Creating Trap Trees for the Detection of *Sirex noctilio* in North America

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Northeastern Area, State and Private Forestry
Forest Health Protection

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Introduction

Sirex noctilio F. (Hymenoptera: Siricidae) detection efforts will be substantially improved with the addition of pine trap trees used in place of host volatile-baited traps. While traps are easily deployed and have successfully detected *S. noctilio*, their efficacy in detection efforts is still being determined. Integrating trap trees into *S. noctilio* detection efforts will increase confidence in our knowledge of the distribution of this invasive species in North America. In addition, trap trees are also an integral component of the biological control program currently being developed for *S. noctilio* in North America. Successful release of *Beddingia siricidicola* into local ecosystems is dependent on trap trees being successfully colonized by *S. noctilio*.

While trap trees are currently being recommended for use in *S. noctilio* detection efforts, their use in North American pine ecosystems is still being studied and further development is needed. Data gathered and experience learned deploying trap trees in 2007 will be critical to helping improve methodology for trap trees in North America.

Site Selection

It is critical to select the proper site for deploying trap trees. In the northeastern US, stands containing Scots pine (*Pinus sylvestris* L.) should be prioritized for trap trees. Other tree species that have been successfully tested as trap trees in North America include red pine (*P. resinosa* Ait.) and white pine (*P. strobus* L.). While white pine trap trees have attracted *S. noctilio*, hard pines should be the focus of trap tree efforts. In areas where jack pine (*Pinus banksiana* Lamb.) is present, trap trees can be created using this pine species. Other hard pines in poor condition could also be used as trap trees although there effectiveness has not yet been tested. Selected stands should be suffering from overstocked growing conditions, have suppressed or overtopped trees present, or have recently been affected by biotic or abiotic stressors.

<u>Site Selection Priorities</u>

1. Tree Species
   a. Scots pine
   b. Red pine
   c. Other hard pine species (jack*, pitch)
2. Stand Condition
   a. Overstocked with overtopped trees and/or damaged trees
   b. Overstocked with only 1 or 2 canopy classes
   c. Managed stand (DO NOT USE, unless suppressed trees can be located in the stands)

*Jack pine has been successfully used as trap trees in other countries. While testing has not been conducted in North America, Jack pine will likely be an effective trap tree species.

Tree Selection

Ideally, trees of poor condition should be selected for trap trees. Overtopped and suppressed trees should be prioritized for selection, but if only larger trees are available they can also be used for trap trees. The most important factor is to find a stand of susceptible pines that is stressed and in decline. Trees with broken tops or suffering from some other injury are ideal and should be used for *S. noctilio* trap trees. Fortunately, these trees have little economic value and landowners will likely be willing to have them sacrificed as trap trees.

Methods

Currently, the only tested method for stressing trees and attracting *S. noctilio* in North America is chemical girdling with the herbicide Dicamba (=Banvel, Vanquish). Chemical girdling of pines in other countries has been well-tested and is successful for attracting *S. noctilio* to trap trees (Neumann et al. 1982). If at all possible, a priority should be placed on using herbicide girdling over mechanical girdling. As method development work continues, other techniques may be determined to be as effective as chemical girdling. Until these studies are completed, it is unknown how effective mechanical girdling will be for attracting *S. noctilio* to trap trees. In other countries where mechanical girdling has been tested, the area below the girdle is the initial focus of oviposition by female *S. noctilio* (Madden 1971, Madden and Irvine 1971). Consequently, mechanical girdles should be placed as high as possible to maximize the bole area attractive to *S. noctilio*. Regardless of girdling method used, a group of **three to five trap trees** should be created. These trees should be as close as possible to one another to maximize apparency to *S. noctilio*.

Datasheets

Appendix 1 has the datasheet that should be used for each individual trap tree. A datasheet for each trap tree should be filled out at the start of each survey. Most of the information is straight forward and should be familiar to those involved in forestry activities. A unique identification code will need to be determined for each trap tree. The following format should be used:

State abbreviation – TT – year – trap tree # Example: **VT-TT-07-01**

This code should also be listed on any collections taken from traps affixed to trap trees. For example:

VT-TT-07-01-Date of collection Example: VT-TT-07-0815

Appendix 2 contains the datasheet that should be used if a trap tree is dissected.

When to create trap trees

Trap trees should be created by June 1, but earlier dates are encouraged. After June 15, trap trees should not be created as it is unknown if trees girdled this late will be attractive to *S. noctilio*. *Sirex noctilio* flight occurred primarily in July and August in New York during the 2006 trapping season. We anticipate a similar flight period for other areas in the northeastern US.

Creating a trap tree - herbicide

After selecting a group of 3 to 5 trees, determine the circumference (not DBH) of each tree in cm. Divide this number by 10 and that will give you the number of holes that will need to be drilled into each tree (See Appendix 3). These holes will be drilled every 10 cm of circumference around each trap tree. At the base of trees, approximately 0.5 m

Figure 1

Figure 2

from the ground, drill holes at a 45° downward angle (Figure 1). Holes should go no further than 6 cm into the tree and care should be taken with small trees so holes do not penetrate through the bole and out the other side. One ml of 20% solution of Dicamba should be injected into each drilled hole (Figure 2). Injecting the herbicide completes the trap tree set-up.

Herbicide Mixing

There are different techniques for mixing pesticides, but a simple method using metric units is outlined here. Agencies will have different requirements and techniques for using herbicides, but two methods have been successfully used in the US. The first method uses a large syringe that allows for accurate herbicide dispensing in milliliter increments. The herbicide is drawn out of a larger container containing the correct concentration of Dicamba and then injected into each drill hole. The second method employs a calibrated spray bottle that dispenses 1 ml of liquid with each pull of the trigger. The spray bottles are available from Calmar (http://www.calmar.com/). An example of how to mix 250 ml of properly formulated Dicamba follows:

1. Total Liquid in Tank = 250 ml

    1 ml=1 g
    250ml=250g

2. To get a 20% concentration of chemical multiply the tank volume (by weight) by the percent mix desired:

    250g*0.20=50g

3. Divide 50 g by the active ingredient on the label (480g/L for Vanquish, i.e. dicamba)

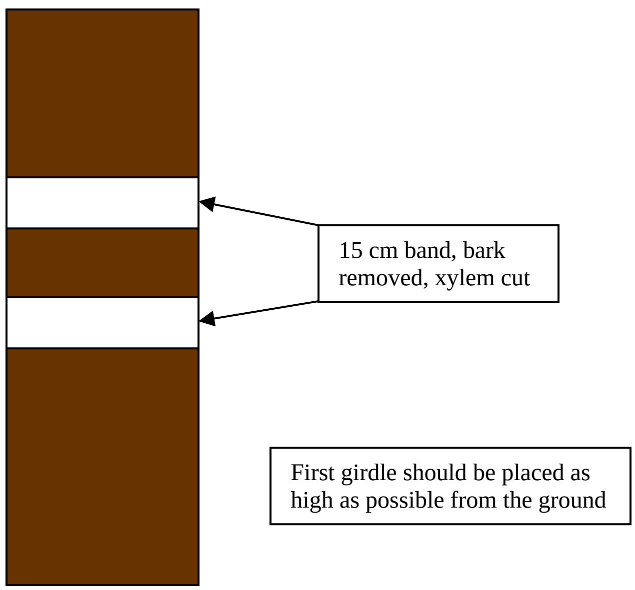
50g/480g/L=0.104 L or 104 ml

4. 104 ml of chemical added to 146 ml of water=250 ml of total solution

Creating a trap tree - mechanical

While mechanical girdling techniques have not been tested for *S. noctilio*, techniques described here are commonly used to kill trees to meet other objectives. A common technique is to use a chainsaw, handsaw, or axe to remove an approximately 15 cm band of bark and phloem while also cutting approximately 1-2 cm into the xylem. Two parallel cuts around the entire circumference of trees are made about 15 cm apart (Figure 3). The bark, phloem, and some xylem can then be removed from between these cuts to complete the girdle. A hand axe or chisel can be used to help remove bark, phloem, and xylem. Approximately 30 cm below the first girdle, a second identical band should also be created using the same techniques outlined above. If a chainsaw is used to make the girdle cuts, then both girdles will need to be lower on the tree bole for safety reasons.

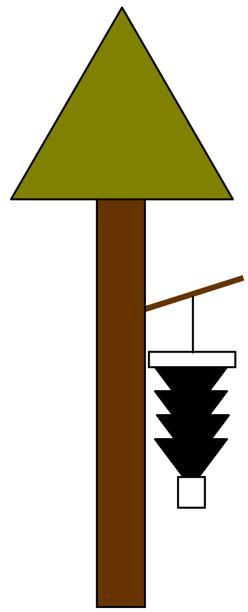
Figure 3. A tree bole depicting a double mechanical girdle.



Traps on trap trees

Regardless of the girdling method, either a **non-baited** intercept panel or Lindgren multiple funnel trap should be attached to each trap tree and checked from **at least June 15 through September**. These traps should be hung from trap trees so that the collection cup is at least 2.5 m off of the ground (Figure 4). Traps can either be hung from a rope affixed to a low branch on the tree or mounted using eyehooks or a similar technique. Whichever trap type is used care should be taken to make sure that traps hang as vertical as possible. If traps are not hung properly, insect may hit traps and then miss collecting funnels and cups. Wet cups with propylene glycol as the collecting agent should be used with either trap type. Traps should be checked and collected once every two weeks, with all insects brought back to labs for sorting. The attached datasheet can be used to keep track of trap collections.

Figure 4. Schematic illustrating how traps should be hung from trap trees



Depending on personnel available within a state, it may be possible to screen siricids for *S. noctilio*. While determining the genera of siricids is relatively easy, Sirex spp. specimens will need to be sent to an expert for confirmation. In the northeastern US, all *Sirex* spp. should be sent for confirmation to:

E. Richard Hoebeke
Senior Extension Associate and Assitant Curator
Department of Entomology,
Comstock Hall
Cornell University,
Ithaca, New York 14853-0901
Phone: 607-255-6530 (office)
Fax: 607-255-0939
E-mail: erh2@cornell.edu

Visual assessment of trap trees

When trap collections are made, visual assessment of trap trees should be conducted. When *S. noctilio* attacks trees, it is typical to see small resin beads spread throughout the tree bole (Figure 5 & 6). These resin beads are characteristic of attack by *S. noctilio*. If resin beading is seen on trap trees, trees should be considered infested and further action will need to be taken.

What to do if you have an infested tree

1. Trap positive for *S. noctilio*: Leave tree standing or fell.
2. Trap not positive for *S. noctilio*: Rely on visual assessments to determine if trap tree is suspect for *S. noctilio* infestation.
    a. Visual symptoms of *S. noctilio* present: If resin beading or adults are found on trees, then trap tree should be considered suspect for *S. noctilio*.
        i. Trap tree should be cut down, bucked into pieces, and split to collect siricid larvae.
        ii. Larvae should be placed in 95% alcohol and submitted for genetic testing. Contact your USFS Forest Health Protection office for details on where to send samples.
        iii. Logs can be reared to collect adults
    b. No visual symptoms on tree bole: tree can be left alone or cut down and dissected to look for presence of siricid larvae. However, if no visual symptoms are present and the tree still has green foliage, it can be considered non-infested and left standing for use next season.

Dissecting a trap tree

If a trap tree is determined to be suspect for *S. noctilio*, then it should be cut down and dissected to locate and collect siricid larvae. Trap tree dissections should not occur before November as larvae may be more difficult to locate. Other woodborers will likely be present in trees, but only siricid larvae should be collected (Figure 7).

When a tree is dissected, complete the trap tree dissection data sheet (Appendix 2). Trees should be cut, and then bucked into 0.5 m sections up to the base of the live crown. Sections should be labeled, the height from the base of tree measured for each, and diameter at midpoint for each section should be recorded before logs are split. Any siricid larvae found during the dissection should be collected. Larvae should be placed in 95% ETOH and labeled with the trap tree identification number, height of log section, date collected, and the collector. For details on where to send larvae for identification contact your local USFS Forest Health Protection contact.

Figure 7. Examples of siricid larvae removed from trap trees. Note the spine on the posterior end of the larvae. This spine is characteristic of Siricids.

Literature Cited

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Madden, J.L. and C.L. Irvine. 1971. The use of trap trees for the detection of *Sirex noctilio* in the field. Aust. For. 35: 164-166.

Neumann, F.G., J.A. Harris, F.Y. Kassaby, and G. Minko. 1982. An improved technique for early detection and control of the *Sirex* wood wasp in radiata pine plantations. Aust. For. 45: 117-124.

Appendix 1. US Forest Service *Sirex noctilio* Trap Tree Data Sheet

State:__________	County:________________________	Agency:______________________________
Site Name:__________________________	Tree Species:_________________________	Landownership[1]:______________________
Tree # ________ of __________ total at site	Trap Tree ID:____	
DBH:_____________________(cm)	Crown Class[2]: OT I CD D	Trap Type: Panel Funnel
GPS Coordinates (dd.ddddd, NAD 83)	N___________________________________	W____________________________________
Girdle Type: Chemical Mechanical	Date Set:____________________________	Date Ended:__________________________
Trap Tree Destination: Cut and left on site Cut and dissected Logs being reared Left Standing		
Comments:		

T r a p C o l l e c t i o n s				
Collection Date	**Sample Number**	**Siricidae Present?**	**Date Sent for Confirmation**	**Comments**
	Trap Tree ID-Sample #	Y N		

[1]Private property, county, state, federal
[2]Crown Class: OT = Overtopped, I = Intermediate, CD = Codominant, D = Dominant

Appendix 2. US Forest Service *Sirex noctilio* Trap Tree Dissection Data Sheet

Trap Tree ID:______________________ | Date of Tree Felling:_________________ | Dissected by:________________________

Crown Condition When Cut: Green Yellow Red Brown

Reason for Dissection: Resin beading Adult/ovipositor present Other __________________________

Comments:

Dissection Date	Height of log section from base of tree (m)	Diameter at midpoint of section (cm)	Sample number	# of larvae extracted	Other species present	Comments
					Cerm Bupr BB	
					Cerm Bupr BB	
					Cerm Bupr BB	
					Cerm Bupr BB	
					Cerm Bupr BB	
					Cerm Bupr BB	
					Cerm Bupr BB	
					Cerm Bupr BB	
					Cerm Bupr BB	
					Cerm Bupr BB	
					Cerm Bupr BB	
					Cerm Bupr BB	

Cerm = Cerambycidae, Bupr = Buprestidae, BB = Scolytidae

Appendix 3. Diameter to circumference conversions for determining the number of drill holes to put in a trap tree.

Diameter (in)	Diameter (cm)	Circumference (in)	Circumference (cm)	**ml/10cm, # of drills**
6	15.2	18.85	47.88	4.79
6.5	16.5	20.42	51.87	5.19
7	17.8	21.99	55.86	5.59
7.5	19.1	23.56	59.85	5.98
8.0	20.3	25.13	63.84	6.38
8.5	21.6	26.70	67.83	6.78
9.0	22.9	28.27	71.82	7.18
9.5	24.1	29.85	75.81	7.58
10.0	25.4	31.42	79.80	7.98
10.5	26.7	32.99	83.79	8.38
11.0	27.9	34.56	87.78	8.78
11.5	29.2	36.13	91.77	9.18
12.0	30.5	37.70	95.76	9.58
12.5	31.8	39.27	99.75	9.97
13.0	33.0	40.84	103.74	10.37
13.5	34.3	42.41	107.73	10.77
14.0	35.6	43.98	111.72	11.17
14.5	36.8	45.55	115.70	11.57
15.0	38.1	47.12	119.69	11.97
15.5	39.4	48.69	123.68	12.37
16.0	40.6	50.27	127.67	12.77
16.5	41.9	51.84	131.66	13.17
17.0	43.2	53.41	135.65	13.57
17.5	44.5	54.98	139.64	13.96
18.0	45.7	56.55	143.63	14.36
18.5	47.0	58.12	147.62	14.76
19.0	48.3	59.69	151.61	15.16
19.5	49.5	61.26	155.60	15.56
20.0	50.8	62.83	159.59	15.96
20.5	52.1	64.40	163.58	16.36
21.0	53.3	65.97	167.57	16.76
21.5	54.6	67.54	171.56	17.16
22.0	55.9	69.12	175.55	17.56
22.5	57.2	70.69	179.54	17.95
23.0	58.4	72.26	183.53	18.35
23.5	59.7	73.83	187.52	18.75
24.0	61.0	75.40	191.51	19.15
24.5	62.2	76.97	195.50	19.55
25.0	63.5	78.54	199.49	19.95
25.5	64.8	80.11	203.48	20.35
26.0	66.0	81.68	207.47	20.75
26.5	67.3	83.25	211.46	21.15
27.0	68.6	84.82	215.45	21.55
27.5	69.9	86.39	219.44	21.94
28.0	71.1	87.96	223.43	22.34

Appendix 4. Dicamba Information

E X T O X N E T

Extension Toxicology Network

A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Michigan State University, Oregon State University, and University of California at Davis. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program.

Pesticide Information Profile	Dicamba
	Publication Date: 9/93

TRADE OR OTHER NAMES

Metambane, Dianat, Banfel, Banvel, Banvel CST, Banvel D, Banvel XG, Mediben.

REGULATORY STATUS

Products containing dicamba must bear the signal word "Warning" (10).

INTRODUCTION

Dicamba is a benzoic acid herbicide. It can be applied to the leaves or to the soil. Dicamba controls annual and perennial broadleaf weeds in grain crops and grasslands, and it is used to control brush and bracken in pastures. It will kill broadleaf weeds before and after they sprout. Legumes will be killed by dicamba (3, 5). In combination with a phenoxyalkanoic acid or other herbicide, dicamba is used in pastures, range land, and non-crop areas (fence-rows, roadways and wastage) to control weeds (1).

TOXICOLOGICAL EFFECTS

ACUTE TOXICITY

Dicamba is moderately toxic by ingestion and slightly toxic by inhalation or dermal exposure (11). Symptoms of poisoning with dicamba include loss of appetite (anorexia), vomiting, muscle weakness, slowed heart rate, shortness of breath, central nervous system effects (victim may become excited or depressed), benzoic acid in the urine, incontinence, cyanosis (bluing of the skin and gums), and exhaustion following repeated muscle spasms (2, 3). In addition to these symptoms, inhalation can cause irritation of the linings of the nasal passages and the lungs, and loss of voice (11). Most individuals who have survived severe poisoning from dicamba have recovered within 2 to 3 days with no permanent effects (11).

Dicamba is very irritating and corrosive and can cause severe and permanent damage to the eyes (11, 14). Running water should be flushed through the eyes for at least 15 minutes if any dicamba is splashed into them (5). The eyelids may swell and the cornea may be cloudy for a week after dicamba is splashed in the eyes (3).

In some individuals, dicamba is a skin sensitizer (5). It may cause skin burns (15). There is no evidence that dicamba is absorbed into the body through the skin (3).

The amount of a chemical that is lethal to one-half (50%) of experimental animals fed the material is referred to as its acute oral lethal dose fifty, or LD50. The oral LD50 for dicamba in rats is 757 to 1,707 mg/kg, 1190 mg/kg in mice, 2000 mg/kg in rabbits, and 566 to 3,000 mg/kg in guinea pigs (3, 10). The dermal LD50 in rabbits is greater than 2,000 mg/kg (10). The lethal concentration fifty, or LC50, is that concentration of a chemical in air or water that kills half of the experimental animals exposed to it for a set time period. The inhalation LC50 for dicamba in rats is greater than 200 mg/l (11).

CHRONIC TOXICITY

Chronic exposure can lead to the development of the same symptoms as described for acute exposure.

Doses of 500 ppm (25 mg/kg) in the diet administered to rats for a 2-year interval produced no observable effects on survival, body weight, food consumption, organ weight, blood chemistry, or tissue structure (3, 13). A 2-year chronic feeding study in rats at dietary doses up to 25 mg/kg/day did not affect survival (2).

The EPA has established a Lifetime Health Advisory (LHA) level of 200 micrograms per liter (ug/l) for dicamba in drinking water. This means that EPA believes that water containing dicamba at or below this level is acceptable for drinking every day over the course of one's lifetime, and does not pose any health concerns. However, consumption of dicamba at high levels well above the LHA level over a long period of time has been shown to cause adverse health effects in animal studies, including changes in the liver and a decrease in body weight (12).

Reproductive Effects

In a 3-generation study, dicamba did not affect the reproductive capacity of rats (3). When rabbits were given doses of 0, 0.5, 1, 3, 10 or 20 mg/kg/day of technical dicamba from days 6 through 18 of pregnancy, toxic effects on the mothers, slightly reduced fetal body weights, and increased loss of fetuses occurred at the 10 mg/kg dose. EPA has set the NOAEL for this study at 3 mg/kg/day (11, 13).

Teratogenic Effects

Dicamba is suspected of being a human teratogen. No teratogenic effects have been shown in lab animals such as rabbits and rats (14).

Mutagenic Effects

Dicamba has not been shown to be a mutagen (8, 13).

Carcinogenic Effects

Data from laboratory studies are inadequate for EPA to determine if dicamba can increase the risk of cancer in humans (12). Rats fed up to 25 mg dicamba/kg/day for 2 years showed no increased incidence of tumors (13).

Organ Toxicity

In mice, some enlargement of liver cells has occurred. A similar effect has not been shown in man.

Fate in Humans and Animals

Dicamba was excreted rapidly by rats, mainly in the urine, when administered orally or subcutaneously. One to 4% was excreted in the feces (3). Mice, rats, rabbits and dogs excreted 85% of an oral dose as unmetabolized dicamba in the urine within 48 hours of dosing. Eventually, between 90 and 99% of the dose was excreted unmetabolized in the urine. This indicates that dicamba is rapidly absorbed into the bloodstream from the gastrointestinal tract (13). Like most organic acids, dicamba is joined to glycine (8), or glucuronic acid (6) in the liver.

When dicamba was ingested daily in the feed, the concentrations in different organs reached a steady state within 2 weeks. When daily intake stopped, storage in the organs declined rapidly (3). It is therefore concluded that dicamba does not bioaccumulate in mammalian tissues.

Following an attempted suicide with a mixture of dicamba and 2,4-D, dicamba levels in the blood serum and urine of the victim became undetectable within 2 weeks (3).

ECOLOGICAL EFFECTS

Effects on Birds

Dicamba is only slightly toxic to birds. The LD50 for technical dicamba in mallard ducks is 2,009 mg/kg. The 8-day dietary LC50 in mallards and in bobwhite quail is greater than 10,000 ppm (2).

Effects on Aquatic Organisms

Dicamba is of low toxicity to fish (2, 5). The lethal concentration fifty, or LC50, is that concentration of a chemical in air or water that kills half of the experimental animals exposed to it for a set time period. The 96-hour LC50 for technical dicamba in rainbow trout is 135.4 mg/l, 135.3 mg/l in bluegill sunfish, greater than 100.0 mg/l in grass shrimp, and greater than 180.0 mg/l in fiddler crab and sheepshead minnow (2). The 48-hour LC50 for dicamba in rainbow trout is 35 mg/l, 40 mg/l in bluegill, 465 mg/l in carp (10), and 110.7 mg/l in Daphnia magna, a small freshwater crustacean (2).

Effects on Other Animals (Nontarget species)

When used according to the instructions, dicamba poses little threat to wildlife. Dicamba is not toxic to bees (10).

ENVIRONMENTAL FATE

Breakdown of Chemical in Soil and Groundwater

Dicamba does not bind to soil particles (Koc = 2 g/ml) (4) and is highly soluble in water. It is therefore highly mobile in the soil and may contaminate groundwater. Its leaching potential increases with precipitation and the volume applied.

Metabolism by soil microorganisms is the major pathway of loss under most soil conditions. The rate of biodegradation increases with temperature and increasing soil moisture, and tends to be faster when soil is slightly acidic. When soil moisture increases above 50%, the rate of biodegradation declines (2).

Dicamba slowly breaks down in sunlight (2). Volatilization from soil surfaces is probably not significant, but some volatilization may occur from plant surfaces (7). It is stable to water and other chemicals in the soil (8). In humid areas, dicamba will be leached from the soil in 3-12 weeks. The half-life if dicamba in soil has varied from 4 to 555 days with the typical half-life being 1 to 4 weeks. Under conditions suitable to rapid metabolism, the half-life is less than 2 weeks (7). At an application rate of 6.7 kg/HA, no dicamba remained in the soil after one year.

Breakdown of Chemical in Water

In water, microbial degradation is the main route of dicamba disappearance. Photolysis may also occur. Aquatic hydrolysis, volatilization, adsorption to sediments, and bioconcentration are not expected to be significant (7).

Breakdown of Chemical in Vegetation

Dicamba is rapidly taken up by the leaves and roots of plants and it is readily translocated to other plant parts. It some plant species, dicamba accumulates in the tips of mature leaves (2, 3, 8). Desirable broadleaf plants (such as fruit trees, tomatoes, etc.) may be harmed during their growth and development stages (9).

Residues of dicamba on treated plants can disappear through exudation from the roots into the surrounding soil, metabolism within the plant, or by loss from leaf surfaces (2).

PHYSICAL PROPERTIES AND GUIDELINES

Pure dicamba is an odorless, white crystalline solid. The technical acid is a pale buff crystalline solid. The technical material is stable and resistant to hydrolysis and oxidation under normal conditions (2, 3).

Dicamba is stable under normal temperatures and pressures, but it may pose a slight fire hazard if exposed to heat or flame. It poses a fire and explosion hazard in the presence of strong oxidizers. Thermal decomposition of dicamba will release toxic and corrosive fumes of chlorides and toxic oxides of carbon (11).

Spills or other releases of 1,000 pounds (454 kg) or more of dicamba must be reported to the National Response Center: (800) 424-8802. Dicamba is volatile and presents a drift hazard.

Occupational Exposure Limits:

No occupational exposure limits have been established for dicamba by OSHA, NIOSH or ACGIH (11).

Physical Properties

CAS #:	1918-00-9
Specific gravity:	1.57 at 25 degrees C (11)
Solubility in water:	Highly soluble; 500,000 ug/ml (4)
Solubility in other solvents:	**Solvent** / **Solubility at 25 degrees C**: Acetone 810 g/L (5); Dichloromethane 260 g/L (5); Dioxane 1.18 kg/L (5); Ethanol 922 g/L (5); Toluene 130 g/L (5); Xylene 8 g/L (5)
Dicamba is an acid that forms water soluble salts:	Sodium salts - 360 g.a.e./L; Potassium salts - 480 g.a.e./L; Dimethylammonium - 720 g.a.e./L.
Melting point:	114-116 degrees C (237-241 degrees F) (10).
Flash point:	390 degrees F (199 degrees C) (11)
Decomposition temperature:	decomposes at approx. 392 degrees F (200 degrees C) (11)
Vapor pressure:	3.75 x 10 to the minus 3 power mm Hg at 100 degrees C (5); Zero (4)
Oil:	water partition coefficient:
Koc:	2 g/ml (4)
Odor threshold:	250.8 ppm (6)
Chemical class/use:	phenoxy herbicide; benzoic acid derivative; carboxylic acid

Solvent	Solubility at 25 degrees C
Acetone	810 g/L (5)
Dichloromethane	260 g/L (5)
Dioxane	1.18 kg/L (5)
Ethanol	922 g/L (5)
Toluene	130 g/L (5)
Xylene	8 g/L (5)

BASIC MANUFACTURER

Sandoz Crop Protection Corp.
1300 E. Touhy Ave.
Des Plaines, IL 60018

Review by Basic Manufacturer

Comments solicited: October, 1992
Comments received:

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