CASE GS0014 ENDOSULFAN STUDY 32 EM 11C 08/12/79

CHEM C79401 Endosulfan

BRANCH EFB DISC 30 TOPIC 050530 GUIDELINE 40 CFR 163.62-10b

FORMULATION 12 - EMULSIFIABLE CONCENTRATE (EC OR E)

FICHE/MASTER ID C0003EC0 CONTENT CAT C1

Stancvick, R.P. (1966) Determination of Thiodan I, II and Sulfate Residues in Soil: R-1898. Includes method dated Jun 6, 1966. (Unpublished study received Apr 4, 1966 under 7F0526; submitted by FMC Corp., Philadelphia, Pa.; CDL:C0003C-F)

GUIDE. CLASS = S.

DIRECT RVW TIME = 10 (MH) START-DATE END DATE

REVIEWED BY: D. Harper
TITLE: Staff Scientist
ORG: Enviro Control, Inc., Rockville, MD
LOC/TEL: 468-2500

SIGNATURE: Daniel Harper DATE: Nov. 16, 1979

APPROVED BY:
TITLE:
ORG:
LOC/TEL:

SIGNATURE: DATE:

CONCLUSIONS:

Field Dissipation - Terrestrial

1. This study is scientifically valid.

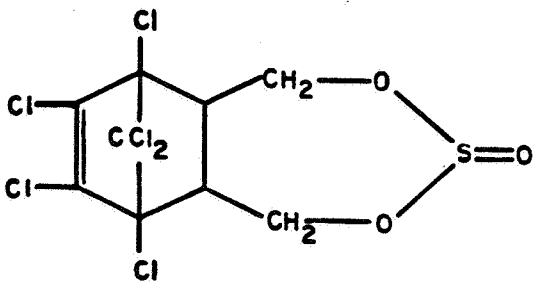
2. Approximately 1 year after treatment with endosulfan at 20 lb ai/A, residue levels less than 1.59 ppm were found in soil samples taken at depths of 0-6 inches. Approximately 1 year after treatment at 2.0 lb/A, residue levels found in soil samples were less than 0.05 ppm.

3. When endosulfan was applied to the soil surface, it dissipated one half-life during the first 4 months and 2.5 half-lives over the 17-month period. When the compound was incorporated into the soil, the dissipation rate was slower and it degraded 1.5 half-lives in 16 months. Essentially no endosulfan was degraded during the winter months.

4. Data from this study satisfy part of the data requirements for field dissipation in Section 163.62-10(b) of EPA's Proposed Guidelines for Registering Pesticides (July 1978) by providing information on the dissipation of endosulfan in two soils.

MATERIALS AND METHODS:

ENDOSULFAN, BENZOEPIN, BEOSIT, CHLORTIEPIN, CYCLODAN, INSECTOPHENE, MALIX, THIFOR, THIMUL, THIODAN, THIONEX, THIOSULFAN, TIONEL, TIOVEL



6,7,8,9,10,10-Hexachloro-1,5,5a,6, 9,9a-hexahydro-6,9-methano-2,4, 3-benzodioxathiepin-3-oxide

Endosulfan (Thiodan), as a 2 lb/gal emulsifiable concentrate, was applied to a New York soil and a Mississippi soil at rates of 2 and 20 lb ai/A. The insecticide was either applied to the soil surface or incorporated into the soil to an unknown depth. Soil samples were collected at 0-6, 6-12, and 12-18 inches at various time intervals for up to 469-530 days after treatment.

Endosulfan was extracted from the soil by maceration with benzene and isopropanol for 3 minutes. To the macerated soil, 2% aqueous NaCl was added and the benzene layer was decanted off. The benzene extracts were dried and stored at 4 C until they could be analyzed. The benzene extracts were cleaned up by saturating them with distilled water, adding carbon attaclay, and shaking the resultant mixture. The carbon attaclay was filtered out, and the extract was dried prior to analysis by micro-coulometer-gas chromatography (MCGC).

All recovery data were obtained by adding known amounts of α-endosulfan, β-endosulfan, and endosulfan sulfate to untreated samples prior to extraction and analysis by the procedure described above.

REPORTED RESULTS:

The data indicate that when endosulfan was applied to the surface of the soil, it dissipated one half-life during the first 4 months and 2.5 half-lives over a 17-month period in both the New York and Mississippi soils. When it was incorporated into the soil, the dissipation rate was much lower, with a degradation of 1.5 half-lives in 16 months. Essentially no degradation occurred during the winter months (Figures 1-3).

Endosulfan residue levels found in soil samples taken at depths of 6-12 and 12-18 inches increased over a period of up to 90 days and then decreased over the remainder of the experiment. After approximately 1 year, residue levels of less than 1.59 ppm and less than 0.05 ppm were found in soils treated at 20 and 2.0 lb/A, respectively (Tables 1-3).

DISCUSSION:

1. The reviewer questions how the New York control soil samples could have had as much as 0.46 ppm endosulfan (Tables 1 and 3). The control samples should have had no detectable residues. The reviewer believes that if endosulfan residues remained in the New York plots from previous applications, then other sites should have been used for the study since these lingering residues could have affected the results of the study.

2. The author does not explain the increases in endosulfan residue levels that occurred at various times during the study (Figures 1-3).

3. The author did not explain why low residue levels were found at zero days after application at 20 lb/A to the New York soil. Residue levels of 6.84 and 6.24 ppm (Tables 1 and 3) were found when endosulfan was applied at 10 ppm.

4. The fact that between 14 and 27% (calculated from data in Tables 1 and 2) of the endosulfan recovered from soil samples at zero days after surface treatment was found in the samples collected at depths of 6-12 and 12-18 inches indicates to the reviewer that endosulfan is very mobile.

5. The author neither described the soil characteristics nor indicated how deeply endosulfan was incorporated into the soil.

6. The reviewer notes that there was no pattern to the formation of endosulfan sulfate residues.

7. The reviewer concludes from the data that when endosulfan was applied at 2.0 lb/A, it did not persist from year to year; however, at 20 lb/A it did persist from year to year.

8. The minimum detection limit of the method appeared to be 0.05 ppm. The average recovery rate for α-endosulfan and β-endosulfan was 97% and that for endosulfan sulfate was 78%. The reviewer judges the method used to be adequate.

X - α- and β-endosulfan; one 20 lb/A application
O - endosulfan sulfate
Z - total residues
P - total residues in the 6-12 inch layer

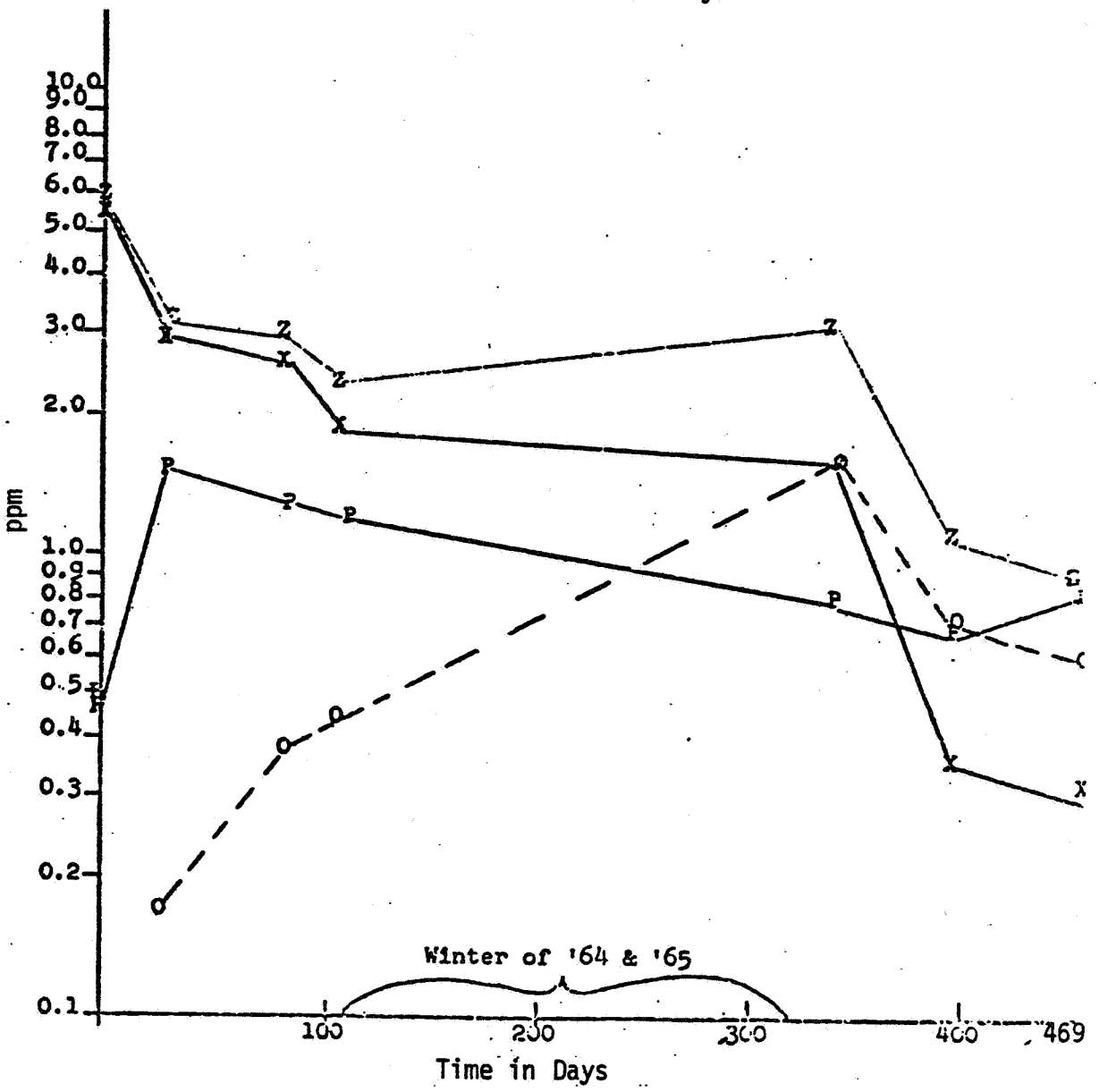


Figure 1. Dissipation of endosulfan with time in soil (0-6 inch layer) in New York plots.

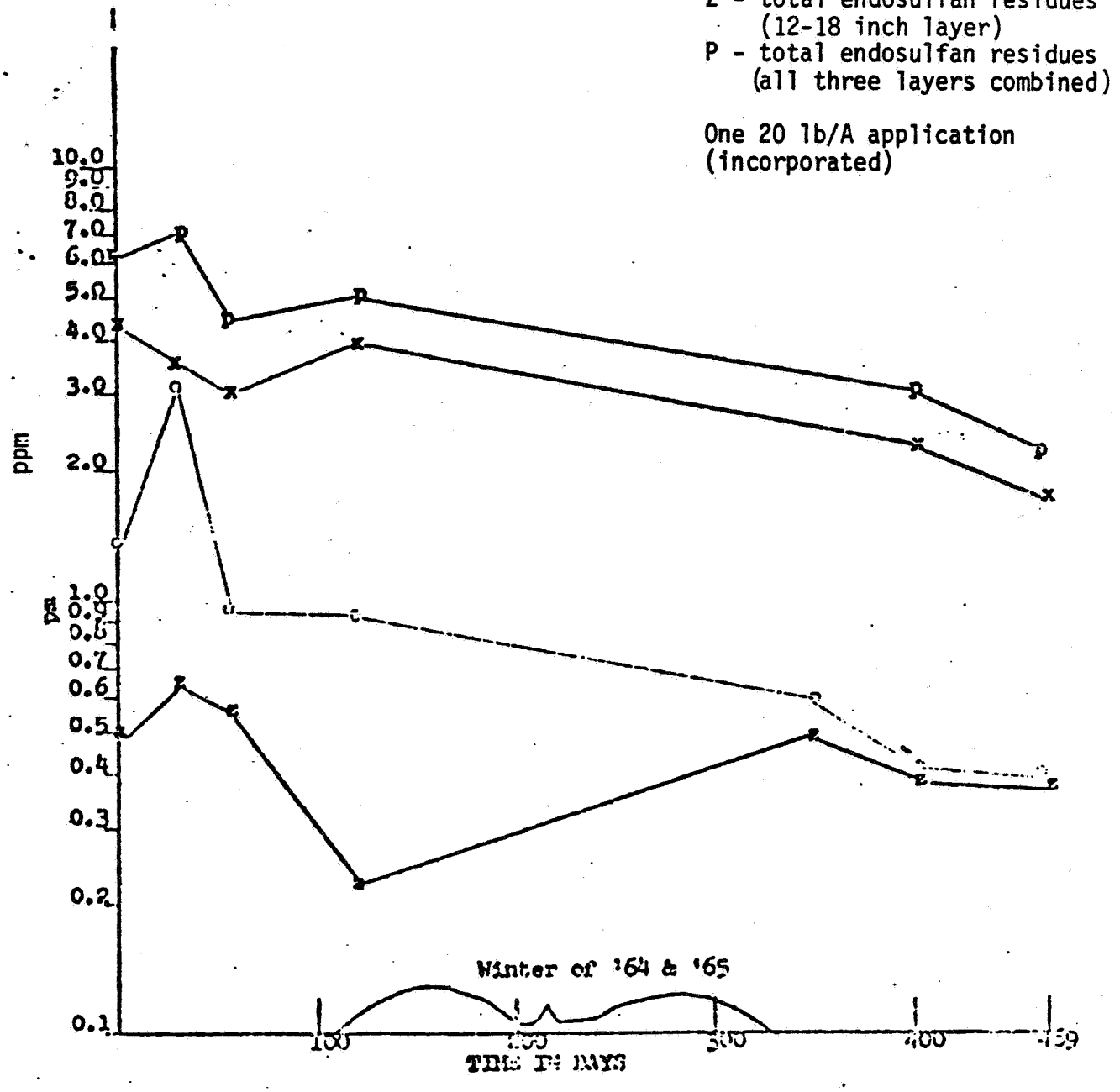


Figure 2. Dissipation of endosulfan with time in soil in New York plots.

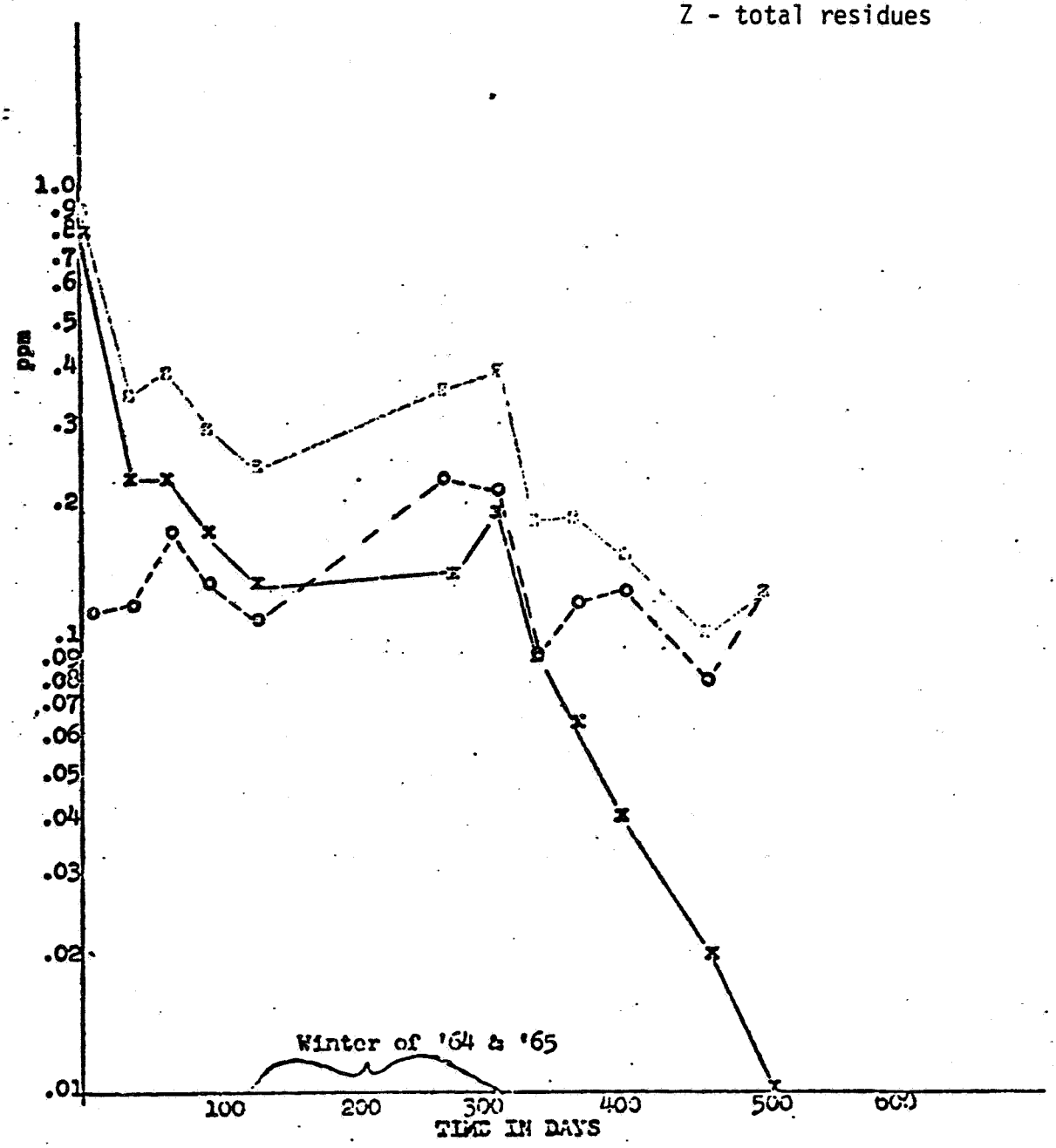


Figure 3. Dissipation of endosulfan with time in soil (0-6 inch layer) in Mississippi plots.

Table 1. Average residue levels found in New York soil treated with endosulfan by surface application.[a]

Depth of soil samples (inches)	Endosulfan residues	Control	Time interval after treatment (days) 0	91	122	349	469
		Treatment: 20 lb/A					
0-6	α and β	0.32	5.87	1.55	1.83	1.59	0.30
	Sulfate	ND[b]	ND	0.39	0.54	1.56	0.61
6-12	α and β	0.46	0.47	1.13	1.00	0.48	0.36
	Sulfate	ND	ND	0.14	0.18	0.33	0.50
12-18	α and β	0.16	0.50	0.55	0.41	0.19	0.13
	Sulfate	ND	ND	ND	0.11	0.14	0.12
		Treatment: 2.0 lb/A					
0-6	α and β	0.42	0.80	0.45	0.38	0.05	0.05
	Sulfate	ND	ND	0.09	0.15	0.28	0.20
6-12	α and β	0.15	0.18	0.17	0.16	ND	ND
	Sulfate	ND	ND	0.08	0.09	ND	0.08
12-18	α and β	0.06	0.11	0.06	ND	ND	ND
	Sulfate	ND	ND	ND	ND	ND	ND

[a]Data are in ppm.

[b]ND indicates levels <0.05.

Table 2. Average residue levels found in Mississippi soil treated with endosulfan by surface application.[a]

Depth of soil samples (inches)	Endosulfan residues	Control	Time interval after treatment (days) 0	96	130	368	503
		Treatment: 20 lb/A					
0-6	α and β	0.09	8.37	2.08	2.07	0.67	0.24
	Sulfate	ND[b]	ND	1.15	1.60	0.87	1.34
6-12	α and β	ND	1.85	0.13	0.08	0.15	0.07
	Sulfate	ND	0.17	ND	ND	0.18	0.09
12-18	α and β	ND	0.82	0.13	0.09	ND	0.06
	Sulfate	ND	ND	ND	ND	ND	0.06
		Treatment: 2.0 lb/A					
0-6	α and β	0.11	0.80	0.17	0.13	0.07	ND
	Sulfate	ND	0.12	0.14	0.11	0.13	0.14
6-12	α and β	ND	0.17	ND	ND	ND	ND
	Sulfate	ND	ND	ND	ND	ND	ND
12-18	α and β	ND	0.06	ND	ND	ND	ND
	Sulfate	ND	ND	ND	ND	ND	ND

[a]Data are in ppm.

[b]ND indicates levels < 0.05.

Table 3. Average residue levels[a] found in New York soil treated with endosulfan by soil incorporation.

Depth of soil samples (inches)	Endosulfan residues	Control	Time interval after treatment (days) 0	58	121	409	469
		Treatment: 20 lb/A					
0-6	α and β	0.32	4.33	2.67	3.01	0.76	0.39
	Sulfate	ND[b]	ND	0.33	0.99	1.38	1.28
6-12	α and β	0.30	1.32	0.94	0.79	0.16	0.16
	Sulfate	ND	ND	ND	0.14	0.24	0.23
12-18	α and β	0.06	0.59	0.49	0.18	0.16	0.16
	Sulfate	ND	ND	0.06	0.04	0.22	0.20
		Treatment: 2.0 lb/A					
0-6	α and β	0.12	0.52	0.39	0.21	ND	0.14
	Sulfate	ND	ND	0.17	0.14	0.05	0.09
6-12	α and β	0.27	0.49	0.09	0.08	ND	0.05
	Sulfate	ND	ND	ND	ND	ND	ND
12-18	α and β	0.06	0.19	0.15	0.11	ND	0.05
	Sulfate	0.05	0.05	ND	ND	0.10	0.06

[a]Data are in ppm.

[b]ND indicates levels < 0.05.