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Abstract

Whole-plant corn silages were treated with Ecosyl® or Foraform® in one trial and Biomate® or Biomate + Cold-flo® in the second trial. In both trials, the silages were well preserved, but all were highly unstable in air during the first 3 to 4 weeks of the feed-out period. Foraform-treated silage was 2 to 6 degrees F cooler than its control, but Cold-flo-treated silage was 2 to 8 degrees F warmer during the first 10 days post-filling. Laboratory silo results showed that both control silages fermented extremely fast; however, inoculated silages had slightly lower pH and higher lactic acid values through the first 4 to 7 days postfilling. Foraform lowered the initial pH of the ensiled material, restricted subsequent fermentation, and produced a silage with about one-half the acid content compared to its control. Cold-flo raised the initial pH and delayed the start of fermentation, but resulted in a silage with greater acid content and an increased dry matter loss. Though not significant, calves fed Ecosyl, Foraform, and Biomate silages had about 6 percent better feed conversion than those fed control silages and gain per ton of crop ensiled was also higher for the three treated silages. Cold-flo-treated silage produced 3.5 lb less gain per ton of crop ensiled than its control. Whole-plant forage sorghums were treated with TriLac® in one trial and Silagest® in the second trial. Inoculated silages had slightly lower ensiling temperatures than controls. All silages fermented rapidly, but both inoculants increased ensiling efficiency as indicated by higher lactic to acetic acid ratios (in laboratory silos) and decreased dry matter losses (in farm-scale silos). Calves fed Silagest silage outperformed those fed control silages, and both inoculants increased gain per ton of crop ensiled over control silages.

Keywords

Cattlemen's Day, 1989; Kansas Agricultural Experiment Station contribution; no. 89-567-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 567; Beef; Corn; Sorghum; Growing cattle

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ADDITIVE-TREATED CORN AND FORAGE SORGHUM SILAGES FOR GROWING CATTLE [1,2,3,4,5,6,7]

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Summary

Whole-plant corn silages were treated with Ecosyl® or Foraform® in one trial and Biomate® or Biomate + Cold-flo® in the second trial. In both trials, the silages were well preserved, but all were highly unstable in air during the first 3 to 4 weeks of the feed-out period. Foraform-treated silage was 2 to 6 degrees F cooler than its control, but Cold-flo-treated silage was 2 to 8 degrees F warmer during the first 10 days post-filling. Laboratory silo results showed that both control silages fermented extremely fast; however, inoculated silages had slightly lower pH and higher lactic acid values through the first 4 to 7 days post-filling. Foraform lowered the initial pH of the ensiled material, restricted subsequent fermentation, and produced a silage with about one-half the acid content compared to its control. Cold-flo raised the initial pH and delayed the start of fermentation, but resulted in a silage with greater acid content and an increased dry matter loss. Though not significant, calves fed Ecosyl, Foraform, and Biomate silages had about 6 percent better feed conversion than those fed control silages and gain per ton of crop ensiled was also higher for the three treated silages. Cold-flo-treated silage produced 3.5 lb less gain per ton of crop ensiled than its control.

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[1] Ecosyl® contains *Lactobacillus plantarum* and is a product of C-I-L, Inc., London, Ontario, Canada.

[2] Biomate® contains *Lactobacillus plantarum* and *Pediococcus cerevisiae* and is a product of Chr. Hansen's Laboratory, Inc., Milwaukee, Wisconsin.

[3] Foraform® contains ammonium tetraformate, a salt of formic acid, and is a product of BP Chemicals, LTD, London, England.

[4] TriLac® contains *Lactobacillus plantarum* and *Pediococcus cerevisiae* and is a product of Quali Tech, Inc., Chaska, Minnesota.

[5] Silagest® contains multiple strains of lactic acid bacteria and is a product of Interbio, Inc., Naperville, Illinois.

[6] Cold-flo® is a non-protein nitrogen product of USS Agri-Chemicals Division of United States Steel, Atlanta, Georgia.

[7] C-I-L, Inc.; Chr. Hansen's Laboratory, Inc.; BP Chemicals, Ltd; Quali Tech, Inc.; and Interbio, Inc. all provided partial financial assistance.

Whole-plant forage sorghums were treated with TriLac® in one trial and Silagest® in the second trial. Inoculated silages had slightly lower ensiling temperatures than controls. All silages fermented rapidly, but both inoculants increased ensiling efficiency as indicated by higher lactic to acetic acid ratios (in laboratory silos) and decreased dry matter losses (in farm-scale silos). Calves fed Silagest silage outperformed those fed control silages, and both inoculants increased gain per ton of crop ensiled over control silages.

Introduction

Corn is the nearly ideal silage crop in the US and around the world. It has a high tonnage yield, a suitable dry matter content, a high level of fermentable sugars, a low buffer capacity, and, under normal conditions, can be harvested over a 2 to 3 week period without significant loss of yield or quality. Several management practices can improve corn and sorghum silages, including harvesting at the optimum maturity and moisture, fine chopping, rapid silo filling and packing, tight sealing, and a fast feed-out rate.

Numerous silage additives are marketed for corn and other crops, and many of these have been evaluated here during the past 10 years (KAES Reports of Progress 448, 514, and 539). Our objective was to continue documenting how commercial additives affect both conservation efficiency and nutritive value of corn and forage sorghum silages. Four biological inoculants (Ecosyl, Biomate, TriLac, and Silagest) and two chemical products (Foraform and Cold-flo) were evaluated using laboratory and farm-scale silos.

Experimental Procedures

Trial 1. Three whole-plant corn silages were compared: (1) control (no additive), (2) Ecosyl®, and (3) Foraform®. All three silages were made by the alternate load method in 10 x 50 ft concrete stave silos on August 11 and 12, 1987, from Ohlde 0-230 corn harvested in the mid to full-dent stage at 38 to 39% dry matter (DM). Ecosyl was applied at the blower as a liquid and supplied an average of 1.25×10^5 colony-forming units (CFU) of lactic acid bacteria (LAB) per gram of crop. The corn, as harvested, contained an average of 9.5×10^6 CFU of indigenous LAB per gram. Foraform was applied as a liquid at the blower and at a rate of 5.0 liters per ton of crop.

Each silo was partitioned vertically into thirds as it was filled, approximately 16 tons per third. The partitions were separated by plastic mesh fencing. Five thermocouple wires were placed in the vertical center of each third, and ensiling temperatures were monitored for the first 4 weeks of storage. Twice during the filling of the stave silos, fresh forage was removed from randomly selected loads and control and treated material was ensiled in PVC laboratory silos, 18 silos each. Triplicate silos were opened at 6, 12, 24, and 48 hours and 4 and 90 days post-filling.

The farm-scale silos were opened on December 23, 1987 and emptied at a uniform rate during the following 14 weeks. Samples were taken three times weekly for DM recovery calculations and chemical analyses. Each silage was fed to 15 steer and heifer calves (three pens of five calves per silage) in an 84-day growing trial, which began on December 24, 1987. Rations were full-fed and contained 87.6% silage and 12.4% supplement on a DM basis.

Rations were formulated to provide 12.0% crude protein (DM basis); 200 mg of Rumensin® per animal daily; required amounts of calcium and phosphorus; and vitamins A, D, and E. Supplements were top-dressed and partially mixed with the silages in the bunk. Feed offered was recorded daily for each pen, and the quantity of silage fed was adjusted daily to assure that fresh feed was always available. Feed not consumed was removed, weighed, and discarded every 7 days or as necessary.

For 3 days before the start of the feeding trail, all cattle were limit-fed a forage sorghum silage ration to provide a DM intake of 1.8% of body weight. Cattle were then weighed individually on 2 consecutive days after 16 hr without feed or water. For 2 days before the final weighing, the cattle were fed their respective silage rations at a restricted DM intake of 1.8% of body weight.

<u>Trial 2</u>. Three whole-plant corn silages were compared: (1) control (no additive), (2) Biomate®, and (3) Biomate + Cold-flo®. Both additives were applied at the blower. Biomate supplied an average of 1.5×10^5 CFU of indigenous LAB per gram of crop and Cold-flo ammonia was added at 8.0 lb per ton of crop. The corn, as harvested, contained an average of 1.4×10^6 CFU of indigenous LAB per gram. The silages were made by the alternate load method in 10 x 50 ft concrete stave silos on August 19 and 20, 1987 from Pioneer 3183 corn harvested in the full-dent stage at 38 to 40% dry matter. Each silo was partitioned vertically into thirds as it was filled, approximately 20 to 22 tons per third. All other procedures for filling and emptying the silos and the cattle feeding period were identical to those described in Trial 1. The laboratory silos were opened at 5, 10, 20, and 40 hours and 7 and 90 days post-filling.

The cattle feeding periods for Trials 1 and 2 were conducted concurrently.

<u>Trial 3</u>. Two whole-plant forage sorghum silages were compared: (1) control (no additive) and (2) TriLac®. Both silages were made by the alternate load method in 10 x 50 ft concrete stave silos on September 23, 1987. The sorghum hybrid was Funk’s 102F, harvested in the late-dough stage of kernel development at 30 to 32% dry matter. TriLac was applied as a liquid at the blower at 2.0 liters per ton and supplied an average of 4.6×10^5 CFU of LAB per gram of crop. The sorghum, as harvested, contained an average of 4.3×10^6 CFU of indigenous LAB per gram and 3.5×10^5 yeast and mold per gram.

Each silo was partitioned vertically into thirds as it was filled, approximately 14 to 17 tons per third. The partitions were separated by plastic mesh fencing. Five thermocouple wires were placed in the vertical center of each third. Ensiling temperatures were monitored for the first 5 weeks of storage. During the filling of the middle third of the silos, fresh forage was removed from a randomly selected load, and control and inoculated material were ensiled in PVC laboratory silos, 42 silos each. One-half of the silos from each treatment were stored at 60 F, one-half at 90 F. Triplicate silos were opened at 6, 12, 24, and 48 hours and 4, 7, and 90 days post-tilling.

Each silage was fed to 15 crossbred yearling heifers (three pens of five cattle per silage) in a 75-day growing trial, which began on March 30, 1988. Rations were full-fed and contained 87.6% silage and 12.4% supplement on a DM basis. All other procedures for the rations and feeding management were as described in Trial 1. For 3 days before the start of the feeding trial, all cattle were limit-fed a prairie hay and grain sorghum ration to provide a DM intake of 1.8% of body weight. Other weighing procedures were as described in Trial 1.

Trial 4. Two whole-plant forage sorghum silages were compared: (1) control (no additive) and (2) Silagest®. The silages were made on consecutive days (October 10 and 11, 1987) in 8 ft diameter AgBags® using a Kelly Ryan Bagger®. The sorghum hybrid was DeKalb 25E harvested in the late-dough stage at 32 to 33% dry matter. Silagest was applied as granules at the bagger at a rate of 500 grams per ton. Silagest supplied an average of 2.0×10^6 CFU of LAB per gram of crop. The forage, as harvested, contained an average of 1.4×10^5 CFU of indigenous LAB per gram and 2.9×10^5 yeast and mold per gram.

Five thermocouple wires were placed in each Ag Bag during filling and ensiling temperatures were monitored for the first 5 weeks of storage. On the first filling day, fresh forage was removed from a randomly selected load and control and inoculated material were ensiled in PVC laboratory silos, 21 silos each. Triplicate silos were opened at 6, 12, 24, and 48 hours and 4, 7, and 90 days post-filling.

All procedures for rations and cattle feeding were identical to those described in Trial 3. The cattle feeding periods for Trials 3 and 4 were conducted concurrently.

Results and Discussion

Trials 1 and 2. Ensiling temperatures are shown in Table 21.1. The initial forage temperatures ranged from 90.0 to 92.9 F in Trial 1; 84.3 to 87.8 F in Trial 2. Change from initial temperature was 1.6 to 5.7 F lower for Foraform-treated silage compared to its control, but Cold-flo addition dramatically increased ensiling temperature over its control during the first 10 days post-filling. Neither inoculant affected ensiling temperatures.

Silage fermentation dynamics for the six silages in the two trials are shown in Tables 21.2 and 21.3. Control and inoculated silages underwent very rapid fermentations, reaching a pH of 4.05 or below within the first 40 to 48 hours post-filling. Ecosyl and Biomate silages still had lower pH and higher lactic acid values at some opening times, even though the control silages fermented quickly. Inoculated and control 90-day silages had very similar chemical compositions. In Trial 1, Foraform, which breaks down in the silo to formic acid, lowered the initial pH of the ensiled material from approximately 5.8 to 4.5. The subsequent fermentation was both delayed and restricted, and the Foraform-treated silage had lower lactic and acetic acids. In Trial 2, Cold-flo raised the initial pH from approximately 6.0 to 8.7 and delayed the start of fermentation, However, by days 7 and 90 post-filling, the Biomate + Cold-flo-treated silages had 1 ½ to 2 times the level of lactic acid and much less ethanol than Biomate or control silages.

Shown in Tables 21.4 and 21.5 are DM losses and fermentation end-products for the six corn silages in the farm-scale silos. Chemical composition of these silages was consistent with results from the PVC silos. The DM loss was slightly lower for the inoculated silages in both trials; however, Cold-flo addition increased DM loss by about 4 percentage units over Biomate or control silages.

Performance by calves during the 84-day growing trials is presented in Table 21.6. Rates and efficiencies of gain were exceptional, due to the high grain content of the two corn hybrids and the mild weather during the feeding period. In Trial 1, DM intakes were similar for the three silage rations and, although calves fed Ecosyl and Foraform silages gained about 5 to 6% faster and more efficiently than those fed control, these differences were not statistically significant. In Trial 2, calves fed the three silage rations had similar gains, but those receiving Biomate silage were 6.6% more efficient than those fed control silage because of an unexpected lower feed intake coupled with nearly equal gain.

When the data for farm-scale silage recoveries (Table 21.6) were combined with cattle performance, Ecosyl, Foraform, and Biomate-treated silages produced 7.2, 6.2, and 7.9 lb more gain per ton of crop ensiled, respectively, compared to control silages. Adding Cold-flo to the inoculated silage reduced gain per ton by over 10 lb compared to Biomate silage.

Trials 3 and 4. Ensiling temperatures, as change from initial forage temperature, are shown in Table 21.7. The initial temperatures were about 84 F in Trial 3, and TriLac-treated silage was consistently 1.5 to 3.0 F cooler compared to its control during the first 7 days post-filling. Although Silagest-treated silage was always numerically cooler than its control, the treated material had a 6.0 F lower initial temperature, which could have accounted for this difference.

Silage fermentation dynamics for the silages in the two trials are shown in Table 21.8. In Trial 3, fermentation was delayed in the 60 F silages, especially during the first 24 to 48 hours post-filling. Both 90 F silages reached a pH of about 4.10 in 48 hours, while both 60 F silages did not reach pH 4.10 until 7 days. Although all four silages were well preserved, the TriLac 60 and 90 F silages had significantly lower acetic acid and ethanol values than their control counterparts. In Trial 4, both silages fermented rapidly but the Silagest-treated silage had a significantly lower pH and/or higher lactic acid content at three opening times during the first week and lower acetic acid at 90 days.

Performance by calves during the 75-day growing trials is presented in Table 21.9. TriLac and control silages supported similar performance in Trial 3, but calves fed Silagest-treated silage in Trial 4 gained faster ($P<.05$) and more efficiently ($P<.05$) than those fed control. Both inoculants increased silage DM recoveries by about 1.0 percentage unit, which increased gain per ton of crop ensiled by 3.0 lb for TriLac-treated silage and 5.4 lb for Silagest.

Table 21.1. Ensiling Temperatures as Change from Initial Temperature for Control and Treated Corn Silages in Trials 1 and 2

	Trial 1			Trial 2		
Days Post-filling	Control	Ecosyl	Foraform	Control	Biomate	Biomate + Cold-flo[1]
	--------- Initial Forage Temperature, F ------------					
	92.9	90.0	91.6	84.6	84.3	87.8
	----------- Change from Initial Temperature, F --------					
1	+9.6	+9.3	+3.9	+7.3	+8.2	+8.8
2	+11.4	+11.0	+6.1	+ 10.5	+11.5	+ 13.5
3	+11.9	+11.6	+7.3	+11.3	+ 12.2	+ 16.3
4	+11.7	+11.8	+8.0	+11.5	+ 12.3	+ 17.3
5	+11.2	+11.8	+8.2	+11.1	+11.1	+ 16.9
6	+ 10.6	+11.6	+8.2	+11.4	+ 12.4	+ 16.8
7	+9.7	+ 10.7	+7.2	+ 10.0	+11.6	+14.7
10	+8.5	+ 10.0	+6.9	+9.1	+9.1	+ 17.2
14	+6.2	+8.8	+5.6	+7.8	+8.9	+ 12.0
21	+1.1	+3.1	-.1	+5.5	+7.8	+6.0
28	-1.4	-.2	-1.2	+1.1	+2.8	+2.4

[1] Mean of only six wires, as difficulties in placing the thermocouples gave inaccurate readings for several wires.

Table 21.2. pH and Chemical Composition over Time for the Corn Silages in Trial 1

Time Post-filling and Item[1]	Replication 1: August 11			Replication 2: August 12		
	Control	Ecosyl	Foraform	Control	Ecosyl	Foraform
Initial: pH	5.79	5.76	4.52	5.80	5.78	4.56
Hour 6: pH	5.09	5.09	4.48	4.95	4.94	4.51
Lactic	.44	.45	.15	.52	.63	.14
Hour 12: pH	4.55	4.49	4.56	4.61	4.60	4.59
Lactic	1.01	1.00	.17	1.10	1.19	.16
Hour 24: pH	4.18	4.17	4.54	4.30	4.28	4.61
Lactic	2.40	2.70	.15	2.34	2.40	.12
Hour 48: pH	4.05	4.04	4.55	4.01	3.98	4.60
Lactic	3.61	3.64	.36	3.56	3.63	.32
Day 4: pH	3.89	3.89	4.39	3.89	3.88	4.41
Lactic	4.27	4.77	1.10	4.47	4.74	1.58
Day 90: pH	3.92	3.91	4.08	3.91	3.91	4.09
Lactic	4.24	4.30	2.41	4.16	4.12	2.21
Acetic	1.07	1.04	.45	1.01	.96	.47
Ethanol	.87	.78	1.67	1.17	1.16	1.83
NH_3-N	.063	.061	.117	.058	.058	.133

[1] Acids, ethanol, and NH_3-N are reported as a % of the silage dry matter.

Table 21.3. pH and Chemical Composition over Time for the Corn Silages from the Concrete Stave Silos in Trial 2

Time Post-filling and Item[1]		Replication 1: Aug. 19			Replication 2: Aug. 12	
		Control	Biomate	Biomate + Cold-flo	Control	Biomate
Initial:	pH	5.98	5.98	8.68	5.97	5.98
Hour 5:	pH	5.31	5.31	8.63	5.79	5.75
	Lactic	.31	.33	.22	.18	.30
Hour 10:	pH	4.73	4.73	8.44	4.70	4.61
	Lactic	.56	.60	.29	.80	1.04
Hour 20:	pH	4.23	4.19	6.15	4.25	4.20
	Lactic	1.45	1.53	.90	2.44	2.61
Hour 40:	pH	3.91	3.90	4.93	3.97	3.96
	Lactic	3.63	3.75	3.46	3.76	4.33
Day 7:	pH	3.79	3.78	4.04	3.88	3.88
	Lactic	4.10	4.24	7.16	4.43	5.05
Day 90:	pH	3.81	3.79	4.00	3.91	3.91
	Lactic	5.05	5.36	7.83	6.15	6.35
	Acetic	1.27	1.19	1.11	1.96	.94
	Ethanol	1.41	1.15	.15	.88	.84
	NH_3-N	.070	.068	.494	.050	.045

[1] Acids, ethanol, and NH_3-N are reported as a % of the silage dry matter.

Table 21.4. Dry Matter Losses and Fermentation End-products for the Corn Silages from the Concrete Stave Silos in Trial 1

Treatment and Location in the Silo		No. of Samples	DM Loss[1]	DM, %	pH	Lactic Acid	Acetic Acid	Ethanol	NH_3-N
						% of the Silage DM			
Control:	Top	11	6.89	40.78	4.17	4.27	.92	.87	.076
	Middle	16	6.10	40.41	4.10	4.45	1.33	.68	.083
	Bottom	11	4.41	37.45	4.00	4.99	1.63	.81	.077
	Avg.	38	5.80	39.60	4.09	4.57	1.30	.77	.079
Ecosyl:	Top	10	4.32	41.45	4.10	4.61	.95	.74	.070
	Middle	13	4.62	39.71	4.06	4.70	1.01	.43	.076
	Bottom	13	3.61	38.71	4.01	5.11	1.70	.52	.087
	Avg.	36	4.18	39.55	4.06	4.82	1.23	.56	.078
Foraform:	Top	11	7.17	37.59	4.15	3.52	.75	1.04	.123
	Middle	16	5.58	40.75	4.17	3.10	.53	1.14	.120
	Bottom	9	7.36	38.45	4.15	3.60	.86	1.43	.131
	Avg.	36	6.70	39.19	4.16	3.22	.68	1.16	.127

[1] Percent of the dry matter ensiled.

Table 21.5. Dry Matter Losses and Fermentation End-products for the Corn Silages from the Concrete Stave Silos in Trial 2

Treatment and Location in the Silo		No. of Samples	DM Loss[1]	DM, %	pH	Lactic Acid	Acetic Acid	Ethanol	NH_3-N
						% of the Silage DM			
Control:	Top	11	10.08	37.01	3.91	5.60	1.27	.90	.073
	Middle	12	8.94	34.77	3.78	6.06	2.61	.53	.103
	Bottom	13	3.70	36.10	3.79	5.94	3.09	1.13	.114
	Avg.	36	7.57	35.91	3.82	5.88	2.37	.86	.098
Biomate:	Top	9	9.56	35.14	3.79	5.68	1.20	1.26	.076
	Middle	12	8.59	34.50	3.80	6.07	2.52	.69	.101
	Bottom	13	3.28	35.99	3.77	6.11	3.00	.81	.110
	Avg.	34	7.14	35.26	3.78	6.00	2.35	.88	.097
Biomate + Cold-flo	Avg.	41	11.84	35.52	4.24	7.66	2.65	.23	.731

[1] Percent of the dry matter ensiled.

Table 21.6. Performance by Cattle Fed Control and Additive-treated Corn Silages in Trials 1 and 2

	Trial 1				Trial 2			
Item	Control	Ecosyl	Foraform	SE	Control	Biomate	Biomate + Cold-flo	SE
No. of Cattle	15	15	15		15	15	15	
Initial Wt., lb	568	573	567		556	567	557	
Final Wt., lb	732	746	739		746	755	746	
Avg. Daily Gain, lb	1.95	2.06	2.05	.07	2.26	2.24	2.25	.07
Daily Feed Intake, lb [1]	15.52	15.49	15.22	.40	17.08[a]	15.78[b]	16.81[ab]	.40
Feed/lb of Gain, lb [1]	7.95	7.52	7.44	.23	7.55	7.05	7.48	.23
Silage DM Recovery, % of the DM Ensiled	94.2	95.8	93.6		92.4	93.2	88.1	
Silage Fed, lb/Ton Ensiled [2]	1884	1916	1872		1848	1864	1762	
Silage/lb of Gain, lb [2]	19.92	18.82	18.58		18.91	17.63	18.70	
Cattle Gain/Ton of Crop Ensiled, lb [2]	94.6	101.8	100.8		97.7	105.7	94.2	

[1] 100% dry matter basis.

[2] Adjusted to 35% dry matter.

[a b] Means in the same row within a trial with different superscripts differ (P<.05).

Table 21.7. Ensiling Temperatures as Change from Initial Temperature for the Control and Inoculated Forage Sorghum Silages in Trials 3 and 4

Days Post-filling	Trial 3 Control	Trial 3 TriLac	Trial 4 Control	Trial 4 Silagest
	-------- Initial Forage Temperature, F ---------			
	83.7	84.7	72.3	66.3
	----- Change from Initial Temperature, F --------			
1	+ 8.0	+ 6.5	+ 9.5	+ 3.3
2	+ 9.4	+ 7.7	+10.1	+ 9.8
3	+11.5	+ 9.5	+ 14.7	+13.8
4	+ 12.4	+ 9.8	+ 16.5	+ 16.4
5	+ 13.0	+ 10.0	+18.1	+ 16.9
6	+ 12.7	+ 10.5	+ 17.1	+ 16.6
7	+ 12.0	+ 10.2	+ 16.3	+ 16.0
8	+ 12.2	+ 10.8	+16.1	+ 15.6
9	+ 10.2	+9.6	+ 15.8	+ 15.2
10	+ 9.3	+ 8.7	+15.1	+ 14.9
14	+ 8.4	+ 7.2	+ 14.0	+13.3
18	+ 4.0	+ 3.5	+12.1	+11.6
21	+ 2.1	+ .5	+10.1	+ 9.6
28	- 1.4	- 2.2	+ 4.8	+ 4.7
35	- 6.3	- 7.3	+ 2.5	+ 2.2

Table 21.8. pH and Chemical Composition over Time for the Control and Inoculated Forage Sorghum Silages in Trials 3 and 4

Time Post-filling and Item[1]		Trial 3 Control 60F	Trial 3 Control 90F	Trial 3 TriLac 60F	Trial 3 TriLac 90F	Trial 4 Control	Trial 4 Silagest
Initial:	pH	5.97	5.98	5.97	5.96	5.89	5.90
Hour 6:	pH	5.92	5.80	5.91	5.68[y]	5.78	5.76
	Lactic	.23	.27	.26	.30	.58	.58
Hour 12:	pH	5.91	4.78	5.79[x]	4.66[y]	5.71	5.69
	Lactic	.31	1.12	.33	1.40[y]	.57	.58
Hour 24:	pH	5.44	4.44	5.29[x]	4.34[y]	4.48	4.40[z]
	Lactic	.51	2.27	.61	2.81[y]	1.42	1.53
Hour 48:	pH	4.59	4.11	4.49[x]	4.07	4.24	4.20
	Lactic	1.25	3.90	1.49	4.18	2.61	2.63
Day 4:	pH	4.33	3.96	4.23[x]	3.95	4.07	4.01[z]
	Lactic	2.56	5.79	4.05	5.92	4.19	4.99[z]
Day 7:	pH	4.11	3.94	4.08	3.93	3.93	3.88[z]
	Lactic	4.55	5.96	4.68	6.46[y]	5.26	5.50
Day 90:	pH	3.97	3.93	3.95	3.90	3.92	3.90
	Lactic	6.04	6.33	6.24	6.56	5.98	6.25
	Acetic	1.91	1.62	1.61[x]	1.31[y]	2.40	2.20[z]
	Ethanol	.624	.740	.589	.745	2.050	2.012
	NH_3-N	.038	.049	.039	.048	.041	.042

[1] Acids, ethanol, and NH_3-N are reported as a % of the silage dry matter.

[x] Control 60 F vs. TriLac 60 F means differed (P<.05).

[y] Control 90 F vs. TriLac 90 F means differed (P<.05).

[z] Control vs. Silagest means differed (P<.05).

Table 21.9. Performance by Heifers Fed the Control and Inoculated Forage Sorghum Silages in Trials 3 and 4

Item	Trial 3 Control	Trial 3 TriLac	Trial 4 Control	Trial 4 Silagest
No. of Heifers	15	15	15	15
Initial Wt., lb	607	604	602	600
Final Wt., lb	762	760	730	738
Avg. Daily Gain, lb	2.07	2.08	1.71[b]	1.84[a]
Daily Feed Intake, lb[1]	18.43	18.00	15.04	15.13
Feed/lb of Gain, lb[1]	8.94	8.70	8.82[b]	8.23[a]
Silage DM Recovery, % of the DM Ensiled	90.8	92.0	84.3	85.3
Silage Fed, lb/Ton Ensiled[2]	1,816	1,840	1,686	1,706
Silage/lb of Gain, lb[2]	26.00	25.27	25.68	24.01
Cattle Gain/Ton of Crop Ensiled, lb[2]	69.8	72.8	65.7	71.1
Silage DM, %	30.11	30.19	31.97	31.92
Silage pH	4.09	4.00	3.93	3.89

[1] 100% dry matter basis.

[2] Adjusted to 30% dry matter.

[a b] Control vs. Silagest means differed (P<.05).