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Enzyme (Ensila Plus) and non-protein nitrogen (Cold-flo) silage additives were evaluated with whole-plant corn silage. Cold-flo increased ensiling temperatures 6 to 80 F during the first week. Growing steers fed Ensila Plus, Cold-flo, or control + SBM silage rations had similar performances, and better than steers fed a control + urea ration. Cold-flo corn silage was more stable in air than control or Ensila Plus silages. No heating or molding was observed in Cold-flo silage after 28 days of air exposure; control silage heated after 10 days; Ensila Plus after 8 days. Dry matter removed from the silos and fed was similar for control (93.3%) and Ensila Plus (94.1%) silages, but only 88.55% of the Cold-flo silage was removed and fed. When fermentation, storage, and feedout losses were combined with steer performance, one ton of control silage (supplemented with SBM) produced 2.1 lbs. more gain than one ton of Ensila Plus silage (93.7 vs. 91.6 lbs.) and 9.5 lbs. more gain than one ton of Cold-flo silage (93.7 vs. 84.2 lbs.). Control silage supplemented with urea produced 85.8 lbs. of gain per ton.

Keywords

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Ensila Plus and Cold-flo Additives for Corn Silage[1,2]

Keith Bolsen and Harvey Ilg

Summary

Enzyme (Ensila Plus) and non-protein nitrogen (Cold-flo) silage additives were evaluated with whole-plant corn silage. Cold-flo increased ensiling temperatures 6 to 8°F during the first week. Growing steers fed Ensila Plus, Cold-flo, or control + SBM silage rations had similar performances, and better than steers fed a control + urea ration.

Cold-flo corn silage was more stable in air than control or Ensila Plus silages. No heating or molding was observed in Cold-flo silage after 28 days of air exposure; control silage heated after 10 days; Ensila Plus after 8 days. Dry matter removed from the silos and fed was similar for control (93.3%) and Ensila Plus (94.1%) silages, but only 88.55% of the Cold-flo silage was removed and fed. When fermentation, storage, and feedout losses were combined with steer performance, one ton of control silage (supplemented with SBM) produced 2.1 lbs. more gain than one ton of Ensila Plus silage (93.7 vs. 91.6 lbs.) and 9.5 lbs. more gain than one ton of Cold-flo silage (93.7 vs. 84.2 lbs.). Control silage supplemented with urea produced 85.8 lbs. of gain per ton.

Experimental Procedure

Three concrete stave silos (10 ft. x 50 ft.) were filled with whole-plant corn (dent stage kernel maturity) containing 36 to 39% dry matter. Corn silage treatments were: 1) control (no additive); 2) Ensila Plus applied at .19 lb. of product + .91 lb. of finely rolled sorghum grain/ton of fresh crop; and 3) Cold-flo applied at 9.10 lbs./ton of fresh crop. Harvest and filling dates were August 20 to 22, 1979. Corn was grown under irrigation near Manhattan and grain yield was approximately 120 bushels/acre.

Silos were opened after 51 days. Each ration was full-fed to 20 yearling Hereford steers (four pens of five steers) during a 78-day growing trial (October 12 to December 29, 1979). Control silage was supplemented with soybean meal (SBM) for one group of 20 steers and urea for another group of 20 (urea provided 26% of the total ration crude protein); Ensila Plus silage was supplemented with SBM; and Cold-flo silage was supplemented with sorghum grain and no additional protein (Table 22.1). Supplements were fed at 2 lbs. per steer per day. All four rations were formulated to contain about 11.5% crude protein and equal amounts of calcium, phosphorus, vitamin A, and aureomycin.

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

[2]Cold-flo[R] is a non-protein nitrogen product of USS Agri-Chemicals Division of United States Steel, P.O. Box 1605, Atlanta, GA 30301.

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

Silage samples were collected weekly from the silos. Feed consumed was recorded daily for each of the 16 pens. The quantity of corn silage fed was regulated by the amount the steers would consume, and corn silage was always in the bunks. Silage not consumed was removed, weighed and discarded every 7 days.

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

Aerobic stability (bunk life) of each silage was determined. Approximately 60 lbs. of fresh silage was obtained from each silo December 18, 1979, and divided into 15 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°F and temperature was recorded twice daily. After 3, 6, 9, 12, and 28 days of air exposure triplicate containers of each silage were weighed, mixed, and sampled, and dry matter loss was determined.

Results

Visual appraisal indicated that all three silages were well preserved. Chemical analyses are shown in Table .2. Values were similar for control and Ensila Plus silages, however, Cold-flo silage had slightly higher pH and lactic acid and much higher NH_3-N. Of the Cold-flo applied to the fresh crop, 57.85% was recovered in the silage. The silage averaged 11.34% crude protein (CP) compared with 7.73% CP for the pre-ensiled crop. Assuming no losses, the 9.10 lbs. of Cold-flo added per ton would have raised the silage CP equivalent to 14.15%.

Ensiling temperatures are shown in Figure 1. Ensila Plus silage was slightly cooler and Cold-flo silage was considerably warmer (3 to 10°F) than control silage throughout the 7-week ensiling period.

Steer performances are shown in Table 22.3. Rates and efficiencies of gain were excellent, reflecting the high grain content of the silage and the mild weather during the trial. The only significant differences were the faster ($P<.05$) gain of steers fed Ensila Plus silage than those fed control silage + urea, and the lower ($P<.05$) feed required per lb. of gain for steers fed control silage + SBM than those fed control silage + urea. Cold-flo silage produced nearly 4% faster and more efficient gains than control silage + urea.

Presented in Table22.4 are silage fermentation, storage, and feedout losses. Control and Ensila Plus had similar losses (6.70 and 5.89%, respectively) and both had an advantage over Cold-flo in percentages of silage dry matter removed and fed (93.30 and 94.11% vs. 88.55%).

Aerobic stabilities of the three corn silages are presented in Table 22.5. The Cold-flo silage was highly stable and showed no signs of deteriorating throughout the 28 days. The control and Ensila Plus silages were moderately stable in air, with initial temperature rise on day 10 for control and day 8 for Ensila Plus. Aerobic deterioration was characterized by simultaneous rises in temperature and pH, loss of dry matter, and loss of fermentation acids.

Table 22.1. Composition of the supplements fed with the corn silages.

Ingredient	Control SBM	Control Urea	Ensila Plus	Cold-flo
	lbs./ton			
Soybean meal	1630	--	1630	--
Grain sorghum	180	1545	180	1775
Urea	--	230	--	--
Dicalcium phosphate	100	135	100	135
Salt	50	50	50	50
Trace minerals	10	10	10	10
Tallow	20	20	20	20
Aurofac-10*	7	7	7	7
Vitamin A**	3	3	3	3
	% dry matter basis			
Calculated crude protein	42.0	44.0	42.0	10.0

*Added to supply 70 mg of chlortetracycline/steer daily.

**Added to supply 30,000 IU of vitamin A/steer daily.

Table 22.2. Chemical analyses of control, Ensila Plus, and Cold-flo corn silages.[1]

Silage	Dry matter	pH	starch	NFE[2]	Crude protein	Crude fiber	Lactic acid	Acetic acid	Propionic acid	Butyric acid	NH_3-N*
	%		% of the DM								
Control	36.4	3.60	30.00	66.2	8.6	17.0	3.13	1.46	.27	.01	4.97
Ensila Plus	37.8	3.73	32.7	67.8	8.1	16.2	2.94	1.06	.22	.02	4.14
Cold-flo	36.4	4.00	31.0	63.7	11.2**	17.6	4.38	1.65	.24	.09	37.26

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

[2]NFE means nitrogen-free extract.

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

**Crude protein for the Cold-flo silage was also determined weekly for the fresh, wet sample. The average CP was 11.34% on a DM basis.

Table 22.3. Performances by steers fed the four corn silage rations.[1]

Item	Corn silage: Control SBM	Control Urea	Ensila Plus	Cold-flo
No. of steers	20	20	20	20
Initial wt., lbs.	645	645	645	647
Final wt., lbs.	837	824	840	833
Avg. daily gain, lbs.	2.46[a,b]	2.29[b]	2.50[a]	2.38[a,b]
Avg. daily feed intake, lbs.[2]				
corn silage	17.14	17.42	17.98	17.52
supplement	1.75	1.75	1.75	1.75
total	18.89	19.17	19.73	19.27
Feed/lb. of gain, lbs.[2]	7.72[a]	8.40[b]	7.95[a,b]	8.10[a,b]

[1]78-day trial; October 12 to December 29, 1979.

[2]100% dry matter basis.

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

Table 22.4. Corn silage fermentation, storage, and feedout losses.[1]

Corn 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	50,790	93.30	1.58	5.12
Ensila Plus	50,570	94.11	1.99	3.90
Cold-flo	55,688	88.55	1.29	10.16

[1]Dry matter percentages of the forages when ensiled were: control, 37.0; Ensila Plus, 38.0; and Cold-flo, 36.4.

Table 22.5. Changes in temperature and losses of dry matter and nutrients during air exposure by the three corn silages.

Corn silage	Day of initial rise above ambient temp.*	Maximum temp.	days exposed to air 0	3	6	9	12	28
		°F	Accumulated temp. above ambient, °F					
Control	10	121	--	**	**	**	13.5	305.6
Ensila Plus	8	125	--	**	**	40.7	146.8	435.5
Cold-flo	**	**	--	**	**	**	**	**
			Loss of DM (% of DM exposed to air)					
Control			--	1.2	1.1	4.9	3.5	29.5
Ensila Plus			--	3.4	3.5	7.2	11.0	31.6
Cold-flo			--	<1.0	<1.0	<1.0	<1.0	2.3
			pH					
Control			3.60	3.73	3.77	3.80	3.83	6.54
Ensila Plus			3.70	3.80	3.83	4.53	6.57	6.60
Cold-flo			3.80	3.80	3.83	3.80	3.87	3.94
			Lactic acid (% of the DM)					
Control			3.12	4.08	3.08	2.98	3.17	.61
Ensila Plus			2.31	2.59	2.86	1.02	.77	.40
Cold-flo			4.52	4.52	4.05	4.45	4.54	4.01
			Acetic acid (% of the DM)					
Control			1.19	1.14	1.19	.84	.69	.22
Ensila Plus			1.14	.96	.83	.39	.28	.18
Cold-flo			2.88	2.70	3.17	2.65	3.31	1.34

*3.0°F rise above ambient temperature (65°F).

**No rise in temperature.

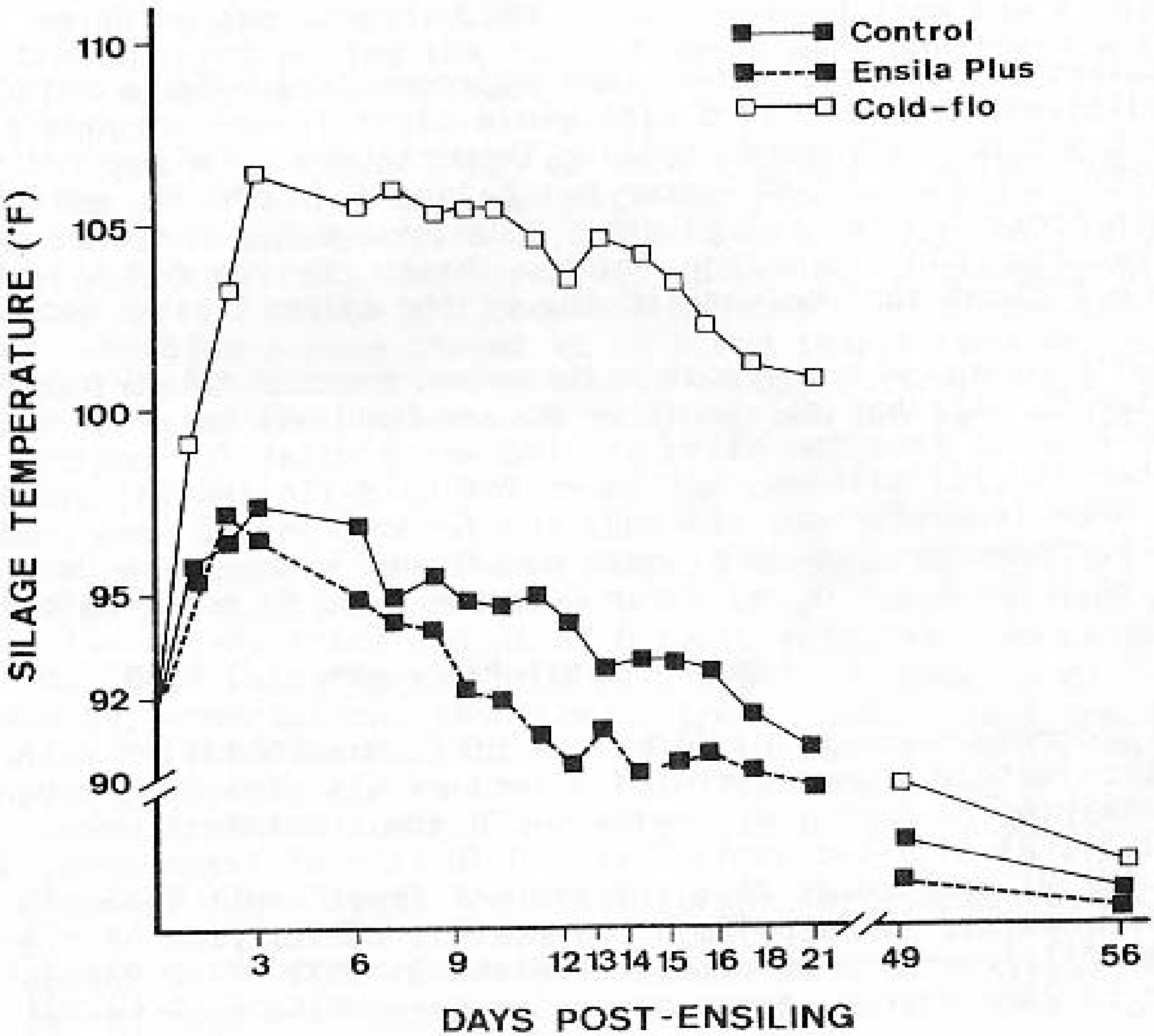

Figure 1. Ensiling temperatures for control, Ensila Plus, and Cold-flo corn silages (August 22-24 to October 17-19, 1979).