The Occurrence of Polychlorinated Biphenyls (PCB's) in Silage Stored in Pit and Upright Silos

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Background

Silage is commonly used as cattle feed in the high plains, and thousands of acres of green corn are harvested each fall for use during the winter months. The silage is stored in pit and upright silos. Pit silage is covered with a thin layer of plastic, and numerous tires are placed on top of the plastic to hold it in place during high winds. Since polychlorinated biphenyls (PCB's) may be used in plastic and in upright silo sealants, the Institute of Rural Environmental Health decided to check silage stored in both types of silo to determine if any PCB contamination had occurred. SKRENTNY et al. (1971) had reported finding PCB's in silage stored in upright silos. The PCB's had leached into the silage from the sealants that had been used to coat the silo walls.

Methods

Silage samples were collected from 21 pit silos and 10 upright silos on ranches in Weld County, Colorado during the period of March to May, 1972. Ranches positive for PCB's were resampled during the summer of 1972 and these samples were also analyzed for PCB's.

All silage samples were collected in 100 ml bottles with plastic screw tops lined with aluminum foil. The bottles were washed with hexane prior to collection.

The silage samples were collected at random from the top, center, or bottom of the silage pits. In some instances, samples were taken from directly underneath the plastic.

In the case of the upright silos, the samples were taken from the dispensing nozzle of the flaker. Although it would have been more desirable to collect samples from various locations within the upright silos, access to these areas was not available at the

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time of the collection. The samples were collected directly into the collection bottles, labeled, and returned immediately to the laboratory for analysis. Samples were allowed to warm to ambient room temperature before being weighed out in one- to ten-gram samples. The samples were weighed with an analytical balance in hexane cleaned cellulose thimbles. The thimble and weighed silage sample were then placed in a soxhlet extractor and refluxed for four hours.

After drying to approximately 2 ml, the sample was taken through a clean-up procedure using a florisil column as described by the authors in a previous paper (SAVAGE et al., 1972). All analyses were made on a Micro Tek 220 Gas Liquid Chromatograph and confirmed by thin layer chromatography. The extraction procedure and operating parameters used were the same as those previously described by the authors (SAVAGE et al., 1972).

Results

Of the 31 silage samples originally collected, two were positive for PCB's. The positive sites were resampled during the summer. Table 1 depicts the positive samples for PCB's collected from the two positive ranches. Site 20 is a ranch that feeds large numbers of feeder cattle. Silage is stored in pit silos and one upright silo at this ranch.

TABLE 1

Silage Samples Positive for PCB's.
Weld County, Colorado - 1972.

Site No.	Collection Date	Comments
20	5/31/72	Pit silage - 0.07 ppm
20	8/1/72	Pit silage - 0.04 ppm
20	9/8/72	Upright silo - trace
21	5/24/72	Silage & shelled corn from cattle trough - 0.06 ppm
21	8/3/72	Pit silage - 0.08 ppm
21	8/3/72	Shelled corn - 0.04 ppm
21	9/7/72	Shelled corn collected from truck - trace

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The silage from site 20 contained a residue level of 0.07 ppm on the first sampling and 0.04 ppm on the second sampling. Corn collected from an upright silo on the same ranch showed only a trace of PCB's and was at the lower levels of our PCB detection capability.

Site 21 is a dairy operation. The silage collected from the pit silo on this ranch contained PCB's at a residue level of 0.06 ppm. Collections of silage and shelled corn taken separately on the second collection had levels of 0.08 ppm and 0.04 ppm, respectively.

The percent moisture of the silage in both pit and upright silos is shown in Table 2. The moisture content of the pit silos ranged from 7.6 to 57.9 percent. The moisture content of the upright silos ranged from 3.0 to 15.0 percent.

TABLE 2

Moisture Content of Silage in Pit and Upright Silos. Weld County, Colorado - 1972.

Pit Silos		Upright Silos	
Site No.	Percent Moisture	Site No.	Percent Moisture
1	50.6	20	4.78
2	46.3	20	15.0
3	22.2	24	2.76
4	49.6	25	5.85
5	57.9	26	8.16
6	35.7	27	3.0
7	33.0	28	14.0
8	42.5		
9	45.6		
10	7.6		
11	40.8		
12	46.0		
13	45.6		
14	41.0		
15	36.5		
16	51.8		
17	46.0		
18	50.8		
19	38.6		
20	31.5 - 1st collection		
20	16.6 - 2nd collection		
21	25.3		
21	--		
21	--		
22	40.0		
23	43.0		

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All of the silage samples were also analyzed for chlorinated hydrocarbon pesticides and none were positive.

Discussion

Although PCB's were found in silage stored in both pit and upright silos on Colorado ranches, all of the positive samples were at very low levels, the highest level being 0.08 ppm. Only two (7.1 percent) of the ranches sampled were positive. One site had positive samples taken from an upright and a pit silo. Since this was a dairy ranch, 102 grams of milk were also collected and analyzed. This sample was negative for PCB's.

Results of this study indicate that PCB's are prevalent in silage at low levels on a limited number of Colorado ranches. It is interesting that none of the persistent organochlorine pesticides were found in any of the silage samples.

References

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