United State
Environmental Protection
Agency

Office of Pesticides and Toxic Substances
Office of Pesticide Programs (TS-766C)
Washington, DC 20460

EPA

Pesticide Fact Sheet

Name of Chemical: Phosphamidon
Reason for Issuance: Registration Standard
Date Issued: JAN - 1 1988
Fact Sheet Number: 154

1. Description of Chemical

Common Name: Phosphamidon

Chemical Name: 2-chloro-3-(diethylamino)-1-methyl-3-oxo-1-propenyl dimethyl phosphate

Other Chemical Nomenclature: dimethyl phosphate ester 2-chloro-N,N-diethyl-3-hydroxycrotonamide;

2-chloro-2-diethylcarbamoyl-1-methylvinyl dimethyl phosphate;

O,O-dimethyl-O-(2-chloro-2-diethylcarbamoyl-1-methylvinyl) phosphate

Trade Names: Apamidon; C570; Ciba 570; Dimecron; Dixon; Dimenox

Chemical Class: Organophosphate
Empirical Formula: $C_{10}H_{19}ClNO_5P$
Chemical Abstracts Service (CAS) Nos.:
13171-21-6 [(E)-+(Z)-isomers]
23783-98-4 [(Z)-isomer]
297-99-4 [(E)-isomer]
OPP Shaughnessy No.: 018201
Pesticide Type: Systemic insecticide/acaricide
Year of Initial Registration: 1963
U.S. and Foreign Producers: Ciba-Geigy Corp., USA

2. Use Patterns and Formulations

Application sites: terrestrial food crops -- apple; apple (nonbearing); broccoli; cantaloupe; cauliflower; cotton; cucumber; grapefruit; lemon; orange; peppers; potato; sugarcane; tangerine; tomato; walnut; watermelon.

Types of Formulation: Phosphamidon is marketed as an 8 lb ai/gal SC/L (soluble concentrate/ liquid), and is formulated from a single 89.5% technical product.

Types/Methods of Application: Phosphamidon is applied by ground and aerial application.

3. Science Findings

Summary Science Statements:

Phosphamidon is an organophosphate compound. The Agency has no valid acute toxicity studies for phosphamidon, although the Agency believes that phosphamidon is highly toxic. No valid subchronic studies are available for phosphamidon. A 2-year rat feeding study showed toxic signs of cholinesterase inhibition activity in serum and brain, decreased body weights, erythrocyte counts, hemoglobin levels and, necrotic changes in the stomach and other organs. Studies on the toxic effects of phosphamidon in nonrodent species are not available. The submitted oncogenicity data are considered inadequate to assess the oncogenic potential of phosphamidon. Sufficient developmental toxicity data are available to satisfy the regulatory requirements in two species. Based on these data the Agency concluded that phosphamidon did not demonstrate any significant developmental toxic effects. The available 2-generation rat reproduction study satisfies this requirement. No data are available to evaluate the mutagenic potential of phosphamidon. No data on the metabolic pathway of phosphamidon are available. Phosphamidon is acutely and subacutely very highly toxic to a variety of avian species and can be lethal to birds through dermal exposure. In addition, available information indicate that delayed mortality of birds occurs after applications of phosphamidon (in some cases up to several weeks). Since available information suggests that phosphamidon may have a relatively short half-life, it is possible that some degradate is toxic to birds. Based upon the fish and wildlife data available, it is observed that technical phosphamidon is very highly toxic to both coldwater and warmwater fish species, aquatic invertebrates, and mammals. Available data indicate that phosphamidon is highly toxic to honey bees, predaceous mites, parasitic wasps, and predaceous beetles.

Chemical Characteristics:

Physical/chemical properties of pure phosphamidon and of the technical phosphamidon.

Color: Colorless (PAI*), slightly amber oil (T*)
Physical State: Liquid (PAI)
Odor: Odorless, faint, mild (PAI)
Melting Point: Liquid at room temperature
Boiling Point: 160 °C, 1.5 mm (PAI)
Density: 1.2 at 20 °C (PAI)
Solubility: Miscible with water, alcohol, and ketones. Highly soluble in aromatic and chlorinated hydrocarbons, esters and ethers. Solubility in hexane is 3.23 g/100 g 25°C (PAI)
Vapor Pressure: 2.5×10^{-5} mm Hg at 20 °C (PAI)
Octanol/Water Partition Coefficient: Log P = 0.8 (PAI)
Stability in water: Half-life at 2 ppm and 38 °C is 70 hours at pH 9.1 and > 300 hours at pH 1.1 (PAI). Half-life (in days) of phosphamidon in buffered media (T):

	Temperature	
pH	23 °C	45 °C
4	74	6.6
7	13.8	2.1
10	2.2	0.14

Toxicology Characteristics:

Acute oral: Data gap
Acute dermal: Data gap
Acute inhalation: Data gap
Primary dermal irritation: Data gap
Primary eye irritation: Data gap
Acute delayed neurotoxicity: Data gap
Subchronic oral (nonrodent): Data gap **
Chronic feeding (nonrodent): Data gap
Oncogenicity : Data inadequate to assess oncogenic potential, Study required in the mouse.
Metabolism: Data gap

Developmental Toxicity:
Rabbit - Maternal NOEL = 3 mg/kg
Maternal LEL = 10 mg/kg
Developmental NOEL = > 10 mg/kg

Rat - Maternal NOEL = 0.5 and 1 mg/kg
Developmental NOEL = 2 mg/kg

*PAI = Pure Active Ingredient, T = Technical
** Not required if an acceptable chronic study is submitted.

Reproductive effects:
Rat - Parental NOEL = 30 ppm (1.5 mg/kg/day)
Parental LEL = 50 ppm (2.5 mg/kg/day)
Reproductive/Developmental
NOEL = 5 ppm (0.25 mg/kg/day)
Reproductive/Developmental
LEL = 30 ppm (1.5 mg/kg/day)
Mutagenicity: Data gap

Physiological and Biochemical Characteristics:

Metabolism and persistence in plants and animals

The metabolism of phosphamidon in plants and animals is not adequately understood. Residues of [^{14}C] phosphamidon were identified and quantitatively determined only in immature bean plants. No edible livestock tissues (other than milk) were analyzed for residues, and residues were not characterized sufficiently in livestock. No poultry data were submitted. The available plant metabolism data indicate that phosphamidon degrades rapidly when applied directly to the leaves of very young "two-leaf stage" bean plants. The limited available ruminant metabolism data indicate that phosphamidon is degraded rapidly in animals, with most of the metabolic compounds being excreted in the urine. Available data support the established tolerances for residues of phosphamidon including all of its related cholinesterase-inhibiting compounds (as currently known) in or on the raw agricultural commodities (RACs) potatoes, tomatoes, cucumbers, cottonseed, and sugarcane. Note, however, that these tolerances, including the residue definition, will be reassessed upon receipt of the requested plant metabolism studies. Ultimately, the tolerance definition will be changed to list specific metabolites.

Environmental Characteristics:

Available data are not sufficient to allow the Agency to fully assess the environmental fate of phosphamidon. The available data suggest that phosphamidon is readily susceptable to hydrolysis. Phosphamidon appears to be relatively short lived in aerobic soil. N,N-diethyl-2-chloroacetoacetamide and N-ethyl-2-chloroacetamide were identified as the two major nonvolatile degradates, but the characterization of degradates has not been completed. Phosphamidon residues are considered to be highly mobile in soil. However, the relative mobilities of the parent compound and its degradates have not been adequately defined. Available data are not adequate to fully assess the potential of phosphamidon to contaminate ground water.

Ecological Characteristics:

Avian Species

Technical phosphamidon is very highly acutely toxic to birds as demonstrated by both acute and dietary studies. Subacute dietary studies demonstrate that there is a range of toxicity from 24 ppm (bobwhite quail) to 712 ppm (mallard duck). Available data indicate that phosphamidon can be toxic to birds through contact with head, feet or through contact with sprayed foliage. Data indicate that small doses picked up from perches or applied to the feet of birds can be lethal. Special tests are being required to determine the dermal toxicity of phosphamidon to birds. Avian reproduction studies for phosphamidon are not available. There are no data available on the toxicity of degradates of phosphamidon to birds. Because delayed mortality is an indicated adverse effect of phosphamidon on birds, and because substantial reduction of populations of songbirds have occurred several weeks after phosphamidon applications to forests, it is possible that degradation products of phosphamidon can result in such effects.

Aquatic Organisms

Acceptable acute toxicity tests with technical phosphamidon indicate that phosphamidon is highly toxic to fish. The acute toxicity tests with freshwater invertebrates indicate that phosphamidon is very highly acutely toxic to aquatic invertebrates. There are no acceptable data evaluating the toxicity of technical phosphamidon to estuarine and marine organisms. Phosphamidon may reach estuarine environments from its use on citrus orchards. Acute studies on the toxicity of phosphamidon to estuarine and marine invertebrates are required. Aquatic invertebrate life cycle studies are required to support the agricultural use applications.

Wild Mammal Toxicity

There are no adequate data with which to assess the toxicity of phosphamidon to mammals. The only study available, which suggests a lethal dose of 18 mg/kg in the deer mouse, indicates that phosphamidon may be highly toxic to wild mammals. Although the Agency can draw no conclusions regarding the potential toxicity of phosphamidon to mammals, a wild mammal toxicity study is not being required at this time. However, if the acute mammalian studies required in the Toxicology Section indicate a rat acute toxicity $\leq$ 5 mg/kg then a wild mammal toxicity study will be required.

Non-target Insects

Available data indicate that phosphamidon is highly toxic to honey bees, predaceous mites, parasitic wasps, and predaceous beetles.

Tolerance Reassessment

Tolerances (expressed as phosphamidon) for residues of the insecticide phosphamidon (2-chloro-2-diethylcarbamoyl-1-methylvinyl dimethyl phosphate) including all of its related cholinesterase-inhibiting compounds have been established in or on various raw agricultural commodities (40 CFR 180.239).

Because of the extensive residue chemistry and toxicology data gaps, the Agency cannot complete a tolerance reassessment.

4. Required Labeling and Regulatory Position Summary

Restricted Use Classification

All currently registered products containing phosphamidon have been classified for Restricted Use (40 CFR 162.31) due to the acute dermal toxicity to humans and residue effects on avian and mammalian species.

Endangered Species Labeling

Refer to PR Notice 87-5, issued May 1, 1987, for endangered species labeling statements for all end-use products containing phosphamidon for use on cotton.

It is the Agency's position that in order to remain in compliance with FIFRA, all products containing phosphamidon must include labeling which requires compliance with the following precautionary measures, pending receipt and evaluation of additional data which will allow the Agency to fully assess the potential to induce adverse effects.

Protective Clothing, Equipment and Work Safety Statements

The use of maximum full body protective clothing/equipment by mixers/loaders/applicators, and by field workers entering treated fields prior to the end of the 48 hour reentry interval is required.

Reentry Interval

A 48-hour reentry interval is required for all agricultural uses of phosphamidon. In addition, the use of protective clothing is required for early reentry into treated areas.

Tolerances

No tolerances or significant new food uses will be granted until the Agency has received sufficient data to evaluate the dietary exposure to phosphamidon.

5. Summary of Major Data Gaps

Toxicology	Date Due *
Acute Oral Toxicity	9 Months
Acute Dermal Toxicity	9 Months
Acute Inhalation Toxicity	9 Months
Primary Eye Irritation	9 Months.
Primary Dermal Irritation	9 Months
Dermal Sensitization	9 Months
Acute Delayed Neurotoxicity (hen)	12 Months
Subchronic 90-day feeding (nonrodent)**	18 Months
Subchronic 21-Day Dermal	12 Months
Chronic Toxicity (nonrodent)	50 Months
Oncogenicity (mouse)	50 Months
Mutagenicity (Gene Mutation, Chromosomal Aberration and Direct DNA Damage and Repair Studies)	9 Months
Metabolism (rats)	24 Months
Environmental Fate/Exposure	
Hydrolysis	9 Months
Photodegradation	
In water	9 Months
In soil	9 Months
In air	9 Months
Metabolism	
Aerobic Soil	27 Months
Anaerobic Soil	27 Months
Mobility	
Leaching and Adsorption/Desorption	12 Months
Laboratory Volatility	12 Months
Dissipation Studies - Field	
Soil Dissipation	27 Months
Confined Accumulation Study	39 Months
Fish Accumulation Study	12 Months

* Due date is measured from the date of receipt of Standard by the registrant, unless otherwise indicated.

** Not required if an acceptable chronic study is submitted.

Environmental Fate/Exposure (cont'd)	Date Due*
Spray Drift	
Droplet Size Spectrum	24 Months
Drift Field Evaluation	24 Months
Ecological Effects	
Acute Avian Oral Toxicity (Degradate)	9 Months
Acute Avian Dietary Toxicity (Degradate)	9 Months
Avian Reproduction	24 Months
Avian Field Testing (Mammals, Birds)	24 Months
Special Avian Testing (Dermal Toxicity)	6 Months - (acceptable protocol)
Acute Toxicity to Estuarine and Marine Organisms	12 Months
Fish Early Life Stage and Aquatic Invertebrate Life Cycle	15 Months
Aquatic Residue Monitoring	6 Months - (acceptable protocol)
Residue Chemistry	
Nature of Residues (Plants, Livestock)	18 Months
Residue Analytical Method (Plant, Animal)	15 Months
Storage Stability	18 Months
Magnitude of Residues (Field Crops)	18 Months

6. Contact Person at EPA

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DISCLAIMER: The information presented in this chemical information Fact Sheet is for informational purposed only and may not be used to fulfill data requirements for pesticide registration and reregistration.

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