient than those fed 0, 32, or 68% stillage.

Feeding decanted stillage (10.5% dry matter) as a protein supplement in finishing rations gave poorer rate and efficiency of gains than did soybean meal or urea.

Introduction

When cereal grains are fermented, starch, which makes up about two-thirds of grain dry matter, is converted to alcohol and carbon dioxide. Thus, fermenting the starch results in a three-fold increase in the remaining nutrients.

The residue after distillation, commonly called "stillage," contains only 5 to 10% dry matter and has a relatively short storage life. The recovery of stillage can contribute a significant economic return to grain alcohol production. However, drying stillage is not economical for farm-scale units, and dumping the effluent into rivers or streams can damage the environment.

Several universities have shown that the protein in commercial dried distillers' feeds is well used by growing cattle. Our objectives were to evaluate methods of feeding whole stillage to beef cattle. Stillage was obtained from a farm-scale still at approximately 14-day intervals and stored in a polyethylene tank at the feeding site. A flow diagram and outline of the alcohol-production process is shown in Figure 1.

[1]Financial support for this project came from the Kansas Wheat, Corn and Grain Sorghum Commissions through the Kansas Energy Office.

Experimental Procedures and Results

Chemical analyses of the stillage are shown in Table 12.1. Dry matter content averaged 7.5% (5.4 to 8.3 percent). Crude protein averaged 33% on a dry matter basis and ranged from 26 to 35%.

Trial 1: Stillage Fed Free-Choice. Twenty mixed breed yearling steers averaging 809 lb were randomly assigned (10 steers/treatment) to free choice stillage with or without access to drinking water. Steers, housed in individual stalls, were fed stillage in polyethylene troughs twice daily. All received 5 lb of longstem grass hay once daily and had free access to a salt block. The trial lasted 16 days (May 13 to May 29, 1981). The steers were not pre-adapted to stillage.

Steer performances are shown in Table 12.2. Stillage intakes were quite variable among all steers. Average daily stillage intake peaked at 115 lb on day 11, after delivery of fresh stillage on day 10. Steers without drinking water adapted to the stillage somewhat faster than did those with water; but by the end of the trial, intakes were about equal.

Fed whole stillage in this manner, steers consumed only 1.26% of their body weight as dry matter and all 20 lost weight. Poor performances were likely due to the extremely high moisture content and high acidity of the stillage. Steers looked emanciated by day 4, but no serious digestive problems occurred.

Trial 2: Stillage in Growing Rations. Sixty-four Hereford and Hereford x Simmental steers averaging 653 lb were fed growing rations for 56 days (April 24 to June 19, 1981). Four pens of four steers each were randomly assigned by blocks to each of four rations: 1) control; 2) 32% stillage; 3) 50% stillage; and 4) 68% stillage (as-fed basis).

All rations contained a fixed percentage of roughage and supplement on a dry matter basis. As stillage dry matter was added to the control ration, the same amount of milo dry matter was removed, and soybean meal and minerals in the corresponding supplement were replaced with milo to compensate for stillage protein and minerals. Water was added to the control ration so that its moisture content would equal that of the 32% stillage ration. Ration and the supplement compositions and ration proximate analyses are presented in Table 12.3.

Roughages were ground in a tub grinder through a 2-inch screen. Milo was coarsely rolled. Stillage was agitated in the holding tank before each feeding. All rations were mixed once but fed twice daily.

Steers were fed a fixed amount of corn silage for three feedings, then weighed individually after 16 hr without feed or water at the start and again at the end of the trial. That was to remove the effect of fill differences due to different moisture levels in the rations.

Steer performances are shown in Table 12.4. Daily gain from 50% stillage was greater ($P<.05$) than that from the control or the 32% stillage but similar to that from the 68% stillage. Feed intakes and efficiencies were not significantly different, but the 50% and the 68% stillage were 10 and 8%

more efficient, respectively, than the control ration. We concluded that stillage dry matter can successfully replace milo as an energy source and soybean meal as a supplemental protein source for growing steers.

Trial 3: Stillage in Finishing Rations. The 64 steers from trial 2 were used in an 84-day finishing trial (June 19 to September 13, 1981). Pens were re-allotted randomly, one pen from each previous ration, to four protein treatments: 1) soybean meal; 2) urea; 3) stillage; and 4) stillage plus urea.

Rations were 85% concentrate and 15% drought-stressed corn silage (dry matter basis). Steers were brought to full-feed within 10 days. The composition of the rations and the supplements and the proximate analyses of the mixed rations are given in Table 12.5.

All steers received 300 mg of Rumensin daily. Stillage moisture was reduced as follows: stillage was agitated within the holding tank, then the amount needed for the next day was pumped into two 55-gallon drums with siphoning ports about one-third the distance down from the top. After stillage had settled 24 hr; the thin slurry (top one-third) was removed. Dry matter of the thin phase was 1.5 to 2.0%; that in the remaining stillage was 10.5%. Rations were mixed once but fed twice daily.

Final weights from trial 2 were used as the initial weight in this trial. At the end, steers were weighed individually after 16 hr without feed or water. Final weights were adjusted to a 61.5% dressing percentage.

Performance data are shown in Table 12.6. Steers fed soybean meal gained 10% faster and 9% more efficiently ($P<.05$) than did those fed stillage as supplemental protein. Urea or stillage plus urea produced faster and more efficient gains than did stillage alone, but no rations containing stillage or urea performed as well as soybean meal. Dry matter intakes were not significantly different among treatments.

No significant differences were observed in dressing percentages.

Alcohol-production Process

1. One hundred bushels of milo was finely ground (1/4-inch screen) in a portable grinder-mixer.
2. A slurry (mash) was made in the cook tank by adding 12 gallons of preheated water per bushel of grain.
3. Live steam was added to bring the slurry temperature up to 130°F. Then a carbohydrase enzyme (taka-therm) was added to convert the starch to sugars (dextrins). The slurry was then heated with steam to 200°F and held there for 45 min. Agitation was continuous.
4. Another 8 gallons of water per bushel was added to cool the mash to 130°F. After the temperature had stabilized, amylase (an enzyme) was added to break the dextrins down to simple sugars (glucose). This process took about 6 hr.
5. The mash was then cooled to 80°F by passing it through a tube-in-shell heat exchanger.
6. The mash was transferred to the fermenting tank, inoculated with yeast, and allowed to ferment 72 hr. Glucose was converted to alcohol.
7. The mash was transferred to the beer column. Steam was added at the bottom of the beer still to vaporize the alcohol. The temperature at the top of the column was maintained at 190° to 200°F.
8. The uncondensed alcohol vapors were passed to the rectifier column. The temperature at the top of the rectifier column was controlled at 170°F by reflux (i.e., by pumping a portion of condensed product back into the column top).
9. The vapors from the rectifier column were condensed in a water-cooled condenser and the product flowed either into the reflux tank or into a product-storage tank.
10. Whole stillage was recovered from the bottom of the columns and was pumped directly to a transfer tank.

Cook tank	make-up
Grain sorghum	100 bushels (600 gallon)-displacement
Make-up	1200 gallon
Cooling water	800 gallon
Condensed steam	267 gallon
Total	2867 gallon

Recovery volume	
Whole stillage	2700 gallon
Alcohol (180 proof)	167 gallon
Total volume	2867 gallon

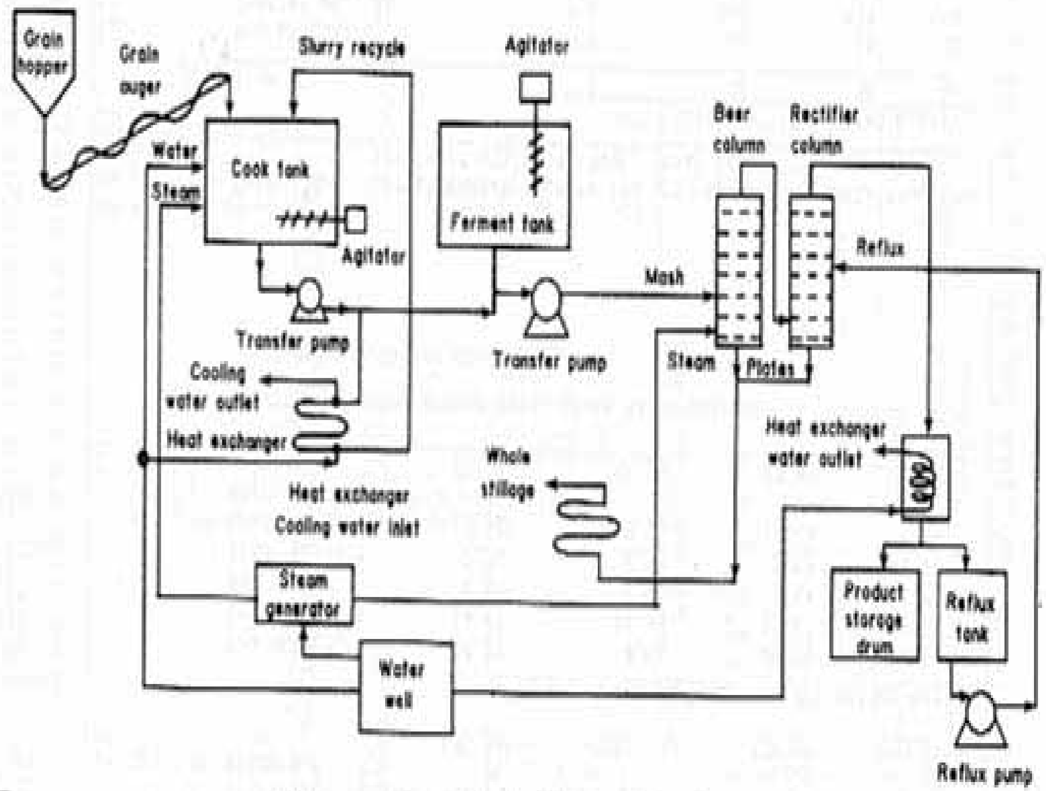


Figure 1. Alcohol Production Process

Table 12.1. Chemical composition of whole sorghum grain stillage[1]

Item	Dry analysis[2] Range	Average
Dry matter	5.40 - 8.3	7.5
Crude protein	26.0 - 35.0	33.2
Ash	4.3 - 5.2	5.0
Ether extract	11.7 - 12.7	12.2
Crude fiber	5.9 - 6.8	6.2
Nitrogen-free extract	41.4 - 45.4	43.4
Hemicellulose*	23.6 - 30.2	26.3
Cellulose*	17.2 - 26.3	20.2
Lignin*	6.5 - 9.5	8.1
Calcium	.11 - .12	.115
Phosphorus	.61 - .72	.67
Sodium	.028- .032	.030
Magnesium	.31 - .35	.322
	Wet analysis[3]	
pH	3.90 - 4.10	4.05
Lactate, % (w/v)	.27 - .42	.31
Acetate, % (w/v)	.02 - .42	.18
Ethanol, % (v/v)	.5 - 3.2	1.9

[1]Values presented are from five distillations (three samples/distillation).

[2]Expressed as a % of stillage dry matter.

[3]Expressed as a % of stillage volume.

*Van Soest analysis.

Table 12.2. Performance by steers fed whole stillage, trial 1[1]

Item	With water	Without water
No. of steers	10	10
Initial wt., lb	824	794
Final wt., lb	800	783
Avg. total weight change, lb	-24	-11
Avg. daily feed intake, lb as-fed[2]		
prairie hay	5.0 (4.5)	5.0 (4.5)
stillage[3]	71.8 (5.4)	76.8 (5.8)
total	76.8 (9.9)	81.8 (10.3)

[1]16-day trial.

[2]Value in parenthesis: feed intake on a 100% dry matter basis.

[3]Stillage: 7.5% dry matter.

Table 12.3. Composition of growing rations and supplements, trial 2

Ingredients	Ration (%, as-mixed basis)* 1	2	3	4
Alfalfa	14.3 (20.3)	14.3 (20.6)	11.1 (20.7)	7.5 (20.2)
Wheat straw	17.9 (25.4)	17.9 (25.7)	13.9 (26.0)	9.4 (25.3)
Milo	32.0 (44.3)	28.6 (40.0)	19.4 (35.4)	11.3 (29.7)
Water	28.6 --	-- --	-- --	-- --
Stillage[1]	-- --	32.2 (3.8)	50.0 (7.6)	68.0 (14.8)
Supplement	7.2 (10.0)	7.0 (9.9)	5.6 (10.3)	3.8 (10.0)
	100.0	100.0	100.0	100.0
	Supplement (%, as-mixed basis)			
Soybean meal	72.70	53.30	33.84	--
Milo	20.80	40.55	60.55	94.75
Salt	5.00	5.00	5.00	5.00
Dicalcium phosphate	1.25	.90	.36	--
Vitamin A	.25	.25	.25	.25
	100.00	100.00	100.00	100.00
	Ration proximate analyses (%, dry matter basis)			
Dry matter, %	64.13	64.00	48.70	33.50
Crude protein	14.67	14.33	13.67	14.22
Ash	6.82	6.59	6.99	6.60
Ether extract	2.28	2.38	2.67	4.10
Crude fiber	17.62	19.15	18.84	17.84
Nitrogen-free extract	58.62	57.55	57.81	57.24

*Percent on a dry matter basis given in parenthesis.

[1]Stillage: 7.5% dry matter.

Table 12.4. Performance by steers fed growing rations containing four levels of whole stillage, trial 2[1]

Item	Stillage[2] (%, as-fed basis) 0	32	50	68
No. of steers	16	16	16	16
Initial wt., lb	656	648	654	654
Final wt., lb	792	775	811	797
Avg. daily gain, lb	2.43[b]	2.24[b]	2.80[a]	2.54[ab]
Avg. daily feed intake, lb[3]	21.84	22.67	23.20	21.54
Feed/lb of gain, lb[3]	9.15	10.09	8.32	8.48

[1]56-day trial.

[2]Stillage: 7.5% dry matter

[3]100% dry matter basis.

[a,b]Means on same line with different superscripts differ significantly (P<.05).

Table 12.5. Composition of finishing rations and supplements, trial 3

Ingredient	Soybean meal	Urea	Stillage	Stillage[1] + urea
	Ration (%, as-mixed basis)*			
Milo	64.7 (80.7)	64.7 (80.7)	41.2 (73.1)	53.7 (77.9)
Corn silage	31.2 (14.2	31.2 (14.2)	22.5 (14.5)	27.2 (14.3)
Stillage[2]	--	--	33.3 (7.1)	15.6 (2.7)
Supplement	4.1 (5.1)	4.1 (5.1)	3.0 (5.3)	3.5 (5.1)
	Supplement (%, as-mixed basis)			
Soybean meal	73.80	--	--	--
Milo	--	62.93	73.80	67.33
Urea	--	10.57	--	6.47
Trace mineral salt	10.00	10.00	10.00	10.00
Limestone	15.60	15.90	15.60	15.60
Vitamin A premix	.23	.23	.23	.23
Vitamin D premix	.04	.04	.04	.04
Rumensin premix	.33	.33	.33	.33
	100.00	100.00	100.00	100.00
	Ration proximate analyses (%, dry matter basis)			
Dry matter, %	70.81	70.52	50.47	61.25
Crude protein	12.32	12.48	12.08	12.48
Ash	4.51	4.32	4.67	4.81
Ether extract	2.31	2.28	2.74	2.54
Crude fiber	5.24	4.84	5.59	5.14
Nitrogen-free extract	75.62	76.08	74.92	75.03

*Percent on a dry matter basis given in parenthesis.

[1]Urea supplied 50% of the supplemental nitrogen.

[2]Stillage: 10.5% dry matter.

Table 12.6. Performance by finishing steers fed the four sources of supplemental protein, trial 3[1]

Item	Soybean meal	Urea	Stillage[2]	Stillage + urea
No. of steers	16	16	16	16
Initial wt., lb	802	784	791	797
Final wt., lb	1083	1056	1048	1060
Avg. daily gain, lb	3.27	3.16	2.99	3.07
Avg. daily feed intake, lb[3]	24.25	24.30	24.09	24.30
Feed/lb of gain, lb[3]	7.44[a]	7.68[ab]	8.10[b]	8.00[ab]

[1]86-day trial.

[2]Stillage: 10.5% dry matter.

[3]100% dry matter basis.

[a,b]Means on the same line with different superscripts differ significantly ($P<.05$).

Ruminal Effects of Rumensin During Cold Stress

J.B. Robinson, D.R. Ames, and D.A. Nichols

Summary

Two trials were conducted to determine the effects of Rumensin in cold-stressed cattle. Steers fed diets with and without Rumensin were exposed to cold stress (0 C) and thermoneutrality (20 C). Rumen volatile fatty acids and rumen vault gases were sampled to monitor rumen fermentation. Although not statistically significant, Rumensin decreased rumen acetate to propionate ratios and increased CO_2/CH_4 ratios in both thermal environments. Such a methane decrease should improve feed efficiency because less energy is wasted. Thus, Rumensin appears to support a more efficient rumen fermentation in cold stress as well as thermoneutrality.

Introduction

Rumensin improves ruminant feed efficiency and/or average daily gain. It shifts the rumen fermentation by decreasing the acetic-to-propionic acid ratio, thus cutting energy loss. Rumen function can change during thermal stress. We attempted to determine if the fermentation shift due to Rumensin still occurred during cold stress.

Procedure

In two 56-day trials involving 16 steers (average initial weight 310 kg), we compared the effect of Rumensin on rumen fermentation during cold stress (0 C) and in the thermoneutral zone (TNZ) (20C). The steers were housed in chambers capable of controlling both temperature (± 2 C) and humidity (± 5%). The steers were on concrete slats and had approximately 2.33 m^2 per head.

Two steers per trial were allotted by weight to each of the following treatments: cold-Rumensin, cold-control, TNZ-Rumensin, and TNZ-control. The diets(Table 13.1)were fed with or without 30 g Rumensin/ton of air-dry feed. The diet was changed because of bloat problems in Trial I. Cattle were individually fed, twice daily *ad libitum*, by using electronic headgates. Rumen fluid and vault gases were sampled at 14-day intervals beginning approximately 3 hours after feeding.

Results and Discussion

Rumensin-fed cattle characteristically have increased propionate and reduced levels of acetate and CH_4, and thus have improved feed efficiency. Our VFA concentrations are shown in Table 13.2. Although not statistically different, Rumensin decreased the acetic/propionic acid ratio and increased the CO_2/CH_4 ratio for thermoneutrality and cold stress. Although our numbers were limited, Rumensin appeared to have the same impact on VFA and rumen vault gases during cold stress as during thermoneutrality.

Table 13.1. Effect of Rumensin and Temperature on Rumen Volatile Fatty Acid Concentrations and Rumen Vault Gas Composition

Temperature	0 C		20 C	
	Rumensin	No Rumensin	Rumensin	No Rumensin
Volatile fatty acid, molar concentrations				
Acetic acid (molar %)	55.27	55.57	55.27	56.06
Propionic acid (molar %)	31.12	28.99	29.92	27.61
Isobutyric acid (molar %)	1.34	1.40	1.81	1.56
Butyric acid (molar %)	9.62	10.34	9.81	10.67
Isovaleric acid (molar %)	1.06	1.19	1.09	1.38
Valeric acid (molar %)	0.98	1.35	0.98	1.29
Total VFA (μmoles/ml)	77.48	82.06	78.37	79.65
Acetic/propionic acid ratio	1.89	2.20	1.93	2.17
Rumen vault gas, percent of H_2+CH_4+CO_2				
H_2	1.02	0.84	0.65	0.91
CH_4	27.87	28.54	28.95	29.93
CO_2	71.11	70.62	70.40	69.16
CO_2/CH_4	2.55	2.48	2.43	2.31

No significant differences ($P<.05$).

Table 13.2. Composition of Diet (dry matter basis) for Steers

Ingredient	%
Trial 1	
Alfalfa hay, S-C, mid-bloom, grnd	33.3
Corn, dent yellow, grain, cracked	62.0
Soybean meal, solv-extd	3.0
Fat, animal	0.7
Dicalcium phosphate	0.5
Salt	0.5
Trial 2	
Prairie hay, mid bloom	4.5
Alfalfa pellets, dehy, meal	12.0
Corn, dent yellow, grain, cracked	70.0
Soybean meal, solv-extd	10.1
Fat, animal	1.0
Dicalcium phosphate	1.2
Limestone	.6
T. M. Salt	.6

Using Sprinklers to Improve Performance of Heat-stressed Feedlot Cattle

D.A. Nichols, D.R. Ames, and J.B. Robinson

Summary

During a 56-day test, four pens of finishing cattle were sprinkled when dry-bulb temperatures exceeded 80°F. The performance of the cattle was compared with that of cattle in pens not sprinkled. Cattle in sprinkled pens gained faster (2.83 vs 2.44 lbs per day, $P<.05$) and more efficiently (4.45 vs 5.20 lbs feed per lb gain) than did those in the nonsprinkled. Feed intakes of all cattle were similar.

Introduction

Feedlot performance of cattle is reduced during heat stress because maintenance requirement increases and the animal's appetite is reduced. Sprinklers can be used to reduce heat stress by increasing evaporative heat loss, and reducing ground temperature, thus decreasing radiant heat gain. The benefits from sprinkling increase with air movement and low humidity. Using foggers or fine mist nozzles may increase heat problems, because they increase humidity and reduce rate of evaporation.

Procedure

Fifty-six finishing heifers on a high concentrate diet were maintained (seven to a pen) in eight unshaded concrete pens. When dry-bulb temperature exceeded 80F, sprinklers came on for 2 minutes, followed by 28 minutes of drying. (The sprinkler control system is shown in Figure 14.1. In each pen, a 45-square-foot area was wetted. Sprinklers used 2.4 gallons of water per hour. The trial began July 1 and ended August 26, 1981. Average daily maximum temperature was 86.7F and temperatures exceeded 80F 50 days of the test. Relative humidity (measured at 4:00 p.m. daily) was 42% during the test period. Performance of heifers in sprinkled pens was compared with that of heifers in the nonsprinkled pens.

Results and Discussion

Average daily gain of finishing heifers and their feed to gain ratio were improved ($P<.05$) by sprinkling (Table 14.1), but daily feed intake was not affected. Sprinkled cattle appeared more comfortable and had lower respiratory rates than those not sprinkled.

Our data suggest that sprinklers can be used relatively inexpensively and effectively to reduce heat stress and improve performance of feedlot cattle, especially when air movement is adequate and relative humidity is low.

Table 14.1. Performance of sprinkled versus nonsprinkled feedlot cattle

Treatment	Daily feed (lb)	ADG (lb)	F/G
Sprinkled	12.53	2.83	4.43
Nonsprinkled	12.61	2.44	5.20

ADG = Average daily gain.
F/G - Feed-to-gain ratio.

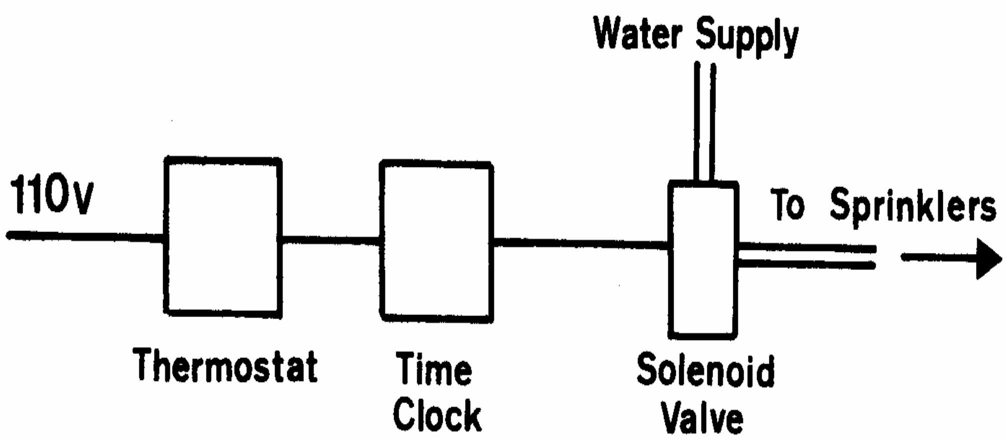


Figure 14.1. Control system for sprinkled pens.

Effect of Rumensin on Legume Bloat in Cattle

M.P. Katz, T.G. Nagaraja, E.E. Bartley, and E.S. Pressman

Summary

Rumensin[1] with or without Bloatguard[2] was fed to rumen-fistulated cattle grazing lush alfalfa pasture. Although Rumensin alone or in combination with low doses of Bloatguard reduced bloat, it was not completely effective. Hence, Bloatguard at the recommended dose is still necessary for full bloat control.

Introduction

Legume bloat is excess frothing of rumen contents after intake of lush legume forage. Many cattlemen have observed that cattle fed Rumensin while grazing alfalfa pasture have less frothy bloat. That led us to investigate the effects of Rumensin alone or combined with Bloatguard on alfalfa-pasture bloat.

Experimental Procedure

Our alfalfa pasture was divided into small plots and strip-grazed to provide bloat-provocative forage at all times. Cattle were pastured for about 1 hr in the morning and 1 hr in the evening: a schedule designed to cause bloat. When not grazing, cattle were held in drylot with shade, salt, and water available. Bloat was scored on a scale of 0 to 5 (0 = no bloat; 1 or 2 = moderate bloat; 3 to 5 = severe bloat) after each grazing period. We tested Rumensin alone at 300 mg (approved dose), 450 mg, and 600 mg per 1000 lbs of body weight. The approved dose of Bloatguard is 20 g per 1000 lbs of body weight. Treatment was not started until cattle had bloated for 3 consecutive days. Drugs were given via the rumen fistula before the morning grazing period. Treatment periods were 7 days or fewer if there were 3 consecutive days without bloat.

Results and Discussion

Bloat scores before and after treatment were compared, and the percentages of reduction in bloat are shown in Table 15.1. Rumensin alone at 300, 450, and 600 mg/1000 lbs reduced bloat by 36, 64, and 72%, respectively. Bloatguard at the recommended dose (20 g/1000 lbs) was 100% effective. Rumensin (300 mg) with 5 g of Bloatguard reduced bloat 46% and with 10 g, 66%.

---

[1]Elanco Products Co., Indianapolis, IN.

[2]Smith Kline Laboratories, Philadelphia, PA.

Rumensin alone or combined with reduced doses of Bloatguard did not control 100% of the bloat. Bloat on even one occasion in an experiment indicates the possibility, under field conditions, of many animals bloating on any given day. Thus, though Rumensin provides some bloat control and though control is better with Rumensin and low doses of Bloatguard, it is still necessary to use the recommended dose of Bloatguard if legume bloat is to be controlled effectively.

Table 15.1. Effect of Rumensin with or without Bloatguard on legume bloat

Drug	Dose*	Bloat score: Pre-treatment	Bloat score: Post-treatment	Percent reduction
Rumensin	300 mg	3.2	2.1	36.4
+ Bloatguard	5 g	3.1	1.7	45.9
+ Bloatguard	10 g	3.1	1.1	66.4
Rumensin	450 mg	3.2	1.1	64.2
Rumensin	600 mg	3.2	.9	72.5
Bloatguard	20 g	3.2	0	100.0

*Per 1000 lbs body weight.

Effects of Rumensin[1] or Rumensin-Tylan[1] Combination on Steer Performance and Liver Abscess Control

Jack Riley and Ron Pope

Summary

Combining Tylan with Rumensin dramatically reduced abscessed liver incidence, compared with that of steers fed a non-medicated control ration or Rumensin without Tylan. Only one steer out of 50 on the Rumensin plus Tylan combination had an abscessed liver, whereas livers from 16 of the control steers and 27 on Rumensin were condemned. There were no significant differences in daily gain among treatments; however, Rumensin plus Tylan improved feed efficiency by 9.4% compared with that of the control. Rumensin alone improved efficiency by 6%.

Introduction

Abscessed livers must be condemned, causing losses for the cattle-feeding industry. Because FDA regulations restrict feed additives that can be fed in combination, some cattle feeders have discontinued antibiotic feeding. The combination of Rumensin and Tylan in cattle rations is approved by FDA. Our purpose was to determine if that combination could prevent abscessed livers and improve performance.

Experimental Procedures

We used 150 mixed breed yearling steers from a local auction. Steers were individually identified; vaccinated for IBR, BVD, Leptospirosis, and 6-way clostridium; wormed; and implanted. Beginning and ending weights were individual non-shrunk weights taken on two consecutive mornings prior to feeding. Steers were randomly allotted to 15 groups of 10 and blocked for the three treatments to provide five replications. All steers received a diet of 5% corn silage, 85% dry rolled corn, and 10% supplement (dry basis). The diet was 11.1% crude protein (all natural), .45% calcium, .35% phosphorus, .7% potassium, and .4% salt. A premix was added to the supplements to provide Rumensin (30 grams/ton of complete ration) or Rumensin (30 grams/ton) plus Tylan (10 grams/ton) of complete ration.

Results and Discussion

Steer performance during the May 28 - September 30, 1981 trial is shown in Table 16.1. There was no significant difference in daily gain among the three treatments; however, Rumensin plus Tylan improved feed efficiency 9.4% over that of the control ration. Rumensin alone improved efficiency 6%.

---

[1]Rumensin, Tylan and partial financial assistance were provided by Elanco products Co., Indianapolis, Ind. Special assistance was provided by Dr. Herman Grueter.

The steers were slaughtered at Dubuque Packing Co., Mankato, Kansas. Individual liver abscess scores and carcass data were collected (Table 16.1). Rumensin plus Tylan dramatically reduced the incidence of abscessed livers. Only one steer out of 50 on Rumensin plus Tylan had an abscess, whereas 32% of the non-medicated control steers and 54% of those fed Rumensin had livers condemned. There were no significant differences in quality or yield grade.

Table 16.1. Effect of Rumensin or Rumensin-Tylan Combination on Steer Performance, Abscess Control and Carcass Grade. KSU, May 28 - September 30, 1981

Treatment	Control	Rumensin	Rumensin-Tylan
No. steers	50	50	50
Initial wt., lb.	725.1	727.7	723.2
Final wt., lb.	1135.8	1139.5	1131.7
Gain, lb.	410.7	416.8	408.5
ADG	3.31	3.36	3.29
Daily feed	27.02	25.0	24.31
Feed efficiency	8.16[a]	7.67[b]	7.39[b]
Liver abscess score:			
0	68%	46%	98%
1	6%	6%	2%
2	12%	20%	--
3	14%	28%	--
Carcass data:			
Carcass wt., lb.	709.9	701.0	701.3
Quality grade			
Prime	2%	2%	2%
Choice	82%	80%	82%
Good	16%	18%	16%

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

Insecticide-impregnated Ear Tags for Range Cattle

Gary L. Lynch, Keith O. Zoellner, Alberto B. Broce,
and Jack G. Riley

Summary

When both cows and calves were double-tagged (one tag per ear) with ear tags impregnated with fenvalerate[1] (Ectrin®) or permethrin[2] (Atroban®), the calves gained faster ($P<.01$) than when neither cows nor calves were tagged. Double-tagged yearling heifers gained faster ($P<.05$) than did heifers without tags. When all cows had been double-tagged, tagging the calves did not increase calf weight gain.

Introduction

Insecticide-impregnated ear tags effectively eliminate horn flies and reduce face flies. We measured the effect of tags on cattle weight gain and on fly population in a large geographical area in which most cattle were tagged.

Procedure

Ear tags impregnated with fenvalerate (Ectrin®) or permethrin (Atroban®) were attached to all cows (one tag per ear) and most calves and yearlings (one tag per ear) in a 28-section block in Butler County, Kansas. Cattle of similar type and breed outside the block were left untagged to serve as controls. Tagging was in the spring (April to early June). Horn flies and face flies were counted regularly all summer. Fly emergence was recorded from 1- to 2-day-old cow pats collected along transects inside and outside of the experimental block to determine fly dispersal into the test area. Average daily gains and weight per day of age were determined for calves and yearlings in and out of the test area.

Results and Discussion

Both types of tags completely controlled horn flies, counts of which in the experimental area were zero. Outside the experimental area, cattle had 50-400 flies/head. Although low throughout the season (0.75 flies/head in

---

[1] ® Ectrin is a registered trademark name for fenvalerate, produced by Diamond Shamrock. Ectrin tags were in part provided by Diamond Shamrock Co., Cleveland, OH.

[2] ® Atroban is a registered trademark name for permethrin, produced by Burroughs Wellcome. Atroban tags were in part provided by Burroughs Wellcome Co., Kansas City, MO.

Mention of products and companies is made with the understanding that no discrimination is intended and no endorsement implied.

control pastures), face flies were reduced by 92, 50, and 16% in early, mid, and late summer, respectively, in pastures with tagged cattle.

When both cows and calves were double-tagged, the calves gained 0.41 lb a day more ($P<.01$) than when neither cows nor calves were tagged (Table 17.1). Double-tagged yearling heifers gained 0.14 lb a day more than did untagged heifers (Table 17.1). In two herds, one with fenvalerate tags and one with permethrin tags, there was no significant difference in calf weight per day of age when both cow and calf were double-tagged, compared with when only the cow was double-tagged (Table 17.1).

Table 17.1. Effect of insecticide-impregnated ear tags on weight gain of beef calves and grazing heifers

Comparison 1. Effect of double tagging (of both cows and calves) on weight gain of calves			
	Tagged	Not tagged	
No. calves	47	21	
ADG, lb[a]	2.35	1.94	$P<.01$
Comparison 2. Effect of double tagging on weight gain of grazing heifers			
	Tagged	Not tagged	
No. heifers	26	18	
ADG, lb[a]	1.34	1.20	$P<.05$
Comparison 3. Effect of double tagging or not tagging of calves -- with all cows double tagged -- on calf weight[b]			
	Herd No. 1		
	Atroban tagged	Not tagged	
No. calves	24	15	
Trial length, days	122	122	
Wt/day of age	2.42	2.39	$P<.75$
	Herd No. 2		
	Ectrin tagged	Not tagged	
No. calves	24	16	
Trial length, days	164	164	
Wt/day of age	2.31	2.20	$P<.20$

[a]ADG = Average daily gain.

[b]A direct comparison between Atroban and Ectrin should not be attempted because two distinctly different herds were involved.

Effect of Ralgro[1] and COMPUDOSE[2,4] on Grazing Steer Performance

Lyle W. Lomas[3]

Summary

COMPUDOSE (an estradiol removable implant) increased steer gains during 202 days of grazing by 11.4%. Ralgro implants (once at the beginning of the study) increased gain 8.5%. Steer performance on the two implants was statistically similar.

Introduction

Growth-promoting implants usually result in an 8 to 15% faster gain in growing and finishing cattle. Synovex and Ralgro, the only implants currently approved for beef cattle, cannot be used within 60 and 65 days, respectively, of slaughter. Because both implants have an effective life of about 100 days, reimplanting is necessary for maximum benefits.

COMPUDOSE is a silicone rubber implant that releases estradiol-17β (a naturally occurring hormone) at a controlled rate. Although not currently cleared for use by the Food and Drug Administration, approval is anticipated in early 1982. Because it does contain a naturally occurring hormone, COMPUDOSE is expected to be approved for use without a required withdrawal period.

Procedure

On April 2, 1980, eighty-one Charolais steers averaging 539 lb were allotted thus: 1) control (no implant); 2) 36 mg of Ralgro; 3) COMPUDOSE (a removable, 4.76 mm x 3.0 cm silicone rubber implant containing estradiol-17β). Implants were placed subcutaneously in the median surface of the ear at the beginning of the trial and at no other time was any additional anabolic treatment given. Each COMPUDOSE-implanted steer was checked every 28 days to determine implant losses and was reimplanted if necessary. Steers were observed daily for abnormal behavior, such as "buller" steers. Cattle were grazed in three bromegrass pastures; all treatments were represented equally in each. Supplemental feed was provided equally when forage became short. Initial and final weights were the average of nonshrunk individual weights taken on consecutive days. The study was terminated October 22, 1980.

---

[1]Ralgro is the trademark name for zeranol implants produced by International Minerals and Chemical Corp., Terre Haute, IN 47808. Implants provided by IMC.

[2]COMPUDOSE is the trademark name for the estradiol implant produced by Elanco Products Co., Division of Eli Lilly Co., Indianapolis, IN 42606. Implants and partial financial assistance provided by Eli Lilly Co.

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

[4]COMPUDOSE is not currently cleared by the FDA for use in cattle.

Results

During the 202-day grazing study, steers implanted with COMPUDOSE gained 11.4% more ($P<.01$) than controls did. Ralgro-implanted steers gained 8.5% more ($P<.05$) (Table 18.1). The gain difference between the two implants was not significant ($P>.20$). Average calculated estradiol-17$_{\beta}$ release from the COMPUDOSE implants was 49μg per day. The incidence of "buller" steers or other mounting activity was similar among treatments.

Early in the study, several cattle lost their COMPUDOSE implants. Most implants retained for the first 28 days, however, remained for the entire 202 days. At the end of the test, 74% of the original COMPUDOSE implants remained in place.

Table 18.1. Effect of Implants on Steer Performance (202 days)

Item	Implant treatment		
	Control	Ralgro	COMPUDOSE
No. of steers	27	27	26
Initial wt., lb	539	536	540
Final wt., lb	894	922	937
Total gain, lb	$355^{a,c}$	$386^{b,c,d}$	$397^{b,d}$
Average daily gain, lb	$1.76^{a,c}$	$1.91^{b,c,d}$	$1.96^{b,d}$

[a,b]Values in the same row with different superscripts differ significantly ($P<.05$).
[c,d]Values in the same row with different superscripts differ significantly ($P<.01$).

Table 19.2. Effects of Ralgro on sexual development of bulls

	Control	Implant
No. bulls	20	20
Scrotal circumference, cm		
Average age -331 days	28.3[a]	21.2[b]
Average age - 517 days	32.4[a]	29.7[b]
Libido test (avg. age - 374 days)		
Libido score[x]	3.8	4.9
Number of mounts per bull	2.7	4.7
Number of services per bull	0.15	0.00
% bulls mounting	50.0[a]	80.0[b]
Libido test (avg. age - 501 days)		
Libido score[x]	4.7	4.8
Number of mounts per bull	2.5	3.0
Number of services per bull	0.25	0.05
% bulls mounting	70.0	70.0
Semen collection by electro-ejaculation (avg. age - 515 days)		
% with penis extension	100.0	90.0
% with erection	79.0	90.0
% with sperm in ejaculate	100.0[a]	45.0[b]
% motility	27.8[a]	2.0[b]
Reproductive organs at slaughter		
Paired testicle weight, g	499.6[a]	261.0[b]
Paired testicle volume, ml	469.8[a]	250.6[b]
Testicle density, g/ml	1.07[a]	1.04[b]
Penis weight, g	364.0[a]	282.5[b]
Penis length, cm	75.7[a]	72.4[b]
Seminal vesicles weight, g	73.6[a]	62.1[b]
Pituitary weight, g	1.6	1.5

[a,b]Means in same row with different superscripts are different ($P<.05$).

[x]A score of 10 = two services followed by mounts, mounting attempts, or further services; a score of 1 = no interest.

Table 19.3. Slaughter information for Ralgro implanted bulls

	Light control	Heavy control	Light implant	Heavy implant
Slaughter weight, lbs	1000	1134	997	1104
Avg. age at slaughter, days	581	552	538	522
Hot carcass weight, lbs	614	719	639	681
Dressing %	61.4	63.4	64.1	61.7

Table 19.4. Effects of Ralgro on bull carcass characteristics and palatability ratings

	Control	Implant
Carcass characteristics		
48-hour quality grade	Good 73	Good 78
Marbling	Slight[a] 81	Slight 93
Maturity	A 70[a]	A 80[b]
Lean color[s]	2.1	2.2
Lean texture[s]	2.9[a]	3.1[b]
Firmness of lean[s]	1.9[a]	2.3[b]
Yield grade	2.79[a]	3.09[b]
Adjusted fat thickness, in.	0.45[c]	0.56[d]
Loineye area, in.^{2}	11.71	11.73
% Kidney, pelvic, and heart fat	2.0[a]	2.2[b]
Palatability ratings (loineye steaks)		
Taste panel analysis scores		
Flavor intensity[x]	6.15	6.22
Juiciness[x]	6.24	6.01
Myofibrillar tenderness[x]	5.65[e]	6.47[f]
Connective tissue amount[y]	6.41[c]	6.81[d]
Overall tenderness[x]	5.80[e]	6.54[f]
Warner-Bratzler shear forces[z]	7.07[f]	5.12[e]

[a,b]Means in same row with different superscripts are different ($P<.10$).

[c,d]Means in same row with different superscripts are different ($P<.05$).

[e,f]Means in same row with different superscripts are different ($P<.01$).

[s]A score of 4 = moderately dark red color, slightly fine texture, or slightly soft firmness; 1 = very light cherry red color, very fine texture or very firm firmness.

[x]A score of 8 = extremely intense flavor, extremely juicy, or extremely tender myofibrillar or overall tenderness; 1 = extremely bland, extremely dry, or extremely tough myofibrillar or overall tenderness.

[y]A score of 8 = no connective tissue; 1 = abundant connective tissue.

[z]Pounds of force required to shear through a 0.5-in. core of cooked steak.

A trial at K.S.U. (Cattlemen's Day, 1979) showed that implanting bulls every 100 days from birth to slaughter improved average daily gain, impaired sexual development, and reduced mounting activity. That trial also indicated that implanting may improve carcass traits and the eating quality of bull meat.

Our trial was conducted to evaluate the effects of implanting bulls with Ralgro on: 1) growth and performance; 2) sexual development; and 3) carcass and palatability (eating quality) characteristics.

Experimental Procedure

Twenty of 40 Angus bull calves were implanted with 36 mg of Ralgro within 3 days after birth, then were reimplanted at an average of 123, 198, 324, and 425 days of age. The remaining 20 bulls served as nonimplanted controls.

All bulls were born in September and October and remained with their dams on native southeast Kansas pasture for an average of 320 days. The bulls were then assigned to drylot pens (feedlot beginning) and placed on adjustment rations, before being finished on a 75% concentrate ration.

Bulls from each treatment were slaughtered at two target weights (1000 and 1100 pounds). Each bull was weighed at the beginning of the finishing period and thereafter at regular intervals until slaughter; feed intake was monitered.

Maximum circumference of the scrotum (scrotal circumference) of each bull was measured at an average of 331 days and again at 517 days of age. At an average of 374 days and again at 501 days, groups of four bulls were penned with three restrained heifers in heat. The number of mounts, services, and other sexual activities were recorded on each bull for 10 minutes. Bulls were scored on a scale from 1 to 10 for libido (sex drive), with 1 being no interest and 10 being two services followed by mounts, mounting attempts, or further services. At an average age of 515 days, semen collection by electro-ejaculation was attempted on each bull. Collection continued until sperm were found in the ejaculate or until three attempts had been made. At slaughter the testicles, penis, seminal vesicles, and pituitary gland were removed and weighed, and testicle volume and penis length were recorded.

Carcass quality grade, yield grade, lean color, lean firmness, and lean texture were evaluated after a 48-hour chill. Loin steaks were removed from the shortloin of each carcass. The longissimus dorsi muscle (loineye) of one steak was evaluated by a trained taste panel for tenderness, juiciness, and flavor. Six 0.5-inch diameter cores were removed from another loineye steak and sheared with a Warner-Bratzler shear to mechanically measure tenderness.

Results and Discussion

Growth and performance: Average daily gain (ADG) and feed efficiency data are shown in Table 19.1. Implanting improved ADG 6.6% ($P<.05$) from birth to the feedlot beginning (320 days, average age). From the feedlot beginning until the first group of bulls was slaughtered (196 days), implanted bulls gained 9.4% faster (P<.01), with a 7.9% advantage (P<.10) in feed efficiency, than did controls. Compared within slaughter weight endpoints, implanting increased ADG 9.1% (P<.01). Feed efficiency for all implanted bulls up to the first slaughter (196 days) was 7.13 lbs of feed/lb of gain. Control bulls required 35 more days to reach the same target weight, and their feed efficiency was 7.71 lbs of feed/lb of gain -- an 8.2% advantage (P<.10) for implanted bulls.

Sexual development: Table 19.2 shows that testicular development was depressed (P<.05) by implanting. Sperm were successfully collected from all control bulls but from only 45% of the implanted bulls, and percent motility was lower (P<.05) for implanted bulls. Sex drive (libido) was not affected in this trial, which is in disagreement with an earlier trial at Kansas State (Cattlemen's Day, 1979) where bulls implanted with Ralgro had lower libido scores.

Because repeated implanting with Ralgro supresses sexual development in bulls, implanted bulls should not be used for breeding purposes.

Carcass and palatability characteristics: Slaughter weight, average age at slaughter, hot carcass weight, and dressing percent are shown in Table 19.3. We cannot explain the inconsistency in dressing percentages for bulls within slaughter weight groups.

Table 19.4 shows that implanted bulls had more (P<.05) external fat (adjusted fat thickness) and more (P<.10) kidney, pelvic, and heart fat than did the controls. Yield grades tended (P<.10) to be lower for control bulls, with no difference in loineye areas. Quality grades were similar between treatments, and no differences were found in lean color, but control bulls tended (P<.10) to have more desirable lean texture and firmness ratings. Even though implanted bulls were slaughtered at an earlier chronological age, they tended (P<.10) to have higher carcass maturity scores.

A trained taste panel rated steaks from implanted bulls as being significantly more tender for myofibrillar tenderness, connective tissue amount, and overall tenderness. Warner-Bratzler shear forces confirmed the taste panel tenderness ratings. Flavor intensity and juiciness ratings were similar between treatments.

Table 19.1. Effects of Ralgro on bull growth and performance

	Control	Implant	% advantage of implanted over control
No. bulls	20	20	-
Avg. daily gain, lbs from birth to feedlot beginning	1.37^a	1.46^b	6.6%
Avg. daily gain, lbs from feedlot beginning to slaughter 1	2.35^c	2.57^d	9.4%
Avg. daily gain, lbs from feedlot beginning to actual slaughter endpoints	2.31^c	2.52^d	9.1%
Feed/lb of gain from feedlot beginning to slaughter 1	7.69^f	7.13^e	7.9%

a,b Means in same row with different superscripts are different (P<.05).

c,d Means in same row with different superscripts are different (P<.01).

e,f Means in same row with different superscripts are different (P<.10).

Table 19.2. Effects of Ralgro on sexual development of bulls

	Control	Implant
No. bulls	20	20
Scrotal circumference, cm		
Average age -331 days	28.3[a]	21.2[b]
Average age - 517 days	32.4[a]	29.7[b]
Libido test (avg. age - 374 days)		
Libido score[x]	3.8	4.9
Number of mounts per bull	2.7	4.7
Number of services per bull	0.15	0.00
% bulls mounting	50.0[a]	80.0[b]
Libido test (avg. age - 501 days)		
Libido score[x]	4.7	4.8
Number of mounts per bull	2.5	3.0
Number of services per bull	0.25	0.05
% bulls mounting	70.0	70.0
Semen collection by electro-ejaculation (avg. age - 515 days)		
% with penis extension	100.0	90.0
% with erection	79.0	90.0
% with sperm in ejaculate	100.0[a]	45.0[b]
% motility	27.8[a]	2.0[b]
Reproductive organs at slaughter		
Paired testicle weight, g	499.6[a]	261.0[b]
Paired testicle volume, ml	469.8[a]	250.6[b]
Testicle density, g/ml	1.07[a]	1.04[b]
Penis weight, g	364.0[a]	282.5[b]
Penis length, cm	75.7[a]	72.4[b]
Seminal vesicles weight, g	73.6[a]	62.1[b]
Pituitary weight, g	1.6	1.5

[a,b]Means in same row with different superscripts are different ($P<.05$).

[x]A score of 10 = two services followed by mounts, mounting attempts, or further services; a score of 1 = no interest.

Table 19.3. Slaughter information for Ralgro implanted bulls

	Light control	Heavy control	Light implant	Heavy implant
Slaughter weight, lbs	1000	1134	997	1104
Avg. age at slaughter, days	581	552	538	522
Hot carcass weight, lbs	614	719	639	681
Dressing %	61.4	63.4	64.1	61.7

Table 19.4. Effects of Ralgro on bull carcass characteristics and palatability ratings

	Control	Implant
Carcass characteristics		
48-hour quality grade	Good 73	Good 78
Marbling	Slight 81	Slight 93
Maturity	A 70[a]	A 80[b]
Lean color[s]	2.1	2.2
Lean texture[s]	2.9[a]	3.1[b]
Firmness of lean[s]	1.9[a]	2.3[b]
Yield grade	2.79[a]	3.09[b]
Adjusted fat thickness, in.	0.45[c]	0.56[d]
Loineye area, in.^{2}	11.71	11.73
% Kidney, pelvic, and heart fat	2.0[a]	2.2[b]
Palatability ratings (loineye steaks)		
Taste panel analysis scores		
Flavor intensity[x]	6.15	6.22
Juiciness[x]	6.24	6.01
Myofibrillar tenderness[x]	5.65[e]	6.47[f]
Connective tissue amount[y]	6.41[c]	6.81[d]
Overall tenderness[x]	5.80[e]	6.54[f]
Warner-Bratzler shear forces[z]	7.07[f]	5.12[e]

[a,b]Means in same row with different superscripts are different ($P<.10$).

[c,d]Means in same row with different superscripts are different ($P<.05$).

[e,f]Means in same row with different superscripts are different ($P<.01$).

[s]A score of 4 = moderately dark red color, slightly fine texture, or slightly soft firmness; 1 = very light cherry red color, very fine texture or very firm firmness.

[x]A score of 8 = extremely intense flavor, extremely juicy, or extremely tender myofibrillar or overall tenderness; 1 = extremely bland, extremely dry, or extremely tough myofibrillar or overall tenderness.

[y]A score of 8 = no connective tissue; 1 = abundant connective tissue.

[z]Pounds of force required to shear through a 0.5-in. core of cooked steak.

Feeding Rumensin[R] to Yearling Heifers on Late-summer Grass

Mike Jensen, Rosalie Held, Jack Riley and E.F. Smith

Summary

Rumensin was self-fed in a loose salt mixture to yearling heifers on late-summer bluestem pasture (August to November). They ate 0.036 lbs. of salt mixture (124 mg of Rumensin) daily, but performance did not improve.

Introduction

Rumensin has been shown to improve the gain and efficiency of grazing cattle. Its intake has been regulated in a variety of ways. We tested regulating Rumensin intake in a loose salt mixture.

Experimental Procedure

Thirty-two Angus, Hereford, and crossbred heifers were grazed in four groups from August 4 to November 4, 1981. Two groups received a salt/Rumensin mixture and the other two were fed only salt. The cattle were allotted into four pastures, at an average stocking rate of 8 acres per head. The pastures had not been grazed since spring. The heifers were rotated between pastures every 2 weeks. The mixtures were fed free-choice in commercial mineral feeders. The amount fed was weighed and adjusted weekly according to intake. The cattle were weighed at the first of each month, after being penned overnight without feed or water.

Results and Discussion

Average daily gains of 0.72 pounds for Rumensin-group steers were statistically similar to the 0.67 pounds for the controls. The average daily Rumensin intake ranged from 18.4 to 200.5 mg. Adding Rumensin to the salt decreased salt intake by 22.8%. The wide variation of salt intake on the dry, mature grass prevented the close regulation of Rumensin intake. Also, the maturity of the late-summer grass contributed to decreased gain and could have affected the response.

[R]Rumensin, product of Elanco Products Co., Indianapolis, IN 46706.

Effect of Bovatec[1,4] and Ralgro[2] Implants on Finishing Steer Performance

Lyle W. Lomas[3]

Summary

Cattle fed Bovatec[1] consumed 17.4% less feed and were 17.7% more efficient than controls, with no effect on gain. Ralgro[2] implants improved gain 12% and feed efficiency 6.9%, with no effect on feed intake. Bovatec and Ralgro combined had an additive effect on feed efficiency.

Introduction

Bovatec is the trade name of lasalocid sodium, a feed additive similar to Rumensin. Both antibiotics were used as poultry coccidiostats before they were used for cattle. Both alter the proportion of rumen volatile fatty acids toward more propionate and less acetate. Although not currently approved, Bovatec is expected to be cleared for use in feedlot cattle by the Food and Drug Administration in early 1982. The approved dosage is expected to be 10 to 30 grams per ton of ration dry matter.

Procedure

Eighty-four Simmental steers averaging 832 lb were randomly allotted by weight to 12 pens of seven head each. Treatments were: 1) control (neither Bovatec nor Ralgro); 2) Bovatec only (45 gm per ton of dry ration); 3) Ralgro only (36 mg, implant); and 4) Bovatec and Ralgro combined. Each treatment was replicated in three pens. When the study began, March 11, 1980, we used 30% concentrate and 70% corn silage (dry basis). Then the concentrate was increased and the silage decreased by 5% daily until 80% concentrate and 20% corn silage had been reached. Initially, steers were weighed after a 16-hour shrink (off feed and water). Final weights were taken after 16 hours without feed. The trial terminated on July 1, 1980. Cattle were slaughtered July 16, 1980, and individual carcass data were collected.

---

[1]Bovatec is the trademark name for lasalocid sodium produced by Hoffmann-LaRoche, Inc., Nutley, N.J. 07110. Feed additive and partial financial assistance provided by Hoffmann-LaRoche, Inc.

[2]Ralgro is the trademark name for zeranol implants produced by International Minerals and Chemical Corp., Terre Haute, IN 47808. Implants and partial financial assistance provided by IMC.

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

[4]Bovatech is not currently cleared by the FDA for use in cattle.

Results

During the 112-day finishing study, gains with and without Bovatec were similar (Table 21.1). Feeding the steers Bovatec decreased their feed intake 17.4% (P=.002) and improved feed efficiency 17.7% (P=.0001). Cattle fed Bovatec in this study also had smaller ribeye area (P=.0001), more internal fat (P=.0051), and a higher yield grade (P=.0002) than did those fed no Bovatec, contrary to most other studies.

Ralgro implants increased steer gain (Table 21.1) 12.0% (P=.0001) and improved feed efficiency 6.9% (P=.0276); there was no effect on feed intake. Implanted cattle also had less internal fat (P=.0360). Effects of Bovatec and Ralgro on feed efficiency were additive.

Table 21.1. Effect of Bovatec and Ralgro on Feedlot Performance (112 days) of Simmental Steers

Item	Effect of Bovatec			Effect of Ralgro		
	No Bovatec	Bovatec 45g/ton	Statistical significance[a]	No Ralgro	36 mg Ralgro	Statistical significance[a]
No. of steers	42	42	-	42	42	-
Initial wt., lb	831.5	833.5	-	831.7	833.3	-
Final wt., lb	1243.8	1248.5	-	1222.2	1270.0	-
Gain, lb	412.3	415.0	N.S.	390.5	436.7	.0001
ADG, lb	3.68	3.71	N.S.	3.49	3.90	.0001
Daily DM intake, lb	27.68	22.89	.002	24.76	25.78	N.S.
Feed/gain	7.52	6.19	.0001	7.10	6.61	.0276
Fat thickness, in.	.28	.29	N.S.	.28	.29	N.S.
REA, sq. in.	14.9	13.9	.0001	14.3	14.6	N.S.
KPH fat, %	2.5	2.7	.0051	2.7	2.5	.0360
Marbling score[b]	5.9	5.9	N.S.	6.1	5.7	N.S.
Quality grade[c]	10.9	10.7	N.S.	11.0	10.5	N.S.
Yield grade	1.9	2.3	.0002	2.2	2.0	N.S.

[a]N.S.= Not statistically different (P>.05).

[b]Marbling score: Small = 5; modest = 6.

[c]Quality grade: Ch^- = 10; Ch^o = 11.

Effect of Bovatec[1,3] on Grazing Steer Performance

Lyle W. Lomas[2]

Summary

Steers fed 100 mg or 200 mg of Bovatec[1] per head daily while grazing brome bromegrass gained 16.4% and 23.9% faster, respectively, during 112 days of grazing than did controls.

Introduction

Previous research has shown Bovatec to be effective in increasing rate of gain and improving feed efficiency in feedlot cattle. Limited research has shown Bovatec to be effective in increasing rate of gain in grazing cattle. Our trial evaluated two levels of Bovatec in a grazing study.

Procedure

Seventy-two Simmental steers, averaging 645 lb, from one ranch were randomly allotted by weight to nine 10-acre bromegrass pastures on June 24, 1981; so each pasture contained eight steers. Their treatments were: 1) control; 2) 100 mg of Bovatec per head daily; and 3) 200 mg of Bovatec per head daily. Each treatment was replicated three times.

All cattle received 3 lb of dry, rolled milo per head daily for the first 84 days and 5 lb for the last 28 days. Cattle on Bovatec received the additive daily; it was mixed with the rolled milo.

All cattle had free access to a mixture of equal parts steamed bone meal and trace-mineral salt and were provided fly control by dust bags.

Steers were weighed every 28 days. Initial and final weights were taken after a 16-hour shrink off feed and water. The study was terminated after 112 days, on October 14, 1981.

Results

During this 112-day grazing study, steers fed 100 mg of Bovatec per head daily gained 16.4% ($P<.05$) and those fed 200 mg gained 23.9% ($P<.01$) more than control steers did (Table 22.1). There was no statistically significant difference ($P>.20$) between Bovatec levels. Bovatec caused no palatability problems.

---

[1]Bovatec is the trademark name for lasalocid sodium produced by Hoffmann-LaRoche, Inc., Nutley, N.J. 07110. Feed additive and partial financial assistance provided by Hoffmann-LaRoche, Inc.

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

[3]Bovatech is not currently cleared by the FDA for use in cattle.

Table 22.1. Effect of Bovatec on Steer Performance - 112 days

Item	Level of Bovatec (mg/head/day) 0	100	200
No. of steers	24	24	24
Initial wt, lb	644	639	642
Final wt, lb	794	813	827
Total gain, lb	$150^{a,c}$	$174^{b,c,d}$	$185^{b,d}$
Average daily gain, lb	$1.34^{a,c}$	$1.56^{b,c,d}$	$1.66^{b,d}$

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

[c,d]Values in the same row with different superscripts differ significantly ($P<.01$).

Effect of Lasalocid[1] on Performance of Grazing Steers

L.R. Corah, J.G. Riley and Ron Pope

Summary

Steers fed 200 mg of Lasalocid per day while grazing bromegrass pasture gained 7.6% faster than non-medicated controls; however, this difference was not statistically significant.

Introduction

Feedlot research has shown that the experimental feed additive, Lasalocid, will improve average daily gain and feed efficiency. Also, a few grazing studies have shown that Lasalocid will improve daily gain. Our study was designed to find the best dosage level of Lasalocid for grazing steers.

Experimental Procedure

One hundred five Hereford steers from one ranch were processed upon arrival at the Beef Research Unit and monitored for sickness for about 2 weeks. Individual weights were taken after 15 hours off feed and water. The steers were stratified by weight and randomly allotted to 16 replicates. There were four replicates per treatment: two with four animals and two with seven. The trial started on April 7 and the last replicate concluded on July 24, 1981, providing an average of 102 grazing days.

The 16 pastures were predominantly bromegrass, stocked at one head per acre. All pastures were fertilized and had enough growth that ample grass was always available. The cattle were rotated between pastures within replicates to reduce any potential pasture effect.

The four treatments were: 1) control, 2) 100 mg of Lasalocid, 3) 200 mg of Lasalocid, and 4) 300 mg of Lasalocid per head daily. Lasalocid was mixed with 2 pounds of ground corn per head and fed once daily in open feedbunks with enough space for all steers to eat at once. Controls received the grain with no Lasalocid. Cattle had free access to a salt-mineral mix and fly-control dust bags.

A 55-day non-shrunk weight was taken on June 1; the cattle were weighed directly off grass. At trial completion, one replicate per treatment was gathered at approximately 8:00 a.m. and weighed within 3 hours. This was used as the final weight, but a "check" weight was taken the following day. That process was repeated for each replicate, so the steers were weighed off test on four different dates.

---

[1]Lasalocid and partial financial assistance provided by Hoffman LaRoche, Nutley, NJ 07110.

The cattle were observed daily for illness and upon completion of the trial they remained at the Beef Cattle Research Unit 44 days for further observation.

Results

The steers started eating the corn-additive mix immediately with no palatability problems at any level of Lasalocid. This consistent intake continued even though grazing conditions were excellent throughout the trial. No health problems occurred either on grass or during the 44-day post-trial observation period.

Initial weight, final weight, and gain are shown in Table 23.1. Lasalocid at 200 mg per head per day improved average daily gain by 7.6%, but the difference was not statistically significant.

Table 23.1. Effect of Lasalocid on Performance of Grazing Steers.

	Lasalocid mg/hd/day			
Treatment	0	100	200	200
No. steers	22	22	22	22
Initial wt., lb	555.4	552.4	551.5	548.3
Final wt., lb	782.7	785.1	797.0	781.2
Gain, lb	2227.3	232.7	245.5	232.9
ADG	2.23[a]	2.28[a]	2.41[a]	2.28[a]

[a]Means in same row not statistically different (P>.05).

The Effect of Avoparcin[2] on the Performance of Grazing Steers

L.R. Corah, W.D. Busby and Jack Riley[1]

Summary

One hundred two steers were used to study the effect of Avoparcin on the performance of grazing steers. Four desired dosages -- 0, 200, 400, and 600 mg/head/day -- were compared in a self-fed mineral mix. Feeding Avoparcin at the desired level of 400 mg/head/day increased steer gains by 22%.

Introduction

Avoparcin has already been shown to improve the rate of gain and feed efficiency of feedlot cattle. However, our trial was conducted to determine the optimum dosage and efficacy of Avoparcin with grazing steers.

Experimental Procedure

One hundred two head of yearling Hereford steers averaging 499.5 lb and from a uniform genetic and nutritional background were started on prairie hay and a base mineral mix that was 50% dicalcium phosphate, 25% salt, 10% monosodium phosphate, 7% limestone, 2% trace minerals, 1% magnesium oxide, and 5% wet molasses. At the start of the trial, all steers were weighed after 15 hours off feed and water and allotted by weight to 0, 200, 400, or 600 mg of Avoparcin/head/day. The pastures were predominantly bromegrass. Each treatment was replicated in four pastures. Animals were rotated among pastures to remove effects of pastures and stocking rates. Due to lack of rainfall, some steers were grazed only 74 days. Others grazed 93 days. However, this difference was balanced between treatments. All steers received 1.0 lb of a grain cube daily.

The mineral mix (Table 24.1) was fed *ad lib* in wind-vane mineral feeders. On day 70, the Avoparcin was diluted further as mineral consumption was increasing.

Individual daily gains were statistically analyzed by analysis of variance.

Results and Discussion

The average daily mineral and actual Avoparcin intakes are shown in Table 24.2.

---

[1]Appreciation is expressed to the American Cyanamid Co. for partial funding support.

[2]Avoparcin is not currently cleared by the FDA for use in cattle.

The desired level of Avoparcin for finishing cattle is 400 mg/head/day. Feeding Avoparcin to grass cattle at that level increased average daily gain by 22% over controls ($P<0.05$). There was no significant difference in average daily gain among the three Avoparcin levels.

Avoparcin is currently not cleared for use in the cattle industry.

Table 24.1. Mineral Mix

	Control	Avoparcin treatment level 200 mg	400 mg	600 mg
Day 0 to 70				
Avoparcin, %	0	5.5	10.4	14.8
Base Mix, %	100	94.5	89.6	85.2
Day 70 to 93				
Avoparcin, %	0	3.7	7.2	10.4
Base Mix	100	96.3	92.8	89.6

Table 24.2. Effect of Avoparcin on Steer Performance

Item	Control	Nominal Avoparcin intake 200 mg	400 mg	600 mg
No. of pastures	4	4	4	4
No. of steers	25	25	24	24
Avg. Weekly Mineral Consumption (gm/head/day	81.5	63.4	60.5	62.9
Avg. Daily Avoparcin Intake (mg/head/day)	0	223	401	594
ADG, lb	1.68[a]	1.90[ab]	2.05[b]	1.91[b]

[ab]Means with different superscripts are significantly different at ($P<.05$).

Estrus Synchronization of Cattle in Kansas

Danny D. Simms, L.R. Sprott, Ken Odde,
and Larry R. Corah[1]

Summary

In 22 field trials involving 1,692 cattle, we evaluated Lutalyse as an estrus-synchronization agent for both natural mating and artificial insemination. Only 52.7% of the females in all 22 trials were cycling at the start of the breeding season. Both body condition and days postpartum at the start of the breeding season influenced the response to Lutalyse. First-service pregnancy rate in the 2 or 3 days of synchronization was 38.4% for all 453 females bred artificially in 12 trials in northwestern Kansas. The rate was 59%, however, if only females observed to be in heat were counted; but only 24.5% if only those in which no heat was observed were counted.

Introduction

Lutalyse, a synchronizing agent, offers great potential for making artificial insemination more practical for cattlemen. Our trials were conducted to determine the effectiveness of this product under Kansas field conditions.

Experimental Procedure

In twenty-two field trials, both natural mating and artificial insemination (AI) were used to breed Lutalyse-synchronized females. Data on cycling activity and the effect of body condition and days postpartum on response to Lutalyse include both AI and natural-mating trials; however, 12 AI trials conducted in northwestern Kansas are summarized separately.

Cooperators selected the synchronization system that best fit their management. Both one-injection and two-injection systems were used in combination with either timed insemination or breeding when heat was observed. Heat-detection records were kept, even if timed insemination (80 hours) was used. Where possible, the cattle were scored for body condition at the start of the breeding season (1 = thin to 9 = fat). We recorded days postpartum at the start of the breeding season, and we determined cycling activity based on ovarian palpation or observed heat.

Results and Discussion

Table 25.1. shows the results of 12 trials in northwestern Kansas. The first-service pregnancy rate of 38.4% (39.9% in heifers, 20% in first-calf heifers, and 43.0% in cows) in the 2- or 3-day synchronization period was relatively low; however, the rate in cattle that exhibited heat after treatment was a respectable 59%, whereas it was only 24.5% in the cattle that failed to exhibit heat but were still bred on timed insemination. Only 52.7%

[1]Appreciation is expressed to the Upjohn Co. for providing Lutalyse and partial funding support.

of the cattle in all 22 trials (Table 25.2) were cycling at the start of the breeding season.

Only 25.4% of the cows in below-average body condition (scores of 3 or 4) at the start of the breeding season cycled, compared with 70.0% of the cows in above-average condition (scores of 6, 7, or 8, Table 25.3). Correspondingly, days postpartum at the start of the breeding season influenced the cycling percentage (Table 25.3). Thus, for successful estrus synchronization, cows require an adequate postpartum period and must be in adequate flesh.

Table 25.1. Results of 12 Synchronization Trials in Northwestern Kansas

Total no.	No. inseminated	No. pregnant in synchronization period	First service conception rate of those inseminated (%)	First service pregnancy rate of all heifers (%)
Observed in heat prior to 80-hr post-injection				
249	249	147	59.0	59.0
Not observed in heat-A portion bred on timed insemination (80 hr)				
204	110	27	24.5	13.2
453	359	174	48.5	38.4

Table 25.2. Cycling Activity of Females Involved in 22 Synchronization Trials in Kansas

Age	No. injected	No. cycling at[a] start of breeding season	% cycling
Cows	986	474	48.1
Heifers	646	400	61.9
1st-calf heifers	60	19	31.7
Total	1692	893	52.7

[a]Based on ovarian palpation or observed heat

Table 25.3. Effect of Condition Score and Days Postpartum at the Start of the Breeding Season on Cycling Activity

Factor	No.	No. observed in heat	% observed in heat
Condition score			
3,4	205	52	25.4
5	224	117	52.2
6,7,8	90	63	70.0
Days postpartum			
Under 60	69	32	46.4
60-90	141	71	50.4
Over 90	54	42	77.8

Effect of 48-hour Calf Removal

Danny D. Simms, Ken Odde, and Larry R. Corah[1]

Summary

In three field trials, we removed calves from 187 beef cows for 48 hours at the beginning of the breeding season to determine the effect on the cows' cycling activity, conception rate, and pregnancy rate. When calves were removed, the cows were injected with Lutalyse. Removing calves for 48 hours did not change weight gain or sickness incidence of calves, but neither did it facilitate the cows' rebreeding.

Introduction

Nursing stimulus is one factor that prevents a cow from cycling after calving. Research has shown that limiting suckling intensity will initiate cycling. The following field trials were conducted to determine if removing a calf from a cow for 48 hours could increase the cow's cycling activity under field conditions and if the removal would influence the calf weight gain or susceptibility to sickness.

Experimental Procedure

In each trial, the spring-calving cows were left with their calves (control) or their calves were removed for 48 hours at the start of the breeding season. Treatments were equalized for days postpartum, sex of calf, and cow age. All cows were at least 45 days postpartum. In trials 1 and 2, all cows were injected with Lutalyse (25 mg) when calves were removed (May 20 in Trial 1 and May 13 in Trial 2). Then cows exhibiting heat were artificially inseminated. All cows that failed to exhibit heat after the first injection were re-injected 11 days later, and those cows exhibiting heat also were bred artificially. About 11 days after the 2nd injection, clean-up bulls were turned in. In trial 3, both treatments, bulls were turned in when calves were removed (May 11).

All calves were weighed at removal and at weaning. "Removed" calves were given access to high-quality roughage, grain, and water. Following separation, an attempt was made to "mother up" the calves in a corral before turning the pairs out to pasture.

Pregnancy rates and estimated fetal age were determined by rectal palpation on August 21.

---

[1]Appreciation to The UpJohn Co. for supplying Lutalyse and to the three cooperative cattlemen: Rick Jessup, Long Island; Bill Greving, Prairie View; and Henry Tien, Prairie View.

Results and Discussion

The results of trials 1 and 2 (Table 26.1) indicated there was no advantage to calf removal. However, because the percentage of cows exhibiting heat was very high in the control group, few cows could have responded to treatment, so perhaps the trials were a poor test of the merit of 48-hour calf removal.

Table 26.2 shows the average days that cows in each herd were pregnant at time of palpation. Through cows in the treated group tended to be "farther along" (75.6 days to 73.8), the difference was not significant.

Calf weight gains were not affected by 48-hour separation in any of the trials (Table 26.2). Additionally, none of the calves became sick when separated from their mothers.

Table 26.1. Effect of 48-hour Calf Removal on Pregnancy Rates in a Synchronization Program -- trials 1 and 2

Treatment	No. injected	No. exhibiting heat	% exhibiting heat	No. pregnant, 1st service	% conception, 1st service of those bred	% pregnant 1st service (all cows)
Control	41	34	82.9	27	79.4	65.9
Removal	40	30	75.0	20	66.7	50.0

Table 26.2. Effect of 48-hour Calf Removal on Average Days Cows Were Pregnant at Time of Palpation, on No. of Open Cows, and on Calf Weight Gains

Trial	Treatment	No. cows	Estimated days pregnant	No. open cows	% pregnant at time of palpation	Calf average daily gain, lbs
1	Control	22	72.2	5	87.3	1.79
	Removal	23	72.5	5	88.3	1.79
2	Control	19	77.1	1	94.7	1.49
	Removal	17	74.2	0	100.0	1.49
3	Control	60	73.4	7	88.3	1.57
	Removal	46	77.7	1	97.8	1.61
Total	Control	101	73.8	13	87.1	1.60
	Removal	86	75.6	6	93.0	1.63

Reproduction and Production of Heifers Implanted with Ralgro Before Weaning

Danny D. Simms, Frank L. Schwarz, and Larry R. Corah[1]

Summary

Over a 3-year period (1976-1978), heifer calves either were not implanted or were implanted between 2 and 5 months of age. In 1977, the study also included heifers implanted at birth. Implanting at birth increased the percentage of heifers open as yearlings. More implanted heifers tended to be open as 2- to 5-year-olds than control heifers, but the differences were not statistically significant. Implanting of the heifers had no effect on weight gains of their calves.

Introduction

Implanting heifer calves with Ralgro when weaned (or later) subsequently can have some detrimental effect on their reproduction performance, particularly if they have been implanted more than once. Information is limited, however, on how implanting calves at birth or before they are weaned subsequently can affect their reproduction and the performance of their offspring.

Experimental Procedure

One hundred and sixty-four heifer calves born over a 3-year period on the Ruthven, Inc. Ranch in Russell County were randomly assigned to one of three treatments: 1) left unimplanted, 2) implanted at birth (1 year only), 3) implanted at 2 to 5 months of age. Replacement heifers were selected at weaning without respect to treatment. From weaning through the first breeding season, all heifers were handled similarly. Yearling heifers were bred for 45 days, starting about 20 days before the main cowherd was bred. During subsequent reproductive seasons, cows were randomly assigned to breeding pastures and bulls. Open heifers or cows were culled based on fall rectal palpation.

Results and Discussion

Table 27.1 shows the reproductive performance of each group for each year and for all 3 years combined. Implanting at birth markedly increased ($P<.05$) the number of heifers open as yearlings. Females open during subsequent seasons also tended to be higher for heifers implanted at birth or when 2 to 5 months old than for those not implanted, although this difference was not statistically significant. The average calving date was essentially the same for all treatments.

Implanting replacement heifers during the suckling period did not affect the weaning weights of their offspring.

---

[1]The IMC Chemical Co. supplied implants and provided partial funding support.

Table 27.1. Reproductive Performance of Heifers Implanted With Ralgro As Calves

Treatment of heifers as calves	Number retained as replacements	Number open as yearlings	% Open as yearlings	Total no. open in later years	% of heifers calving as 2-yr-olds open in later years	Avg. calving date
			Heifers born 1976			
Control	10	0	0	0	0	March 5
Ralgro (6/17)	27	0	0	5	18.5	March 9
			Heifers born 1977			
Control	15	1	6.7	1	7.1	March 3
Ralgro (birth)	41	18	43.9	2	8.7	March 3
Ralgro (7/26)	18	2	11.1	1	12.5	March 6
			Heifers born 1978			
Control	17	0	0	0	0	March 7
Ralgro (5/13)	21	0	0	0	0	March 4
Ralgro (8/2)	15	0	0	1	6.7	March 3
			Combined data			
Control	42	1	2.4[a]	1	2.4	March 5
Ralgro (birth)	41	18	43.9[b]	2	8.7	March 3
Ralgro (between 2 and 5 months of age)	81	2	2.5[a]	8	10.1	March 6

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

Natural Mating of Estrus-synchronized Heifers and Indicators of Bull Fertility[1]

R. J. Pruitt, L. R. Corah, D. D. Simms, and M. F. Spire

Summary

In six trials involving 486 heifers and 23 bulls, we studied factors affecting pregnancy rates of estrus-synchronized heifers mated naturally and evaluated indicators of bull fertility. Heavier heifers and those in fleshier condition had a higher response to estrus synchronization with Lutalyse. Heifers serviced more than once did not have higher pregnancy rates. Pregnancy rates achieved by bulls ejaculating up to 32 times in 2 1/2 days decreased only slightly as the number of ejaculations increased. There was considerable variation in pregnancy rates and the number of ejaculations achieved by individual bulls. Sex drive measured by a 30-minute serving-capacity test was positively correlated with the number of ejaculations during the mating period and the number of heifers pregnant per bull. None of the variables studied could adequately explain the wide variation in pregnancy rates attributed to individual bulls.

Introduction

Since Lutalyse has been cleared for synchronizing estrus in cattle, some producers have been interested in breeding synchronized females naturally. The purpose of these trials was to 1) study feasibility of using bulls naturally on synchronized females, 2) study factors affecting pregnancy rates in such a system, and 3) evaluate indicators of bull fertility.

Experimental Procedure

Three trials at the Kansas State Beef Research Unit and three field trials involved 486 heifers and 23 bulls. Table 28.1 shows the number of animals, breeds, and procedures in each trial. Two injections of prostoglandin $F_{2\alpha}$ (Lutalyse) 11 days apart were used in trials 1 through 5. A single injection was used in trial 6 after 5 days of estrus detection and artificial insemination. The last injection in each trial was given between 7 and 10 a.m. In the three trials at Kansas State University, heifers were checked for estrus twice daily beginning at least 21 days before the first injection. The Kansas State heifers were weighed and hip heights were recorded at the first injection. Weight-height ratios were used to estimate body condition; larger ratios indicate fatter heifers.

[1]Appreciation is expressed to the UpJohn Company for making Lutalyse available and partial funding support.

Scrotal circumference was measured on each bull except in trial 5. Bulls in trial 1 through 5 were given a 30-minute serving-capacity test. Each bull was penned with a heifer in estrus for 30 minutes and the number of mounts and services and other sexual activity were recorded. A libido score of 1 to 10 was given for the first 10 minutes of the test (1 = no interest, 10 = 2 services followed by further interest). The test was conducted at least 1 week before the synchronized mating.

During the synchronized mating period, heifers were observed at least hourly during the daylight. When detected in standing estrus, they were penned with one bull until serviced 1, 2, or 3 times. In the three Kansas State trials, semen was collected with an artifical vagina from each bull after he had served once and then after about every six ejaculations; the semen quality was evaluated. In the trials at Kansas State, bulls were allowed to service as many heifers as they could. In the other three trials, the number of services per bull was limited by the number of heifers in estrus. Heifers were pregnancy-checked 60-90 days after synchronization.

Results and Discussion

Table 28.1 shows that the percentage of serviced heifers pregnant ranged from 28.8 to 75.0%. The percentage injected heifers pregnant was low in trials 1 through 3, but the number of females in estrus was intentionally larger than the bulls could service. The distribution of the onset of estrus for 7 days after the last injection is shown in Table 28.2 for trials 1 through 3. In that 13.1% of these heifers were in estrus on the fourth to the sixth day after the last injection, we probably underestimated the percentage responding to Lutalyse in the trials in which estrus detection was for a shorter period.

Table 28.3 shows the influence of weight and weight-height ratio on the percentage of heifers in estrus, percentage pregnant, and the time from the last injection to the onset of estrus for trials 1 through 3. As weight and weight-height ratio increased, so did the percentage responding to synchronization, probably because more heifers had reached puberty and were cycling. Weight or weight-height ratio did not affect the time from the last injection to estrus.

Table 28.4 shows that heifers served more than once did not have higher pregnancy rates. For bulls that ejaculated at least 16 or 24 times, pregnancy rates were only slightly lower for later services (Table 28.5). Although the overall pregnancy rates that could be attributed to bulls ejaculating at least 32 times was low, the decrease was slight if we compare the first eight ejaculations with the 24th to the 32nd ejaculations. That indicates that the number of females pregnant was limited by sex drive or physical stamina of the bull rather than by semen depletion or reduction in semen quality.

The means and ranges of bull performance in Table 28.6 show considerable variability in both pregnancy rates achieved by individual bulls and number of ejaculations per bull. Because the number of services per heifer was controlled and semen collections were also made, both the number of heifers serviced and the number of pregnant heifers per bull were limited. If we estimate the number of possible pregnancies per bull by multiplying the number of ejaculations by the percent pregnant, the average for all 23 bulls would be 10.3 (0 to 23). The average for the 12 bulls used to their capacity would be 9.4 (0 to 21).

The residual correlations in Table 28.7 show that activity during the serving-capacity test was not significantly related to the percentage of heifers pregnant but was important in predicting the number of ejaculactions of an individual bull during the synchronized mating. The number of mounts during the test was positively correlated to the number of heifers pregnant per bull, but the number of services during the test and the libido score were not. The 30-minute serving-capacity test was more highly correlated to breeding performance than it would have been if the test had been conducted for only 10 minutes. We did not find scrotal circumference to be significantly correlated to pregnancy rates, contrary to other research. Based on the Breeding Soundness Exam of the Society for Theriogenology, these bulls rated "good" or "very good" for scrotal circumference. Based on 11 bulls from trials 1 through 3, semen characteristics from the first collection were not related to the percentage of heifers pregnant. The only semen characteristic significantly correlated to the number pregnant per bull was the number of normal sperm in an ejaculate (r = .66).

Three of 11 bulls in trials 1 through 3 were classified as "questionable potential breeders" according to the Breeding Soundness Exam. They were responsible for pregnancy rates of 17, 21, and 57%. Four of eight bulls classified as "satisfactory" achieved pregnancy rates of less than 50% (6, 13, 16, and 33%) compared with 58, 56, 50, and 50% for the other "satisfactory" bulls. If we eliminate four bulls classified "fair" or "poor" for percentage of abnormal sperm or sperm motility, pregnancy rates would be 11.4% higher. Thus, the Breeding Soundness Exam can eliminate some low-fertility bulls, but cannot predict the breeding performance of the remainder.

Table 28.1. Trial procedures and summary of results

	Trial number 1	2	3	4	5	6	Average
Location	KSU	KSU	KSU	field trial	field trial	field trial	
Number of heifers injected	103	105	116	51	43	68	
Breed of heifers	Crossbred	Crossbred	Crossbred	Crossbred	Hereford	Polled Hereford	
Number of bulls	4	4	4	2	3	6	
Breed of bulls	Hereford	Angus	1 Hereford 3 Angus	Angus	Hereford	Polled Hereford	
Age of bulls	>3 years	>3 years	>3 years	1 18 mo. 1 >3 years	1 yearling 2 >3 years	>3 years	
Time from last injection to end of estrus detection	7 d	7 d	7 d	84 hr	120 hr	84 hr	
Time from last injection until mating stopped	84 hr	108 hr	108 hr	84 hr	120 hr	84 hr	
No. services/heifer	1, 2, or 3	1, 2, or 3	1, 2, or 3	1, 2, or 3	1 or 2	1 or 2	
% in estrus during entire heat-detection period	74.2	79.1	86.2	54.9	67.4	57.4	70.0
% in estrus 84 hr after last injection	59.2	66.7	74.3	54.9	48.9	57.4	60.2
Ratio of bulls to females in estrus	1:18	1:20	1:25	1:14	1:10	1:6	1:16
Number serviced	46	64	71	25	29	39	46
% pregnant of serviced	41.3	31.7	28.8	76.0	75.9	75.0	54.8
% pregnant of injected[1]	18.4	18.8	17.1	37.3	51.2	42.2	30.8

[1]The number of females in estrus was intentionally more than the bulls could service in trials 1-3.

Table 28.2. Distribution of the onset of estrus for 7 days after second injection of Lutalyse (Trials 1-3)

Day after injection[1]		Number in estrus	%
2	AM	108	41.5
	PM	64	24.6
3	AM	38	14.6
	PM	16	6.2
4	AM	24	9.2
	PM	4	1.5
5	AM	3	1.2
	PM	1	.4
6	AM	2	.8
	PM	0	0
7	AM	0	0
	PM	0	0
Total period		260	100.0

[1]Day of injection = day 0.

Table 28.3. The effect of weight and weight-height ratio on percentage of heifers in estrus and pregnancy rates (Trial 1-3)

	Number heifers	% in estrus	Number serviced	% pregnant of serviced	Hours from injection to estrus
Weight at first injection, lb					
<683	108	67.6[a]	44	40.9	65.3
683-791	108	81.5[b]	48	39.6	64.0
>791	107	91.6[b]	79	25.3	60.6
Weight-height ratio, lb/inch[1]					
< 15.1	119	65.6[a]	46	37.0	65.4
15.1-17.3	101	87.1[b]	51	39.2	63.0
> 17.3	103	90.3[b]	74	25.7	61.3

[1]Weight-height ratio = weight ÷ height and is used as a measure of body condition. A higher ratio indicates fatter heifers.

a,b(P<.05).

Table 28.4. The number of times serviced and pregnancy rates

	All trials		Trials 1-4[1]		
Times serviced	1	2	1	2	3
Number of heifers	95	85	52	48	40
% pregnant	49.5	47.1	46.2	41.7	45.0

[1]Heifers were serviced only 1 or 2 times in trials 5 and 6.

Table 28.5. The effect of the number of ejaculations of individual bulls on pregnancy rates

	Ejaculation	Number of heifers	% pregnant
Based on 16 bulls ejaculating at least 16 times	1st-8th	50	55.2
	9th-16th	67	46.3
Based on 11 bulls ejaculating at least 24 times	1st-8th	34	50.0
	9th-16th	40	37.5
	17th-24th	47	44.7
Based on 5 bulls ejaculating at least 32 times	1st-8th	15	26.7
	9th-16th	16	18.8
	17th-24th	19	31.6
	24th-32nd	17	23.5

Table 28.6. Bull performance

	All 23 bulls		12 bulls used to capacity[1]	
	Mean	(Range)	Mean	(Range)
Number of ejaculations	22.6	(2-62)	29.2	(2-62)
Number of heifers serviced[2]	13.7	(1-27)	15.1	(1-27
% pregnant	52.3	(0-83.3)	21.4	(0-58.3)
Number of pregnant heifers per bull[2]	5.6	(0-10)	4.8	(0-9)

[1]These are bulls used in trials 1-3 where the number of heifers in estrus did not limit bull performance.

[2]In all trials the number of heifers serviced and number pregnant were limited by the controlled number of services per female.

Table 28.7. Residual correlations of predictors of breeding performance and actual performance[1]

	% pregnant	Number of ejaculations[2]	Number of heifers pregnant per bull[2]
Serving capacity test			
Mounts during 1st 10 minutes	.13	.33	.58*
Services during 1st 10 minutes	-.23	.56*	.03
Libido score for 1st 10 minutes	-.20	.59*	.08
Mounts during 30 minutes	.17	.48	.64**
Services during 30 minutes	-.07	.66**	.30
Scrotal circumference	.12	.20	.20

[1]The statistical model included trial as an independent variable.

[2]Includes only bulls used to capacity.

*P<.10

**P<.05

KSU

Kansas Survey: What do Commercial Cow-calf Producers Consider When Buying Herd Sires?

Ron Bolze, Chuck Lambert, Stan O'Neill, Larry Corah

Recently, Kansas State University surveyed the factors a commercial cowman considers when he buys Angus, Simmental, or Hereford bulls. A mail survey of the customers of 29 purebred breeders of those three breeds was conducted. We attempted to include a reasonable cross section of both performance and show-ring-oriented breeders. A total of 1,447 survey forms were distributed and 613 (42%) were returned.

The Department of Animal Sciences and Industry expresses its appreciation to all participants. Results of the survey are compiled here so purebred producers can more effectively fulfill the needs of their commercial bull buyers.

Typical Angus and Simmental buyers rate growth, structural correctness, and calving ease as important selection criteria. Hereford bull buyers are less interested in calving ease and more concerned about fertility, libido, and color along with growth rate and structural correctness. Cattlemen buy Angus bulls for crossbreeding and calving ease, whereas they buy Simmental bulls for increased progeny growth and maternal traits of daughters. Hereford bulls are chosen for heterosis in a crossbreeding program or to use in purebred Hereford herds. Concerning future breed improvements, Angus and Hereford bull buyers would like improved growth, performance, and frame; Simmental bull buyers are interested in calving ease.

Commercial buyers of all three breeds said that price is a key factor in their choice of a commercial bull; $1,500-$2,000 was listed most frequently as upper price limit. Buyers of all breeds want to see the weaning weights, yearling weights, average daily gains and birth weights of bulls. Angus and Hereford bull buyers indicated they prefer 2-year-old bulls, whereas Simmental buyers are slightly more interested in 18- to 24-month-old bulls. Hereford bull buyers tend to resist yearling bulls, but cattlemen using yearling bulls of all three breeds said they expose them to 10 to 20 or more cows. Angus buyers indicated that their cow herds are mainly Angus, whereas Simmental buyers have mainly Hereford cows. Of the Hereford buyers surveyed, 75% listed Hereford as their main cow breed. There are additional services buyers seemingly want from purebred producers:

1) Breeder follow-up after progeny are on the ground.
2) Calving ease and birth-weight information.
3) Libido and fertility testing information.
4) Sire and dam observation and performance records.

Following are the responses to four questions appearing on the survey form:

Question 1: What are three or four of the most important traits or factors you consider in buying a herd bull?

Responses considered to be growth traits were: weaning weights, yearling weight, average daily gain or feedlot gain, feed efficiency, and some indication of frame including size, weight, and length.

Response:	Angus	Simmental	Hereford
Growth, size, frame, etc.	85%	84%	83%
Conformation, structural correctness, soundness, muscling	73%	54%	75%
Calving ease	23%	58%	7%
Disposition	20%	22%	16%
Masculinity, fertility, libido	18%	11%	22%
Pedigree, bloodlines, total records	6%	9%	16%
Cost, price, buyer acceptance	5%	10%	8%
Color		10%	20%
Maternal traits of dam		11%	13%
Breeder reputation		4%	4%
Polled/horned		4%	

Question 2: Why do you buy (breed) bulls?

Response:	Angus	Simmental	Hereford
Increased growth		70%	16%
Crossbreeding, heterosis	48%	18%	30%
Calving ease	38%	7%	4%
Keep purebred herd	17%		34%
Polled progeny	12%		
Marketability of calves	6%		3%
Carcass grading capabilities	4%		
Less eye problems	3%		
Maternal traits of daughter	3%	23%	
Libido, fertility, aggressiveness	3%		9%
Disposition	2%	10%	16%
Eye appeal, buyer acceptance		17%	
Easy keepers under range conditions			4%

Question 3: In the future, are there any improvements you would like to see in the type of (breed) bulls you buy?

Response	Angus	Simmental	Hereford
Growth, size, performance	35%	16%	29%
Frame	29%		25%
Length and stretch	26%		20%
Calving ease	12%	31%	
Disposition	11%	6%	
Muscle	9%	10%	8%
Feet and legs, soundness	6%		3%
Less extreme		13%	
Carcass quality, easier fleshing		13%	
More Polled bulls		12%	
Cleaner fronted		11%	
Darker pigment around eyes			8%
Less fat on sale bulls			5%
Fertility, libido, conception			3%

Question 4: Are there any performance records you like to consider in buying a bull?

Response	Angus	Simmental	Hereford
Yes	85%	90%	86%
No	15%	10%	14%

If so, what type of records are useful?

	Angus	Simmental	Hereford
Weaning weight	46%	59%	68%
Yearling weight	36%	44%	52%
Average daily gain	34%	40%	32%
Birth weight	33%	52%	30%
Estimated breeding values	8%		
Weight/day age	7%		
Frame score	5%	8%	
Libido testing	4%		
Feed efficiency	3%		
Scrotal circumference	2%		
Maternal records		11%	
All records in general		5%	9%
Pedigrees		3%	

Note: More extensive analysis of this survey can be obtained by contacting:

Department of Animal Sciences and Industry
Weber Hall
Kansas State University
Manhattan, KS 66506

ACKNOWLEDGMENTS

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

Don L. Good, Head
Department of Animal Sciences
& Industry

Agrimerica Inc.	Northbrook, Illinois
American Can Company	Greenwich, Connecticut
American Cyanamid Company	Princeton, New Jersey
A. O. Smith Harvestore Products, Inc.	Arlington Heights, Illinois
Cadco Inc.	Des Moines, Iowa
Cry-O-Vac Division, W. R. Grace	Duncan, South Carolina
Diamond Shamrock	Cleveland, Ohio
Dubuque Packing Co.	Mankato, Kansas
Elanco Products Company Division of Eli Lilly	Indianapolis, Indiana
Falkland Farms	Shellsburg, Pennsylvania
Fourth National Bank	Wichita, Kansas
Glenkirk Farms	Maysville, Missouri
Hoffman-LaRoche	Nutley, New Jersey
Roman L. Hruska U.S. Meat Animal Research Center	Clay Center, Nebraska
IMC Chemical Group Inc.	Terre Haute, Indiana
International Stock Food, Inc.	Waverly, New York
Rick Jessup	Long Island, Kansas
Kamar, Inc.	Steamboat Springs, Colorado
Kansas Corn Commission	Topeka, Kansas
Kansas Energy Office	Topeka, Kansas
Kansas Grain Sorghum Commission	Topeka, Kansas
Kansas Wheat Commission	Topeka, Kansas
Konza Prairie Research Natural Area	Div. of Biology, KSU
Livestock & Meat Industry Council, Inc (LMIC)	Manhattan, Kansas
Medipharm, Inc.	Engelholm, Sweden
Merck & Company, Inc.	Rahway, New Jersey
Mid-America Harvestore, Inc.	Salina, Kansas
New Breeds Industries, Inc.	Manhattan, Kansas
Nomalco, Inc.	Willow Grove, Pennsylvania
Roy Parsons Ecco Ranch	Buffalo, Kansas
Pioneer Hi-Breds Int. Inc., Microbial Genetics Division	Portland, Oregon
Smith Kline Animal Health Products	Philadelphia, Pennsylvania
Henry Tien	Prairie View, Kansas
Union Carbide	Chicago, Illinois
The UpJohn Company	Kalamazoo, Michigan
USS Agri-Chemicals	Atlanta, Georgia
W. A. Westgate Co.	Dairs, California
Wingrove Enterprises, Inc.	Minneapolis, Minnesota

The Livestock and Meat Industry Council

. . . But What About Tomorrow?

Historically, agricultural research at Land Grant institutions like Kansas State has been financed almost totally by state and federal funds. And our industry has come to take this for granted. But times have changed. Agricultural research now gets only 2% of the USDA budget, and there has been no "real" dollar increase in animal research since 1965. Will governmental funding for animal research keep up with inflation? Not likely. More of the appropriated funds each year go to "overhead"; upkeep, utilities, and other necessary expenses that do not directly generate research results. If we are to get the research results we so badly need, our industry needs to supplement state and federal funds. Our industry needs to help support its own research. And it needs to help support teaching programs to train tomorrow's industry leaders.

You can do <u>your</u> part through the Livestock and Meat Industry Council, Inc. (LMIC). The Council is not government connected. It's controlled by industry people. Funds generated by LMIC have already helped accomplish many teaching and research goals. The Council is a nonprofit, educational and charitable corporation that receives, pools, and distributes funds that play an important role in the Department of Animal Sciences and Industry programs.

Funds contributed to the Council are deposited with the Kansas State University Foundation and are used as directed by the Council's Board of Directors, or by it's Project Review Committee.

Officers and directors of the LMIC are: Gene Watson, president and chairman; W. C. Oltjen, immediate past president, Scott Chandler, vice president; Calvin Drake, executive vice president; Fred Germann, secretary; Orville Burtis, Jr., treasurer; Earl Brookover, Charles Cooley, Henry Gardiner, Walter Lewis, Linton Lull, A. G. Pickett, Wayne Rogler, and A. D. Weber.

The Council's individual projects are numerous. For example, LMIC recently funded development of an automated device that promises to increase accuracy and efficiency in beef grading. The instrument is currently being tested by the U.S.D.A.

The need is crucial. LMIC is asking stockmen, agri-businesses, and friends of the livestock and meat industry for liberal contributions. These dollars are used for research and development, and offer you the opportunity to invest in your and your children's futures. Remember, you may be doing fine now, but what about tomorrow? All contributions, including gifts-in-kind, are tax deductible and all active contributors become Council members. Checks should be made to the KSU Foundation, LMIC Fund and mailed to:

Livestock and Meat Industry Council, Inc.
Weber Hall, Kansas State University
Manhattan, KS 66506

KSU KANSAS STATE UNIVERSITY

Agricultural Experiment Station, Kansas State University, Manhattan 66506

Report of Progress 413

March 1982

Publications and public meetings by the Kansas Agricultural Experiment Station are available and open to the public regardless of race, color, national origin, sex, or religion.

3-82—5.7M