Effects of Sila-bac and Silo Guard on Alfalfa Silage Quality and Corn Supplementation on Steer Performance[1,2]

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Summary

Inoculant (Sila-bac) and enzyme (Silo Guard) silage additives were evaluated with first-cutting alfalfa silage. Control and treated silages were made in 50-ton concrete stave silos and three types of experimental silos (nylon bags buried in the stave silos, 5-gallon plastic containers, and 55-gallon metal drums). Each silage from the stave silos was full-fed to 16 steers in individual pens. Half the steers received 2 lbs. of supplement; the other half received supplement + 2 lbs. of cracked corn. Steers fed Sila-bac and Silo Guard silages performed slightly better than those fed control silage. Adding cracked corn improved rate of gain (.37 lb./day) and feed efficiency (.71 lb. less DM/lb. of gain). Each 1.0 lb. of extra gain required 5.5 lbs. of air-dry corn.

Ensiling temperatures were lowest for the Silo Guard silage. Dry matter recovery from the stave silos was similar for the control (81.98%) and Sila-bac (82.04%) silages but higher for the Silo Guard silage (86.14%). Fermentation and storage losses from the buried bags and 5-gallon containers were about 50% of those in the stave silos and 75% of those in the 55-gallon drums. When fermentation, storage, feedout, and spoilage losses were combined with steer performance, one ton of control silage produced 80.4 lbs. of gain compared with 83.7 lbs. for Sila-bac and 90.2 lbs. for Silo Guard silages.

Experimental Procedure

Three concrete stave silos (10 ft. x 50 ft.) were filled with three alfalfa silages: 1) control (no additive), 2) Sila-bac[R] applied at 1.0 lb./ton of fresh crop, and 3) Silo Guard[R] applied at 1.0 lb./ton of fresh crop. Additives (dry products) were applied by hand at the silage blower.

Silages were made May 20 and 21, 1980, and all silos received three loads (approximately 4.5 tons each) of wilted alfalfa on both filling days. The alfalfa was Kanza variety and taken from one field after windrowing with a mower-conditioner and field-wilting for 24 hours. Dry matter contents of the 18 loads of alfalfa are shown in Table 24.1. Chop length was 1/4 to 3/8 inch theoretical cut.

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[1]Sila-bac is a lactobacillus inoculant product of Pioneer Hi-Bred International, Inc., Microbial Products Division, 3930 SW Macadams, Portland, OR 97201.

[2]Silo Guard is an enzyme (and its co-factors) product of International Stock Foods, Inc., P.O. Box 29, Waverly, NY 14892.

Thermocouples were placed in the center of each silo after loads 1, 3, 4, and 6 and the wire ends were soldered to a 12-inch x 1/4 inch copper tube. Ensiling temperatures were monitored for the first 7 weeks.

About 700 lbs. of fresh crop was taken from each silo after loads 3 and 6 and used to fill 48 experimental silos. For each silage treatment each day; we filled 2 metal drums (55 gallon) lined with polyethylene; 3 plastic containers (5 gallon); and 3 nylon bags (25 lbs.) with tightly packed alfalfa. The plastic buckets were made air-tight with lids that were fitted with rubber O ring seals and Bunson valves. The nylon bags were buried in the alfalfa in each stave silo.

The stave silos were opened after 7 weeks. Each of the three silages was full-fed to 16 uniform Hereford steers averaging 609 lbs. Compositions of the six rations compared are shown in Table 24.2. All steers received 2 lbs. of supplement daily and 8 steers received an additional 2 lbs. of cracked shelled corn. Rations were fed twice daily, with the silage and concentrates mixed at the feed bunk. Steers were housed in individual feeding pens throughout the 52-day trial.

All steers were weighed individually after 16 hrs without feed or water at the start and end of the growing trial. Two days before the final weighing, all steers were fed the same amount of silage (11 lbs. of dry matter). An intermediate weight was taken before the a.m. feeding on day 28.

On the day after the feeding trial ended, a rumen fluid sample was taken via stomach tube from each steer approximately 4 hours after the a.m. feeding.

Aerobic stability (bunk life) of each silage was measured twice. Sixty lbs. of fresh silage was obtained from each silo August 8 and 60 lbs. again September 6, 1980. The samples were divided into 12 equal lots of 4.0 lbs. and each lot was placed in an expanded polystyrene container lined with plastic. A thermocouple was placed in the center of the silage and cheesecloth stretched across the top of the container. Containers were stored at 65^{o}F and temperature recorded twice daily. After 3, 6, and 9 days of air exposure in Trial 1 and 3, 6, 9, and 14 days in Trial 2, triplicate containers of each silage were weighed, mixed, and sampled, and dry matter loss was determined.

Results

Chemical analyses of the three alfalfa silages are not completed but preliminary results are shown in Table .3. All three silages appeared to be well preserved.

Ensiling temperatures are shown in Figure 24.1. None of the silages showed excessive heating during the 7 weeks. Silo Guard silage averaged 3.5^{o}F cooler the first week and remained 4 to 6^{o} cooler than the control silage. Sila-bac silage averaged 2.0^{o}F warmer than control first 7 days but 1.0 to 3.5^{o} cooler during weeks 2 to 7.

Steer performances for the six rations are shown in Table 24.4 and for the three silage treatments and two corn treatments, in Table 24.5. There were no interactions between the alfalfa silages and cracked corn addition.

Sila-bac and Silo Guard silages produced slightly faster daily gains (5.2 and 9.6%, respectively) and more efficient gains (4.6 and 7.3%, respectively) than the control silage. However, the differences were not statistically significant.

Adding cracked corn to the alfalfa silage rations resulted in .37 lb. faster daily gain, 1.36 lbs. more DM intake, and .71 lb. less DM/lb. of gain. The extra gain from each 2 lbs. of air-dry cracked corn was .41 lb. for control, .27 lb. for Sila-bac, and .47 lb. for Silo Guard silages. Stated another way, each 1.0 lb. extra gain required 4.88, 7.41, and 4.25 lbs. of air-dry cracked corn for control, Sila-bac, and Silo Guard silages, respectively.

Presented in Table .6 are data for rumen fluid analyses. There were no interactions between silage and corn treatments and only a few of the differences were significant. Adding cracked corn resulted in slightly lower values for pH and acetic:propionic acid ratio but slightly higher values for total volatile fatty acids and lactic acids.

Presented in Table 24.7 are silage DM recoveries from the concrete stave and experimental silos. The dry matter lost during fermentation, storage, and feedout from the concrete staves was similar for the control and Sila-bac silages (12.78 and 12.18%, respectively) compared with 8.09% for Silo Guard silage. For each of the three silages, losses from the buried bags were only 48% of losses from the concrete stave silos. We think there are at least two reasons for these lower losses. First, the bags were buried in the center of the silage where density and compaction were greatest while in the stave silos, a large amount of silage was in contact with the silo walls, doors, and upper surface. Second, the surface of the stave silos was continuously exposed to air for the 8 weeks of silage feeding but buried bags were protected until removed.

Losses from the 5-gallon containers were similar to those in the buried bags, indicating favorable anaerobic conditions in both types of experimental silos. The 55-gallon drums yielded fermentation and storage losses intermediate between concrete stave silos and buried bags or 5-gallon containers for all three silages.

In both the stave silos and 55-gallon drums, 5 to 7% of the dry matter ensiled was removed from the surface and discarded as non-feedable spoilage when the silos were opened. We think those spoilage losses are not related to the alfalfa silage treatments but rather to poor compaction and air penetrating the silage surface.

Stabilities of three alfalfa silages when exposed to air on feedout are presented in Table 24.8. In both aerobic stability trials, initial temperature rise was on day 9 for the control silages and dry matter loss was 4.2 percent. Sila-bac and Silo Guard silages showed no signs of spoilage during the first 9 days in Trial 1 or 14 days in Trial 2.

Table 24.1. Dry matter contents of the alfalfa at ensiling.

Date and load number	Control	Sila-bac	Silo Guard
	Silage treatment		
	Dry matter, %		
May 20			
1	36.5	36.6	38.8
2	36.5	34.1	40.8
3	38.0	32.0	37.3
May 21			
4	28.9	31.3	29.0
5	30.6	32.3	29.5
6	32.2	34.9	34.5
Avg. dry matter[1]	33.8	34.0	34.7

[1]Weighted averages that are adjusted for differences in load weights.

Table 24.2. Compositions of the six alfalfa silage rations.

	Ration number					
	1	2	3	4	5	6
	lbs./steer/day					
Silage:						
Control	full fed	full fed	--	--	--	--
Sila-bac	--	--	full fed	full fed	--	--
Silo Guard	--	--	--	--	full fed	full fed
Supplement[1,2]	2.0	2.0	2.0	2.0	2.0	2.0
Corn, cracked	--	2.0	--	2.0	--	2.0

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

[2]Formulated to contain 9% protein and 1.5% phosphorus and to supply 200 mg of monensin/steer daily.

Table 24.3. Dry matter, pH, and NH_3-N for control, Sila-bac, and Silo Guard silages.[1]

Silage	dry matter	pH	NH_3-N*
	%		
Control	32.21	4.85	9.2
Sila-bac	32.30	4.91	9.7
Silo Guard	33.14	4.93	11.3

[1]Each value is the mean of 8 samples.

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

Table 24.4. Performances by steers fed the six alfalfa silage rations.[1]

Item	Control		Sila-bac		Silo Guard	
	- corn	+ corn	- corn	+ corn	- corn	+ corn
No. of steers	8	8	8	8	8	8
Initial wt., lbs.	610	611	606	607	610	609
Final wt., lbs.	719	740	725	740	728	752
Avg. total gain, lbs.	109	130	119	133	119	143
Avg. daily gain, lbs.	2.09	2.50	2.28	2.55	2.28	2.75
Avg. daily feed, lbs.[2]						
alfalfa silage	15.84	14.65	15.50	15.33	15.54	15.75
supplement	1.80	1.80	1.80	1.80	1.80	1.80
corn	--	1.75	--	1.75	--	1.75
total	17.64	18.20	17.30	18.88	17.34	19.30
Feed/lb. of gain, lbs.[2]	8.58	7.34	7.71	7.47	7.69	7.07

[1]52-day trial; July 22 to September 12, 1980.

[2]100% dry matter basis.

Table 24.5. Performance by steers fed each of the three alfalfa silages and two corn treatments.

Item	Control	Sila-bac	Silo Guard	Without corn	With corn
No. of steers	16	16	16	24	24
Avg. daily gain, lbs.	2.30	2.42	2.52	2.22[a]	2.59[b]
Avg. daily feed, lbs.[1]					
silage	15.24	15.41	15.64	15.63	15.24
supplement	1.80	1.80	1.80	1.80	1.80
corn	.88	.88	.88	--	1.75
total	17.92	18.09	18.32	17.43[a]	18.79[b]
Feed/lb. of gain, lbs.[1]	7.96	7.59	7.38	8.00[c]	7.29[d]

[1]100% dry matter basis.

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

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

Table 24.6. Rumen fluid analyses for steers fed each of the three alfalfa silages and two corn treatments.

Item	pH	Ammonia-nitrogen	Total volatile fatty acids	Acetic acid	Propionic acid	Lactic acid
		ppm	u moles/ml	—— molar % ——		ug/ml
Silage:						
Control	6.91	234.8[b]	87.4	58.3	27.2	175.3
Sila-bac	6.99	185.4[a]	83.2	61.3	24.5	156.9
Silo Guard	6.89	219.9[b]	85.3	58.6	25.8	208.9
Corn:						
without	6.96	212.4	83.0	59.5	25.8	165.4
with	6.89	214.2	85.3	59.3	25.9	180.3

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

Table 24.7. Alfalfa silage fermentation, storage, spoilage, and feedout losses from the concrete stave and experimental silos.

Silo and silage treatment	DM put in the silo	DM recovered: Feedable	DM recovered: Non-feedable (spoilage)	DM lost during fermentation, storage and feedout
	lbs.	% of the DM put into the silo		
Concrete staves				
Control	17,813	81.98	5.24	12.78
Sila-bac	18,634	82.04	5.78	12.18
Silo Guard	18,664	86.14	5.77	8.09
Buried bags[1]				
control	8.51	93.82	--	6.18
Sila-bac	8.30	94.10	--	5.90
Silo Guard	7.94	96.10	--	3.90
5-gallon containers[2]				
control	7.33	93.86	--	6.14
Sila-bac	7.97	92.77	--	7.23
Silo Guard	7.34	94.77	--	5.23
55-gallon drums[3]				
control	90.18	84.00	6.40	9.60
Sila-bac	87.74	86.38	6.72	6.90
Silo Guard	83.92	85.49	7.09	7.42

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

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

[3]Each value is the mean of four drums.

Table 24.8. Alfalfa silage temperature changes and losses of dry matter during air exposure.[1,2]

	Day of initial rise above ambient temp.*	Maximum temp.	Loss of DM, %: day 3	day 6	day 9	day 14
		°F				
Trail 1						
Control	9.0	118	<1.0	<1.0	4.24	--
Sila-bac	11.0	117	<1.0	1.84	1.20	--
Silo Guard	14.0	113	<1.0	<1.0	1.93	--
Trial 2						
Control	9.0	99	<1.0	<1.0	4.18	8.04
Sila-bac	**	**	<1.0	<1.0	1.20	1.78
Silo Guard	**	**	<1.0	<1.0	1.45	2.21

[1]Alfalfa silage used in Trial 1 was ensiled on the second filling day (May 21) and removed from the silos August 8.

[2]Alfalfa silage used in Trial 2 was ensiled on the first filling day (May 20) and removed from the silos September 6.

*A 3°F rise or higher.

**No rise in temperature.

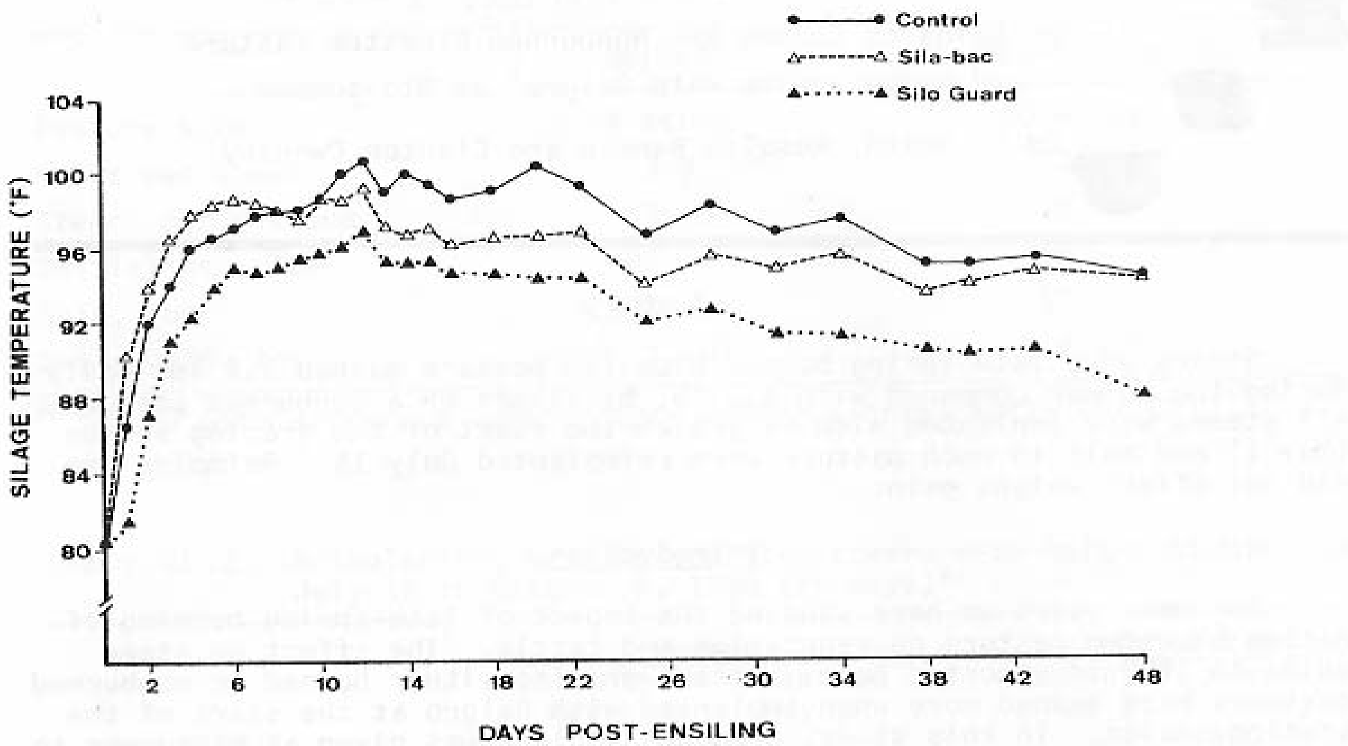

Figure 1. Ensiling temperatures for control, Sila-bac and Silo Guard alfalfa silages (May 20-21 to July 9-10, ,980).

Silage Essentials

Any crop can be ensiled if it has enough available carbohydrate to produce fermentation acids and is stored in the absence of oxygen. Absence of oxygen depends on (a) the right water content, (b) fineness of chop, and (c) packing. Most crops contain enough carbohydrate to ferment, but some low-quality crop residues may need to have carbohydrate in the form of grain or molasses added. No matter how well the silage is prepared, remember that the feeding value of the finished silage is no better than the material ensiled.