CASE GS 0063 ALACHLOR STUDY 3 PM 200 06/10

CHEM 090501 Alachlor

BRANCH EFB DISC 30 TOPIC 051025 GUIDELINE 40 CFR 163.62-10c

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00023014 CONTENT CAT 01

Sutherland, M.L., T.G. Curtis, W.A. Darlington, and J.T. Marvel. 1972. Final report on Lasso and the environment: Part 6: Soil dissipation of Lasso: Agric. Research Report No. 264. Unpublished study received June 29, 1973 under 3F1372; submitted by Monsanto Co., Washington, D.C.; CDL:093660-N.

SUBST. CLASS = S.

DIRECT RVW TIME = 8 (MH) START-DATE END DATE

REVIEWED BY: J. MacPherson, Jr. and R. Schaefer
TITLE: Staff Scientists
ORG: Dynamac Corp., Enviro Control Division, Rockville, MD
LOC/TEL: 468-2500

SIGNATURE: J.R. MacPherson Jr. R. Schaefer DATE: Nov. 12, 1982

APPROVED BY:
TITLE:
ORG:
LOC/TEL:

SIGNATURE: DATE:

CONCLUSIONS:

incubated at ≤32 C

Metabolism - Aerobic Soil

1. This study is scientifically valid.

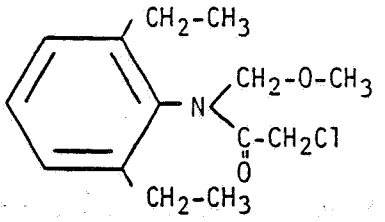
2. [^{14}C]Alachlor applied at ~4 ppm degraded with a half-life of <18 days in sandy loam, silt loam, and silty clay loam nonsterile soils. Ninety days after application [^{14}C]alachlor concentrations were ~0.5 ppm in all three soils.

3. This study partially fulfills EPA Data Requirements for Registering Pesticides (1983) by identifying the alachlor degradate, 2-chloro-2',6'-diethylacetanilide, in soil.

(1)

MATERIALS AND METHODS:

ALACHLOR, LASSO, ALANEX, CP 50144, LAZO



2-Chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide

The aerobic metabolism of ring-labeled [^{14}C]alachlor (96% pure, Monsanto Co.) applied to nonsterile soil at 4 ppm was studied in Norfolk sandy loam (2% clay, 1% organic matter, pH 5.7). Roy silt loam (10% clay, 1% organic matter, pH 6.5), and Drummer silty clay loam (37% clay, 6% organic matter, pH 7.0). The treated and control soils were contained in pans within a greenhouse. The greenhouse temperature fluctuated at $\leq 32^{o}$C and the soils were kept moist enough to grow soybeans. Sampling was done on days 2, 18, 36, 54, 72, and 90. The soils were analyzed for total ^{14}C content, [^{14}C]alachlor, and [^{14}C]2-chloro-2',6'-diethylacetanilide. On day 2, four cores were composited per control and treated pans, thereafter, six cores were composited per pan. The composited cores were frozen, lyophilized, and then extracted, except for the day-90 samples, which were air dried and ground to pass a 32-mesh sieve before extraction.

Extraction was done by shaking the soil with 80% acetonitrile:water, centrifuging, drawing off the supernatant, and then repeating the procedure. The two extracts were composited and an aliquot was analyzed by using LSC to determine ^{14}C content. Another aliquot was evaporated to dryness, redissolved in chloroform, and then concentrated. The concentrate was analyzed for [^{14}C]alachlor and its degradates by using GLC. The extracted soil and portions of the unextracted soil were combusted, and analyzed by using LSC. The extraction efficiencies ranged from 40 to 90%; recovery of radioactive material was 87-95%.

REPORTED RESULTS:

[^{14}C]Alachlor degraded appreciably in soil in 90 days (Table 1). The ^{14}C residues besides [^{14}C]alachlor and [^{14}C]2-chloro-2',6'-diethylacetanilide were not identified. The concentrations of [^{14}C]2-chloro-2',6'-diethylacetonilide are corrected for the interference peak present in the control samples (Table 1).

DISCUSSION:

1. Preapplication and immediate postapplication samples were not taken from the soils.

2. The GLC had an interference peak directly coincidental with the [^{14}C]2-chloro-2',6'-diethylacetanilide peak and roughly 50% of the degradates in the extractable fraction in the latter samples were not identified.

3. The data presented from the GLC results were taken from graphs, numerical values were not reported.

Table 1. Approximate concentrations of [^{14}C]alachlor and [^{14}C]2-chloro-2',6'-diethylacetanilide (ppm) in soils under greenhouse conditions.

Sampling period (days)	Norfolk sandy loam	Ray silt loam	Drummer silty clay loam
		[^{14}C]alachlor	
2	2.1	2.8	2.5
18	1.7	1.8	1.7
36	1.2	0.6	0.9
54	0.6	0.4	0.8
72	0.4	0.0	0.4
90	0.5	0.5	0.4
		[^{14}C]2-chloro-2',6'- diethylacetanilide	
2	0.3	0.7	0.3
18	0.2	0.8	0.3
36	0.2	0.0	0.2
54	0.3	0.3	0.5
72	0.6	0.8	0.2
90	0.3	0.3	0.0

(TDR03B)

DATA EVALUATION RECORD

CASE GS 0063 ALACHLOR STUDY 1 PM 200 06/10/8

CHEM 090501 Alachlor

BRANCH EFB DISC 30 TOPIC 05

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00023012 CONTENT CAT 01

Sutherland, M.L., T.G. Curtis, W.A. Darlington, and J.T. Marvel. 1972. Final report on Lasso and the environment: Part 4: Photolysis of Lasso on soil and in water: Agric. Research Report No. 262. Unpublished study received June 29, 1973 under 3F1372; submitted by Monsanto Co., Washington, D.C.; CDL:093660-L.

SUBST. CLASS = S.

DIRECT RVW TIME = 4 1/2 (MH) START-DATE END DATE

REVIEWED BY: J. MacPherson, Jr. and R. Schaefer
TITLE: Staff Scientists
ORG: Dynamac Corp., Enviro Control Division, Rockville, MD
LOC/TEL: 468-2500

SIGNATURE: J.R. MacPherson Jr. R. Schaefer DATE: Nov. 11, 1982

APPROVED BY:
TITLE:
ORG:
LOC/TEL:
SIGNATURE: DATE:

; ~85% of the applied radioactivity remained in a water solution after exposure

CONCLUSIONS:

Degradation - Photodegradation in Water

1. This study is scientifically valid.

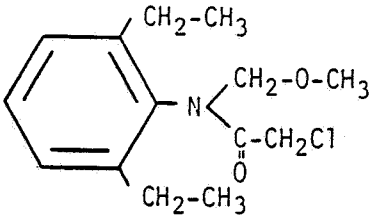
2. [^{14}C]Alachlor ~~does not undergo~~ photodegradation slowly in water ~~when exposed~~ to UV light equivalent to 8 hours of sunlight per day for 16 days.

3. This study does not fulfill EPA Data Requirements for Registering Pesticides (1983) because the study was not carried out long enough. In addition, no materials balance was presented.

5

MATERIALS AND METHODS:

ALACHLOR, LASSO, ALANEX, CP 50144, LAZO



2-Chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide

The photodegradation of ring-labeled [^{14}C]alachlor (Lasso, 96% pure, Monsanto Co.) at 200 ppm in water was studied in Crosby reactor vessels. Four vessels were set up: dark anaerobic, dark aerobic, UV light anaerobic, UV light aerobic. The UV light spectrum was ∿280-420 nm (actual light intensity not reported), with 3 hours of exposure equivalent to an 8 hour sunlight day. (Note that alachlor does not absorb UV light above 240 nm.) The anaerobic vessels contained a nitrogen atmosphere, and the aerobic contained air. The experiment was run for 48 hours, equivalent to 8 hours of sunlight per day for 16 days. Sampling for radioactivity was done at 6, 12, 24 and 48 hours in duplicate. Condensers were attached to reaction vessels to minimize volatilization. The samples were analyzed directly by using LSC; recovery ranged from 74 to 93%. Aliquots of the solution left after 48 hours were mixed with chloroform, centrifuged, and separated. Extractions were done twice, the two chloroform fractions combined, and then concentrated to 0.5 g. Extraction efficiency was ∿93-99%. The extracts were then analyzed on a GLC/RAM.

REPORTED RESULTS:

Approximately 90, 100, 85, and 85% of the applied radioactivity was recovered after 6, 12, 24, and 48 hours of exposure, respectively. No photodegradation products were detected.

DISCUSSION:

1. The sterility of the solutions was not mentioned.

2. The high concentration of alachlor (200 ppm) was intended to yield larger amounts of photodecomposition products, increasing probability of detection.

CASE GS 0063 ALACHLOR STUDY 7 PM 200 06/10/8

CHEM 090501 Alachlor

BRANCH EFB DISC 30 TOPIC 0510

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00027140 CONTENT CAT 01

Lavy, T.L. 1974. Mobility and deactivation of herbicides in soil-water systems: Project A-024-NEB. Available from: National Technical Information Service, Springfield, VA: PB-238 632; unpublished study received July 19, 1978 under 201-403; prepared by Univ. of Nebraska, Water Resources Research Institute, submitted by Shell Chemical Co., Washington, D.C.: CDL:234472-P.

FICHE/MASTER ID 00027139 CONTENT CAT 01

Weidner, D.W. 1974. Degradation in groundwater and mobility of herbicides. Master's thesis, Univ. of Nebraska, Dept. of Agronomy. Unpublished study received July 19, 1978 under 201-403; submitted by Shell Chemical Co., Washington, D.C.; CDL:234472-0.

SUBST. CLASS = S.

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

REVIEWED BY: B. Gregg and W. Spangler
TITLE: Staff Scientists
ORG: Dynamac Corp., Enviro Control Division, Rockville, MD
LOC/TEL: 468-2500

SIGNATURE: B. Gregg W. Spangler DATE: Nov. 5, 1982

APPROVED BY:
TITLE:
ORG:
LOC/TEL:

SIGNATURE: DATE:

CONCLUSIONS:

Metabolism - Aerobic Aquatic

1. The portion of the study concerning groundwater metabolism is scientifically invalid because of an insufficient sampling protocol (first samples analyzed at 6 months post-treatment); however, the portion of the study concerning soil:water slurry metabolism is scientifically valid.

2. Phytotoxic residues of alachlor dissipated from the aqueous phase in ≤12 weeks for both the 10 C and 35 C incubations of soil:water slurries treated with alachlor at 32 ppm. In the soil phase, alachlor dissipation occurred more rapidly at 35 C than at 10 C.

3. The portion of the study concerning alachlor metabolism in soil:water slurries does not fulfill EPA Data Requirements for Registering Pesticides (1983) because alachlor analyses were performed by using bioassay procedures.

Mobility - Leaching and Adsorption/Desorption

7

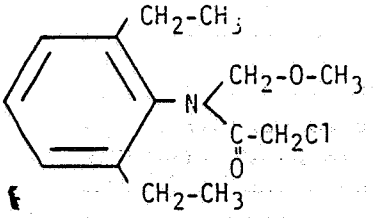
1. This portion of the study is scientifically valid.

2. [^{14}C]Alachlor is mobile in Sharpsburg silty clay loam and Jansen sandy loam, and very mobile in Jansen gravelly sand, based on mean K_d values (14-hours shaking at 1-10 ppm) of 3.74, 2.88, and 0.80, respectively. Leaching studies (8-inch soil columns and 10 inches of added water) showed similar results with 0, ∿51, and ∿96% of the added [^{14}C]alachlor leaching through the soil columns, respectively.

3. This portion of the study partially fulfills EPA Data Requirements for Registering Pesticides (1983) by providing data on the mobility of alachlor in gravelly sand, sandy loam, and silty clay loam soils.

MATERIALS AND METHODS:

ALACHLOR, LASSO, ALANEX, CP 50144, LAZO



2-Chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide

Metabolism - Aerobic Aquatic

[^{14}C]Alachlor (label position, source, formulation, and purity not specified) was added at 0.072 and 10 ppm to groundwater samples (characteristics not provided) collected from four Nebraska locations:Clay Center, North Platte, Atkinson, and O'Neill. Six replicate glass vials (information on vial covers, if utilized, not provided) were incubated in the dark at 10 or 25 C for 0, 2, 4, 6, 9, 12, or 15 months. On each sampling date, 1 ml was sampled from each replicate vial and analyzed by LSC, with actual alachlor concentrations analyzed by GLC after incubation for 6, 9, 12, and 15 months.

Metabolism studies with soil:water slurries were also conducted, by adding alachlor (source, formulation, and purity not specified) in a distilled water solution at 41.6 ppm to soils to achieve a final desired concentration on soil of 32 ppm. The soils tested included Sharpsburg silty clay loam (0- to 6-inch depth, pH 5.2, 4.6% organic matter, 10% sand, 57% silt, and 33% clay), Jansen sandy loam (0- to 6-inch depth, pH 5.7, 2.9% organic matter, 64% sand, 25% silt, and 11% clay), and Jansen gravelly sand (34- to 40-inch depth, pH 6.3, 0.07% organic matter, 93% sand, 2% silt, and 5% clay). Jars containing 450 ml of alachlor-treated water and 450 g of soil were shaken for 2 hours, and four replicates of each treatment stored in constant temperature chambers at 10 or 35 C. After incubation periods of 0, 12, and 24 weeks, alachlor-induced phytotoxicity was assayed in the aqueous phase by using a cucumber bioassay. Seeds were placed on filter paper moistened with supernatant and incubated at 25 C in the dark for 8 days to compare shoot lengths of seedlings on control and treated water. Alachlor was determined in the soil phase with a soybean bioassay. Vacuum- and air-dried soils were potted and seeds were planted and grown for 4 weeks to compare the weights of plants grown in control and treated soil.

8

Mobility - Adsorption/Desorption

[^{14}C]Alachlor (source, formulation, and purity not specified) was dissolved in distilled water to prepare solutions of 1, 2, 5, and 10 ppm. Sharpsburg silty clay loam, Jansen sandy loam, and Jansen gravelly sand (characteristics previously described) were sieved ($\leq$2 mm) and treated in triplicate at each concentration. Soil samples were shaken for 14 hours on a gyrotory shaker, then centrifuged at 1400 rpm for 1 hour and further settled by refrigeration for 24 hours. Samples were analyzed by using LSC. K_d values were calculated for each [^{14}C]-alachlor concentration for each soil type.

Mobility - Leaching

[^{14}C]Alachlor (source, formulation, and purity unspecified) at 1 ppm was added to the top 0.5 inches of 8-inch glass columns packed with Sharpsburg silty clay loam, Jansen sandy loam, and Jansen gravelly sand (characteristics previously described). The columns were packed at an average bulk density of 1.15, 1.34, and 1.57 g/cm^3, respectively. The soils were at about two-thirds of field capacity prior to packing. Distilled water was leached through the column at 0.1 inches/hour (10 inches total) and the leachate was collected at 90-minute intervals. After leaching, the soils in the column were sectioned. Leachate and the soil sections were analyzed by using LSC.

REPORTED RESULTS:

Metabolism - Aerobic Aquatic

In the groundwater-treated samples, LSC analyses indicated there had been little loss of ^{14}C between the 0- and 15-month incubation periods (actual data not presented). Based on GLC data, little degradation of alachlor occurred in any of the soils between 6 and 15 months after treatment at 10 ppm (Table 1). Data from the 0.072 ppm treatment were quite variable. In the soil:water slurries, soybean bioassays indicated that alachlor activity in the soil phase decreased with time and that alachlor degraded more rapidly at 35 C than at 10 C (Table 2). Cucumber bioassays to test the aqueous phase indicated that the phytotoxicity had dissipated from week 0 to week 12, with no substantial differences in bioassay results between the samples incubated at 10 C or 35 C (Table 2).

Mobility - Adsorption/Desorption

The K_d decreased with a decrease in soil organic matter, with values being highest in Sharpsburg silty clay loam, somewhat lower in the Jansen sandy loam, and lowest in the Jansen gravelly sand. The mean K_d values were 3.74, 2.88, and 0.80, respectively (Table 3). K_d values decreased with an increase in the [^{14}C]alachlor concentration for the silty clay loam and sandy loam.

9

Mobility - Leaching

[^{14}C]Alachlor readily leached through the gravelly sand, but less through the sandy loam and the silty clay loam, with ∿96, ∿51, and 0% (as ^{14}C) having leached through the respective soil columns (Table 4).

DISCUSSION:

Metabolism - Aerobic Aquatic

1. There was considerable variability in the GLC data for groundwater treated at 0.072 ppm. In addition, alachlor concentrations were not determined prior to 6 months posttreatment.

2. Groundwater characteristics including pH were not reported.

3. Sensitivity and recovery levels were not provided for the GLC method.

4. The cucumber and soybean bioassay data showed little further breakdown in phytotoxic alachlor residues from week 12 to week 24.

Mobility - Adsorption/Desorption

K_d values were reported in terms of total ^{14}C rather than actual alachlor concentration.

Mobility - Leaching

1. The soil columns were only 8 inches deep and only 10 inches of water were added, but the data reported were sufficient to indicate that leaching of alachlor had occurred.

2. Leaching and soil retention data were reported based on ^{14}C rather than concentrations of alachlor or its degradates.

Table 1. Degradation of alachlor in groundwater incubated samples.

Initial alachlor concentration (ppm)	Source of groundwater (Nebraska)	Incubation temperature (°C)	Final alachlor concentration (ppm) Incubation period (months) 6	9	12	15
0.072	Atkinson	10	0.022	0.030	0.063	0.019
		25	0.013	0.032	0.041	0.014
	O'Neill	10	0.043	0.022	0.018	0.018
		25	0.011	0.027	0.029	0.037
	North Platte	10	0.031	0.048	0.054	0.019
		25	0.036	0.044	0.041	0.045
	Clay Center	10	0.027	0.031	0.001	0.011
		25	0.032	--[a]	0.003	--
10.0	Atkinson	10	7.12	7.68	8.49	7.76
		25	6.97	6.17	10.95	7.93
	O'Neill	10	7.31	7.25	9.75	5.98
		25	6.44	6.75	10.26	6.37
	North Platte	10	8.25	7.05	11.28	7.41
		25	6.76	6.39	11.65	8.41
	Clay Center	10	6.73	7.62	10.36	5.58
		25	6.86	5.77	--	0.09

[a]Data not reported.

Table 2. Bioassay results for alachlor incubated in soil:water slurries.

	Growth inhibition (% of control growth)			
	Sharpsburg silty clay loam	Jansen sandy loam	Jansen gravelly sand	Water
Cucumber bioassay (to test aqueous phase):				
Week 0	55.5	39.9	30.8	31.1
Week 12 (10 C)	102.2	105.1	80.0	92.2
Week 24 (10 C)	83.0	108.4	101.4	78.4
Week 12 (35 C)	92.2	101.9	98.0	74.3
Week 24 (35 C)	86.9	98.9	99.1	78.9
Soybean bioassay (to test soil phase):				
Week 0	51.0	49.1	10.6	51.0
Week 12 (10 C)	66.9	78.9	35.6	36.6
Week 24 (10 C)	66.6	81.5	22.2	33.8
Week 12 (35 C)	136.6	113.2	93.9	50.0
Week 24 (35 C)	137.4	108.5	86.1	29.5

Table 3. Relative adsorption of [^{14}C]alachlor onto three soils.

	K_d[a]				
	1 ppm	2 ppm	5 ppm	10 ppm	Mean
Sharpsburg silty clay loam	4.31	4.07	3.52	3.08	3.74
Jansen sandy loam	3.15	3.20	2.76	2.40	2.88
Jansen gravelly sand	0.76	0.94	0.70	0.78	0.80

[a] $K_d = \frac{\text{dpm standard-dpm equilibrium solution}}{\text{dpm equilibrium solution}} \times \frac{\text{ml solution}}{\text{g adsorbent}}$

Table 4. Soil column leaching data for [^{14}C]alachlor applied to three soils.

Sample depth (inches)	Percent of radioactivity remaining on the column		
	Sharpsburg silty clay loam	Jansen sandy loam	Jansen gravelly sand
0.5	3.6	14.1	7.7
1.0	6.3	13.7	7.7
1.5	6.6	16.8	5.1
2.0	11.8	11.8	7.7
2.5	8.8	8.0	7.7
3.0	15.3	6.6	7.7
3.5	9.3	8.2	5.1
4.0	8.0	2.9	5.1
4.5	5.0	3.1	7.7
5.0	2.8	2.7	5.1
5.5	4.6	1.2	5.1
6.0	3.2	2.1	6.1
6.5	3.0	1.8	5.1
7.0	3.3	2.3	10.3
7.5	4.3	3.1	3.9
8.0	4.2	1.8	3.9
^{14}C in leachate[a]	0	51.2	96.1

[a]Percent of recovered ^{14}C.

(TDR03B)

DATA EVALUATION RECORD

CASE GS 0063 ALACHLOR STUDY 8 PM 200 06/10

CHEM 090501 Alachlor

BRANCH EFB DISC 30 TOPIC 050525 GUIDELINE 40 CFR 163.62-9b/c/d

FORMULATION 12 - EMULSIFIABLE CONCENTRATE (EC OR E)

FICHE/MASTER ID 00078301 CONTENT CAT 01

Guth, J.A. 1975. CGA-24705 Leaching model study with the herbicide CGA-24705 in four standard soils: Nr. SPR 3/75. Unpublished study received July 23, 1981 under 100-587; prepared by Ciba-Geigy, Ltd., Switzerland, submitted by Ciba-Geigy Corp., Greensboro, N.C.; CDL:245628-E.

SUBST. CLASS = S.

DIRECT RVW TIME = 5 (MH) START-DATE END DATE

REVIEWED BY: L. Borghi
TITLE: Staff Scientist
ORG: Dynamac Corp., Enviro Control Division, Rockville, MD
LOC/TEL: 468-2500

SIGNATURE: L. Borghi DATE: Nov. 12, 1982

APPROVED BY:
TITLE:
ORG:
LOC/TEL:

SIGNATURE: DATE:

CONCLUSIONS:

Mobility - Leaching

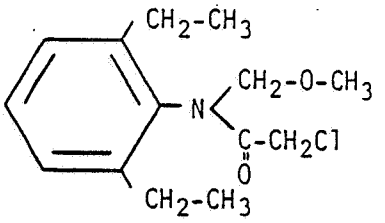
1. This study is scientifically valid.

2. Alachlor was very mobile in Lakeland sand columns (30 cm) following elution with 8 inches of water. Fifty-nine percent of applied alachlor was recovered in column eluates. The compound was less mobile in other soils tested, with maximum leaching depths of 18 cm, 10 cm, and 4 cm in Collembey sand, silt loam and sandy clay loam columns, respectively. Alachlor was not detected in the eluates of these columns.

3. This study partially fulfills EPA Data Requirements for Registering Pesticides (1983) by providing information on the mobility of alachlor in a Lakeland and Collembey sand. Insufficient elution water (8 versus 20 inches) was used for proper assessment of mobility in the other test soils.

MATERIALS AND METHODS:

ALACHLOR, LASSO, ALANEX, CP 50144, LAZO



2-Chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide

Air-dried test soils (Table 1) were packed into metal columns (40 cm long x 4 cm diameter). Alachlor (Lasso 50% EC, source unspecified) was applied to the tops of the soil columns at 5 kg ai/ha. The soil surfaces were covered with filter paper discs and 20 cm of water were applied to the tops of the columns over 48 hours. The columns were then sectioned (15 2-cm sections) and Soxhlet extracted with acetone for 4 hours. The extracts were concentrated and analyzed by using GC with flame ionization detection. Leachates were collected and analyzed in a similar manner. The detection limit was 0.5 ppm.

REPORTED RESULTS:

Concentrations of alachlor in the column sections and in leachates are shown in Table 2. Alachlor leached to depths of 4 cm, 10 cm, 18 cm, and >30 cm in the sandy clay loam, silt loam, Collembey sand, and Lakeland sand, respectively. Alachlor was detected only in the eluates of the Lakeland sand column.

DISCUSSION:

1. Insufficient elution water was applied to the sandy clay loam and silt loam soils, therefore, conclusions regarding the mobility of alachlor in these soils could not be made. While only 8 inches of water was also applied to the two sand columns, this amount was sufficient to demonstrate the mobility of alachlor in these soils.

2. The Vetroz sandy clay loam was classified as a sandy loam in the study, however, according to the mechanical analysis data provided and the USDA Soil Classification System, the soil is a sandy clay loam. It has been reported as such in this review.

Table 1. Characteristics of test soils.

Soil type	Sand (%)	Silt (%)	Clay (%)	Organic matter (%)	pH
Collembey sand	87.0	10.2	2.8	2.2	7.8
Lakeland sand	99.1	0.5	0.4	0.4	6.6
Les Evouettes silt loam	38.4	49.4	12.2	3.6	6.1
Vetroz sandy clay loam[a]	57.8	19.6	22.6	5.6	6.7

[a]See Discussion point 2.

Table 2. Alachlor concentrations in soil column sections and eluates following elution with 200 mm water.

Fraction / Column sections (cm)	Concentration (% of applied) Collembey sand	Les Evouettes silt loam	Vetroz sandy clay loam[a]	Lakeland sand
0-2	3.8	15.1	55.6	4.6
2-4	6.0	29.4	36.5	2.3
4-6	9.9	39.7	<0.5	1.0
6-8	11.9	6.7	<0.5	3.2
8-10	16.3	1.0	<0.5	1.2
10-12	15.1	<0.5	<0.5	1.8
12-14	15.9	<0.5	<0.5	1.2
14-16	7.1	<0.5	<0.5	1.7
16-18	3.8	<0.5	<0.5	1.1
18-20	<0.5	<0.5	<0.5	2.3
20-22	<0.5	<0.5	<0.5	3.0
22-24	<0.5	<0.5	<0.5	4.1
24-26	<0.5	<0.5	<0.5	3.3
26-28	<0.5	<0.5	<0.5	3.9
28-30	<0.5	<0.5	<0.5	6.4
Eluates	<0.5	<0.5	<0.5	58.7
Total recovered	89.8	91.9	92.1	99.8

[a]See Discussion point 2.