Effect of ADDITIVE *on corn and oat* SILAGE PRESERVATION

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Trials conducted in Madera County with corn silage and oat and vetch silage indicated that treatment with a popular silage additive resulted in no discernable differences between treated and untreated silages. The silages were analyzed for pH (acidity) and percentage of dry matter, crude protein, crude fiber, ether extract and ash. In addition, observation of the treated and untreated silages revealed no differences in color, odor, amount of seepage, and cow acceptance.

THERE HAS BEEN recently a tremendous increase in production and feeding of silages to dairy cattle in California. Concurrently, a great deal of interest has arisen in the use of silage additives to improve the rate and pattern of fermentation in the silo. For some additives, recommended use is one lb per ton of green forage as the forage is ensiled. Although there are many claims and testimonials about the effectiveness of these additives, there is little rigorous experimental evidence to confirm their efficacy.

Most silage in California is stored in bunker or trench silos, in contrast to other parts of the U.S. where upright (tower) silos are more popular. Measurement by sampling of silage quality and storage losses is difficult in large bunker silos because of the huge mass of material. To identify the important factors in making and preserving silage under controlled conditions, four small experimental bunker silos were constructed on the Henry Massaro Dairy Ranch near Chowchilla, in cooperation with University of California Cooperative Extension in Madera County.

Bunker construction

The bunkers were constructed on a concrete slab, with lumber sidewalls supported by wood posts. The slab extended beyond the mouth of the bunkers to facilitate the dumping and handling of green-chopped forage to be ensiled (see photo). Each silo was 16 ft long, 10 ft wide, and 5 ft high.

The sides of the bunkers were lined with 6 mil polyethylene sheets to decrease air entry into the ensiled forage. Each silo had a capacity of about 12 to 13 tons of green-chopped forage. They were filled by pushing the forage into the bunkers with a dozer blade on the front of a tractor (see photo). The bunkers were large enough to allow some packing of the forage with the tractor wheels after the silos were filled. However, a good job of packing was not possible because of the small size of the bunkers. The silage mass was covered with 6 mil black polyethylene weighted down with automobile tires immediately after the bunkers were filled and packed.

In the first trial, the four bunkers were filled with oats and vetch forage, which had a moisture content of 76% (24% dry matter) at the time of ensiling. Forage in two of the silos received no additives. With the forage in the other two silos a popular silage additive was used according to the manufacturer's recommendations at the rate of one lb per ton of green forage. The guaranteed analysis showed crude protein content to be not less than 6%, crude fat content not less than .5%, crude fiber not more than 16%, and ash not more than 12%. Ingredients were cane molasses, soybean hulls, invert sugars, lactic acid (alpha-hydroxypropionic acid), amorphous diatomaceous

Experimental silos

Bunker silos being filled

earth, cobalt carbonate, wheat bran, ferrous sulphate, zinc sulphate, ethylene diamine dihydroiodide, citric acid, and disodium ethylenediamine tetraacetate.

The next fall, the bunkers were filled with corn forage, which had a moisture content of 68% (32% dry matter) at the time of ensiling. The same additive was used, again at the the rate of one lb per ton in two of the silos. The remaining two silos without additives served as controls. To obtain a more effective mixing of the additive with the forage, one of the authors rode on the truck and broadcast the additive onto the green forage as it was chopped into the truck.

During the filling process in both trials, samples of forage were collected and sealed in double-thickness polyethylene bags. Subsequent analysis for oats and vetch showed a moisture content of 76%, and dry matter composition of 13.2% crude protein, 31.2% crude fiber, 3% ether extract, and 9.2% ash. For corn the moisture content was 68.5%, and dry matter composition was 8.1% crude protein, 21.0% crude fiber, 3.1% ether extract, and 6% ash.

During the filling of the silos, samples of the green forage were wrapped in nylon mesh bags. An example of one of the mesh bags filled with fresh corn forage is shown in the photo. These bags were weighed and then buried at three different depths at four different sites in each of the silos (see sketch).

The oat and vetch silage remained in the silos for 72 days before it was fed; the corn was ensiled for 190 days. The silos were unloaded with a front-end loader on a tractor, and all of the silage was weighed before feeding. The nylon mesh bags were recovered and sealed in double-thickness polyethylene bags. Within a few hours after recovery, these bags of silage were individually weighed and analyzed for moisture, crude protein, crude fiber, ether extract, and ash. Oats and vetch silage was analyzed for pH level.

Silage from the four silos was observed for color, odor, and cow acceptability. Cow acceptability was determined by placing the treated and untreated silages in separate feed bunks located in one of the milking cow corrals. Ample silage was placed before the cows so that it was not consumed immediately. The rate of disappearance of the two silages was then observed.

Results

There were no observable differences in color, odor, or cow acceptability between the treated and untreated silages. Results of the chemical analyses on the oat and vetch silage recovered from the nylon bags showed moisture content to be 76.2% in the treated silage and 75.9% in the untreated silage. In the treated silage, crude protein was 11.7%, crude fiber was 34.2%, ether extract was 5.1%, ash was 11%, and the pH was 4.3. The untreated silage was 12.2% crude protein, 34.2% crude fiber, 5.2% ether extract, 11.9% ash, and had a pH of 4.5.

For corn silage recovered from the nylon bags, chemical analysis showed a moisture content of 69.9% in the treated silage and 70.4% in the untreated silage. The treated material was 8.8% protein, significantly different from the 8.4% protein in the untreated material. The treated silage was 23.1% crude fiber, 4.6% ether extract, and 6.8% ash. The same figures for the untreated silage were 23.6%, 4.5%, and 6.8%, respectively.

Of the factors measured in these trials, the only difference found was a slightly higher protein content in the corn silage treated with the additive. Although this difference was statistically significant, the actual difference was so slight that it would not be of any practical value from a nutritional viewpoint.

Amounts of forages put into the silos and recovered as preserved silage are shown in the table. There was considerable variation in percentages recovered from the four silos. Subsequent trials (see following article) have shown that the result probably was more dependent on the job of packing and sealing of the individual silos rather than the effect of the additive. Dry matter recovery of preserved silage favored the silos with the additive in the oats and vetch trials (88.6% versus 80.8%). However, this was reversed in the corn silage trials where a higher dry matter recovery of preserved silage was obtained from the control silos with no additive (80.3% versus 90.7%). The average recovery from both trials indicates very little difference between the treated and control silages and the observed differences are probably within the range of experimental error associated with a field trial such as this.

Based on the experience gained and observations made in these trials, it was concluded that the effects of packing and sealing these bunkers was of primary importance in obtaining a high percentage of preserved silage. Therefore, it was decided to follow up this work with a series of trials designed to test the effectiveness of using black polyethylene sheets to cover and seal bunker silos. This work is re-reported in the following article.

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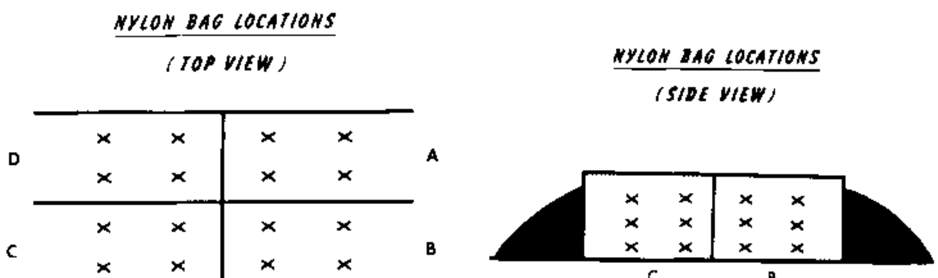
Mesh bag filled with corn forage

NYLON BAG PLACEMENT IN SILOS



EFFECT OF SILAGE ADDITIVE ON SILAGE LOSSES

	Oats and Vetch		Corn	
	Additive	Control	Additive	Control
Forage into silos (lb)	45,080	45,020	40,090	41,190
Dry matter (%)	23.1	24.7	32.8	30.2
Dry matter into silos (lb)	10,435	11,116	13,166	12,427
Preserved silage recovered (lb)	37,281	34,951	35,051	38,032
Dry matter (%)	24.8	25.7	30.2	29.6
Preserved silage dry matter (lb)	9,243	8,979	10,573	11,272
Preserved silage recovered (%)	88.6	80.8	80.3	90.7