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The heavy metal concentration of plant tissues varies considerably. Generally, elevated levels of the metals have been detected in vegetation growing in areas adjacent to industrial, highway, and mining locations (Lagerwerff and Specht, 1970; Motto et al., 1970; Buchauer, 1973; Hemphill et al., 1973). Forage species would seem to be especially susceptible to coverage by airborne pollutants, with subsequent food chain accumulation, since the above ground portions are exposed to ambient conditions for long periods of time prior to ingestion by domestic animals.

Connecticut is a small state with both agricultural and industrial enterprises. In addition, the state carries a heavy traffic burden. Consequently, one might expect vegetation in such an area to readily reflect ongoing pollution. The primary agricultural enterprise in Connecticut is dairy farming. One of the main forage crops used at present is alfalfa (*Medicago sativa* L.). This study was undertaken to determine the levels of cadmium, copper, lead, nickel, and zinc occurring in alfalfa produced on commercial dairy farms.

Materials and Methods

Alfalfa was collected from commercial alfalfa fields in the state of Connecticut in 1972 and 1973. The locations of these fields are described in Table 1. The fields varied considerably with respect to their proximity to major highways, industrial sites, and general suburbia. In each year samples were taken immediately prior to the field being harvested.

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Table 1. Location of alfalfa fields.

Field No.	Location
1	O.J. Thrall, Windsor Locks, 0.16 km W on Kennedy Rd. from jct. of Kennedy and Basswood, on S side of Rd.
2	W. Foster, Wapping, 0.16 km NE on Foster St. from jct. of Foster and Rt. 30, 0.16 km E off Foster St.
3	Coulter Bros., Suffield, 0.16 km S on Tainter Rd. from jct. of Tainter and Hale St. on E side of Tainter Rd.
4	R. Hastings, W. Suffield, 1.29 km N on Hill St. from jct. Hill and Rt. 190, W for 30 m off Hill St.
5	Exeley Farm, Plainfield, 2.25 km E of jct. Rt. 169 and Rt. 14 on Rt. 14 and 0.97 km W on Rt. 14 from jct. Rt. 14 and Cemetery Rd.
6	Tarryk Bros., Norwich (Occum), 0.16 km S on Canterbury Tpke from jct. Canterbury and Old Canterbury Tpke. 0.16 km N of bridge over Rt. 52 on Canterbury Tpke.
7	J. DeBarl, Gildersleeve, W side Rt. 17, 0.48 km on 17 N from jct. Rt. 17A and Rt. 17.
8	G. Schmaltz, Middlefield, 1.77 km S on Jackson Rd. from jct. Jackson and Rt. 66 and 0.48 km S on Jackson Rd. from jct. Jackson and Strictland Rd.
9	Neubig Bros., Mantowese, 61 m S on N Hill Rd. from jct. of N Hill Rd. and Half Mile Rd.
10	H.J. Brockett, North Haven, 0.32 km N on Mansfield Rd. from jct. Mansfield and Kings Highway, and 0.80 km N on Kings Highway from jct. Kings and Hartford Tpke.
11	C. Greenbacker, Meriden, 0.64 km N of jct. Northrop Rd. and Carpenter Lane and 0.80 km S of jct. Northrop and Murdock Ave.
12	H. Gehike, Meriden, 0.32 km N on Research Hgwy. from jct. Research and Carpenter Lane and 1.29 km N on Research Hgwy. from jct. Research and Rt. 68.
13	Univ. of Conn., Agronomy Farm, Rt. 195, Storrs, Field P-5.
14	_____Newington, 0.48 km N on Deming St. from jct. of Deming and Candlewick Dr. and 0.16 km S on Deming from jct. Deming and Griswoldville Ave.
15	W. Moskaluk, Watertown, 0.64 km N on Park Rd. from jct. Park and Echo Lake Rd.
16	Geer Bros., Conn. State Correctional Farm for Women, Niantic, 0.64 km E on Rt. 156 from Rocky Neck Park and 2.74 km W from jct. Rt. 156 and Black Point Rd.
17	R.B. Lynn, Watertown, 0.32 km N on Bunker Hill Rd. from jct. Bunker Hill and Sperry Rd. and 2.57 km N on Bunker Hill Rd. from jct. Bunker Hill and Rt. 63.

	18	C.D. Parks Co., Danbury, 0.32 km N on Tarrywille Lake Dr. from jct. Tarrywille and Southern Blvd.
	19	H. Camp, Harwinton, 0.16 km S on Locust Rd. from jct. Locust and Rt. 4.
	20	H. Camp, Harwinton, 0.16 km N on Harmony Hill Rd. from jct. Harmony Hill and Rt. 4.
1973 *only*	21	_____Manchester, 0.32 km S on Spencer St. from jct. Spencer and Hillstown St. and 0.48 km N on W Center St. from jct. W Center and Hartford Rd.

In 1972, 20 fields were sampled. Fifteen of these fields were harvested three times, while the remaining five fields were harvested — and hence sampled — two times. Time periods during which samples were obtained were June 6-14 (first harvest), July 18-25 (second harvest), and September 5-12 (third harvest). A representative sample of approximately 1,000 g was obtained from each field site. Each sample was divided into two subsamples. One subsample was thoroughly washed in a series of distilled water baths whereas the other subsample was not washed. Subsamples were dried in a forced-draft oven at 60 C, ground through a Wiley mill fitted with a 1-mm stainless steel screen, and stored in stoppered glass bottles until analyzed. The ground alfalfa was digested in nitric and perchloric acid using the procedure described by Hagstrom and Rubins (1961). After digestion, samples were diluted to 25 ml volume and the digest was analyzed for cadmium, copper, lead, nickel, and zinc by atomic absorption spectrophotometry. A Perkin-Elmer 403 atomic absorption spectrophotometer was used following the methodology prescribed in the Perkin-Elmer handbook. Analyses were performed at least in duplicate. Blanks were carried throughout and corrections made where necessary. All metal concentrations are expressed on a tissue dry matter basis.

In 1973 the same 20 fields, plus one additional field, were sampled. Alfalfa samples, 1,000 g as before, were collected from three random

locations in each field. Time periods during which samples were obtained were May 31-June 2 (first harvest), July 18-July 20 (second harvest), and August 31-September 5 (third harvest). All 21 fields were harvested — and hence sampled — three times. All samples were washed with distilled water and handled thereafter identically to the 1972 samples. Since, in 1973, three independent samples were obtained from each field, analyses of variance were made using a one-way classification to evaluate differences in metal concentrations among fields.

Results and Discussion

The concentrations of cadmium, copper, lead, nickel, and zinc found in alfalfa in all fields and at all harvests are summarized in Tables 2 and 3. The values presented are for alfalfa samples that were washed prior to analysis. Washing alfalfa did not consistently influence the detected-values for the metals in this study. The mean concentrations of cadmium, copper, lead, nickel, and zinc across all harvests in washed and unwashed alfalfa were 0.32 and 0.30, 10.7 and 9.8, 7.9 and 8.2, 3.5 and 3.0, and 30.6 and 29.9 ppm, respectively. These results contradict some reports in the literature which indicate that washing plant materials removes considerable quantities of heavy metals (Page, Ganje, and Joshi, 1971; Lagerwerff, Armiger, and Specht, 1973; Beavington, 1975). However, washing techniques may have differed, i.e., a wetting agent was not used in this study, as well as the exact nature of the contaminating source and the method of contamination.

CADMIUM

Detectable concentrations of cadmium over the two-year period were low. The highest concentration observed was 0.96 ppm while most of the observed concentrations were less than 0.50 ppm. These concentrations are similar to those reported by Lagerwerff and Specht (1970) and substantially less than concentrations reported by Dorn et al. (1975). Huffman and Hodgson (1973) found an average cadmium concentration of 0.44 ppm for perennial grass samples collected from rural areas in 19 states east of the Rocky Mountains. However, they also indicated that the cadmium concentration for perennial grass samples from Connecticut was 0.13 ppm. The mean cadmium concentration of the alfalfa obtained in the second harvest in 1973 was noticeably lower than that for the other five harvests. Cadmium concentrations significantly differed among fields for all three harvests in 1973.

Table 2. Concentrations of cadmium, copper, lead, nickel, and zinc found in washed alfalfa samples obtained from 20 fields in Connecticut in 1972.

Field No.	Harvest														
	1					2					3				
	Cd	Cu	Pb	Ni	Zn	Cd	Cu	Pb	Ni	Zn	Cd	Cu	Pb	Ni	Zn
	ppm														
1	0.27*	5.0	10.7	6.1	30.1	0.53	9.3	13.5	4.3	52.3	0.27	7.4	20.0	2.0	31.3
2	0.27	4.0	8.0	5.2	22.2	0.27	10.9	5.8	4.5	33.3	0.27	6.5	5.1	0.5	21.4
3	0.27	8.2	8.0	3.9	38.0	0.27	16.1	11.6	6.1	48.2	---**				
4	0.27	7.8	8.0	7.4	37.3	0.35	9.1	5.6	1.7	29.3	0.27	7.8	5.6	3.0	22.7
5	0.26	8.2	7.9	7.4	37.8	0.43	8.4	5.7	2.0	24.5	0.55	10.1	6.4	2.0	32.3
6	0.27	5.9	8.0	5.3	22.1	0.56	10.2	6.4	4.0	27.2	0.37	9.9	11.1	2.4	42.0
7	0.27	6.3	8.0	5.3	27.7	0.51	9.9	6.1	4.5	51.6	0.42	1.6	9.1	5.2	24.0
8	0.27	7.2	8.0	7.5	19.1	0.96	12.0	5.8	3.8	37.9	0.37	12.7	5.5	2.0	26.2
9	0.26	7.4	7.9	5.3	29.2	0.41	11.3	5.4	1.6	30.1	0.28	12.9	5.7	1.7	32.2
10	0.26	8.9	7.9	5.2	23.6	0.31	12.5	8.1	2.3	42.0	0.28	15.6	5.5	2.8	31.4
11	0.26	9.2	10.6	5.3	32.6	0.27	8.8	10.7	2.7	32.9	0.28	16.8	16.4	3.3	36.6
12	0.26	10.5	7.8	5.2	25.1	0.29	11.7	9.0	1.5	24.9	0.27	16.3	13.8	3.6	35.5
13	0.27	7.7	5.3	5.3	17.8	0.28	29.3	4.2	2.4	20.3	0.27	12.6	5.0	3.6	21.7
14	0.27	9.0	8.0	5.3	22.5	0.28	13.4	8.3	1.8	26.7	---				
15	0.27	10.0	6.7	2.7	33.6	0.29	17.8	7.5	1.6	46.9	---				
16	0.27	8.8	8.0	5.3	21.1	0.27	10.3	5.1	0.7	17.3	0.28	16.0	2.8	3.8	30.7
17	0.27	6.1	10.8	5.4	18.3	0.29	16.4	6.8	1.4	40.7	---				
18	0.27	7.6	8.1	1.4	21.7	0.29	16.7	9.6	2.9	41.2	---				
19	0.25	7.8	7.6	1.9	35.4	0.35	10.2	5.6	1.4	30.5	0.28	13.6	7.9	3.9	36.8
20	0.27	8.6	8.1	4.1	23.8	0.28	12.3	7.0	1.5	29.2	0.27	16.5	5.5	2.2	30.5
Mean	0.27	7.7	8.2	5.0	27.0	0.37	12.8	7.4	2.6	34.4	0.32	11.8	8.4	2.8	30.4
SD†	0.01	1.6	1.3	1.6	6.8	0.17	4.8	2.4	1.4	10.3	0.08	4.5	4.9	1.1	6.1

* Detection limit 0.01 μg/ml. ** No third harvest. † Standard deviation for all fields sampled.

Table 3. Concentrations of cadmium, copper, lead, nickel, and zinc found in washed alfalfa samples obtained from 21 fields in Connecticut in 1973.

Field No.	Harvest 1					Harvest 2					Harvest 3				
	Cd	Cu	Pb	Ni	Zn	Cd	Cu	Pb	Ni	Zn	Cd	Cu	Pb	Ni	Zn
	ppm														
1	0.09	5.9	13.8	4.3	24.6	ND †	11.7	15.8	3.1	30.1	0.35	18.6	30.2	4.2	40.3
2	0.05	4.9	5.5	2.8	17.1	0.05	12.3	6.1	3.5	20.0	0.23	17.6	6.4	2.7	22.0
3	0.23	9.7	7.7	5.4	35.7	0.09	14.3	7.1	4.9	29.7	0.36	18.8	9.4	6.3	27.6
4	ND	10.7	8.1	2.3	37.7	0.09	15.8	5.7	3.4	31.6	0.54	20.6	4.0	4.0	43.3
5	0.28	5.7	5.5	5.1	39.5	ND	9.5	5.4	2.7	27.9	0.31	20.7	6.2	5.6	22.6
6	0.46	5.9	9.1	6.8	35.2	0.05	13.0	11.8	3.4	24.5	0.24	15.9	14.1	4.3	19.7
7	0.45	5.5	5.4	4.6	29.8	ND	10.2	7.3	3.6	24.0	0.51	10.9	8.4	6.5	26.2
8	0.50	10.2	5.9	3.6	27.9	ND	10.9	6.9	3.6	23.1	0.23	11.1	8.3	5.6	21.9
9	0.28	9.7	5.5	3.2	22.2	ND	13.7	6.4	3.2	25.8	0.27	12.0	7.3	3.7	24.7
10	0.36	10.5	10.1	5.2	25.0	ND	13.8	7.3	3.2	24.0	0.23	12.7	10.5	3.6	21.1
11	0.25	15.3	13.1	3.6	39.0	ND	13.1	12.0	3.1	35.6	0.23	18.1	12.8	3.3	40.1
12	0.27	13.0	8.1	6.1	26.7	ND	17.8	6.7	3.0	28.1	0.23	13.6	11.1	3.7	20.5
13	0.27	6.5	5.3	3.2	20.1	0.05	11.7	5.9	2.7	17.3	0.28	15.5	7.4	3.7	18.3
14	0.27	7.6	6.3	3.6	21.5	ND	18.8	5.9	3.6	30.4	0.45	18.5	10.5	8.8	36.5
15	0.26	9.2	6.1	2.6	34.2	0.03	15.2	6.8	3.5	41.5	0.37	17.3	9.0	5.2	26.6
16	0.27	8.2	5.4	2.7	16.6	ND	11.4	7.6	3.2	20.9	0.32	18.4	9.0	5.0	25.4
17	0.27	10.6	11.3	5.5	34.2	0.07	16.3	7.1	4.8	40.1	0.27	23.5	7.3	6.9	51.3
18	0.27	8.4	8.1	5.9	23.8	0.07	13.3	6.2	4.1	28.8	0.27	16.8	9.0	9.4	22.7
19	0.50	7.1	7.8	5.4	49.2	ND	10.7	5.9	4.1	37.7	0.27	19.0	10.4	5.8	31.5
20	0.27	9.6	8.0	6.0	28.3	ND	12.2	5.9	5.0	26.0	0.36	21.8	11.2	4.9	23.8
21	0.22	8.3	23.0	5.3	29.3	ND	13.6	25.1	3.2	31.1	0.09	15.9	33.2	4.1	21.6
Mean	0.28	8.7	8.5	4.4	29.4	0.02	13.3	8.3	3.6	28.5	0.31	17.0	11.2	5.1	28.0
SD††	0.15	2.9	4.5	1.6	8.6	0.05	2.8	4.9	1.0	8.6	0.12	3.8	7.7	2.4	9.7
F	6.96**	6.6**	9.8**	5.1**	18.7**	2.12*	5.0**	12.3**	1.4	2.4**	4.81**	7.9**	12.7**	2.1*	10.9**

**, * Values significant at the 1 and 5% levels, respectively.
† Not detectable. †† Standard deviation among fields.

COPPER

Copper concentrations, over the two-year period, ranged from 1.6-29.3 ppm. Levels were generally higher in 1973 compared to 1972 and levels in first harvests were generally lower than those observed in the second and third alfalfa harvests in each year. While the mean copper concentration, across all fields, harvests, and years, of 11.9 ppm is not unusually high, it is twice that reported by Hagstrom and Rubins (1961). These workers determined the copper content in both cultivated and native species growing in Connecticut. They reported a range of 2.6-13.7 ppm for all vegetation while the concentration range in alfalfa was 2.6-8.6 with a mean of 5.4 ppm. Maier and Earley (1965) found the concentration of copper in alfalfa leaves ranged from 16-26 ppm, while in the stems the range was 8-20 ppm. These values are in agreement with those obtained in this study.

LEAD

Lead concentrations, over the two-year period, ranged from 2.8-33.2 ppm. The range, however, is limited when compared to that reported in the literature. Alloway and Davies (1971) reported lead concentrations in herbage of 30-100 ppm. Harbourne, McCrea and Watkinson (1968) obtained lead concentrations of 12-350 ppm in pasture forage. Roadside grass, growing 9.4 m from a New Jersey road, contained 63-664 ppm lead (Motto et al., 1970).

As was the case for copper concentrations, the differences in alfalfa lead concentrations among fields were significant ($P < 0.01$) in 1973.

NICKEL

Concentrations of nickel in alfalfa samples ranged from 0.5-9.4 ppm. These concentrations were higher than those reported by Bear (1954) who indicated a range of 0.50-2.50 ppm to be average for nickel concentrations in plants. However, Anderson, Meyer, and Mayer (1973) indicated that oats (*Avena sativa* L.), grown in an area where ultrabasic rocks occurred, had nickel concentrations of 43-308 ppm.

In 1973 the differences in alfalfa nickel concentrations among fields were significant for the first ($P < 0.01$) and third ($P < 0.05$) harvests but not for the second. Nickel concentrations in 1973 were slightly higher than those obtained in 1972.

ZINC

Of the five metals studied, zinc concentrations were the highest. Over the two-year period the range of alfalfa zinc concentrations was 16.6-52.3 ppm. Chapman (1966) has indicated that, for a wide range of plants, concentrations of 25-150 ppm are not uncommon. Alternately, Boawn and Viets (1952) reported that alfalfa grown in zinc deficient soils contained 0.8 ppm zinc while a more normal concentration was 13.8 ppm. Lo and Reisenauer (1968) observed that, in alfalfa grown in a solution with zinc concentrations of 1.0 μ mole/liter, the concentrations of zinc in the stems, leaves, and roots were 20.1, 22.8, and 64.7 ppm, respectively. Whitehead and Jones (1969) gave a range of zinc concentrations in alfalfa of 20-34 ppm with a mean of 24 ppm. In the study reported herein, the mean zinc concentrations were 27.0, 34.5, 30.4, 29.4, 28.5, and 28.0 ppm in the six successive harvests, respectively. Consequently, it would appear that the concentrations of zinc in the Connecticut alfalfa crop were slightly higher than values reported in the literature. Significant ($P < 0.01$) differences were evident among fields, for all harvests in 1973, with respect to zinc concentrations.

LOCATIONS

For further interpretation, fields have been grouped into rural, suburban, and industrial/highway locations. Field numbers 3, 4, 5, 13 and 15 were considered rural locations, fields 2, 7, 8, 9, 10, 16, 17, 19, and 20 were considered suburban locations, while fields 1, 6, 11, 12, 14, and 18 were considered industrial/highway locations. Field number 21, sampled in 1973 only, was considered as an industrial/highway location. The distribution of these locations is shown in Figure 1.

The mean cadmium, copper, lead, nickel, and zinc concentrations found in alfalfa, and grouped on a location basis, are summarized in Table 4. With the exception of lead concentrations, few trends appear consistently across both years and all harvests. While the lead concentrations were not unusually high, there was, however, a consistent trend for the alfalfa lead concentrations to be greatest in the industrial/highway sites and lowest in the rural sites. The sites from which the two highest concentrations were obtained, i.e., 30.2 and 33.2 ppm, were both located

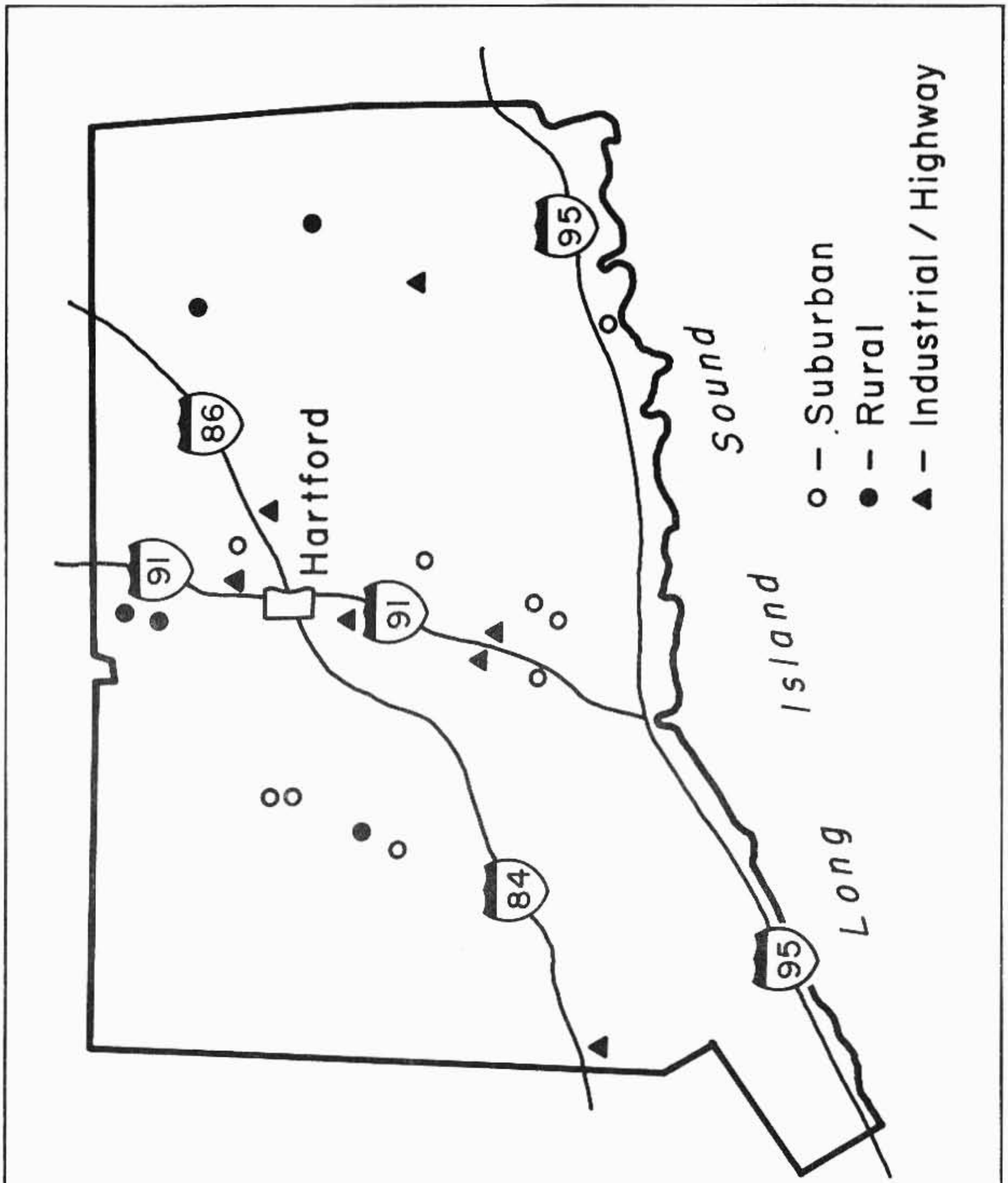

Fig. 1. The location of sites from which alfalfa samples were obtained in 1972 and 1973.

Table 4. Mean concentrations of cadmium, copper, lead, nickel, and zinc in alfalfa sampled in rural, suburban, and industrial/highway locations in 1972 and 1973.

Harvest	Location	Cadmium		Copper		Lead		Nickel		Zinc	
		1972	1973	1972	1973	1972	1973	1972	1973	1972	1973
		ppm									
1	Rural	0.27	0.21	8.4	8.4	7.2	6.5	5.3	3.7	32.9	33.4
	Suburban	0.27	0.33	7.2	8.5	8.3	7.2	5.0	4.3	24.5	27.8
	I/H*	0.27	0.26	7.9	9.2	8.9	11.6	4.8	5.1	25.7	28.6
2	Rural	0.32	0.05	16.1	13.3	6.9	6.2	2.8	3.4	33.8	29.6
	Suburban	0.41	0.01	11.8	12.4	6.2	6.7	2.4	3.8	34.7	26.8
	I/H	0.37	0.02	11.7	14.5	9.6	11.9	2.9	3.4	34.2	29.8
3	Rural	0.36	0.37	10.2	18.6	5.7	7.2	2.9	5.0	25.6	27.7
	Suburban	0.31	0.30	11.9	16.3	5.9	8.8	2.8	5.0	29.2	27.5
	I/H	0.30	0.27	12.6	16.8	15.3	17.3	2.8	5.4	36.4	28.8

*Industrial/Highway

Table 5. Simple correlations between harvests for cadmium, copper, lead, nickel, and zinc concentrations in 1972 and 1973. Data were paired on a field basis.

Harvests correlated	Metal									
	Cd		Cu		Pb		Ni		Zn	
	1972†	1973††	1972	1973	1972	1973	1972	1973	1972	1973
First vs Second	+0.11	−0.38	+0.03	+0.47*	+0.56**	+0.91**	+0.04	+0.38	+0.49*	+0.66**
First vs Third	−0.01	−0.20	+0.28	−0.00	+0.72**	+0.84**	−0.29	+0.25	+0.30	+0.33
Third vs Second	+0.43	+0.21	+0.28	+0.15	+0.89**	+0.93**	−0.23	+0.48*	+0.06	+0.64**

**, * Significant at the 1 and 5% levels, respectively.
† Number of pairs for first and second harvest, n = 20, third harvest, n = 15.
†† Number of pairs for all harvests, n = 21.

close to highways. The former was approximately 400 m east of interstate 91 and immediately adjacent to a two-lane paved highway. The latter was located 15 m east of a heavily travelled main street in Manchester, Connecticut. The lowest concentration of 4.0 ppm was obtained in alfalfa growing in a rural site. This latter site was located 1.3 km from the nearest two-lane paved highway and 2.6 km from the nearest town.

For each metal, simple correlations were calculated for metal concentrations between harvests. Harvests were paired on an individual field basis. These correlations are given in Table 5. Of the five metals determined, only lead concentrations were significantly ($P < 0.01$) and positively correlated between all harvests in both 1972 and 1973. This would confirm the previous observation that certain fields consistently received a heavier lead burden than others. Similar correlations calculated for the cadmium, copper, and nickel data indicated an absence of consistent and significant correlations. Correlations derived from the zinc data were consistently positive and, in a number of instances, significant. This would suggest that alfalfa growing in certain fields consistently has a greater zinc concentration than others.

Summary

The concentration of cadmium, copper, lead, nickel, and zinc found in alfalfa, harvested in 1972 and 1973 from various locations in the state of Connecticut, were within the ranges of these metals reported to be common in plant tissues. Over the two-year period the ranges of cadmium, copper, lead, nickel, and zinc concentrations were nondetectable — 0.96, 1.6-29.3, 2.8-33.2, 0.5-9.4, and 16.6-52.3 ppm, respectively. Copper concentrations were greater than those reported in 1961 by Hagstrom and Rubins in Connecticut.

Grouping the fields into rural, suburban, and industrial/highway locations indicated that lead concentrations were consistently greater in alfalfa obtained from the latter location than the other locations. Similarly, positive and significant correlations existed between alfalfa lead con-

centrations obtained at different harvests. To a lesser degree, alfalfa zinc concentrations were also correlated. This suggests that lead and zinc may be accumulating in certain areas.

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ZINC

Of the five metals studied, zinc concentrations were the highest. Over the two-year period the range of alfalfa zinc concentrations was 16.6-52.3 ppm. Chapman (1966) has indicated that, for a wide range of plants, concentrations of 25-150 ppm are not uncommon. Alternately, Boawn and Viets (1952) reported that alfalfa grown in zinc deficient soils contained 0.8 ppm zinc while a more normal concentration was 13.8 ppm. Lo and Reisenauer (1968) observed that, in alfalfa grown in a solution with zinc concentrations of 1.0 μ mole/liter, the concentrations of zinc in the stems, leaves, and roots were 20.1, 22.8, and 64.7 ppm, respectively. Whitehead and Jones (1969) gave a range of zinc concentrations in alfalfa of 20-34 ppm with a mean of 24 ppm. In the study reported herein, the mean zinc concentrations were 27.0, 34.5, 30.4, 29.4, 28.5, and 28.0 ppm in the six successive harvests, respectively. Consequently, it would appear that the concentrations of zinc in the Connecticut alfalfa crop were slightly higher than values reported in the literature. Significant ($P < 0.01$) differences were evident among fields, for all harvests in 1973, with respect to zinc concentrations.

LOCATIONS

For further interpretation, fields have been grouped into rural, suburban, and industrial/highway locations. Field numbers 3, 4, 5, 13 and 15 were considered rural locations, fields 2, 7, 8, 9, 10, 16, 17, 19, and 20 were considered suburban locations, while fields 1, 6, 11, 12, 14, and 18 were considered industrial/highway locations. Field number 21, sampled in 1973 only, was considered as an industrial/highway location. The distribution of these locations is shown in Figure 1.

The mean cadmium, copper, lead, nickel, and zinc concentrations found in alfalfa, and grouped on a location basis, are summarized in Table 4. With the exception of lead concentrations, few trends appear consistently across both years and all harvests. While the lead concentrations were not unusually high, there was, however, a consistent trend for the alfalfa lead concentrations to be greatest in the industrial/highway sites and lowest in the rural sites. The sites from which the two highest concentrations were obtained, i.e., 30.2 and 33.2 ppm, were both located