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Abstract

Enzyme (Ensila Plus) and alkali (NaOH) silage additives were evaluated with whole-plant wheat silages which were fed with or without alfalfa haylage (45% moisture). Steers fed NaOH silage consumed the most feed but were the least efficient. Although adding haylage increased feed intake, daily gain was not improved. Ensila Plus wheat silage was used 5.2% more efficiently than control wheat silage. NaOH increased ensiling temperatures by 5 to 80 C during the 4-week ensiling period. The amount of silage dry matter removed from the silos and fed was unusually low for all three wheat silages (77.6,79.4, and 77.1% for control, Ensila Plus, and NaOH silages, respectively).

Keywords

Cattlemen's Day, 1981; Report of progress (Kansas State University. Agricultural Experiment Station); 394; Beef; Alkali; Ensila Plus; Wheat silage; Alfalfa silage; Steers

NaOH and Ensila Plus Additives for Wheat Silage and Alfalfa Haylage for Growing Steers[1]

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Summary

Enzyme (Ensila Plus) and alkali (NaOH) silage additives were evaluated with whole-plant wheat silages which were fed with or without alfalfa haylage (45% moisture). Steers fed NaOH silage consumed the most feed but were the least efficient. Although adding haylage increased feed intake, daily gain was not improved. Ensila Plus wheat silage was used 5.2% more efficiently than control wheat silage. NaOH increased ensiling temperatures by 5 to 8°C during the 4-week ensiling period. The amount of silage dry matter removed from the silos and fed was unusually low for all three wheat silages (77.6, 79.4, and 77.1% for control, Ensila Plus, and NaOH silages, respectively).

Experimental Procedure

Three whole-plant wheat silages (42 to 48% DM) were made June 19 to 21, 1979. Silage treatments were: 1) control (no additive); 2) dry NaOH applied at 3.8% of the crop DM; and 3) Ensila Plus applied at 0.19 lb. of product + 0.19 lb. of finely rolled sorghum grain/ton of fresh crop.

At harvest, the wheat was in the hard-dough stage and the whole plant contained about 50% dry matter. Water was added at the silo to increase moisture content to approximately 58% moisture.

Silos were opened after 70 days. Each silage was full-fed to 20 yearling Hereford steers (four pens of five steers) during a 78-day growing trial (August 29 to November 15, 1979). In two pens, cattle were fed 88.75% wheat silage and 11.25% supplement. In the other two, alfalfa haylage replaced half of the wheat silage. Rations and supplements are presented in Table 21.1. All rations were formulated to contain 12% crude protein and equal amounts of phosphorus and aureomycin. The two NaOH wheat silage rations also contained supplemental potassium. Alfalfa haylage provided about 67% of the total CP in rations B, D, and F; soybean meal + urea provided about 50% of the total CP in rations A, C, and E. The alfalfa haylage (ensiled at 52 to 58% DM in a 14 ft. x 40 ft. A. O. Smith Harvestore) was from 3rd and 4th cut alfalfa harvested in August and September, 1979.

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

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[1]Ensila Plus® is an enzyme product of Agrimerica, Inc., 1829 Stanley Street Northbrook, IL 60062.

Dry matter losses during fermentation, storage, and feedout were measured for the three wheat silages by weighing and sampling all loads of fresh crop put into the silos and later weighing and sampling all wheat silage removed. Ensiling temperatures during the first 4 weeks were monitored with five thermocouples evenly spaced in each silo.

Aerobic stability (bunk life) of each silage was also determined. Approximately 40 lbs. of fresh silage was obtained from each silo October 29, 1979, and divided into 9 equal lots of 4.0 lbs. and each lot 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. After 6, 13, and 28 days of air exposure, triplicate containers of each silage were weighed, mixed, and sampled, and dry matter loss was determined.

Table 21.1. Composition of the six rations and supplements fed with the three wheat silages.

	Control wheat silage		NaOH wheat silage		Ensila Plus wheat silage	
	alone	+ haylage	alone	+ haylage	alone	+ haylage
	A	B	C	D	E	F
Ration composition	% of the DM					
Wheat silage:						
control	88.75	44.375	---	---	---	---
NaOH	---	---	88.75	44.375	---	---
Ensila Plus	---	---	---	---	88.75	44.375
Alfalfa haylage	---	44.375	---	44.375	---	44.375
Supplement	11.25	11.25	11.25	11.25	11.25	11.25
Supplement composition (calculated):						
crude protein	50.0	9.0	50.0	9.0	50.0	9.0
calcium	1.75	---	1.75	---	1.75	---
phosphorus	1.75	---	1.75	---	1.75	---
potassium	---	---	7.1	3.5	---	---

Results

Chemical analyses of the three wheat silages and alfalfa haylage are not completed, however, % dry matter at feeding averaged 43.0 for control, 43.7 for NaOH, 41.1 for Ensila Plus, and 55.7 for haylage.

Ensiling temperatures are shown in Figure 21.1. NaOH silage averaged 5 to 8^{o} C warmer and Ensila Plus silage 0.5 to 2.0^{o} C cooler than the control during the 4-week ensiling period.

Steer performances are shown in Tables 21.2 and 21.3. Steers fed NaOH wheat silage consumed the most feed ($P<.01$), but they were 7.8 and 13.8% less efficient ($P<.05$), respectively, than steers fed control or Ensila Plus

silages. Although NaOH wheat silage produced slightly faster daily gains than the other two wheat silages, the differences were not significant. The high sodium content of the two NaOH silage rations caused excessively high water intake and urine excretion. The effects of these increased metabolic functions and wet pen conditions on steer performances are not known.

Adding alfalfa haylage did not affect daily gain but did increase ($P<.05$) feed intake by 14.9% overall--much more for the control (19.1%) and Ensila Plus (22.6%) silages than for NaOH silage (5.4%). This indicates that alfalfa haylage had less net energy for maintenance and gain than any of the three wheat silages.

Ensila Plus wheat silage rations were used 5.2% more efficiently than control rations (7.54 vs. 7.96 lbs. of dry matter/lb. of gain).

Wheat silage DM losses during fermentation, storage, and feedout were unusually high (18.0, 16.9, and 15.8% for control, Ensila Plus, and NaOH silages, respectively, Table 21.4). Silage chemical composition results (when available) may help to explain these losses. Also air penetration into the silage surface on feedout could have increased the aerobic losses (particularly for the control and Ensila Plus silages as mentioned in the footnote to Table 21.5).

Aerobic stability (Table 21.5) was greater for Ensila Plus and NaOH wheat silages than either control wheat silage or alfalfa haylage.

Table 21.2. Performance by steers fed the six wheat silage and haylage rations[1]

	Control wheat silage		NaOH wheat silage		Ensila Plus wheat silage	
	alone	+ haylage	alone	+ haylage	alone	+ haylage
No. of steers	10	10	10	10	10	10
Initial wt., lbs.	590	590	590	590	590	590
Final wt., lbs.	758	755	769	770	756	762
Avg. daily gain, lbs.	2.16	2.11	2.29	2.31	2.12	2.20
Avg. daily feed intake, lbs.[2]						
Wheat silage	13.65	8.31	17.30	9.18	12.83	8.05
Haylage	---	8.33	---	9.20	---	8.12
Supplement	1.82	1.79	1.84	1.80	1.82	1.79
Total	15.47	18.43	19.14	20.18	14.65	17.96
Feed/lb. of gain, lbs.[2]	7.19	8.73	8.37	8.78	6.91	8.17

[1] 78-day trial; August 29 to November 15, 1979

[2] 100% dry matter basis.

Table 21.3. Performance by steers fed the three wheat silages and two alfalfa haylage treatments.

	Control	NaOH	Ensila Plus	Wheat silage alone	Wheat silage + haylage
No. of steers	20	20	20	30	30
Avg. daily gain, lbs.[1]	2.14	2.30	2.16	2.19	2.21
Avg. daily feed, lbs.[1]	16.95[b]	19.66[a]	16.31[b]	16.42[d]	18.86[c]
Feed/lb. of gain, lbs.[1]	7.96[f]	8.58[e]	7.54[f]	7.49[d]	8.56[c]

[1]100% dry matter basis.

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

[c,d]Values with different superscripts differ significantly (P<.01).

[e,f]Values with different superscripts differ significantly (P<.05).

Table 21.4. Wheat silage fermentation, storage, spoilage, and feedout losses.

Wheat silage	DM put into 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		
Control	29,854	77.6	4.4	18.0
NaOH	28,368	77.1	7.1	15.8
Ensila Plus	33,232	79.4	3.7	16.9

*Removed from the silage surface: (1) when the silos were opened August 28, 1979, and (2) September 5, 1979, when excessive spoilage had accumulated in the silos.

Table 21.5. Changes in temperature and losses of dry matter by the three wheat silages and alfalfa haylage during air exposure.[1,2]

Silage	Day of initial rise above ambient temp.*	Maximum temp.	Accumulated temp. above ambient, °C: day 6	day 13	day 28	Loss of DM (% of DM exposed to air): day 6	day 13	day 28
		°C						
Control	8	43.3	**	24.8	24.8	<1.0	4.5	13.4
NaOH	**	**	**	**	**	<1.0	2.1	2.5
Ensila Plus	24	21.7	**	**	8.8	<1.0	1.5	3.7
Alfalfa haylage	4	43.9	17.0	73.2	94.5	2.5	11.2	16.1

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

**No rise in temperature.

[1]Silage removed from the silos October 29.

[2]During September, ambient temperatures reached 30 to 35°C on several days. Control and Ensila Plus silage were highly unstable and both silages heated and spoiled after only 2 to 4 days of air exposure.

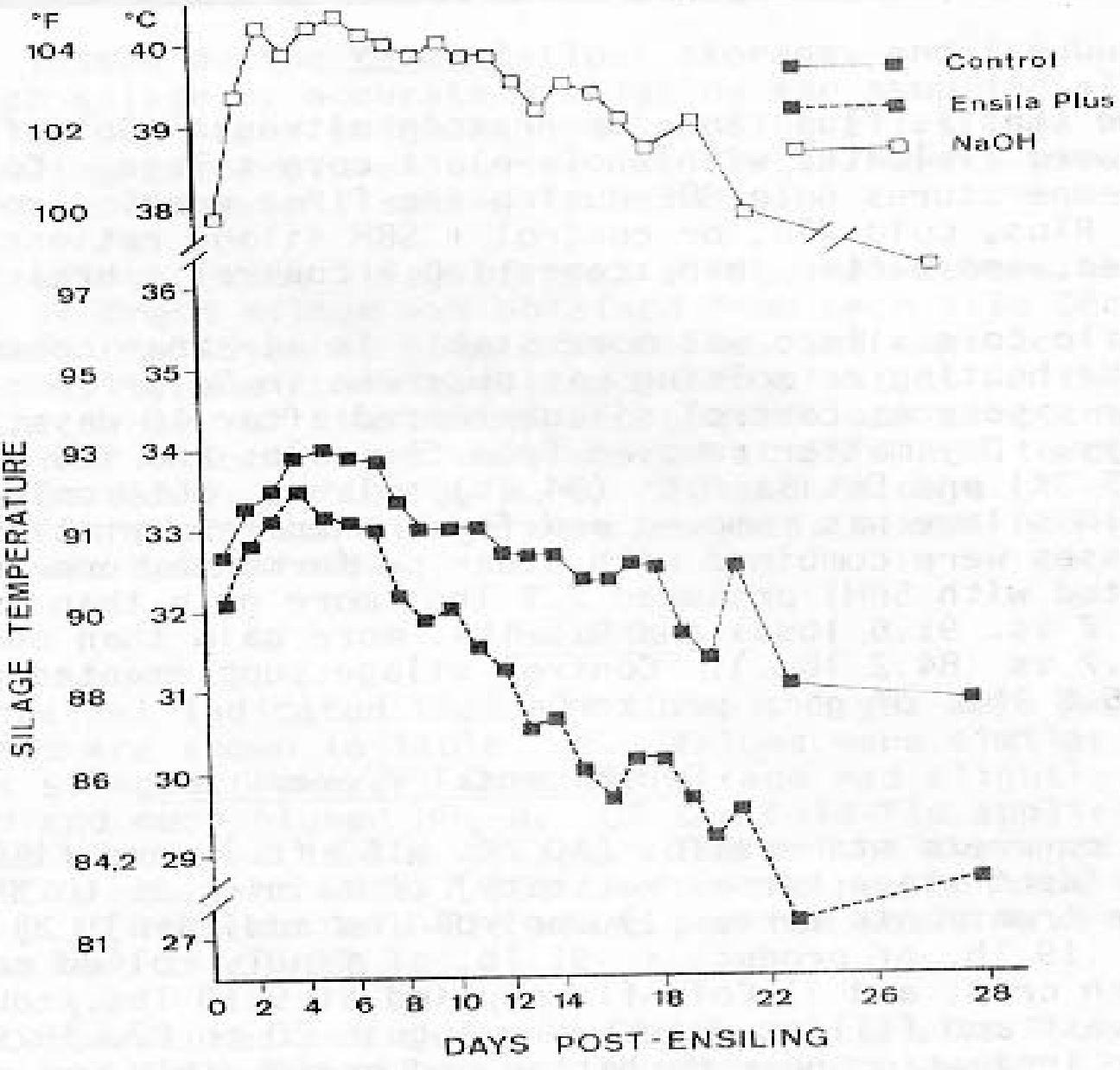

Figure 1. Ensiling temperatures for control, Ensila Plus, and NaOH wheat silages (June 18-20 to July 16-18, 1979).