

Technical Bulletin

DuPont™ Vydate® insecticide/nematicide

Protect your crops against damage from insects, mites and nematodes



Over and Under Plant Health



The miracles of science®

Table of Contents

Introduction	4
Physical and Chemical Properties of Vydate®	5
Formulations	6
Activity:	
Insects	7
Mites	8
Nematodes	8-9
Plants	10
Analytical Methods:	
Residue	10
Water and Soil	10
Crop Residue Overview	10
Carbamate Market Basket Survey	11
Current U.S. Tolerances for Oxamyl	11
Compatibility	12
Vydate® Spray Tank Stability	12
Environmental Fate:	
Behavior in Soil.....	13
Behavior in Water.....	13
Photolysis	14
Volatilization Potential	14
Ionization Potential (pKa).....	14
Behavior in Plants.....	14

Vydate® L and C-LV Toxicology	15
Acute Toxicity Studies	16
Acetylcholinesterase Inhibition	16
Mutagenicity and Genetic Toxicity Studies	16
Developmental Toxicity, Reproductive Toxicity and Carcinogenicity	16
Wildlife Toxicity.....	16
Toxicity to Bees.....	16
Material Safety Information	17
Health, Safety and Handling Information.....	17
Hazardous Reactivity	17
Fire and Explosion Data	17
Fire and Explosion Hazards	17
Extinguishing Media	17
Special Fire Fighting Instructions	17
NFPA Rating	17
Disposal Information	18
Spill, Leak or Release	18
Pesticide Disposal	18
Container Disposal	18
Vydate® C-LV Returnable Container System	18
Shipping Information	19
Storage Conditions	19
Personal Precautions, Symptoms and Treatments	20
Health Hazards and Protection Information	20
Warning Symptoms	20
First Aid	20
Personal Protective Equipment	21
Medical Emergencies	21
Notice of Warranty/Disclaimer	Back Cover

Introduction

DuPont™ Vydate® is a broad-spectrum insecticide/nematicide for the control of key pests in field, fruit and vegetable crops. Vydate® is active on many pest species of beetles, aphids, thrips, leafperforators, fleahoppers, leafhoppers, leafminers, lygus bugs, mites and multiple species of economically important nematodes. The active ingredient in Vydate® is oxamyl, a carbamate insecticide/nematicide. The mode of action for Vydate® is the inhibition of acetylcholinesterase, an enzyme that functions in nerve impulse transmissions. Vydate® is active via direct contact or by ingestion. Treated insects will exhibit symptoms that include hyperactivity, incoordination, convulsions, paralysis and death. Nematode symptoms include inhibition of hatching, movement, and feeding.

IMPORTANT CHARACTERISTICS OF VYDATE®

Application flexibility—Vydate® can be applied as a foliar spray or by soil incorporation (broadcast, band, or in-furrow, at, before or after planting). Because Vydate® is highly water-soluble, it can also be applied via chemigation (drip, micro-sprinkler and center pivot irrigation).



Systemic Movement—Foliar applications of Vydate® translocate downward to the root system. When applied to the roots, Vydate® will rapidly move throughout the plant canopy and roots. Vydate® accumulates more in young, actively growing leaves and roots.

Quick Action—At lethal doses, Vydate® affects feeding, movement, reproduction, and hatching within minutes; mortality occurs within hours. At sub-lethal doses, Vydate® can inhibit reproduction and feeding.

Affects Multiple Life Stages—Vydate® is effective against adults, nymphs and larvae of many pest species. Vydate® is active as an ovicide against nematodes and some lepidopterous species.

Resistance Management Tool—As a carbamate, Vydate®, can be used very effectively in resistance management programs for insecticides with a different mode of action. Although carbamates have the same mode of action as organophosphates, there is normally not cross-resistance between these chemical classes.

Beneficial Insects—When applied to the soil, Vydate® has no effect on foliar beneficial insects. As a foliar application, Vydate® can be toxic to some beneficial insects. However, due to its moderate foliar residual activity, beneficial insects repopulate treated areas quickly.

The many unique characteristics of Vydate® are why Vydate® usage has continued to grow throughout the global agricultural industry.

Physical and Chemical Properties of Vydate®

COMMON NAME:	Oxamyl
CHEMICAL NAME:	[Methyl N'N'-dimethyl-N-[(methylcarbamoyl) oxy]-1-thiooxamimidate]
CAS REGISTRY NUMBER:	23135-22-0
STRUCTURAL FORMULA:	$\begin{array}{c} \text{O} \qquad \qquad \text{O} \\ \parallel \qquad \qquad \parallel \\ (\text{CH}_3)_2\text{NC} - \text{C} = \text{NOCNHCH}_3 \\ \\ \text{SCH}_3 \end{array}$
EMPIRICAL FORMULA:	C ₇ H ₁₃ N ₃ O ₃ S
MOLECULAR WEIGHT:	219.25
PHYSICAL FORM:	Solid
ODOR:	Slight Sulfurous
VOLATILITY:	Vapor Pressure = 3.84 x 10 ⁻⁷ mm Hg (5.12 x 10 ⁻⁵ h) Pa
FORMULATION STABILITY:	Vydate® L and C-LV are stable at room temperature for more than two years based on accelerated aging tests at 54°C for two weeks.

APPROXIMATE SOLUBILITY AT 25°C:	GMS./100 GMS. SOLVENT
Methanol	129
DMF	108
Acetone	67
Ethanol	33
Cyclohexanone	29
Water	28
Isopropanol	12
Toluene	0.8i

Physical and Chemical Properties of Vydate® (continued)

VYDATE® L INSECTICIDE/NEMATICIDE

Density	0.98 gm/cc. at 25°C 8.14 lb/gal at 77°F (25°C)
Flash Point (Open Cup)	86°F (30°C)
Flash Point (Closed Cup)	74°F (23°C)
Incipient Crystallization Temperature	Approx. 23°F (-5°C)
Color	Green
Dilutability	Completely miscible with water

VYDATE® C-LV INSECTICIDE/NEMATICIDE

Density	1.08 gm/cc @ 25°C 9.02 lb/gal at 77°F (25°C)
Flash Point (Open Cup)	220°F (104°C)
Flash Point (Closed Cup)	125°F (52°C)
Color	Blue
Dilutability	Completely miscible with water

Formulations

Oxamyl is available in the U.S. as:

1. Vydate® L, a 24% (oxamyl) liquid formulation that is soluble with water. The material contains 2 pounds of oxamyl (active ingredient) per gallon. This formulation contains methanol.
2. Vydate® C-LV, a 42% (oxamyl) liquid formulation that is soluble with water. The material contains 3.77 pounds oxamyl (active ingredient) per gallon. This formulation contains cyclohexanone.

Vydate® L and Vydate® C-LV contain a dye and an embittering agent to deter accidental consumption.

Activity

INSECTS

Vydate® controls many insect and mite species. The active ingredient, oxamyl, is toxic to susceptible insects by direct contact and ingestion. Control is achieved through inhibition of acetylcholinesterase.

Insect and mite control is often achieved by foliar sprays. However, since Vydate® is highly systemic in plants, application to the soil allows absorption by the roots and movement up to growing points and leaves. When Vydate® is applied to soil in the root zone, transpiration carries oxamyl to foliar areas of the plant. Typically, the distribution is such that new leaves have a higher concentration of oxamyl than the rest of the plant. Some foliar pests are controlled when they ingest this foliage containing the oxamyl.



Partial Listing of Insects Controlled by Vydate®

Aphids	Family: <i>Aphididae</i>
Apple aphid	<i>Aphis pomi</i>
Banana corn borer	<i>Cosmopolites sordidus</i>
Boll weevil	<i>Anthonomus grandis</i>
Brown stink bug	<i>Euschistus servus</i>
Carrot weevil	<i>Listronotus oregonensis</i>
Colorado potato beetle	<i>Leptinotarsa decemlineata</i>
Cotton aphid	<i>Aphis gossypii</i>
Citrus thrips	<i>Scirtothrips citri</i>
Cotton leafperforator	<i>Bucculatrix thurberiella</i>
Cotton fleahopper	<i>Pseudatomoscelis seriatus</i>
Flea beetles	Family: <i>Chrysomelidae</i>
Green stink bug	<i>Acrosternum hilare</i>
Green peach aphid	<i>Myzus persicae</i>
Leafhoppers	Family: <i>Cicadellidae</i>
Leafminers	<i>Liriomyza spp.</i>
Onion thrips	<i>Thrips tabaci</i>
Pepper weevil	<i>Anthonomus eugenni</i>
Pink bollworm	<i>Pectinophora gossypiella</i>
Potato leafhopper	<i>Empoasca fabae</i>
Rosy apple aphid	<i>Dysaphis plantaginea</i>
Serpentine leafminer	<i>Liriomyza brassicae</i>
Silverleaf whitefly (suppression)	<i>Bemisia argentifolii</i>
Southern green stink bug	<i>Nezara viridula</i>
Spotted tentiform leafminers	<i>Phyllonorycter blancardella</i> , <i>P. craetegella</i>
Tarnished plant bug	<i>Lygus lineolaris</i>
Thrips	Family: <i>Thripidae</i>
Tobacco thrips	<i>Frankliniella fusca</i>
Vegetable leafminer	<i>Liriomyza sativae</i>
Western flower thrips	<i>Frankliniella occidentalis</i>
Western tarnished plant bug	<i>Lygus hesperus</i>
White apple leafhopper	<i>Typhocya pomaria</i>



MITES

Vydate® applied at high rates to eggs of the two-spotted spider mite kills the emerging nymphs just before or after hatching. Even so, Vydate® is not a practical ovicide based on field studies of several species of mites.

Field use rates of Vydate® control all motile stages of mites.

Partial Listing of Mites Controlled by Vydate®

Citrus rust mite	<i>Phyllocoptruta oleivora</i>
European red mite	<i>Panonychus ulmi</i>
McDaniel spider mite	<i>Tetranychus mcdanieli</i>
Pear rust mite	<i>Epitrimerus pyri</i>
Two-spotted spider mite	<i>Tetranychus urticae</i>

SUBLETHAL EFFECTS OF VYDATE® ON APHIDS AND MITES

Vydate® not only reduces the existing mite and aphid populations, but also inhibits reproduction. At labeled rates, mites and aphids exposed to oxamyl via contact or via ingestion die within minutes. Tests at DuPont Stine-Haskell Laboratory examined the effect of non-lethal doses of Vydate® on adult two-spotted spider mites and on adult green peach aphids. These studies determined that adult female spider mites treated with a non-lethal dose of Vydate® produce nonviable eggs. Adult green peach aphids treated with a non-lethal dose of Vydate® produce fewer nymphs. These studies validate observations of many people in the field in various crops across the United States.

When female, two-spotted spider mites and green peach aphids are exposed to sub-lethal rates:

- Aphids produced 50% fewer nymphs vs. untreated.
- Mites produced 40% fewer viable eggs vs. untreated.

Vydate® not only reduces current mite and aphid populations, but also helps reduce the magnitude of subsequent generations.

NEMATODES

Vydate® is effective at controlling many nematode species. The most significant pests are probably the plant-feeding *Meloidogyne* genus, which attacks many agricultural crops both in field and protected environments. Vydate® controls nematodes by contact and ingestion action. Control is achieved by acetylcholinesterase inhibition. Research indicates that oxamyl inhibits nematode movement and feeding at normal field use rates.

Plant parasitic nematodes are generally found free in the soil at some stage in their development. Once the host crop is planted, root exudates attract the nematodes to the root system where they begin feeding. Feeding can reduce root growth, affect availability of water and nutrients, produce galling and allow infection by plant pathogens. All of these effects can significantly reduce yields.

At labeled field use rates Vydate® has a nematostatic effect – paralysis. It functions as a crop protection agent by preventing the feeding of nematodes and by disrupting the life cycle. This disruption includes a reduction in reproduction due to the inability to orientate to sexual partners and the inability of feeding females to produce viable larvae. Vydate® also inhibits egg or cyst hatch in many species. The following indicates the activity of Vydate® at given concentrations in the soil:

- 5–10 ppm—inhibition of hatching
- 2–5 ppm—inhibition of movement
- 0.5–2 ppm—inhibition of feeding

Contact action of Vydate® is achieved either by placement or movement in the soil and by systemic movement in the plant to tissue where nematodes are feeding. Since Vydate® is not volatile, it should be placed in the soil in the target area of root development where protection is needed.

In annual crops, the critical stage of crop development is during germination and early stand establishment. Vydate® should be applied in the seed furrow, incorporated overall or in a band in the soil where roots of plants will be located. Under moderate to severe infestations, light soil or heavy rainfall, nematode protection may need to be maintained by foliar sprays on a two-week schedule.

For perennial crops, such as citrus or bananas, the period of root growth is also critical. Application should be timed to coincide with periods of root flush or growth. Treatment at one-month intervals during the period of root development has been found optimal.

The appropriate measure of efficacy of Vydate® treatment in terms of damage prevention is best measured by increase in yields of fruits. The main reasons for this are:

- Oxamyl reduces damage by preventing feeding.
- Sampling for nematode population reductions are only useful if many samples are taken and assume a homogenous distribution.
- Population reduction with most nematicides generally takes a number of cycles to produce an effect.

Results of many Vydate® tests have consistently validated population and damage control since commercial applications started over 20 years ago.

Timing is important particularly for endoparasitic nematodes since they are more difficult to control once they have entered the roots. For optimum control Vydate® needs to be applied before nematodes attack.

Saprophytic and other nematodes not bearing stylets are generally not affected by Vydate®.

Vydate® foliar sprays also aid in control of certain foliar feeding nematodes.

Partial Listing of Nematodes Controlled by Vydate®

Bud and Leaf	<i>Aphelenchoides spp.</i>
Bulb	<i>Ditylenchus dipsaci</i>
Burrowing	<i>Radaphulus similis</i>
Citrus (suppression)	<i>Tylenchulus semipenetrans</i>
Dagger	<i>Xiphinema spp.</i>
Golden	<i>Globodera rostochiensis</i>
Lance	<i>Hoploaimus spp.</i>
Lesion	<i>Pratylenchus spp.</i>
Mint	<i>Longidorus spp.</i>
Pin	<i>Paratylenchus spp.</i>
Reniform	<i>Rotylenchulus spp.</i>
Ring	<i>Criconemoides spp.</i>
Root knot	<i>Meloidogyne, spp.</i> (except Javanese)
Soybean cyst	<i>Heterodera glycine</i>
Spiral	<i>Helicocotylenchus spp.</i>
Spring crimp	<i>Aphelenchoides fragariae</i>
Stem	<i>Ditylenchus dipsaci</i>
Sting	<i>Belonolaimus spp.</i>
Stubby Root	<i>Trichodorus spp.</i>
Stunt	<i>Tylenchorhynchus spp.</i>
White tip	<i>Aphelenchoides besseyi</i>



PLANTS

Vydate® applied to the soil is absorbed by the roots and translocated to leaves. In banana, application to soil at the base of the plant controls nematodes in roots outwards from the treated area. Lateral movement in the soil, however, is limited.

Because Vydate® is very water soluble, it moves with the irrigation water when applied through chemigation (drip, micro-sprinkler and center pivot irrigation). Vertical and horizontal distribution in the soil is dependant on the soil texture, the amount of water applied and timing of the application in the irrigation cycle. In irrigated crops the majority of the roots develop in the zone where the irrigation water is available. Therefore, these roots are also in the zone where chemigation-applied Vydate® will be absorbed.



When Vydate® is applied to the leaf surface, some oxamyl remains on the surface, and some is absorbed into the leaf. A portion of the absorbed oxamyl is translocated to the roots.

When using Vydate®, do not rotate to crops other than those labeled for use within four months after last application.

Vydate® formulations have been shown to be non-injurious to a wide range of field, tree and vegetable crops when used in accordance with the label. Multiple applications, even at maximum labeled rates, are not phytotoxic to leaves or fruit.

Analytical Methods

RESIDUE

Flame Photometric Gas Chromatography, J. Agriculture and Food Chemistry, 24: (2) 263-266, 1976.

WATER AND SOIL

Reverse phase high performance liquid chromatography, J. Agriculture and Food Chemistry, 32, 1184-1186, 1984.

CROP RESIDUE OVERVIEW

Definition of Toxic Residue/Crop Residue Methods: Oxamyl is considered the only relevant analyte in the total toxic residue. However, the historic and current crop enforcement gas chromatography methodology (Holt and Pease, 1976) converts oxamyl to its oxime metabolite and reports the total residues of the two analytes in oxamyl equivalents. Due to the use of this methodology, the current crop tolerances are based upon the total residues of oxamyl plus its oxime metabolite.

Carbamate Market Basket Survey

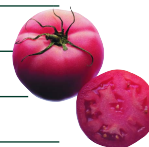
The Carbamate Market Basket Survey Task Force (CMB-STF) sponsored a study to determine the level of certain N-methyl carbamate insecticide residues in single-serving samples of fresh fruits and vegetables available for consumption by the U.S. population. This study, following an EPA approved study design, included 3070 single-serving samples of fresh fruits and vegetables (285 to 400 samples per commodity) collected at 25 sampling events (Shops) at approximate two-week intervals over the course of one year. Fresh samples of each selected commodity were collected from retail stores at approximately four hundred (400) locations throughout the United States.

Oxamyl residues were investigated in oranges, bananas, tomatoes and apples. No oxamyl residues were determined in any of the approximately 400 samples each of oranges and bananas. Residues of oxamyl were found in only 5% of the apple samples and 3% of the tomato samples at maximum levels of >50 times BELOW the tolerance for apples and >140 times BELOW the tolerance for tomatoes.



Current U.S. Tolerances for Oxamyl

Crop	Tolerance (ppm)
Apples	2.0
Bananas	0.3
Cantaloupe	2.0
Celery	3.0
Citrus fruits	3.0
Cottonseed	0.2
Cucumbers	2.0
Eggplants	2.0
Honeydews	2.0
Peanuts	0.2
Peanut hay	2.0
Pears	2.0
Peppermint hay	10.0
Peppers (bell)	3.0
Peppers, non-bell	5.0
Pineapples	1.0
Potatoes	0.1
Pumpkins	2.0
Root Crop Vegetables	0.1
Soybeans	0.2
Spearmint hay	10.0
Summer Squash	2.0
Tomatoes	2.0
Watermelon	2.0
Winter Squash	2.0



COMPATIBILITY

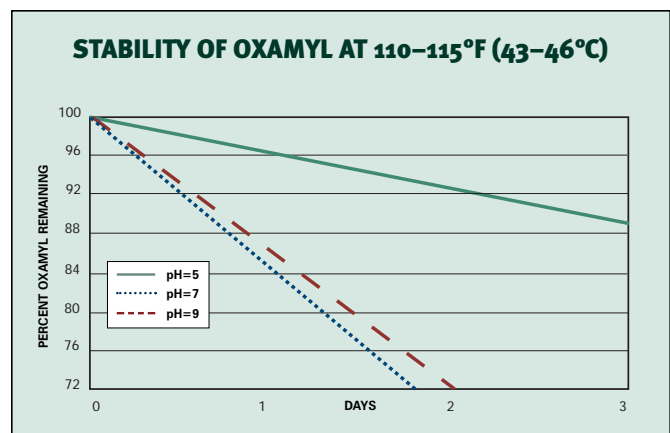
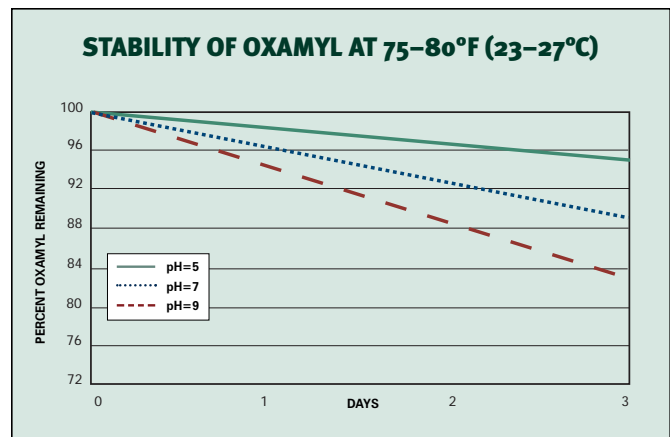
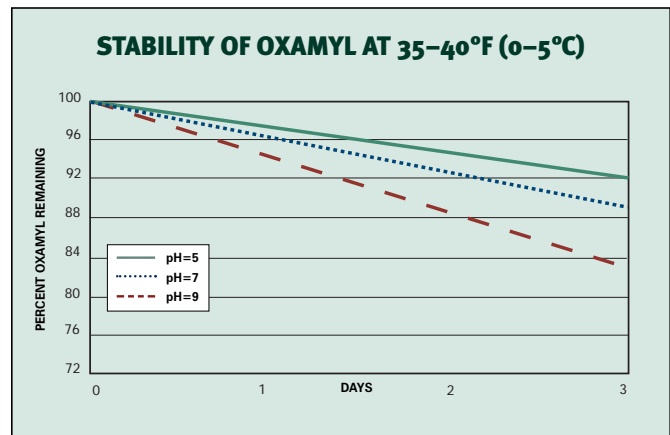
Since formulations may be changed and new ones introduced, it is recommended that users premix a small quantity of a desired tank mix and observe for possible adverse changes (settling out, flocculation, etc.). Avoid mixtures of several materials and very concentrated spray mixtures. Do not use Vydate® with Bordeaux mixture, lime sulfur or highly alkaline mixtures. Use mildly alkaline mixtures immediately after mixing to prevent loss of insecticidal activity.

VYDATE® SPRAY TANK STABILITY

Pesticides should be applied as soon as possible following preparation to avoid the possibility of product degradation. However, equipment breakdown, sudden rain, high winds and other environmental factors can delay or interrupt insecticide applications. When a job must be postponed, the unused spray solution is left sitting in the equipment until the situation improves enough to continue with the application. This can extend into a period of days during which time the tank mix can decompose and be ineffective when spraying is resumed.

The chemical stability of a pesticide in a spray tank is primarily dependent on the temperature and the spray mix pH. The pH of the spray mix is not necessarily the same as the source water since most formulations contain chemicals that will change the tank pH. Knowing the pH and temperature of the spray mix during the delay, the following graphs can be used to determine the approximate percent of oxamyl remaining after the delay. The graphs are only relevant to oxamyl and do not apply to any added tank mix partner. In all cases, spray mixes should be thoroughly agitated to re-mix the products and then checked for re-suspension to ensure that the mixture is properly blended before application.

This information is intended as a guide for understanding the tank stability of Vydate® and is not to be used to determine if, or how much, pesticide should be added to an existing spray mix after a time delay, or as a guide to determine how far in advance a spray mix can be prepared.



Environmental Fate

Oxamyl is short-lived in most use environments. This is due to microbial degradation, hydrolysis, photolysis and reduction by ferrous iron.

BEHAVIOR IN SOIL

Metabolism.

In aerobic topsoil, oxamyl mineralizes readily to carbon dioxide and non-volatile residues, which become incorporated into natural soil organic materials. Oxamyl oxime and (dimethylamino) oxoacetic acid are the major intermediate degradation products observed. These degradation products do not have the active carbamate moiety, so do not inhibit acetylcholinesterase like the parent, oxamyl, and have favorable toxicological and ecotoxicological profiles.

Rate of degradation.

The half-life of oxamyl has been determined both in the laboratory and in the field in soils with a wide range of texture (silty clay loam to sand), pH (4.6 to 8.5), and organic matter (0.11% to 20%). The average half-life of oxamyl is about 14 days. Though the half-life has been reported to range up to 62 days, the vast majority of results were <20 days. Higher soil pH, higher soil moisture, and higher soil temperature speed up the degradation of oxamyl in the soil.

Sorption.

Oxamyl is poorly sorbed to soil materials (average $K_{oc} = 16$ mL/g), which allows it to readily move with the soil water and into crop plants. There is a general direct correlation between soil organic matter and oxamyl sorption, but the effect is small, even over a wide range of soil organic matter content. Due to the high water solubility and poor soil sorption, the potential for leaching of oxamyl to ground water does exist. This is particularly true in areas that have 1) predominately sandy soils of low water holding capacity, 2) a shallow water table aquifer, and 3) high amounts rainfall or irrigation.

BEHAVIOR IN WATER

Hydrolysis.

Do not keep Vydate® insecticide/nematicide spray mixtures for any length of time in alkaline water. Use them promptly. Oxamyl is susceptible to base hydrolysis. While oxamyl is stable in slightly acidic water solutions, it hydrolyzes under basic conditions to the non-toxic, non-insecticidal oximino material. The rate of oxamyl degradation in aqueous solutions increases (half-life decreases) with increasing solution pH. Where alkaline waters are used in chemigation systems or to make spray solutions, it is possible that appreciable losses of oxamyl could occur in a short time. Acidification of the water will reduce the rate of hydrolysis, but the amount of acid needed is dependent upon both the initial pH and the alkalinity of the water source. Optimum efficacy of Vydate® is achieved by the acidification of the irrigation water to pH 4.5–5.5. The major oxamyl hydrolysis product is the oxime, which is resistant to further hydrolysis, but is not biologically active.

Shallow ground water.

If oxamyl were to enter ground water, it may degrade due to hydrolysis and/or reduction by ferrous iron (Fe^{+2}). These two degradation reactions may occur independently or simultaneously, depending on aquifer pH and redox status. Hydrolysis is ubiquitous, but that rate is highly dependent on the ground water pH. At 10°C, the half-life would be approximately 2 days at pH 8, 21 days at pH 7 and 190 days at pH 6. The Fe^{+2} reduction reaction is generally independent of pH, but may occur only where aquifer conditions favor the presence of ferrous iron (low pH, anaerobic/reducing conditions, iron-bearing soil materials). Even in the presence of modest levels of Fe^{+2} (≤ 5 mg L⁻¹), the half-life of oxamyl has been observed to be very short (hours) at 10°C. The combination of degradation reactions may be part of the explanation for the low frequency of oxamyl detection (and low levels detected) in state and national water monitoring programs.

Environmental Fate (cont'd)

PHOTOLYSIS

Oxamyl is susceptible to photolysis. In water, the half-life of oxamyl was 7 days in an irradiated aqueous solution (pH 5 buffer), but >30 days in the dark. The half-life is approximately 1 day in natural water exposed to sunlight. On soil, the oxamyl half-life was 2 to 4 days in irradiated soil samples while the half-life was 17–18 days in the dark. After spray application of Vydate to cotton fields, oxamyl dissipated from leaf surfaces with a half-life of 1 to 4 days in the absence of rain.

VOLATILIZATION POTENTIAL

There is little potential for oxamyl to be lost through volatilization following application. Oxamyl has a moderate vapor pressure (5.12×10^{-5} Pa at 25°C) and high water solubility (2.82×10^5 mg/L), which results in a low Henry's law constant (3.96×10^8 Pa m³ mol⁻¹ at 25°C). Based on a standard estimation technique, <0.001% of the applied dose would be lost into the air within 24 hours from a treated field.

IONIZATION POTENTIAL (pKa)

Oxamyl does not ionize at any environmentally or biologically relevant pH. Oxamyl is nonionic.

BEHAVIOR IN PLANTS

Plant metabolism.

The comparative metabolism of ¹⁴C-oxamyl was studied in various crops under field and greenhouse conditions. Oxamyl was extensively metabolized in the plants and the radio-labeled carbon was ultimately found in plant natural products (eg., starch). The metabolism of oxamyl was also studied in laboratory and food producing (lactating goats and laying hens) animals. In general, oxamyl was rapidly absorbed, extensively metabolized and readily excreted in the animal. No metabolites containing the methylcarbamoyl group or exhibiting acetylcholinesterase activity were found in raw agricultural commodities from any of the treated crops or in human foodstuffs (meat, milk, eggs or edible tissue). Therefore, the metabolites of oxamyl identified in plant and animal systems are not expected to be toxicologically active by the inhibition of acetylcholinesterase since the carbamate ester moiety was either hydrolyzed or metabolically degraded.

Degradation in plants.

The time required for degradation or loss of 50% of the oxamyl applied to plants at labeled rates varies from less than seven days under field conditions to about three weeks in the greenhouse. The major degradation route is hydrolysis to the corresponding non-toxic, non-insecticidal oximino compound, followed by conjugation with glucose. In some species, further degradation by loss of one of the methyl groups from the dimethylamino function occurs.

Vydate® L and C-LV Toxicology

ACUTE TOXICOLOGY ^{1,2}	VYDATE® L	EPA TOXICITY CATEGORY
Acute Oral	10 mg/kg in males (highly toxic)	I
LD ₅₀ Rat	9 mg/kg in females (highly toxic)	
Acute Dermal		
LD ₅₀ Rabbit	>5000 mg/kg (slightly toxic)	IV
Acute Inhalation		
LC ₅₀ Rat	0.3009 mg/L (highly toxic)	II
Eye Contact		
Rabbit	mild irritant	III
Skin Contact		
Rabbit	Not a skin irritant	IV
Guinea Pig	Not a skin sensitizer	

ACUTE TOXICOLOGY ^{1,2}	VYDATE® C-LV	EPA TOXICITY CATEGORY
Acute Oral	8.7 mg/kg in males (highly toxic)	I
LD ₅₀ Rat	9.5 mg/kg in females (highly toxic)	
Acute Dermal		
LD ₅₀ Rabbit	>5000 mg/kg (slightly toxic)	IV
Acute Inhalation		
LC ₅₀ Rat	0.11 mg/L (highly toxic)	II
Eye Contact		
Rabbit	Eye irritant	I
Skin Contact		
Rabbit	Not a skin irritant	IV
Guinea Pig	Not a skin sensitizer	

¹LD₅₀ is the dose of chemical per kilogram of body weight that is lethal to 50% of the animals tested.

²LC₅₀ is the concentration of material in air or water that is lethal to 50% of the animals tested.

Acute Toxicity Studies

Oxamyl formulations (Vydate® C-LV and L) are highly toxic by the oral and inhalation routes of exposure. However, these oxamyl formulations are only slightly toxic by the dermal route of exposure and are not skin irritants or sensitizers. Vydate® C-LV has produced both eye irritation and systemic toxicity and/or mortality when instilled into the eyes of animals. Vydate® L produced mild eye irritation.

Signs of oxamyl intoxication observed in animal studies include soiled fur, lacrimation, salivation, tremors, incoordination or impaired mobility, and change in pupillary response. Effects are rapid in onset (within 30 to 60 minutes of dosing). In cases of non-lethal intoxication, effects are rapidly reversible and generally recovery is complete by the day following dosing/exposure.

ACETYLCHOLINESTERASE INHIBITION

In common with other carbamate insecticides, oxamyl reversibly inhibits an enzyme that functions in nerve impulse transmission—acetylcholinesterase. Several studies have demonstrated this inhibition to be quickly reversible and non-cumulative. There are no delayed effects or nerve damage associated with oxamyl exposure.

MUTAGENICITY AND GENETIC TOXICITY STUDIES

Oxamyl is non-mutagenic and non-genotoxic based on negative results of seven tests for these effects.

DEVELOPMENTAL TOXICITY, REPRODUCTIVE TOXICITY AND CARCINOGENICITY

Oxamyl has been evaluated in animal studies and is not a developmental or reproductive toxin or a carcinogen.

WILDLIFE TOXICITY

This pesticide is toxic to aquatic organisms (fish and invertebrates) and toxic to birds. Cover or disc spill areas. Birds in treated areas may be killed. Do not apply directly to water or wetlands (swamps, bogs, marshes and pot-holes). Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwaters.

ACUTE STUDIES

Coturnix Quail	LD ₅₀	4.18 mg/kg oxamyl
Bobwhite Quail	LD ₅₀	39.2 mg/kg Vydate® L (24%)
Mallard Duck	LD ₅₀	10.75 mg/kg Vydate® L (24%)

EIGHT-DAY DIETARY STUDIES

Bobwhite Quail	LC ₅₀	225 ppm Vydate® L (24%)
Mallard Duck	LC ₅₀	1536 ppm Vydate® L (24%)
Bobwhite Quail	LC ₅₀	340 ppm oxamyl
Mallard Duck	LC ₅₀	766 ppm oxamyl

FIELD STUDIES

White rabbits with food and water exposed were oversprayed with Vydate® insecticide/nematicide at a rate of 3 pounds active per acre for four applications at three-week intervals. There were no effects in this study.

Bobwhite quail and rabbits were oversprayed with Vydate® at a rate of 3 pounds active per acre for three applications. There were no effects in this study.

AQUATIC STUDIES

Bluegill Sunfish	LC ₅₀	5.6 ppm oxamyl (96 hours)
Rainbow Trout	LC ₅₀	4.2 ppm oxamyl (96 hours)
Daphnia magna	LC ₅₀	1.95 ppm Vydate® L (24%) for 48 hours

TOXICITY TO BEES

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow to drift to blooming crops or weeds if bees are visiting the treatment area.

Material Safety Information

Vydate® Insecticide/Nematicide

Consult the Material Safety Data Sheet (MSDS) for more information.

HEALTH, SAFETY & HANDLING INFORMATION

Vydate® L and Vydate® C-LV insecticide/nematicide are restricted-use pesticides.

Safety in handling, storing and application of Vydate® is the responsibility of each individual working with it. Refer to the product label for more information on the proper handling of Vydate®.

Vydate® L

One gallon of Vydate® L contains 2 lbs. active ingredient.

ACTIVE INGREDIENT	BY WEIGHT
Oxamyl [Methyl N'N'-dimethyl-N-[(methylcarbamoyl) oxy]-1-thiooxamimidate]	24%
INERT INGREDIENTS	76%
	TOTAL 100%

EPA Reg. No. 352-372

Vydate® C-LV

One gallon of Vydate® C-LV contains 3.77 lbs. active ingredient.

ACTIVE INGREDIENT	BY WEIGHT
Oxamyl [Methyl N'N'-dimethyl-N-[(methylcarbamoyl) oxy]-1-thiooxamimidate]	42%
INERT INGREDIENTS	58%
	TOTAL 100%

EPA Reg. No. 352-532

HAZARDOUS REACTIVITY

Chemical Stability: Stable at normal temperatures and storage conditions.

Incompatibility: Incompatible with strong acids or bases (slowly hydrolyzes).

Decomposition: Decomposition will not occur.

Polymerization: Polymerization will not occur.

FIRE AND EXPLOSION DATA

Vydate® L

Flash point: 23°C (74°F)
Method: Closed Cup
May be ignited by heat, sparks or open flame

Vydate® C-LV

Flash point: 52°C (125°F)
Method: Closed Cup
May be ignited by heat, sparks or open flame

FIRE AND EXPLOSION HAZARDS

Flammable liquid. Vapor forms explosive mixture with air. Heating can release vapors that can be ignited. Do not use or store near heat or open flame.

EXTINGUISHING MEDIA

Water Spray, Chemical Foam, Dry Chemical, CO₂.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Evacuate personnel to a safe area. Keep personnel removed and upwind of fire. Wear self-contained breathing apparatus. Wear full protective equipment. Shut off source of fuel, if possible and without risk. Use water spray. Cool tank/container with water spray. Runoff from fire control may be a pollution hazard.

NFPA Rating

Vydate® L:

Health: 2
Flammability: 3
Reactivity: 0

Vydate® C-LV:

Health: 2
Flammability: 1
Reactivity: 0

DISPOSAL INFORMATION

SPILL, LEAK OR RELEASE

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

Evacuate personnel, thoroughly ventilate area and use self-contained breathing apparatus. Remove source of heat, sparks, flame, impact, friction or electricity. Keep upwind of leak – evacuate until gas has dispersed. Dike spill. Prevent liquid from entering sewers, waterways or low areas. Soak up with sawdust, sand oil dry or other absorbent material. Neutralize with solid sodium hydroxide at a rate of 3 lbs. per gallon spilled. Shovel or sweep up. Never return to container for reuse. Scoop into bags or boxes with plastic or aluminum shovel.

PESTICIDE DISPOSAL

Do not contaminate water, food or feed by storage or disposal. Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL

For Metal Containers (non-aerosol): Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

For Plastic Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

SHIPPING INFORMATION

DuPont™ Vydate® L is classified by the Department of Transportation (DOT) as:

Proper Shipping Name: Carbamate Pesticide, Liquid, Toxic, Flammable (Oxamyl, Methanol)

Hazard Class: 6.1

UN No.: UN 2991

Packing Group: I

Subsidiary Hazard Class: 3

Marine Pollutant: Marine Pollutant (24% Oxamyl)—Water or Bulk

DuPont™ Vydate® C-LV is classified by the Department of Transportation (DOT) as:

Proper Shipping Name: Carbamate Pesticide, Liquid, Toxic, Flammable (Oxamyl, Cyclohexanone)

Hazard Class: 6.1

UN No.: UN 2991

Packing Group: I

Subsidiary Hazard Class: 3

Marine Pollutant: Marine Pollutant (42% Oxamyl)—Water or Bulk

STORAGE CONDITIONS

- Store in a secure, dry, temperate area.
- Do not subject product to temperature below 32°F.
- Do not use or store near heat or open flame.
- Store product in original container only.
- Store in well ventilated area. Keep container tightly closed.
- Do not store or consume food, drink or tobacco in areas where they may become contaminated with this material.
- Not for use or storage in or around the home.
- Do not contaminate water, other pesticides, fertilizer, food or feed by storage or disposal.

Vydate® L and Vydate® C-LV are shelf-stable for more than two years under normal storage conditions. This period is accurate both with respect to retention of active component and maintenance of acceptable emulsibility properties. This guidance is based on field experience as well as successfully completing standard accelerated aging tests at 54°C for a two-week period.

Personal Precautions, Symptoms and Treatment

HEALTH HAZARDS AND PROTECTION INFORMATION

DANGER! POISON! Vydate® L: Contains methanol. May be fatal or cause blindness if swallowed. May be fatal if absorbed through skin or inhaled.

DANGER! POISON! Vydate® C-LV: Fatal if swallowed or inhaled. May be fatal if absorbed through the eyes. Causes irreversible eye damage. May be harmful if absorbed through the skin.

(Please see pages 15-16 for Acute Toxicity Study Information)

- Do not breathe vapors or spray mist; do not get in eyes, on skin or on clothing.
- Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet.
- Wash contaminated clothing before reuse; discard shoes if contaminated.
- Do not consume food, drink, or tobacco in areas where they may become contaminated.

WARNING SYMPTOMS (All Oxamyl Products)

Oxamyl poisoning produces effects associated with anticholinesterase activity which may include weakness, blurred vision, headache, nausea, abdominal cramps, discomfort in the chest, constriction of pupils, sweating, slow pulse or muscle tremors.

FIRST AID

INGESTION

IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Drink 1 or 2 glass of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person.

EYE CONTACT

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15 – 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

INHALATION

IF INHALED: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

SKIN CONTACT

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15–20 minutes. Call a poison control center or doctor for treatment advice.

ATROPINE IS AN ANTIDOTE—SEEK MEDICAL ATTENTION AT ONCE IN ALL CASES OF SUSPECTED POISONING.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

NOTE TO PHYSICIAN

TREATMENT: Atropine sulfate should be used for treatment. Administer repeated doses, 1.2 to 2.0 mg intravenously every 10 to 30 minutes until full atropinization is achieved. Maintain atropinization until the patient recovers. Artificial respiration or oxygen may be necessary. Allow no further exposure to any cholinesterase inhibitor until recovery is assured.

Do not use 2-PAM for exposure to oxamyl alone. However, for exposure to combinations of oxamyl and organophosphorous insecticides, 2-PAM may be used as required to supplement the atropine sulfate treatment. Do not use morphine.

PERSONAL PROTECTIVE EQUIPMENT

Applicators and other handlers must wear:

- Coveralls over short-sleeved shirt and short pants.
- Chemical-resistant gloves, such as barrier laminate, butyl rubber, neoprene rubber, polyvinyl chloride (PVC), viton or nitrile rubber.
- Chemical-resistant footwear plus socks
- Protective eyewear
- Chemical-resistant headgear for overhead exposure
- Chemical-resistant apron when cleaning equipment, mixing or loading
- A respirator with an organic vapor-removing cartridge with a prefilter approved for pesticides (MSHA/NIOSH approval number prefix TC-23C), or a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G) or a NIOSH approved respirator with an organic vapor (OV) cartridge or canister with any R, P or HE prefilter.

Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining Personal Protective Equipment (PPE). If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil or water is:

- Coveralls over short-sleeved shirt and short pants
- Chemical-resistant gloves, such as barrier laminate, butyl rubber, neoprene rubber, polyvinyl chloride (PVC), viton or nitrile rubber
- Chemical-resistant footwear plus socks
- Protective eyewear
- Chemical resistant headgear for overhead exposure

MEDICAL EMERGENCIES

For medical emergencies involving Vydate® insecticide/nematicide and related formulations of any other DuPont agrichemical product, call toll free: 1-800-441-3637.

This is a 24-hour DuPont product information and emergency response number in Wilmington, Delaware. Caller should state: "This is a Medical Emergency."

The caller will be placed in contact with a poison control center. Caller should be prepared to state name of the DuPont product involved and the attending physician's name, address and phone number.

NOTICE OF WARRANTY/DISCLAIMER

DuPont warrants that when used in accordance with the Directions for Use under normal conditions, the Product conforms to the chemical description on the label thereof and is reasonably fit for the purpose stated in the Directions for Use, subject to the inherent risks arising from weather conditions, soil factors, off target movement, unconventional farming techniques, presence of other materials, the manner of use or application, or other unknown factors, all of which are beyond the control of DuPont. DuPont does not agree to be an insurer of these risks. WHEN YOU BUY OR USE THIS PRODUCT, YOU AGREE TO ACCEPT THESE RISKS.

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