Additive-treated Corn Silages for Growing Cattle[1,2,3]

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Summary

Whole-plant corn silages were treated with USO_3M or Silo-Best Soluble® in one trial and with Garst M-74® in a second trial. In Trial 1 all three silages were well preserved and moderately stable in the air. USO_3M silage lost less dry matter during fermentation than control or Silo-Best silages. Cattle fed the USO_3M silage made 7.6% faster gains and were 5.2% more efficient than those fed the control silage. Cattle performance with the Silo-Best Soluble and control silages was similar. In trial 2, heifer gains were nearly identical for both control and Garst M-74 silages.

Introduction

These trials evaluated three microbial inoculant additives, USO_3M, Silo-Best Soluble®, and Garst M-74®, for whole-plant corn silage using farm silo techniques. The effect of inoculants on the rate and efficiency of fermentation of corn and other silage crops using laboratory silos is reported in the article on page 107 of this Progress Report.

Experimental Procedures

Trial 1. Three whole-plant corn silages were compared: (1) control (no additive), (2) USO_3M, and (3) Silo-Best Soluble. Both additives were applied at the blower and at the manufacturers' recommended rates. The silages were made by the alternate load method in 10 x 50 ft concrete stave silos on September 4 and 5, 1985 from Pioneer 3183 corn harvested in the early-dent stage at 30 to 32% dry matter (DM). Each silo was partitioned vertically into halves as it was filled, with approximately 26 tons per half. The partitions were separated by plastic mesh fencing. Four thermocouple wires and five nylon bags, filled with 4.5 to 5.5 lb of fresh crop, were placed in the vertical center of each half, and ensiling

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[1]Garst M-74® contains Streptococcus faecium M74, Lactobacillus plantarum, and Pediococcus sp. and is marketed by Garst Seed Company, Box 300, Coon Rapids, Iowa.

[2]Silo-Best Soluble® contains Streptococcus faecium, Lactobacillus acidophilus, Lactobacillus plantarum, and Pediococcus sp. fermentation products and is marketed by Cadco, Inc., Des Moines, Iowa, which provided partial financial assistance.

[3]USO_3M is an experimental inoculant containing Lactobacillus plantarum and Lactobacillus casei and was provided by Sanofi Sante Animale, 37 Avenue George V, 75008 Paris, France, which also provided partial financial assistance.

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temperatures were monitored for the first 42 days. The silos were opened on February 16, 1986 and emptied at a uniform rate during the following 14 weeks. Samples were taken twice weekly for dry matter recovery and chemical analyses.

Each silage was fed to 15 yearling steers and heifers (three pens of cattle per silage) in an 84-day growing trial, which began on February 17, 1986. Rations were full-fed and all 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, equal 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 of the pens and the quantity of silage fed was adjusted daily to assure that 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 trial, all cattle were limit-fed a forage sorghum silage ration to provide a DM intake of 1.75% 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 intake of 1.75% of body weight.

Trial 2. Whole-plant corn was treated with Garst M-74 inoculant at the time of ensiling and compared to untreated (control) silage. Both silages were made by the alternate load method in 16 x 50 ft concrete stave silos on August 6, 7, 8, 9 and 12, 1985 from a blend of 120-day Garst hybrids harvested in the mid to full-dent stage at 40 to 45% dry matter. Garst M-74 inoculant was applied at the blower at the manufacturer's recommended rate. The silos were opened on September 25, 1985 and emptied at a uniform rate during the next 36 weeks. Samples were taken twice weekly for DM recovery and chemcial analyses.

Each silage was fed to 18 yearling heifers (three pens of cattle per silage) in an 84-day growing trial which began on March 5, 1986. Rations contained 90.0% corn silage and 10.0% supplement on a DM basis and were fed *ad libitum*. Each ration was formulated to provide 13.0% crude protein (DM basis), 30 g of Bovatec® per ton of ration DM, equal amounts of calcium and phosphorus, and vitamins A, D, and E. Silage and supplement were mixed in a feed wagon and fed as a complete-mixed ration. Feed offered was recorded daily for each pen. Feed not consumed was removed, weighed, and discarded as necessary.

All heifers were fed supplemented control silage *ad libitum* for 8 days prior to the start of the feeding trial. At the beginning of the growing period, all heifers were implanted with Synovex-H® and dewormed with injectable levamasole hydrochloride. Initial and final weights were taken following a 16-hr shrink from both feed and water. One heifer receiving the Garst M-74 silage was removed from the trial for reasons unrelated to experimental treatment.

Results and Discussion

Trial 1. Ensiling temperatures (Figure 35.1) were nearly identical for the three silages; the absolute temperatures were quite high and reflected the very warm temperature of the fresh crop at harvest. The bottom half of each silo was filled in the afternoon and top half on the following morning. The maximum air temperature approached 100 F on both days.

Although chemical analyses are incomplete, preliminary results indicate that all silages had relatively low pH values, intermediate levels of total fermentation acids (predominately lactic acid), and low NH_3-N contents — all characteristics of well preserved corn silage. The three silages were moderately stable in air during the feedout period.

Silage recovery and loss data are shown in Table 35.1. In the concrete stave silos, DM lost during fermentation, storage, and feedout was 16.9% less for the USO_3M silage (5.9%) than for the control silage (7.1%). The data from the buried nylon bags showed a similar trend; USO_3M-treated bags lost 34.4% less DM than control bags (6.1 vs. 3.9%). Silo-Best Soluble did not consistently improve DM recoveries as compared to the control silage.

Table 35.1. Dry Matter Recoveries and Losses from the Concrete Stave Silos and Buried Bags for the Three Corn Silages

Item		DM Recovery: Feedable	DM Recovery: Non-feedable (Top spoilage)	DM Lost during Fermentation, Storage, and Feedout
		% of the DM Ensiled		
Concrete Stave Silos:				
Control	Top	90.3	1.7	8.0
	Bottom	93.5	—	6.5
	Avg.	91.9	—	7.1
USO_3M	Top	91.0	2.1	6.9
	Bottom	95.0	—	5.0
	Avg.	93.0	—	5.9
Silo-Best Soluble	Top	90.3	1.3	8.4
	Bottom	94.1	—	5.9
	Avg.	92.2	—	7.2
Buried Bags:				
Control	Top	93.6	—	6.4
	Bottom	94.2	—	5.8
	Avg.	93.9	—	6.1
USO_3M	Top	95.4	—	4.6
	Bottom	96.7	—	3.3
	Avg.	96.1	—	3.9
Silo-Best Soluble	Top	93.8	—	6.2
	Bottom	95.5	—	4.5
	Avg.	94.7	—	5.3

Performance by cattle during the 84-day feeding period is presented in Table 35.2. Cattle fed the USO_3M corn silage made 7.6% faster gains and were 5.2% more efficient than those fed the control silage. Having only three pens per treatment prevented these differences from being statistically significant. Cattle performance with the Silo-Best Soluble and control silages was similar.

Also shown in Table 35.2 are cattle gains per ton of corn ensiled. These data combine farm-scale silage recovery (Table 35.1) and cattle performance. The USO_3M-treated corn silage produced 7.3 lb more gain per ton of crop ensiled than the control silage; Silo-Best Soluble produced 1.0 lb more gain per ton.

Trial 2. Performance by heifers during the 84-day feeding period is presented in Table 35.2. Gains were nearly identical, although cattle fed Garst M-74 silage consumed 4.6% more feed. When cattle performance was combined with silage recoveries, the better feed conversion from the control silage offset the better recovery for the treated silage.

Table 35.2. Performance by Cattle Fed the Five Corn Silages and Cattle Gain per Ton of Crop Ensiled in the Two Trials

	Trial 1			Trial 2	
Item	Control	USO_3M	Silo-Best Soluble	Control	Garst M-74
No. of Cattle	15	15	15	18	17
Initial Wt., lb	642	640	645	543	544
Final Wt., lb	873	890	872	711	711
Total Gain, lb	231	250	227	168	167
Avg. Daily Gain, lb	2.76	2.97	2.70	2.00	1.99
Daily Feed Intake, lb[1]	18.94^{ab}	19.39^{a}	18.40^{b}	15.76	16.49
Silage	16.59	16.97	16.11	14.18	14.84
Supplement	2.35	2.42	2.29	1.58	1.65
Feed/lb of Gain, lb[1]	6.89	6.53	6.81	7.88	8.29
Silage Fed, lb/Ton Ensiled[2]	1838	1860	1844	1732*	1762*
Silage/lb of Gain, lb[2]	17.2	16.3	17.1	20.3	21.3
Cattle Gain/Ton of Crop Ensiled, lb[2]	106.8	114.1	107.8	85.3	82.7

[ab]Values in Trial 1 in the same row with different superscripts differ ($P<.10$).
[1]100% dry matter basis.
[2]Values are adjusted to the same silage DM content; 35 percent.
*Dry matter recoveries were 86.6% for control and 88.1% for Garst M-74 silages.

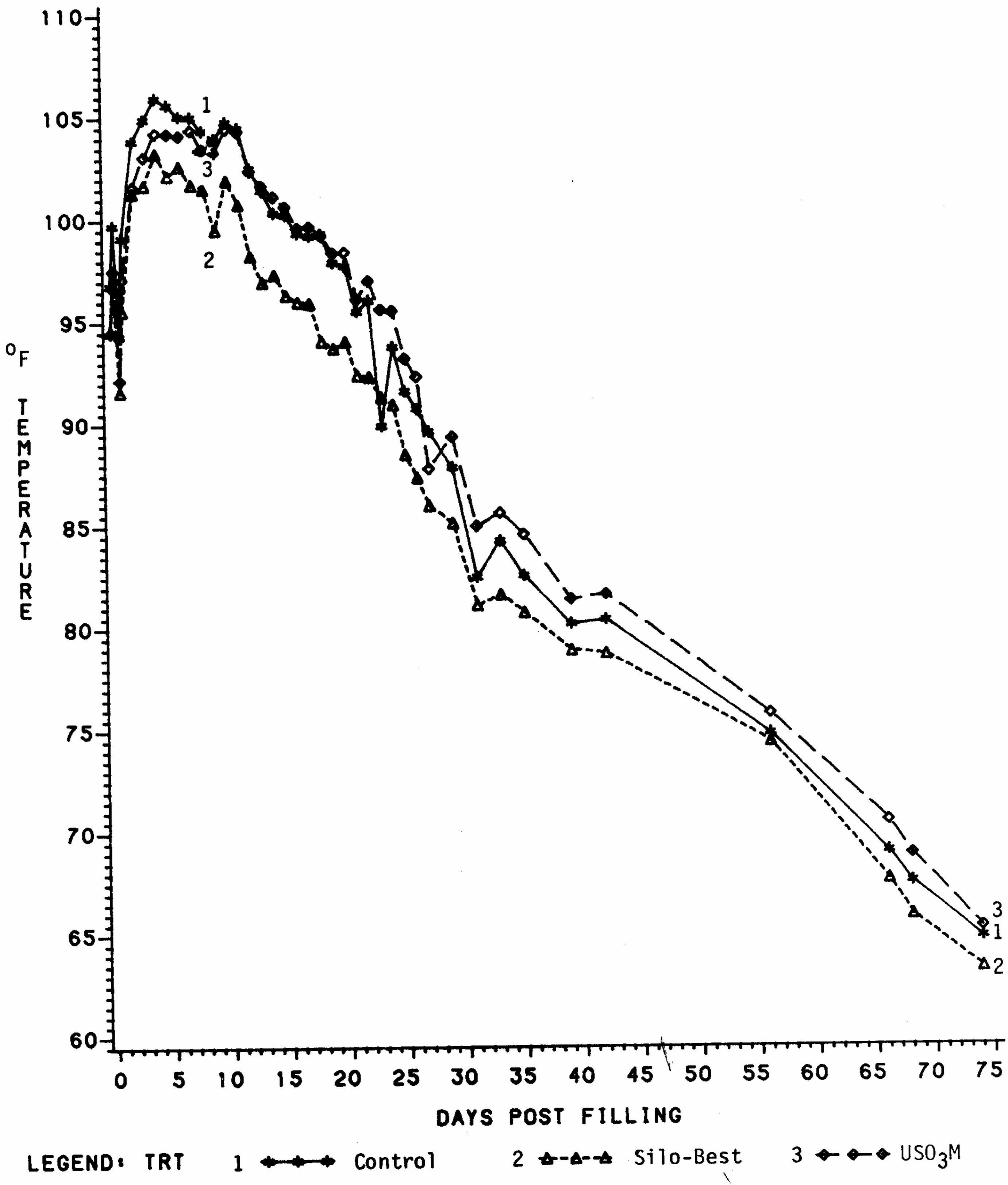

Figure 35.1. Ensiling Temperatures for the Three Corn Silages (Mean of the Top and Bottom Halves of Each Silo)