DP Barcode: D162946

Shaughnessy No.: 125601

Date out of EFGWB: MAY 14 1991

TO: R. Taylor/E. Allen
Product Manager #25
Registration Division (H7507C)

FROM: Paul Mastradone, Ph.D., Chief
Environmental Chemistry Review Section #1
Environmental Fate and Ground Water Branch

THRU: Hank Jacoby, Chief
Environmental Fate and Ground Water Branch
Environmental Fate and Effects Division (H7507C)

Attached, please find the EFGWB review of ...

Reg./File #: 10182-267

Chemical Name: Paclobutrazol

Type Product: Systemic plant growth regulator

Common Name: Clipper

Company Name: ICI Americas, Inc.

Purpose: Registrant's comments to review of addendum to registration (WGM;03/26/90)

Date Received: March 28, 1991 Date Completed: April 12, 1991

Action Code: 361

EFGWB #(s): 91-0490

Total Reviewing Time: 0.2 days

Deferrals to: ___Ecological Effects Branch, EFED

___Science Integration and Policy Staff, EFED

___Non-Dietary Exposure Branch, HED

___Dietary Exposure Branch, HED

___Toxicology Branch

1

1. CHEMICAL:

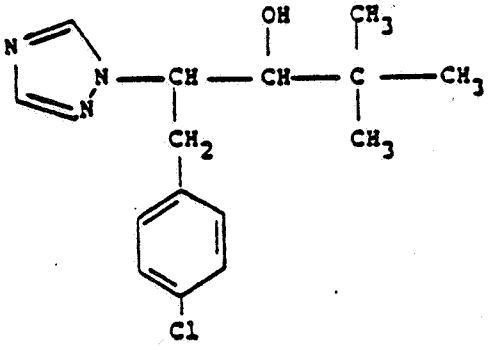
Chemical name: (±)-(R*,R*)-B-[(4-chlorophenyl)methyl]-a-(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol

CAS no.: 76738-62-0

Common name: Paclobutrazol, PP333

Trade name: Clipper

Chemical structure:



Molecular formula: $C_{15}H_{20}ClN_3O$

Molecular weight: 293.5

Formulation: Paclobutrazol 21.8%
Inert ingredients 78.2%

Physical/Chemical properties of active ingredient:

Physical characteristics: White crystalline solid

Melting point: 165°C

Solubility: 35 ppm in water

Log octanol/water partition coefficient: 3.2

Vapor pressure: 7.5×10^{-9} mm Hg at 20°C

2. STUDY/ACTION TYPE:

Registrant's comments to review of addendum to registration (WGM;03/26/90).

3. TEST MATERIAL:

N/A

2

4. STUDY IDENTIFICATION:

Hawk, R.E. CORRESPONDENCE TO R. TAYLOR; CLIPPER 2SC TREE GROWTH REGULATOR EPA REGISTRATION NO. 10182-267 - REVIEW OF ENVIRONMENTAL FATE DATA. Submitted by ICI Americas, Inc., Wilmington, DE; Written March 11, 1991; Received by EPA March 21, 1991.

5. REVIEWED BY:

Gail Maske
Chemist, Review section #1
OPP/EFED/EFGWB

Signature: _____
Date: _____

6. APPROVED BY:

Paul Mastradone
Chief
Review section #1
OPP/EFED/EFGWB

Signature: Paul J Mastradone
Date: MAY 14 1991

7. CONCLUSIONS:

The registrant is responding to the March 26, 1990 review of terrestrial field dissipation studies (MRID 00146597 and MRID 00155854). The storage stability data and the characterization of soil data furnished satisfy the deficiencies addressed in the review (WGM;03/26/90). No further terrestrial field dissipation data for paclobutrazol is required. However, the discrepancy between the following studies:

Environmental Fate Data Requirement		MRID No.
163-1	Leaching, adsorption/desorption	40685004
163-1	Leaching, adsorption/desorption	40685005
164-1	Terrestrial field dissipation	40685006 to 40685012

which indicated paclobutrazol and its ketone analogue are potential groundwater contaminants and the following studies:

164-1	Terrestrial field dissipation	00146597
164-1	Terrestrial field dissipation	00155854

which do not indicate paclobutrazol and its ketone analogue are potential groundwater contaminants is still of concern to EFGWB. Therefore, in lieu of additional field dissipation data, one or more small-scale prospective ground-water study(ies) are required. These studies track the fate of a pesticide and its degradates from the point of application in a highly vulnerable agricultural environment. The study involves sampling soil, soil-water, and ground water.

The above ground-water issue was referred to the Ground-Water Section. They have concurred with the recommendation for a small-scale prospective ground-water study(ies). (See attached Ground-Water Statement on Paclobutrazol.)

8. RECOMMENDATIONS:

The registrant should be informed of the following:

a. EFGWB is not requiring further terrestrial field dissipation data for paclobutrazol. However, in lieu of additional field dissipation data, one or more small-scale prospective ground water studies is required. EFGWB does recommend that a protocol for the small-scale prospective ground-water study be submitted for review prior to initiation of the study.

b. The status of Environmental Fate Data Requirements for use of paclobutrazol on terrestrial food crops and terrestrial nonfood crops is summarized below:

Environmental Fate Data Requirements		Status of Data Requirement	MRID No.
Degradation Studies-lab			
161-1	Hydrolysis	Fulfilled (WGM;03/26/90)	00132698
161-2	Photodegradation in water	Fulfilled (WGM;03/26/90)	00132699
161-3	Photodegradation on soil	Fulfilled (WGM;03/26/90)	40685002
161-4	Photodegradation in air	Waived (WGM;03/26/91)	
Metabolism Studies-lab			
162-1	Aerobic soil	Fulfilled (WGM;03/26/90)	40685003
162-2	Anaerobic soil	Not required (no field and vegetable crop use)	40685003
Mobility Studies			
163-1	Leaching, Adsorption/ Desorption	Fulfilled (WGM;03/26/90)	40685005
163-2	Volatility-Lab	Waived (WGM;03/26/91)	
163-3	Volatility-field	Waived (WGM;03/26/91)	

4

Environmental Fate Data Requirements	Status of Data Requirement	MRID No.
Dissipation Studies-field		
164-1 Soil	(WGM;03/26/90)[1] (WGM;04/25/91)	00146597 00155854 40685006-12
164-5 Soil, long-term	Deferred pending results of 164-1	
Accumulation Studies		
165-1 Rotational crops-confined	Not required (has no field and vegetable crop, aquatic crop, and rotated food crop uses)	
165-2 Rotational crops-field	Not required (has no field and vegetable crop, aquatic crop, and rotated food crop uses)	
165-4 in Fish	Not Fulfilled (WGM;03/26/90) (WGM;03/26/91)	00133560

[1] One or more small-scale prospective ground-water studies (166-1) are required instead of further terrestrial field dissipation.

9. BACKGROUND:

Paclobutrazol is a systemic plant growth regulator that inhibits the formation of gibberellins, resulting in compact plants and enhanced production of flower and fruit buds. Paclobutrazol was developed for use on terrestrial nonfood (turf and trees in nonfood areas) sites. The maximum annual application rate for turf is 2 lbs. ai/acre. The use rate for trees depends on the tree size and number of trees per area. A maximum application rate of 4.5 to 5.0 lbs ai/area is estimated by the registrant for trees. Paclobutrazol may be applied by ground spray to foliage or by injection to the growing media. Paclobutrazol is also used on container-grown ornamental plants in greenhouses which is applied at a maximum rate of 0.5 mg ai/6" pot.

10. DISCUSSION:

None

11: COMPLETION OF ONE-LINER:

See attached one-liner.

12: CBI APPENDIX:

N/A

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
PACLOBUTRAZOL
Last Update on March 26, 1991
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Common Name: PACLOBUTRAZOL
Smiles Code:
PC Code # :125601 CAS #:76738-62-0 Caswell #:

Chem. Name :(2RS,3RD)-1-(4-CHLOROPHENYL)-4,4-DIMETHYL-2-(1H-1,2,4-TRIAZOL-1-YL)PENTAN-3-OL
Action Type: PLANT GROWTH REGULATOR (INHIBITS FORMATION OF GIBBERELLINS)

Trade Names: BONZI; CLIPPER; CULTAR; PARLAY
(Formul'tn): 4G/L SUSP. CONC.; 20 G/L FOR TRUNK INJUNCTION; 250 G/L CONC.
Physical State:

Use Patterns (% Usage) : FOR ORNAMENTAL CROPS (BONZI); AMENITY TREE AND BUSH CONTROL (CLIPPER); APPLE AND PEAR ORCHARD (CULTAR).

Empirical Form: $C_{15}H_{20}ClN_3O$
Molecular Wgt.: 293.79 Vapor Pressure: 7.50E -9 Torr
Melting Point : °C Boiling Point: °C
Log Kow : 3.2 pKa: @ °C
Henry's : E Atm. M3/Mol (Measured)

Solubility in ...					Comments
Water	E	35	ppm	@20.0 °C	
Acetone	E		ppm	@ °C	
Acetonitrile	E		ppm	@ °C	
Benzene	E		ppm	@ °C	
Chloroform	E		ppm	@ °C	
Ethanol	E		ppm	@ °C	
Methanol	E		ppm	@ °C	
Toluene	E		ppm	@ °C	
Xylene	E		ppm	@ °C	
	E		ppm	@ °C	
	E		ppm	@ °C	

Hydrolysis (161-1)
[V] pH 5.0:STABLE
[V] pH 7.0:STABLE
[V] pH 9.0:STABLE
[ ] pH :
[ ] pH :
[ ] pH :

6

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
PACLOBUTRAZOL
Last Update on March 26, 1991
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Photolysis (161-2, -3, -4)
[ ] Air :
[V] Soil :140 DAYS WITH XENON ARC
[V] Water:NO DEGRADATION IN 10 DAYS
[ ] :IRRADIATION WITH ARTIFICIAL
[ ] :LIGHT
[ ] :

Aerobic Soil Metabolism (162-1)
[V] APPROXIMATELY 1 YEAR IN AEROB-
[ ] IC LOAM SOIL AT 20 C.
[V] 9.1 WEEKS IN CLAY LOAM SOIL
[ ] AND 30.5 WEEKS IN SANDY LOAM
[ ] SOIL AT 25 C.
[ ]
[ ]

Anaerobic Soil Metabolism (162-2)
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Anaerobic Aquatic Metabolism (162-3)
[S] >1 year
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Aerobic Aquatic Metabolism (162-4)
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

7

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
PACLOBUTRAZOL
Last Update on March 26, 1991
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Soil Partition Coefficient (Kd) (163-1)

	Sd	Si	Cl	%OM	pH	Kd
[S]	28	47	25	3.9	4.9	21.3
[ ]	55	28	18	5.2	6.0	10.2
[ ]	37	22	41	11.4	8.0	9.5
[ ]	21	39	40	5.6	6.4	7.6
[ ]	88	4	8	1.6	5.5	2.4

Soil Rf Factors (163-1)
[S] RESIDUES CONTAINING THE METH-
[ ] INE MOIETY WERE RELATIVELY
[ ] IMMOBILE IN Sd, SdLm, LmSd,
[ ] AND ClLm SOILS.
[ ]
[ ]

Laboratory Volatility (163-2)
[ ]
[ ]

Field Volatility (163-3)
[ ]
[ ]

Terrestrial Field Dissipation (164-1)
[S] T1/2 = 450 - 973 DAYS IN ORCHARD SOIL FROM CA, WVA, AND FLOR
[ ] IDA.
[V] T1/2 = 95-190 DAYS IN LmSd (NC); 123-189 DAYS IN SiLm (MISS)
[ ] 123-337 DAYS IN SiClLm (IL); 7-14 DAYS IN SdLm (CA).
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Aquatic Dissipation (164-2)
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Forestry Dissipation (164-3)
[ ]
[ ]

8

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
PACLOBUTRAZOL
Last Update on March 26, 1991
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Long-Term Soil Dissipation (164-5)
[ ]
[ ]

Accumulation in Rotational Crops, Confined (165-1)
[ ]
[ ]

Accumulation in Rotational Crops, Field (165-2)
[ ]
[ ]

Accumulation in Irrigated Crops (165-3)
[ ]
[ ]

Bioaccumulation in Fish (165-4)
[S] BLUEGILL SUNFISH BCF: 44 X WHOLE FISH; 20 X MUSCLE;
[ ] 248 X VISCERA.

Bioaccumulation in Non-Target Organisms (165-5)
[ ]
[ ]

Ground Water Monitoring, Prospective (166-1)
[ ]
[ ]
[ ]
[ ]

Ground Water Monitoring, Small Scale Retrospective (166-2)
[ ]
[ ]
[ ]
[ ]

Ground Water Monitoring, Large Scale Retrospective (166-3)
[ ]
[ ]
[ ]
[ ]

Ground Water Monitoring, Miscellaneous Data (158.75)
[ ]
[ ]
[ ]

9

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
PACLOBUTRAZOL
Last Update on March 26, 1991
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Field Runoff (167-1)
[ ]
[ ]
[ ]
[ ]

Surface Water Monitoring (167-2)
[ ]
[ ]
[ ]
[ ]

Spray Drift, Droplet Spectrum (201-1)
[ ]
[ ]
[ ]
[ ]

Spray Drift, Field Evaluation (202-1)
[ ]
[ ]
[ ]
[ ]

Degradation Products

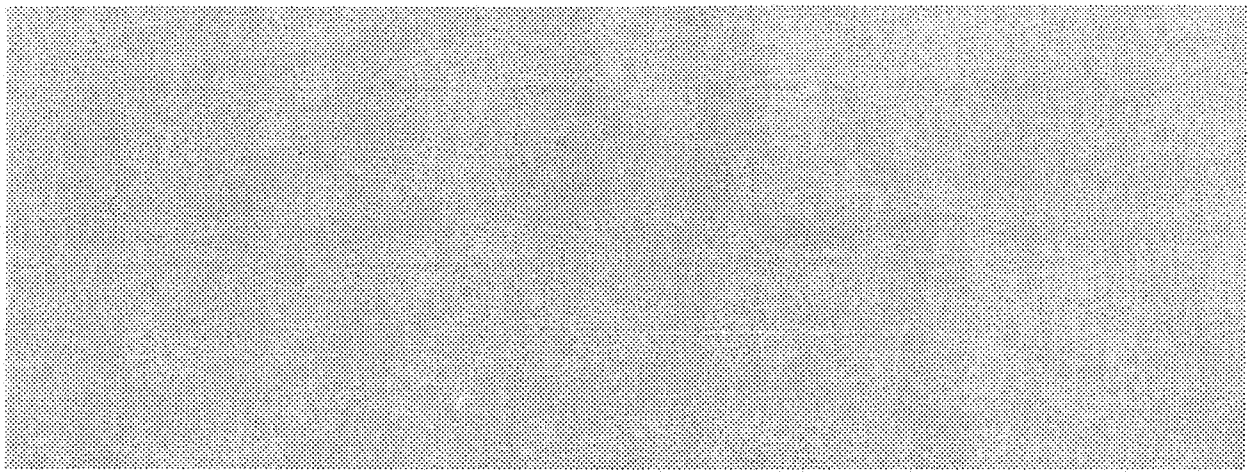
Ketone analogue - [2RS]-1-(4-chlorophenyl)-4,4-dimethyl-2-(1,2,4-triazol-1-yl)-pentan-3-one

1H-1,2,4-triazole

10

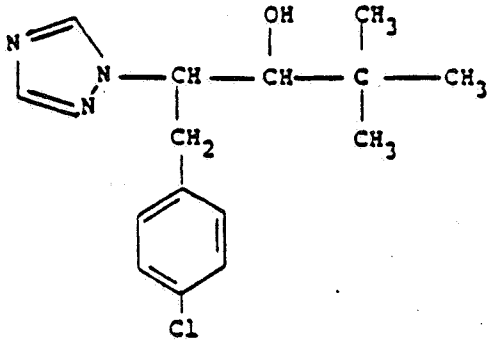
Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
PACLOBUTRAZOL
Last Update on March 26, 1991
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Comments



References: FARM CHEMICALS HANDBOOK; EPA DATA
Writer : WGM

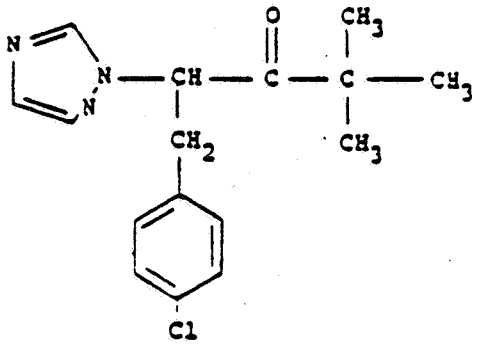
11



Paclobutrazol

(2RS,3RS)-1-(4-Chlorophenyl)-4,4-dimethyl-2-(1,2,4-triazol-1-yl)pentan-3-ol.

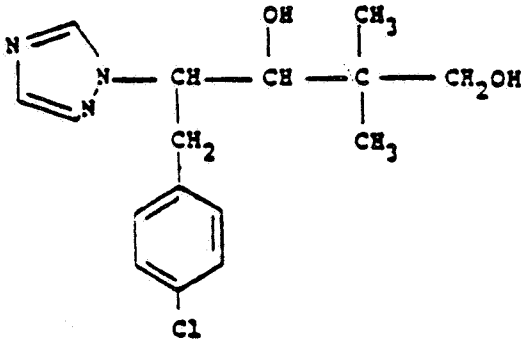
(PP333)



Ketone analogue of paclobutrazol

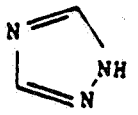
(2RS)-1-(4-Chlorophenyl)-4,4-dimethyl-2-(1,2,4-triazol-1-yl)pentan-3-one.

Compound II



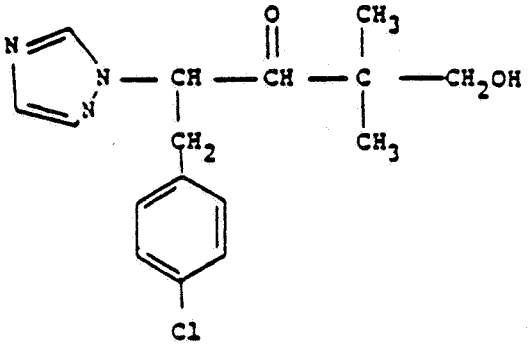
5-(4-Chlorophenyl)-2,2-dimethyl-4-(1,2,4-triazol-1-yl)-pentan-1,3-diol.

Compound III



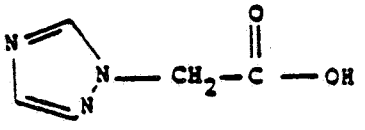
1,2,4-Triazole

Compound V



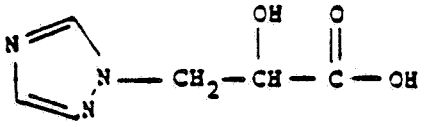
5-(4-Chlorophenyl)-2,2-dimethyl-3-oxo-4-(1,2,4-triazol-1-yl)pentanol

Compound VI



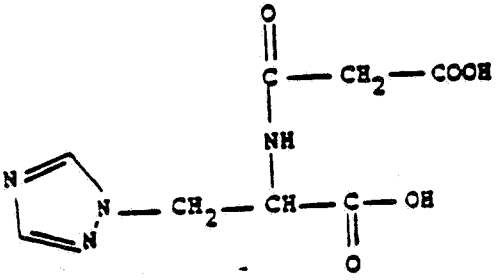
2-(1,2,4-Triazol-1-yl)acetic acid

Compound VII



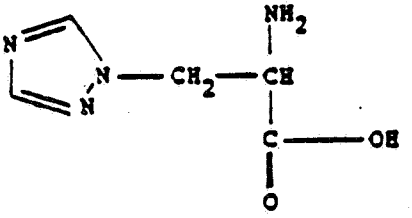
3-(1,2,4-Triazol-1-yl) lactic acid

Compound VIII



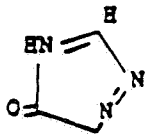
2-Malonyl-3(1,2,4-triazol-1-yl)alanine

Compound IX



3-(1,2,4-Triazol-1-yl)alanine

Compound X



4,5-Dihydrotriazol-3-one

Compound XI

April 23, 1991

MEMORANDUM

SUBJECT: GROUND-WATER STATEMENT ON PACLOBUTRAZOL.

TO: W. Gail Maske, Chemist
Chemical Review Section #2
Environmental Fate and Ground Water Branch
Environmental Fate and Effects Division (H7507C)

THRU: Elizabeth Behl, Acting Chief
Ground Water Technology Section
Environmental Fate and Ground Water Branch
Environmental Fate and Effects Division (H7507C)

FROM: James Wolf, Soil Scientist
Ground Water Technology Section
Environmental Fate and Ground Water Branch
Environmental Fate and Effects Division (H7507C)

Conclusion

The Chemical Review Section's review has determined that the majority of environmental fate data, submitted by the registrant, have been found conform to EPA requirements. These data indicate that under certain conditions there exists the potential for paclobutrazol and its degradates to leach to the ground water. The Ground Water Section concurs with your assessment concerning the environmental fate of paclobutrazol. The data indicates that under certain environmental conditions paclobutrazol and some degradates are persistent and mobile; therefore, indicating the potential for ground water contamination. However, under different environmental conditions the compound appears to be quite short lived with low mobility with a much lower potential to contaminant ground water. From limited environmental chemistry data the following observations can be made: soils which possess the higher Kd values, indicating a lower mobility, appear to be at least somewhat correlated with the soils with higher clay and organic matter contents and soils located in warmer climatic zones appear to have shorter field dissipation half-lives.

The Ground Water Section concurs with recommendation that one or more small-scale prospective ground-water monitoring studies be conducted at hydrogeologically vulnerable sites. One study should be conducted at a warm climatic site and a second at a site with cooler conditions. The fate of paclobutrazol and its degradates should be addressed. The

16

protocol should be submitted for EFGWB review and approval prior to initiation of the study.

Background

Paclobutrazol is a systemic plant growth regulator which inhibits the formation of gibberellin, resulting in compact plants and enhanced production of flowers and fruit buds. Paclobutrazol was developed for use on terrestrial nonfood (turf and trees in nonfood areas) sites. The maximum annual application rate for turf is 2 lbs ai/acre. Paclobutrazol use rate for trees is dependant upon tree size and number of trees per acre. A maximum application rate for trees has been estimated by the registrant to be between 4.5 to 5.0 lbs ai/acre. The compound may be applied by ground spray to foliage or by injection to the growing media. Paclobutrazol is applied at a maximum rate of 0.5 mg ai/6" pot on container-grown ornamental plants grown in greenhouses.

Environmental chemistry and fate data have been reviewed and summarized by W.G. Maske (EFGWB # 91-0490, 4/12/91). The majority of the environmental fate and chemistry data requirements were found to have been fulfilled by the registrant. One requirement which has not been fulfilled is the terrestrial field dissipation study. It was recommended in the above EFGWB review that the field dissipation study requirement be waived in lieu of the Registrant conducting one or more small-scale prospective ground-water studies. Additionally, it was recommended that the study protocol be reviewed by EFGWB prior to the initiation of the study.

Discussion

Paclobutrazol appears to be generally quite persistent in soils, with half-lives greater than 95 days, however, under certain conditions half-life as short as 7 to 14 days have been noted (Table 1). The mobility is also quite variable; ranging from relatively immobile to highly mobile. In field dissipation studies, Paclobutrazol or degradate residues were found to leach to 40 to 48 inches in sand (Florida) and sandy loam (California) soils and to 16 to 24 inches in a West Virginia soil (texture not specified). Other field dissipation studies found no detectable levels of the pesticide at 6 to 24 inch depth. The depths represent the maximum depth sampled in the studies.

Environmental chemistry data, which are summarized by Maske (1991, EFGWB # 91-0490), indicate ten degradate compounds. The persistence and mobility of all these compounds were not stated. The Maske review does indicate that the triazole-labelled (^{14}C)paclobutrazol residues were the most mobile in the soils tested.

From limited environmental chemistry data the following observations can be made: soils which possess the higher Kd values, indicating a lower mobility, appear to be at least somewhat correlated with the soils with higher clay and organic matter contents (Table 1). Terrestrial dissipation half-lives ranged from 7 to days in California to 123 to 337 days in Illinois. These field dissipation half-lives suggest that temperature may have an influence on the pesticide and metabolite persistence. California had the shortest dissipation half-lives (7 - 14 days) while Illinois had the longest (123 - 337 days).

Recommendations

To address the concerns of paclobutrazol and its degradates potential for ground water contamination the Registrant should conduct one or more small-scale prospective ground-water monitoring studies. Based upon available data, it would appear that at least two sites will be required: a site in a warm climate (soil temperatures) and a site with a cooler climate (soil temperatures). These studies should track the fate of the pesticide and its degradates from the point of application in highly vulnerable agricultural environments. The study will include the sampling of soil, soil-water, and ground-water. It is recommend that the Registrant contact and meet with the Ground Water Section to review and discuss the most recent Guidance for Ground-Water monitoring studies.

Table 1. LEACHING ASSESSMENT FOR PACLOBUTRAZOL

Property	Guideline[1]	Paclobutrazol	Soil Information texture	Organic Matter
Solubility	> 30 ppm	35 ppm @ 20°C		
Adsorption Partition Coefficient (Kd)	< 5.0	9.1 to 10.4	calcareous clay loam	11.4
		9.7 to 10.9	coarse sandy clay loam	5.2
		5.2 to 6.2	silty clay	2.4
		7.0 to 8.2	silty clay loam	5.6
		3.8 to 4.2	coarse sandy loam	3.0
		2.0 to 2.8	loamy sand	1.6
		1.3 to 1.5	coarse sand	1.2
		19.7 to 23.0	silt loam	3.9
		3.4 to 4.4	silt loam	1.5
Hydrolysis half-life	> 25 weeks			
Photolysis half-life	> 1 week			
air		No data available		
water		No degradation at 10 days		
soil		140 days		
Soil half-life	> 2-3 weeks			
Aerobic		365 days	loam @ 20 °C	
		64 days	clay loam @ 25 °C	
		213 days	sandy loam @ 25 °C	
Anaerobic		No data available		
Field Dissipation half-life		450 to 973 days	Orchards CA, FL, WVA,	
		95 to 190 days	Loamy sand N.Carolina	
		123 to 189 days	Silty loam Mississippi	
		123 to 337 days	Silty clay loam Illinois	
		7 to 14 days	Sandy loam California	
Depth of leaching				
	> 36"	40" to 48"	Sand, sandy loam FL, CA	
		16" to 24"	Texture not stated, WVA	
		< 6"	Sandy loam, silt loam	

[1] Cohen, S.Z., S.M. Creeger, R.F. Carsel, and C.G. Enfield. 1984.

b

REFERENCE

Cohen, S.Z., S.M. Creeger, R.F. Carsel, and C.G. Enfield. 1984. Potential Pesticide Contamination of Ground Water from Agricultural and Disposal of Pesticide Wastes. ACS Symposium Series # 259. R.F. Kruger and J.N. Seiber, ed. ACS. Washington DC.