Drought-stressed, Irrigated, and Additive-treated Corn Silages for Growing Cattle[1,2]

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Summary

Cattle fed drought-stressed corn silage gained about 10% slower but were just as efficient as cattle fed irrigated corn silage. Because the irrigated corn out yielded the drought corn (17.4 vs. 8.2 tons per acre), the irrigated silage gave a much higher cattle gain per acre (1928 vs. 940 1b). Silo Guard II®-treated silage had an advantage in DM recovery and feed conversion over its control and produced 4.6 more pounds of cattle gain per ton of crop ensiled. Cattle fed H/M Inoculant®- treated silage gained significantly faster than cattle fed the control, however, the treated silage gave only slight improvements in DM recovery and gain per ton of crop ensiled.

Experimental Procedures

Two corn varieties (Ferrie Morse 4020 and Pioneer 3183) were grown with irrigation or without (drought-stressed) in 1983. Silages were made by the alternative load method in 10 x 50 ft concrete stave silos. Corn was harvested in the late-dent stage; August 16 for the drought-stressed and August 31 for the irrigated. The dought-stressed corn had a grain yield of 20.5 bu per acre; the irrigated corn, 128. One silo of irrigated and one of drought-stressed corn served as controls. One silo of drought-stressed corn was treated with Silo Guard II® and one silo of irrigated with H/M Inoculant®. Ensiling temperatures were monitored for the first 42 days in all four silos and nylon bags (nine per silo) were buried for additional observations of silage DM recoveries. The silos were opened on February 8, 1984.

The silages were fed to light weight yearling steers and heifers in six pens of four cattle per silage. Silages were full-fed and all cattle received 2.0 lb of supplement daily (as-fed basis). Rations were formulated to provide 12% crude protein (DM basis), 200 mg of Rumensin® per animal daily, and equal amounts of calcium, phosphorus, and vitamins A, D, and E.

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[1] Silo Guard II® contains enzymes, sodium sulfate, and sodium sulfite and is manufactured by International Stock Foods, Inc., Waverly, which provided partial financial assistance.

[2] H/M Inoculant® contains Streptococcus faecium, Lactobacillus plantartum, and Pediococcus fermentation products and is marketed by Triple "F" Feeds, Des Moines, IA, which provided partial financial assistance.

The silos were emptied at a uniform rate and samples taken twice weekly. Feed offered was recorded daily for each of the 24 pens and the quantity of silage was adjusted daily to assure that fresh feed was always in the bunks. Feed not consumed was removed, weighed, and discarded every 7 days.

All calves were weighed individually on two consecutive days at the start (February 8 and 9, 1984) and at the end of the 84-day trial (May 2 and 3). Intermediate weights were taken before the A.M. feeding on days 28 and 56.

Three aerobic stability (bunk life) measurements were made on each silage. Approximately 60 lb of fresh silage was obtained from 3 ft below the surface in the center of each silo, while feeding out the top, middle, and bottom thirds of the silos. These were divided into 4.0 lb lots and each lot was placed in an expanded polystyrene container lined with plastic. A thermocouple wire was placed in the center of each container and cheesecloth stretched across the top. Containers were stored at 18 to 20 C and the silage temperature was recorded twice daily. After a designated number of days of air exposure, replicated containers of each silage were weighed, mixed, and sampled and dry matter loss was determined.

Results and Discussion

Visual appraisal indicated that all four silages were well preserved. Chemical analyses are shown in Table 20.1. The drought silages, which were much wetter at harvest than the irrigated silages, had more extensive fermentations with higher lactic and acetic acids and lower insoluble nitrogen and pH values. Neither additive significantly affected chemical composition.

Adjusted ensiling temperatures are shown in Figure 20.1. The maximum ambient temperature on the day of harvest was 108 F for the drought silages and 91 F for irrigated. As a result, initial temperature of the forage entering the silos was 7.7 degrees higher for the drought silages (99.4 vs 91.7).

Silage DM recovery and loss results are shown in Table 20.2. In the concrete stave silos, DM lost during fermentation, storage, and feedout was 36% higher for the drought silages (8.25%) than for the irrigated silages (5.25%). The buried nylon bags gave results similar to the silos, with irrigated silages having lower losses than drought silages. Feedable DM recoveries for the treated silages were slightly higher than their controls: 90.9 vs. 89.0% for Silo Guard II and 93.0 vs. 92.2% for H/M Inoculant.

Aerobic stabilities of silage from the top, middle, and bottom thirds of each silo are shown in Table 20.3. In general, stability increased as feeding progressed and the additives had little influence on stability.

Performance by cattle fed the control and treated silages is shown in Table 20.4. Cattle fed Silo Guard II -treated silage gained slightly faster and more efficiently than those fed its control. Cattle fed H/M Inoculant-treated silage gained faster ($P<.05$) and consumed 4.7% more feed than those fed its control. Also shown in Table 20.4 are cattle gains per ton of corn ensiled. These data combine silage recoveries (Table 20.2) and cattle performance. Silo Guard II silage produced 4.6 extra pounds of gain and H/M Inoculant, 2.3 extra pounds when compared with their control silages.

Performance by cattle fed the drought and irrigated silages is shown in Table 20.5. Cattle fed irrigated silage consumed more (P<.05) feed and gained faster (P<.05) than those fed drought silage. However, drought silage was utilized just as efficiently as irrigated silage. Also shown in Table 20.5 are cattle gains per ton of corn ensiled and per acre. The nutritive value of irrigated and drought silages was similar and a ton of each produced about the same amount of cattle gain. However, irrigated silage had double the yield per acre of drought silage (17.4 vs. 8.2 tons) and gave double the cattle gain per acre (1928 vs. 940 lb).

Table 20.1. Chemical Analyses of the Four Corn Silages Made in the Concrete Stave Silos

Item	Drought Silage		Irrigated Silage	
	Control	Silo Guard II	Control	H/M Inoculant
Dry matter:				
Pre-ensiled, %	30.4	30.6	40.0	40.6
Silage, %	29.7	29.6	39.3	40.1
	% of the Silage DM			
Lactic Acid	8.0	8.6	5.9	5.5
Acetic Acid	3.5	3.7	1.9	1.6
Total Fermentation Acids[1]	11.6	12.3	7.9	7.2
Crude Protein	10.0	10.1	8.0	8.0
	% of Total Silage N			
Hot Water Insoluble N	33	33	49	45
ammonia N	9.0	7.3	6.4	6.6
pH	3.88	3.85	3.94	3.98
Lactic:Acetic Ratio	2.3	2.5	3.2	3.6

[1] Only traces of other acids (ie. propionic or butyric) in any of the silage samples.

Table 20.2. Dry Matter Recoveries and Losses From the Concrete Stave Silos and Buried Bags for the Four Corn Silages

Item	DM Recovery		DM Lost During Fermentation, Storage, and Feedout
	Feedable	Non-feedable (Spoilage)	
	% of the DM Ensiled		
		Drought Corn:	
Concrete Stave Silos			
Control	89.0	2.2	8.8
Silo Guard II	90.9	1.4	7.7
Average	89.95	1.8	8.25
Buried Nylon Bags			
Control	92.9	---	7.1
Silo Guard II	93.5	---	6.5
Average	92.2		6.8
		Irrigated corn:	
Concrete Stave Silos			
Control	92.2	2.4	5.4
H/M Inoculant	93.0	1.9	5.1
Average	92.6	2.15	5.25
Buried Nylon Bags			
Control	95.3	---	4.7
H/M Inoculant	93.8	---	6.2
Average	94.55		5.45

Table 20.3. Aerobic Stabilities of the Four Corn Silages

Silage Treatment	Day of Initial Temp. Rise Above Ambient (64 F)	Maximum Temp. (F)	Day of Maximum Temp.
		Drought Corn:	
Top Third			
Control	2.5	120	3
Silo Guard II	4.2	117	4
Middle Third			
Control	7.9	123	13
Silo Guard II	7.8	110	13
Bottom Third			
Control	13.5	76	14
Silo Guard II	*	*	*
		Irrigated Corn:	
Top Third			
Control	6.9	106	7
H/M Inoculant	3.5	106	4
Middle Third			
Control	6.8	119	12
H/M Inoculant	6.0	129	10
Bottom Third			
Control	7.5	108	9
H/M Inoculant	*	*	*

*No rise in temperature or visible aerobic deterioration occurred during 14 days of exposure to air.

Table 20.4. Performance by Cattle Fed the Four Corn Silages and Cattle Gain per Ton of Corn Ensiled

Item	Drought Silage		Irrigated Silage	
	Control	Silo Guard II	Control	H/M Inoculant
No. of Cattle	24	24	24	24
Initial Wt., lb	481	478	476	476
Avg. Daily Gain, lb	2.10	2.14	2.28[b]	2.43[a]
Daily Feed Intake, lb[1]				
Silage	11.63	11.63	13.39	14.10
Supplement	1.80	1.80	1.80	1.80
Total	13.43	13.43	15.19	15.90
Feed/lb of Gain, lb[1]	6.42	6.29	6.66	6.56
Silage Fed, lb/Ton Ensiled[2]	1780	1818	1843	1859
Silage/lb of Gain, lb[2]	15.8	15.5	16.8	16.6
Cattle Gain/Ton of Crop Ensiled, lb[2]	112.7	117.3	109.7	112.0

[a b] P<.05 for irrigated control vs. H/M Inoculant.

[1] 100% dry matter basis.

[2] All values are adjusted to the same silage DM content, 35 percent.

Table 20.5. Performance by Cattle Fed the Drought and Irrigated Corn Silages, Cattle Gain per Ton of Corn Ensiled, and Cattle Gain per Acre

Item	Corn Silage	
	Drought	Irrigated
No. of Cattle	48	48
Avg. Daily Gain, lb	2.12[b]	2.36[a]
Daily Feed Intake, lb[1]	13.43[b]	15.55[a]
Feed/lb of Gain, lb[1]	6.36	6.61
Silage Fed, lb/Ton Ensiled[2]	1800	1851
Silage/lb of Gain, lb[2]	15.7	16.7
Cattle Gain/Ton of Crop Ensiled, lb[2]	114.6	110.8
Silage Yield, Tons/Acre[2]	8.2	17.4
Cattle Gain/Acre, lb[2]	940	1928

[1] 100% dry matter basis.

[2] All values are adjusted to the same silage DM content, 35 percent.

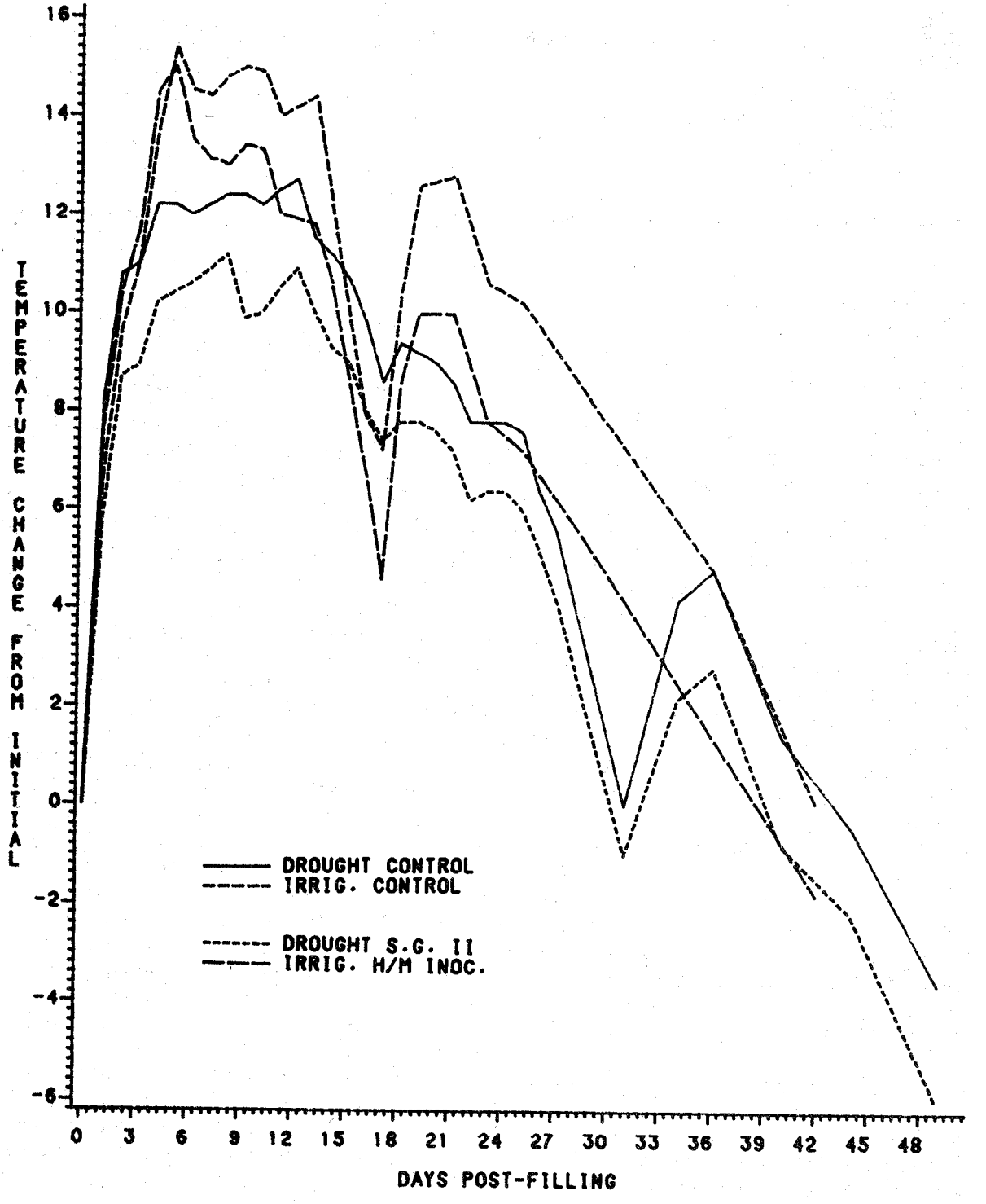

Figure 20.1. Ensiling Temperature (Rise Above Initial Forage Temperature) for the Two Drought Silages (August 16 to September 27, 1983) and the Two Irrigated Silages (August 31 to October 12, 1983).