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For 18 years, Toxics Action Center has assisted residents and neighborhood groups across New England address toxic pollution issues in their community. For more information on Toxics Action Center, please contact us at 207.871.1810 or visit [www.toxicsaction.org](http://www.toxicsaction.org).

This report is dedicated to all those affected by toxic pesticides and the thousands of Mainers who are dedicated to reducing our exposure to these dangerous chemicals.

Sincerely,

Will Everitt  
Associate Director  
Toxics Action Center  
March, 2005

For additional copies of the report, send \$10 to:

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# Executive Summary

## **The Blueberry Industry In Maine: Dominated by Agri-Corporations**

The wild low-bush blueberry is native to the northern climate of Maine and southeastern Canada. Native Americans encouraged wild blueberry growth long before European settlers arrived to what is now Maine. Today it is one of the state's most important agricultural crops.

Maine is the largest producer of wild blueberries in the world, growing 60,000 acres of the crop. Twenty-five percent of all the blueberries grown in North America are grown in Maine. While over 500 different growers produce blueberries commercially, 35 percent of these growers own less than 10 acres, 45 percent own 11-50 acres, 20 percent own 100 to 300 acres, and less than 1 percent of all growers maintain over 5000 acres. This 1 percent constitutes about half Maine's blueberry production annually.

Many smaller farms contract their blueberry production with these larger processors. Typical contracts fall into several types of arrangements: some individuals and cooperatives grow their berries independently of the processor and then sell them directly to the processor; others simply provide the land necessary for cultivation, allowing processors to manage their fields while receiving compensation through a negotiated field price.

## **Blueberries and the Toxic Pesticide Threat**

Pesticides are toxic substances deliberately added to our environment to kill living things. This includes substances that kill weeds (herbicides), insects (insecticides), and fungus

(fungicides). Although blueberries in Maine grow wild, as their economic importance has increased, agri-corporations have come to rely on toxic pesticides to increase production.

Large-scale blueberry monoculture requires significant pest control measures to protect the commodity. The Maine Board of Pesticides Control (BPC) found that the blueberry industry used the following 15 trade-name pesticides (active ingredient in parenthesis):

- Benlate (Benomyl)—fungicide
- (Captan)—fungicide
- (Diazinon ag)—insecticide
- Elevate (Fenhexamid)—fungicide
- Funginex (Triforine)—fungicide
- Gramoxone (Paraquat)—herbicide  
*[restricted use pesticide in Maine]*
- Guthion (Azinphos-methyl)—insecticide  
*[restricted use pesticide in Maine]*
- Imidan (Phosmet)—insecticide
- Orbit (Propiconazole)—fungicide
- Poast (Sethoxydim)—herbicide
- Roundup (Glyphosate)—herbicide
- Select (Clethodim)—herbicide
- Sencor (Metribuzin)—herbicide
- Thiodan (Endosulfan)—insecticide  
*[restricted use pesticide in Maine]*
- Velpar (Hexazinone)—herbicide  
*[restricted use pesticide in Maine]*

In addition to these fifteen pesticides, the University of Maine Cooperative Extension, which acts as a resource for agriculture, recommends eleven additional pesticides as potential solutions to insects, weeds and diseases.

Of the nine fungicides recommended for use on blueberry crops:

- 67% (six) are possible carcinogens according to the EPA.
- 44% (four) cause reproductive or

developmental effects or are endocrine disruptors.

- 33% (three) are moderately to highly toxic through acute exposures.

Of the ten insecticides recommended for use on blueberry crops:

- 33% (three) are possible carcinogens according to the EPA.
- 40% (four) cause reproductive or developmental effects or are endocrine disruptors.
- 60% (six) are moderately to highly toxic through acute exposures.

Of the seven herbicides recommended for use on blueberry crops:

- One (14%) is a known carcinogen according to the EPA.
- One (14%) causes reproductive or developmental effects.
- 29% (two) are moderately to highly toxic through acute exposures.

Of the 26 active ingredients for use by the blueberry industry:

- 62% (sixteen) are moderately to very highly toxic to aquatic life.
- 65% (seventeen) cause chronic problems in aquatic life

### **Missing the Target: the Problem of Toxic Drift**

Drift is the movement of pesticides in the air away from the area where they are applied. Pesticide drift can cause many problems for both humans and the environment.

Since 2002, at least ten toxic drift complaints have been reported to the BPC. These reports include complaints of applicators spraying in extremely windy conditions, organic blueberry fields being contaminated by pesticide drift, and residents being hit directly by spray.

These reports signify that people not only expressing concerns for their health, but also fear that pesticide drift

is contaminating their property.

Since 1999, the BPC has worked to monitor residues from blueberry pesticide drift in the Narraguagus and Pleasant River watersheds near large blueberry production fields. Their most recent report tested for the presence of two aerially applied blueberry pesticides, phosmet and propiconazole as they were applied by the two largest growers in the state, Cherryfield Foods and Jasper Wyman and Son.

The report shows that of the eight sampling sites used in 2003, three detected phosmet either on drift cards, in water samples, or both. According to this report, drift was discovered as far away as 1500 feet from the nearest application site. Comparatively, in 2001, drift was detected 270-1500 feet away; and in 2000, up to 5100 feet from application site.

### **Pesticide Leaching and Water Quality Concerns**

When growers apply pesticides to blueberry fields, some may seep down through the soil and into groundwater stores. Pesticides then run the risk of appearing in drinking water supplies or contaminating rivers and streams fed by underground springs.

The herbicide hexazinone is known to commonly leach into water supplies and has shown up in the groundwater near commercial blueberry fields as well as in rivers and streams.

### **Recommendations**

Dangerous public health and environmental consequences have become part and parcel of toxic pesticide use. The ultimate solution is to use nontoxic ways of growing blueberries and other crops.

Until agriculture moves to non-toxic method, the following state policies

should be adopted to protect our health and environment:

**1. Phase Out Aerial Spraying of Blueberries**

In order to reduce toxic releases into our waterways and decrease human exposure to pesticides, the phasing out of aerial spraying is a natural first step. Already the two largest growers in Maine have committed to stop aerial spraying. Phasing out aerial spraying, would also be equitable for the industry by putting all growers on the same level playing field.

**2. Phase Out the Use of Organophosphates**

These chemicals are among the most dangerous pesticides in use. Organophosphates are persistent, acutely toxic, and have been linked to cancer and other diseases.

**3. Creating Mandatory Buffer Zones around Sensitive Areas**

Buffer zones around sensitive areas, such as drinking water wells, waterways, schools and private residences, provide protections against pesticide exposure.

**4. Develop Chronic Disease Monitoring**

The Department of Agriculture and the Bureau of Health should work together to develop a chronic disease monitoring and tracking program to identify and monitor health trends and successfully

link that data to environmental exposure. Both local residents' and farm workers' health should be tracked.

**5. Increase Citizens' Right to Know**

The BPC should require all commercial pesticide users to report their pesticide use annually, as sellers of pesticides are required to do. The state should then compile and keep comprehensive data on pesticide sales and usage by sector. This would give the state a better information from which to implement protections.

**6. Better Enforce the Laws that Already Exist**

The state can add legitimacy to the regulations already on the books by increasing penalties for violators of blueberry pesticide regulations, and by conducting more inspections of equipment, records, and practices. The state can also provide better enforcement of federal laws, such as the Clean Water Act and the Safe Drinking Water Act. The state is charged with enforcing these two important laws in Maine, and it is not doing enough to provide safe, clean water to citizens.

By better reducing pesticide spraying the state will protect drinking water, our communities, our environment and our health..

## Chapter One

# ■ An Introduction to Maine's Blueberry Industry

The wild low-bush blueberry is native to the northern climate of Maine and southeastern Canada.

Native Americans encouraged wild blueberry growth long before European settlers arrived to what is now Maine. Today it is one of the state's most important agricultural crops.

Blueberries grow in two year cycles. The first year is marked by plant growth. Berries are produced in the second year.

Their plants can grow from seed, but the majority of wild blueberry plants grow as "clones" of existing plants that send out underground stems (rhizomes) to create new plants.

Each year, growers import over 60,000 bee hives to pollinate the plants, which flower in May. Blueberry bushes produce fruit in late July and August.

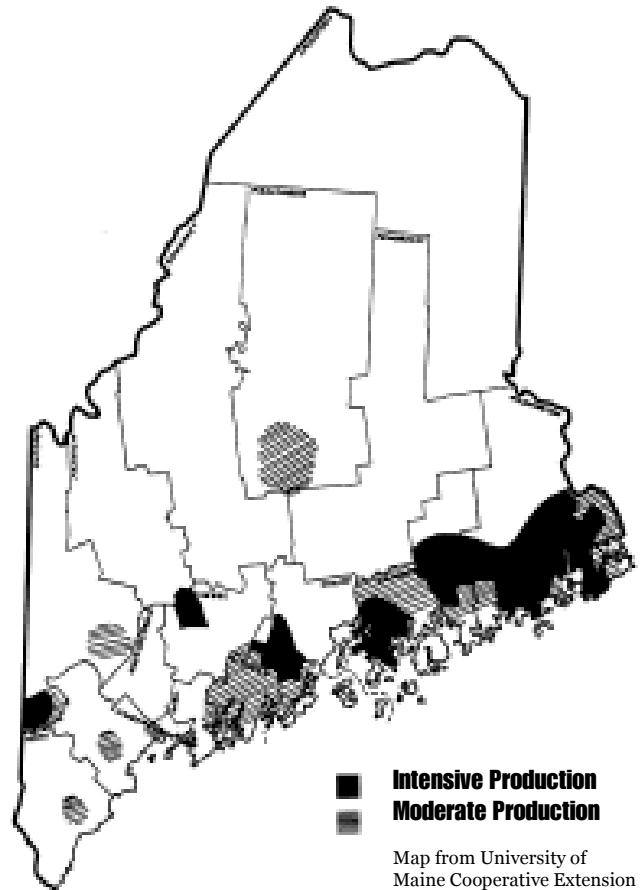
Following the harvest in the second year of the plants' growth, growers typically prune the plants (using burning or mechanical methods) and the cycle begins over again. Due to this practice, only half of the acreage produces fruit each year as the other half is re-growing.<sup>1</sup>

While blueberries grow wild, most growers use mechanical and chemical practices to increased production of the plants.

### **The Blueberry Industry In Maine: Dominated by Agri-Corporations**

Maine is the largest producer of wild blueberries in the world, growing 60,000 acres of the crop.<sup>2</sup> Twenty-five percent of all the blueberries grown in North America are grown in Maine.

### **Blueberry Production in Maine**



The United States Department of Agriculture's most recently compiled statistics (2003) report that wild blueberries are the fifth biggest agricultural commodity in Maine.<sup>3</sup>

It is an especially important industry in the economically challenged areas such as Hancock and Washington County.

Blueberries contributed \$18.7 million to Maine's economy in 2004, representing a significant portion of the state's

agricultural business.<sup>4</sup> As a value-added product, the industry contributes another \$75 million to the state's economy.

During the blueberry harvest, approximately 8,000 people are employed by the industry.<sup>5</sup>

The blueberry industry in Maine is dominated by several corporate farms that control most of the production, processing and sales of blueberries.

While over 500 different growers produce blueberries commercially, 35 percent of these growers own less than 10 acres, 45 percent own 11-50 acres, 20 percent own 100 to 300 acres, and less than 1 percent of all growers maintain over 5000 acres.<sup>6</sup> This 1 percent constitutes about half Maine's blueberry production annually.<sup>7</sup>

The largest company, Cherryfield Foods Incorporated, possesses more than 10,000 acres, followed by Jasper Wyman and Son, with over 7,000 acres. Allen's Freezer owns approximately 5,000 acres.<sup>8</sup>

Many smaller farms contract their blueberry production with these larger processors. Typical contracts fall into several types of arrangements: some

### **Leading Commodities in Maine Agriculture**

- Potatoes 21.8%
- Dairy 17.6%
- Chicken Eggs 14.1%
- Aquaculture 7.7%
- Blueberries 5.7%
- Greenhouse/Nursery 5.0%
- Cattle 3.3%
- Apples 2.9%
- Hay 1.5%
- Maple Products 1.3%
- Corn (sweet) 0.8%
- Oats 0.7%
- Other 17.6%

Source: Department of Agriculture's most recent and available figures (2003).

individuals and cooperatives grow their berries independently of the processor and then sell them directly to the processor; others simply provide the land necessary for cultivation, allowing processors to manage their fields while receiving compensation through a negotiated field price.<sup>9\*</sup>

In this way, even small blueberry farms have become dependent on the larger agri-corporations that rule the market.

\*In November of 2003, the verdict from a class action lawsuit ordered three large processors accused of price fixing to pay \$56.04 million in damages to growers,<sup>10</sup> although the amount was later reduced.

## Chapter Two

# ■ Blueberries and the Toxic Pesticide Threat

Pesticides are toxic substances deliberately added to our environment to kill living things. This includes substances that kill weeds (herbicides), insects (insecticides), and fungus (fungicides). Although blueberries in Maine grow wild, as their economic importance has increased, agri-corporations have come to rely on toxic pesticides to increase production.

### Blueberry Pests and Conventional Controls

Large-scale blueberry monoculture requires significant pest control measures to protect the commodity. Pests that threaten blueberry production include weeds, diseases and insects.

While many small blueberry farmers in Maine use organic or non-chemical methods to control pests, conventional growers, use a combination of cultural practices (such as pruning) and chemical applications (the use of pesticides, for example) in order to optimize production. The University of Maine has developed a detailed Integrated Crop Management (ICM) and Integrated Pest Management Plan (IPM) specifically tailored for conventional growers.<sup>11</sup>

To suppress weeds and diseases which compete with blueberry plants for space and soil nutrients, many growers rely on a combination of fungicides and herbicides.

To combat insect infestation that compromises crop yield and quality, growers apply insecticides to crops.

Growers examine their crops for signs of disease at the onset of the season (May). If the conditions indicate a likelihood of disease, a grower may apply several fungicides to the crop multiple times. However, fungicides are used to prevent potential infection; they do not cure

plants already infected with disease.<sup>12</sup>

The greatest pest problem for blueberry producers is weeds. Weeds can severely limit crop growth and yield, and to fight them, many growers apply several different types of herbicides to their fields. For this reason, herbicides are the most widely used pesticides in industry.<sup>13</sup> Chemical herbicides are categorized as pre- and post-emergence, referring to the time at which the herbicide is applied.<sup>14</sup>

After harvest each year, pest control experts known as “scouts,” visit fields to evaluate the weed pressure for the following year. These scouts examine the types and amount of weeds present. Conventional scouts might then recommend to growers the type of herbicide and rate of application they should use for the following season.<sup>15</sup> Herbicides are typically administered in June of the year after pruning, but before any weeds have taken hold.<sup>16</sup>

Producers apply herbicides in the non-fruit bearing year because this is when weed competition is most likely to limit the growth and production of buds on the plant.<sup>17</sup> Pre-emergence herbicides work by infiltrating the soil to suppress weeds before they start growing.<sup>18</sup> Environmental factors, such as rainfall, could influence the effectiveness of pre-emergence herbicides; too little rain prohibits the herbicide from soaking into the ground and suppressing weeds while too much rain causes the pesticide



to run off the field.<sup>19</sup>

Post-emergence herbicides are used in the fruit-bearing year as a spot treatment to eliminate any weeds that surface.<sup>20</sup> Some post-emergence herbicides (ones that control only grasses, for instance) can be applied broadly to blueberry fields without harming the crop, but other post-emergence herbicides must be applied by hand to unwanted weeds because they can kill the blueberries themselves.<sup>21</sup>

Cultural (non-chemical) weed control methods include hand pulling, pruning, mulching, and maintaining proper nutrient and pH levels that support blueberry bushes but discourage weeds.<sup>22</sup>

For conventional growers, the beginning of July usually marks the start of insecticide applications.<sup>23</sup>

Insects that threaten blueberry production include blueberry maggots, flea beetles, sawfly, spanworm and thrips.

No standard paradigm exists for insecticide use. The frequency of use and amount used varies, depending on the chemical.<sup>24</sup> Some chemicals have total seasonal use amount limits; some have mandatory delay periods between applications; and most limit applications to a certain number of days before harvest.<sup>25</sup> A cease in application 3-14 days before the harvest is the average for the insecticides recommended for blueberries in Maine.<sup>26</sup>

Cultural techniques for insect control include harvesting techniques that minimize the amount of infected fruit left in the field and fire pruning.

## **Pesticides Used By the Industry**

While pesticide use constitutes a significant portion of pest control practices utilized by many growers, it is difficult to quantify exactly how much of these dangerous chemicals are used because the state does little to track this data.<sup>27</sup>

While regulations require growers to record which pesticides they use and the amount consumed over a two-year period, they are not required to submit their records to the state.<sup>28</sup>

Furthermore, pest control practices are unpredictable across the industry since there is little uniformity regarding pesticide need and use.<sup>29</sup> Pest occurrences vary substantially from field to field and season to season, and so too does pesticide application.

While information about the exact amount of pesticides used by the blueberry industry is unknown, information is available about which pesticides are most commonly used. The Maine Board of Pesticides Control (BPC), the state agency that regulates pesticides, conducted crop usage surveys of blueberry growers. Although the Board only sampled a small number of growers, the list generated by the surveys represents a partial list of chemicals applied annually to Maine's blueberry fields.

The surveys found that the blueberry industry used the following 15 trade-name pesticides (active ingredient in parenthesis):

- Benlate (Benomyl)—fungicide
- (Captan)—fungicide
- (Diazinon ag)—insecticide
- Elevate (Fenhexamid)—fungicide
- Funginex (Triforine)—fungicide
- Gramoxone (Paraquat)—herbicide  
*[restricted use pesticide in Maine]*
- Guthion (Azinphos-methyl)—insecticide  
*[restricted use pesticide]*

### **Maine Board of Pesticides Control Pesticide Crop Usage Survey 2002**

Pesticides used by the four blueberry growers who reported:

- Diazinon ag--insecticide
- Funginex (Triforine)--fungicide
- Imidan (Phosmet)--insecticide
- Orbit (Propiconazole)--fungicide
- Poast (Sethoxydim)--herbicide
- Roundup (Glyphosate)--herbicide
- Select (Clethodim)--herbicide
- Velpar (Hexazinone)--herbicide [*restricted use pesticide in Maine*]

### **Maine Board of Pesticides Control Pesticide Crop Usage Survey 2001**

Pesticides used by the nine blueberry growers who reported:

- Benlate (Benomyl)--fungicide
- Captan--fungicide
- Elevate (Fenhexamid)--fungicide
- Gramoxone (Paraquat)—herbicide [*restricted use pesticide in Maine*]
- Guthion (Azinphos-methyl)—insecticide [*restricted use pesticide in Maine*]
- Imidan (Phosmet)—insecticide
- Orbit (Propiconazole)--fungicide
- Poast (Sethoxydim)--herbicide
- Roundup (Glyphosate)--herbicide
- Select (Clethodim)--herbicide
- Sencor (Metribuzin)--herbicide
- Thiodan (Endosulfan)—insecticide [*restricted use pesticide in Maine*]
- Velpar (Hexazinone)—herbicide [*restricted use pesticide in Maine*]

### **Pesticide Sales and Use Figures<sup>31</sup>**

- The U.S. spent more than \$11 billion total on pesticides in 2000 and 2001.
- In each of those two years, the U.S. population applied approximately 5 billion pounds of pesticides nationally in agriculture, industry, and homes.
- Agricultural use accounted for 78% and 76% of the total expenditure in 2000 and 2001 respectively.
- The most recent reliable pesticide sales data (1995)<sup>32</sup> for Maine show that in one year, Maine sold more than 2 million pounds of active ingredient for agricultural uses.<sup>33</sup>

*in Maine]*

- Imidan (Phosmet)—insecticide
- Orbit (Propiconazole)—fungicide
- Poast (Sethoxydim)—herbicide
- Roundup (Glyphosate)—herbicide
- Select (Clethodim)—herbicide
- Sencor (Metribuzin)—herbicide
- Thiodan (Endosulfan)—insecticide [*restricted use pesticide in Maine*]
- Velpar (Hexazinone)—herbicide [*restricted use pesticide in Maine*]<sup>30</sup>

In addition to these fifteen pesticides, the University of Maine Cooperative Extension recommends eleven additional pesticides as potential solutions to insects, weeds and diseases.

### **Dangers to Human Health by the Industry's Pesticides**

The charts on page 7 outline the known human health effects of all twenty-nine of these pesticides. Those marked with an asterisk (“\*”) are those used regularly according to crop usage surveys. The charts show each pesticide’s toxicity rating, whether the federal Environmental Protection Agency (EPA) has determined if it is a possible cancer-causing (carcinogenic) chemical, whether it causes reproductive or developmental problems, and whether it acts as an endocrine disrupter.

### Blueberry Industry Fungicides and Human Health Effects<sup>34</sup>

Active Ingredient	Trade Name	Acute Toxicity	Possible Carcinogen	Reproductive and/or Developmental Effects	Endocrine Disruptor
Benomyl	Benlate	Slightly Toxic	Yes (Possible)	Yes	
Captan*	Captec	Highly Toxic	Yes (Probable)		
Chlorothalonil*	Bravo	Highly Toxic	Yes (Probable)		
Cyprodinil	Switch	Slightly Toxic			
Fenbuconazole*	Indar	Slightly Toxic	Yes (Probable)		Yes (Suspected)
Fludioxonil	Switch	Slightly Toxic			
Propiconazole*	Orbit	Moderately Toxic	Yes (Possible)	Yes	
Pyraclostrobin	Pristine, Cabrio	N/A			
Triforine*	Funginex	Slightly Toxic	Yes (Possible)	Yes	

### Blueberry Industry Insecticides and Human Health Effects<sup>35</sup>

Active Ingredient	Trade Name	Acute Toxicity	Possible Carcinogen	Reproductive and/or Developmental Effects	Endocrine Disruptor
Azinphosmethyl*	Guthion	Highly Toxic			
Bacillus Thuringiensis (Bt)	Biobit, Dipel, Lepinox	Not Acutely toxic			
Bauveria bassiana	Botanigard	N/A			
Carbaryl*	Sevin	Moderately Toxic	Yes (Likely)		Yes (Suspected)
Diazinon*		Moderately Toxic		Yes	
Esfenvalerate	Asana	Moderately Toxic			Yes (Suspected)
Malathion	Cythion	Moderately Toxic	Yes (Suggestive)		Yes (Suspected)
Phosmet*	Imidan	Moderately Toxic	Yes (Suggestive)		
Spinosad	Spintor	Slightly Toxic			
Tebufenozide	Confirm	Slightly Toxic			

### Blueberry Industry Herbicides and Human Health Effects<sup>36</sup>

Active Ingredient	Trade Name	Acute Toxicity	Possible Carcinogen	Reproductive and/or Developmental Effects	Endocrine Disruptor
Clethodim*	Select	Moderately Toxic			
Diuron*	Karmex	Slightly Toxic	Yes (Known)		
Fluazifop-p butyl	Fusillade	Slightly Toxic			
Glyphosate*	Roundup, Touchdown	Slightly Toxic			
Hexazinone*	Velpar, Pronone	Highly Toxic			
Sethoxydim*	Poast	Slightly Toxic			
Terbacil*	Sinbar	Not Acutely Toxic		Yes	

## Toxicity Categories

ORAL LD <sub>50</sub>	TOXICITY CLASS	SIGNAL WORD	DESCRIPTION
Up to 50 mg/kg	I	Danger	Highly Toxic
50-500 mg/kg	II	Warning	Moderately Toxic
500-5000 mg/kg	III	Caution	Slightly Toxic
Above 50000 mg/kg	IV	Caution	Not Acutely Toxic

Toxicity class ratings by the EPA are based on the dose of the pesticide that proves to be lethal for 50 percent of a test population, known as the LD<sub>50</sub>. Classically, the toxicity ratings are based on laboratory tests to rats and mice. The Occupational Health and Safety Commission (OSHA), the Consumer Product Safety Commission (CPSC), the EPA, the Department of Transportation (DOT), and the World Health Organization (WHO) have all adopted the same ratings for regulating chemicals<sup>37</sup> Toxicity categories range from I to IV, with Class I (highly toxic) being the most lethal.

The table above lists toxicity categories, LD<sub>50</sub>, signal words for each category and a description.

For reference, ingesting one teaspoon to one tablespoon of a toxicity Class II (moderately toxic) chemical can kill a human. Class II chemicals must be labeled with the signal word “warning.” specific safety measures should be used when handling these chemicals.<sup>38</sup> Light interactions with Class II chemicals cause skin and eye irritation.

Cancer rankings range from known human carcinogens to evidence of noncarcinogenicity for humans. Known human carcinogens are those compounds in which there are enough human evidence to prove that the compound causes cancer to humans.

Possible and probable carcinogens are those compounds in which there is evidence that these compounds cause cancer in animals and the human data is inconclusive.

Endocrine disruptors impact animals by promoting the development of tumors, and interfering with sexual development. These chemicals mimic hormones and interfere with the hormone’s functions, changing or stopping the translation of a signal. Similar to reproductive toxins, endocrine disruptors can have severe effects on developing fetuses. Exposure to endocrine disruptors can cause learning disabilities, testicular cancer, impaired thyroid function, declining sperm counts, and male genital defects.<sup>39</sup> Endocrine disruptors can mimic estrogen in the body and health experts suspect that they are linked to breast cancer.<sup>40</sup>

Of the nine fungicides recommended for use on blueberry crops:

- 67% (six) are possible carcinogens according to the EPA.
- 44% (four) cause reproductive or developmental effects or are endocrine disruptors.
- 33% (three) are moderately to highly toxic through acute exposures.

Of the five fungicides regularly used by the blueberry industry (as suggested by the BPC’s crop usage surveys):

- 100% (all five) are possible carcinogens.
- 60% (three) cause reproductive or developmental effects or are endocrine disruptors.
- 60% (three) are moderately to highly toxic through acute exposures.

Of the ten insecticides recommended for use on blueberry crops:

- 33% (three) are possible carcinogens according to the EPA.
- 40% (four) cause reproductive or developmental effects or are endocrine disruptors.
- 60% (six) are moderately to highly toxic through acute exposures.

Of the four insecticides regularly used by the blueberry industry (as suggested by the BPC's crop usage surveys):

- 50% (two) are possible carcinogens according to the Environmental Protection Agency (EPA).
- 50% (two) cause reproductive or developmental effects or are endocrine disruptors.
- 100% (four) are moderately to highly toxic through acute exposures.

Of the seven herbicides recommended for use on blueberry crops:

- One (14%) is a known carcinogen according to the EPA.
- One (14%) causes reproductive or developmental effects.
- 29% (two) are moderately to highly toxic through acute exposures.

Of the six herbicides regularly used by the blueberry industry (as suggested by the BPC's crop usage surveys):

- One (17%) is a possible carcinogen according to the Environmental Protection Agency (EPA).
- One (17%) causes reproductive or developmental effects.
- 33% (two) are moderately to highly toxic through acute exposures.

## **Industry Pesticides Threaten the Environment**

The tables on page 10 outline the aquatic toxicity rating for pesticides used in the blueberry industry. The information is gathered from the product label information of each pesticide.

The charts show acute toxicity rating, which is determined by the amount of pesticide present per liter of aqueous solution that is lethal to 50% of the aquatic test organisms (fish or crustaceans, for example) within the stated study time.

The chronic toxicity column in the charts states whether the pesticide is known to cause effects to aquatic organisms beyond mortality (behavioral, biochemical, developmental, enzymatic, genetic, growth, morphological, mobility, physiological, population, and reproductive problems, for example).

The acute and chronic aquatic toxicity are especially important in Maine, where our water resources are important economically and culturally. These toxicity indicators show the degree to which these pesticides threaten our fish, lobster and other aquatic life.

Of the 26 active ingredients for use by the blueberry industry:

- 62% (sixteen) are moderately to very highly toxic to aquatic life.
- 65% (seventeen) cause chronic problems in aquatic life.

Nine of the active ingredients have not yet been evaluated for their acute or chronic aquatic toxicity.

As many of these pesticides have been shown to contaminate our groundwater and waterways, the aquatic toxicity of the industry's pesticides will continue to be an ongoing problem for Maine.

## Blueberry Industry Fungicides and Environmental Effects<sup>41</sup>

Active Ingredient	Trade Name	Acute Aquatic Toxicity	Chronic Aquatic Toxicity
Benomyl	Benlate	Slight	Yes
Captan	Captec	High	Yes
Chlorothalonil	Bravo	Very High	Yes
Cyprodinil	Switch	Moderate	Not evaluated
Fenbuconazole	Indar	High	Not evaluated
Fludioxonil	Switch	Not evaluated	Not evaluated
Propiconazole	Orbit	Moderate	Yes
Pyraclostrobin	Pristine, Cabrio	Not evaluated	Not evaluated
Triforine	Funginex	Not acutely toxic	Yes

## Blueberry Industry Insecticides and Environmental Effects

Active Ingredient	Trade Name	Acute Aquatic Toxicity	Chronic Aquatic Toxicity
Azinphosmethyl	Guthion	Very High	Yes
Bacillus Thuringiensis (Bt)	Biobit, Dipel, Lepinox	Not evaluated	Not evaluated
Bauveria bassiana	Botanigard	Not evaluated	Not evaluated
Carbaryl	Sevin	High	Yes
Diazinon		High	Yes
Esfenvalerate	Asana	Very High	Yes
Malathion	Cythion	High	Yes
Phosmet	Imidan	High	Yes
Spinosad	Spintor	Moderate	Not evaluated
Tebufenozide	Confirm	High	Not evaluated

## Blueberry Industry Herbicides and Environmental Effects

Active Ingredient	Trade Name	Acute Aquatic Toxicity	Chronic Aquatic Toxicity
Clethodim	Select	Slight	Yes
Diuron	Karmex	Very High	Yes
Fluazifop-p butyl	Fusillade	Not evaluated	Not evaluated
Glyphosate	Roundup, Touchdown	Moderate	Yes
Hexazinone	Velpar, Pronone	Slight	Yes
Sethoxydim	Poast	Moderate	Yes
Terbacil	Sinbar	Slight	Yes

## How Pesticides are Applied

While all blueberry pesticides can be applied aerially, only about half of all application is made by air.<sup>42</sup> Most aerial administration is done by the large agri-corporations because their large expanses of fields and their greater resources enable them to do so without a serious financial burden.<sup>43</sup>

In addition to aerial spraying, other methods of application vary according to the type of pesticide being applied.<sup>44</sup> Growers can apply pesticides from the ground by tractor or by hand. Booms, tractor-pulled mechanical devices that spray smaller areas of crops from overhanging arms down onto the fields, use water as a carrier and solvent for the

pesticide.<sup>45</sup> Air blast sprayers are also commonly used. These cylindrically shaped devices aerosolize the pesticide and disperse it onto the berries with a high volume blast of air from a large fan.<sup>46</sup> They work best in winds less than five miles per hour as higher winds interfere with uniform coverage.<sup>47</sup> Hand application, in which workers carry a small compressed air sprayer to distribute the pesticide, is still commonly used.<sup>48</sup>

### **Missing the Target: The Problem of Toxic Drift**

Drift is the movement of pesticides in the air away from the area where they are applied.

Pesticide drift can cause many problems for both humans and the environment. With regard to humans, it can result in exposure to toxic chemicals that have been linked to short and long-term illnesses.<sup>49</sup> It can also manifest damage in other important ways, including contamination of property, injury to domestic animals, and contamination of crops. Adverse environmental effects of pesticide spray drift can include harm to non-target species and contamination of groundwater and nearby waterways.

Any time pesticides are applied, some amount of drift is certain to occur.<sup>50</sup> Estimates of the amount of drift vary from 5 percent under near-perfect application conditions to as high as 60 percent under more common conditions.<sup>51</sup>

Aerial application, as well as ground sprayers that are directed upwards are more likely to result in drift than other types of spraying<sup>52</sup> because the chemicals will more likely be caught in the wind and carried off-target.<sup>53</sup> The closer to the ground the pesticide is applied, the less drift is likely to occur.<sup>54</sup> Unfortunately, application by hand, perhaps the best method for minimizing

drift, has its own drawbacks; namely, the exposure of workers to the chemicals at close proximity.<sup>55</sup>

The Board of Pesticides Control has documented that aerial spraying of blueberries has drifted nearly a mile from its intended target.<sup>56</sup> Studies conducted in Washington State have even measured drift up to 50 miles from its intended target.<sup>57</sup>

### **Pesticide Drift in Maine and Health Concerns**

Pesticide spray drift from blueberry cultivation poses significant problems for people living in areas of production. Because some drift is likely to occur with every pesticide application, and pesticide applications are frequent in the summer, many Mainers may be exposed to drift. Unfortunately, it is difficult to assess the magnitude of exposure to Maine's population because drift instances are not commonly reported and, therefore, few are investigated.

Of those incidents that are reported, the most common complaints received by the Board of Pesticides Control concern spray mists or vapors from pesticide spraying traveling away from their target and causing illness in nearby people.<sup>58</sup> Though people are normally not directly sprayed, many exposed to the drift can become ill even at very low concentrations.<sup>59</sup>

BPC officials say that this level of exposure is generally below an acutely toxic level, but complaints to the Board allege headaches, sore throats, a metallic taste, watery eyes, and dizziness as a result of breathing the vapors and mists of pesticides.<sup>60</sup> The insecticides typically used in July are of the class known as organophosphates and may present a particular danger to human health when they fall off target because of their capacity to cause long term health

### **Spotlight on Organophosphates**

Organophosphates were developed during the early 19th century, but their effects on insects, which are similar to their effects on humans, were discovered in 1932 (they were used in World War II as nerve agents).<sup>61</sup>

While they are not usually persistent in the environment, they are highly toxic to humans and animals. Many studies refer to this class of chemicals as the “most toxic.”

Organophosphate insecticides inhibit an enzyme (acetylcholinesterase) essential for proper functioning of the nervous system. The toxic effect is similar in insects, birds, and mammals.

Each year in the United States tens of thousands of organophosphate poisonings are reported. Non-Hodgkin’s lymphoma among farmers and cancers in children have been linked to their use.<sup>62</sup>

Furthermore, a study at the Colorado State University revealed that Colorado farmers who sprayed with organophosphates were nearly six times more likely to suffer symptoms of depression.<sup>63</sup>

Organophosphates used in the blueberry industry include malathion and azinphosmethyl (which are in the trade-name insecticides Cythion and Guthion respectively).

For more information about these pesticides please see appendix B.

problems,<sup>64</sup> especially in children.<sup>65</sup>

Since 2002, at least ten toxic drift complaints have been reported to the BPC.<sup>66</sup> These reports include complaints of applicators spraying in extremely windy conditions, organic blueberry fields being contaminated by pesticide drift, and residents being hit directly by spray.

These reports signify that people not only expressing concerns for their health, but also fear that pesticide drift is contaminating their property.

These complaints are difficult to quantify and rarely lead to enforcement action.<sup>67</sup> According to BPC staff, they are often either not specific enough or, due to timing, inadequate testing and the limits of science, are unable to be substantiated.<sup>68</sup>

### **Pesticide Drift and Water Quality Concerns**

Since 1999, the BPC has worked to monitor residues from blueberry pesticide drift in the Narraguagus and Pleasant River watersheds near large blueberry production fields. Their most recent report tested for the presence of two aerially applied blueberry pesticides, phosmet and propiconazole as they were applied by the two largest growers in the state, Cherryfield Foods and Jasper Wyman and Son.<sup>69</sup>

The report shows that of the eight sampling sites used in 2003, three detected phosmet either on drift cards, in water samples, or both. No sites detected propiconazole.<sup>70</sup> Drift was discovered as far away as 1500 feet from the nearest application site. Comparatively, in 2001, drift was detected 270-1500 feet away; and in 2000, up to 5100 feet from application site.<sup>71</sup>



## **Active and Inert Ingredients**

Pesticides consist of both “active” and “inert” ingredients. “Active” ingredients are agents that will prevent, destroy, repel or mitigate any pest, as defined by the United State’s main law governing pesticides, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). They are the part of the pesticide that is designed to kill the pest.

“Inert” ingredients are chemicals in the pesticide mixture that are used as solvents, propellants, and carriers for the active ingredients, in order to make the active ingredients effective.<sup>72</sup> Although the name sounds innocuous, inerts can actually be more harmful than the active ingredients. Some inerts are known carcinogens capable of causing central nervous system disorders, liver and kidney damage, and birth defects. The short-term symptoms that may occur as a result of exposure include eye and skin irritation, nausea, dizziness and respiratory difficulties.<sup>73</sup>

Inert ingredients usually make up half, if not most, of the pesticide product. Some pesticide products are 99 percent inerts. Unfortunately, the vast majority of inert ingredients are not disclosed by the pesticide manufactures or applicators.

FIFRA regulations allow information on inert ingredients to be kept secret when the manufacturers request confidentiality of their pesticide mixture “trade secrets.” Most manufacturers claim this confidentiality.

This trade secrecy section of FIFRA was intended to protect manufacturers from competitors in their market. However this regulation missed the target because companies often use “reverse engineering techniques” in order to identify the inert ingredient mixtures, while consumers are left without the information.

FIFRA allows the EPA to mandate disclosure of inert ingredients if the agency declares “that disclosure is necessary to protect against an unreasonable risk of injury to health or the environment.”<sup>74</sup> In 1987 the EPA expanded labeling requirements of inert ingredients by designating inerts into these four categories:

1. Inert Ingredients of Toxicological Concern: substances known to cause long term health and environmental damage.
2. Potentially Toxic Inert/High Priority for Testing Inerts: substances suspected of causing long-term health and environmental damage.
3. Inerts of unknown toxicity.
4. Minimal risk inert ingredients.<sup>75</sup>

The EPA declared that inerts listed in the “Inert Ingredients of Toxicological Concern” category had to be labeled by the manufacturer. No label was required for inerts in the other three categories.<sup>76</sup> Yet, the law has done little to educate consumers about the chemicals in pesticides. Only eight out of 2,300 inert ingredients are required to be listed by the USEPA on the pesticide label.<sup>77</sup> Despite a 93 percent increase since 1987 in the number of inerts used in pesticide products, the public continues to know little about the inert ingredients in pesticide products.

## **Agri-Business, Aerial Spraying, and the Clean Water Act**

Local, statewide, and national citizens' groups convinced the two largest blueberry growers in Maine to halt their use of aerial spraying through threatening to enforce the federal Clean Water Act.

Under the Clean Water Act, any direct discharge into our nation's waterways requires a permit. The act further allows residents to enforce the law through citizen suit provisions.

Toxics Action Center, Environment Maine, the National Environmental Law Center, the Maine Chapter of the Sierra Club and Beyond Pesticides contended that pesticide drift from spray nozzles on airplanes and helicopters directly into waterways was a violation of the letter and the spirit of the law.

Maine Board of Pesticides Control drift monitoring studies showed conclusively that Cherryfield Foods and Jasper Wyman and Son's aerial spraying was drifting into the state's rivers and ponds. Using these studies and citizen suit provisions under the Clean Water Act, the citizen groups filed a letter intending to sue the companies to force them to comply with the law.

Both companies avoided going to court by pledging not to use aerial spraying.

While this is good news for residents living near the companies fields, state and federal officials are still not fully enforcing the Clean Water Act as other companies continue to aerial spray. Furthermore, industry lobbyists are pushing for bills federally to exempt pesticides from the Clean Water Act.

The report concedes several shortcomings. The biggest problem with the current drift testing protocol is that there are not enough studies being conducted. Factors interfering with effective drift monitoring include insufficient staff and resources (of the BPC), inclement weather, inability to coordinate timing with industry applicators,<sup>78</sup> and long travel distances to test sites.<sup>79</sup>

Even with the limited information these studies provide, "it can be concluded from this drift study and from BPC drift studies from past years," writes the author, "that pesticide drift to natural resources such as rivers, streams, brooks, and lakes can and does sometimes occur."<sup>80</sup>

## **Pesticide Leaching and Water Quality Concerns**

When growers apply pesticides to blueberry fields, some may seep down through the soil and into groundwater stores. Pesticides can then appear in drinking water supplies or contaminate rivers and streams fed by underground springs.

The herbicide hexazinone is known to commonly leach into water supplies<sup>81</sup> and has shown up in the groundwater near commercial blueberry fields as well as in rivers and streams.<sup>82</sup> Though the levels of hexazinone detected in wells and public water supplies by the BPC, the University of Maine Cooperative Extension, and private parties have been well below the contamination level that the EPA has set as the health advisory level,<sup>83</sup> this contamination is still of public concern.<sup>84</sup> This is mostly because of how widespread and recurring these detections are.

Since 1994, the University of Maine Cooperative Extension has monitored wells in and around blueberry fields for

hexazinone and other chemicals; they found low levels in most of water samples tested.<sup>85</sup> Recent samples show that of 17 sites sampled, hexazinone was detected in 14 of them in May 2004 and in 13 in June of 2004.<sup>86</sup> School water supplies in Columbia Falls, Gouldsboro, and Aurora show levels of hexazinone as have the Machias and Franklin town water supplies.<sup>87</sup> Many residents of these towns, despite the EPA's recommendation that their water is safe levels to drink, decided to install charcoal filters.<sup>88</sup> Other pesticides have been detected in state groundwater as well. Samples from 2004 exhibit three detections of terbacil in May and June;<sup>89</sup> terbacil and propiconazole were also discovered by the state in 2003.<sup>90</sup>

There are several plausible explanations as to why these pesticides are leaching into water supplies. Chemical composition, soil type, and weather conditions influence leaching, but, fundamentally, prolific pesticide application is to blame.

The BPC, in response to the numerous identifications of hexazinone in water supplies, has registered its use<sup>91</sup> and continues to monitor contamination levels.<sup>92</sup> Additionally, the Cooperative Extension has developed management practices, which encourage growers to use the pesticide in ways that reduce the risk of seeping into groundwater.<sup>93</sup> Despite these steps, the pesticide still poses a threat to groundwater supplies.

## Chapter Three

# ■ Recommendations

“We have subjected enormous numbers of people to contact with these poisons, without their consent and often without their knowledge. If the Bill of Rights contains no guarantee that a citizen shall be secure against lethal poisons distributed either by private individuals or by public officials, it is surely only because our forefathers, despite their considerable wisdom and foresight, could conceive of no such problem.”

-Rachel Carson, *Silent Spring*, 1962

When Rachel Carson wrote those words more than 40 years ago, pesticides were still seen by industry and society at large as a chemical panacea. Pesticides promised to free our farmers from toil and to deliver more food to the world.

Unfortunately, dangerous public health and environmental consequences have become part and parcel of toxic pesticide use.

As described in the previous pages, pesticides used by the blueberry industry in Maine drift from airplanes and helicopters into our communities and our waterways. Pesticides can be found in groundwater, rivers and drinking water wells. These pesticides threaten the public health and Maine’s environment.

The blueberry industry is a treasured resource for Maine. We must protect this industry while advocating for increased protection from the harms caused by extensive pesticide use.

Fortunately, there are a number of positive steps industry, state and local officials can take to reduce our exposure to toxic pesticides used by industry.

## **Environmental Sense Makes Economic Sense**

The ultimate solution is for growers to use proven and effective non-toxic methods to grow blueberries and other crops.

The Maine Organic Farmers and Gardeners Association is an invaluable resource for growers who would like to reduce and eliminate their dependence on toxic chemicals.

To both improve agriculture and protect the public health, state agencies and corporations need to invest more time, funds and research in to developing effective and nontoxic ways of growing blueberries and other crops.

This makes not only public health sense, but economic sense. The economic importance of the organic market continues to grow. More and more educated consumers are buying food free from pesticides, hormones and other chemicals.

According to analysts, the U.S. organic market is projected to reach a value of \$30.7 billion by 2007, with a five-year compound annual growth rate of 21.4 percent between 2002 and 2007, compared to a 21.2 percent rate between 1997 and 2002.<sup>94</sup> And according to the

U.S. Department of Agriculture, even when presented with the conflicting evidence of the benefits of organic products, an increasing number of consumers choose organic food, citing flavor, freshness, less pesticide exposure, environmental protection, and the desire to support local farms.

These trends appear to be no different for the blueberry industry in particular. Organic blueberries typically sell for about 20 percent more than conventionally grown blueberries.<sup>95</sup>

### **Maine Should Adopt Policies to Protect Public Health and the Environment**

Maine should adopt policies to protect public health and the environment for toxic pesticide spraying.

Specifically the state should:

#### **1. Phase Out Aerial Spraying of Blueberries**

The state already has conclusive proof that pesticide drift from aerial spraying of blueberries is a problem. Companies are violating the Clean Water Act when, without a permit, they spray fields and pesticides drift into waterways is a violation of many pesticides' labels. In order to reduce toxic releases into our waterways and decrease human exposure to pesticides, the phasing out of aerial spraying is a natural first step. Already the two largest growers in Maine have committed to stop aerial spraying. Phasing out aerial spraying, would also be equitable for the industry by putting all growers on the same level playing field.

#### **2. Phase Out the Use of Organophosphates**

These chemicals are among the most dangerous pesticides in use. Organophosphates are persistent, acutely toxic, and have been linked to cancer and other diseases.

#### **3. Creating Mandatory Buffer Zones around Sensitive Areas**

Buffer zones around sensitive areas, such as drinking water wells, waterways, schools and private residences, provide protections against pesticide exposure. Current regulations simply do not protect waterways, private property, or public health from direct and indirect contact with pesticides drifting away from application sites.<sup>96</sup>

The proper distance of buffer zones should depend upon the application technique (a larger buffer zone for air blast sprayers should be required, for example, than hand application methods). Proper distances can be determined through drift studies of all application techniques. Any quantifiable off-target residue should be considered a violation. This would allow for enforcement of reported violations that are not currently pursued by the BPC.

#### **4. Develop Chronic Disease Monitoring**

The Department of Agriculture and the Bureau of Health should work together to develop a chronic disease monitoring and tracking program to identify and monitor health trends and successfully link that data to environmental exposure. Both local residents' and farm workers' health should be tracked. This initiative can start to fill in the gaps in our understanding of the relationships between environmental exposures and chronic diseases. Through bio-monitoring, expanding and connecting chronic disease tracking networks such as state cancer registries, and identifying and tracking hazardous environmental pollutants, we can link these health trends to their causes more efficiently, and, in the long run, learn how to prevent them.<sup>97</sup>

#### **5. Increase Citizens' Right to**

## **Know**

The BPC should require all commercial pesticide users to report their pesticide use annually, as sellers of pesticides are required to do. The state should then compile and keep comprehensive data on pesticide sales and usage by sector. This would give the state better information from which to implement protections.

State officials can also support right-to-know provisions by improving the pesticide spray notification law. Currently, many neighbors of pesticide-using blueberry growers are finding out after the fact that they have the right to know before a spraying occurs. Maine law only protects people who know that they have the right to receive notification from their agricultural neighbors, and those who are not aware of this right are often victims of surprise sprayings. This element of surprise prevents them from taking precautions to protect themselves, such as going indoors, closing windows, and protecting animals and children from pesticide fumes and mists. Maine should make notification mandatory, not just for those who are aware that they can request it, but for all neighbors within a certain proximity to agricultural spray areas.

## **6. Better Enforce the Laws that Already Exist**

The state can add legitimacy to the regulations already on the books by increasing penalties for violators of blueberry pesticide regulations, and by conducting more inspections of equipment, records, and practices. The 10 to 20 inspections that the BPC currently makes of blueberry growers annually is simply not enough to ensure that growers are abiding by state and federal regulations and using pesticides in the safest way possible. Also, penalties for violators also are small (often ranging from \$500 to \$2500)

making them ineffective to deter potential violators.

The state can also provide better enforcement of federal laws, such as the Clean Water Act and the Safe Drinking Water Act. The state is charged with enforcing these two important laws in Maine, and it is not doing enough to provide safe, clean water to citizens. Blueberry pesticide spray drift has contaminated waterways in violation of the Clean Water Act and blueberry pesticide leaching has contaminated drinking water sources in the state. Finally, officials can better enforce the state's policy to minimize reliance on pesticides.<sup>98</sup> A policy means little if it is not implemented, and an implemented policy is necessary for Maine. By requiring growers to follow Integrated Pest Management plans (rather than merely *recommending* that they do), the state would put into action its reduced pesticide use policy at the ground level, where the use of pesticides is most prevalent and has the biggest impact on human health and the environment.

## ■ Appendix A: Pesticides Used by Maine’s Blueberry Industry

The following charts list pesticides recommendations by the University of Maine Cooperative Extension for use on blueberries, their active ingredients, and their intended targets.<sup>99</sup> The charts also list nontoxic alternatives for the control of these pests, often at less cost to the grower and at less cost to human health and the environment. The environmental and health threats these pesticides pose can be found in Chapter Two.

### Insecticides and Non-Toxic Alternatives Recommended by University of Maine Cooperative Extension

Active ingredient	Common trade names	Used to Control	Nontoxic Alternatives
Azinphos-methyl*	Guthion	Blueberry maggot	<p>Certain harvesting techniques can reduce fruit loss due to blueberry maggots by minimizing the number of infected fruit left on plants and the ground.</p> <p>Composting, burning, or disposing of winnower refuse helps to combat blueberry maggots.</p> <p>Fire pruning combats flea beetles, sawflies, and thrips by burning blueberry litter and stems.</p> <p>Instead of spraying entire fields, perimeter spraying has proven effective for maggot control.</p>
Phosmet*	Imidan	Blueberry maggot, spanworm larvae, flea beetles, sawfly larvae, strawberry rootworm	
Bacillus Thuringiensis (Bt)	Biobit, Dipel, Lepinox	Spanworm larvae	
Carbaryl*	Sevin	Blueberry maggot, flea beetles, sawfly larvae	
Malathion	Cythion	Blueberry maggot, thrips	
Diazinon*		Thrips	
Esfenvalerate	Asana	Blueberry maggot, spanworm larvae	
Tebufenozide	Confirm	Spanworm larvae	
Spinosad	Spintor	Spanworm larvae, flea beetle larvae, sawfly larvae, strawberry rootworm	
Bauveria bassiana	Botanigard	Flea beetles	

## Herbicides and Non-Toxic Alternatives Recommended by University of Maine Cooperative Extension

Active ingredient	Common trade names	Used to control	Nontoxic Alternatives
Hexazinone*	Velpar, pronone	Annual and perennial weeds	Keeping nitrogen levels low and maintain 4.0-4.5 soil ph. Hand pulling. Clean and inspect equipment to prevent seed being carried. Mowing above berries. Fire pruning. Flail-mow pruning. Mulching.
Terbacil*	Sinbar	Annual and perennial weeds	
Diuron*	Karmex	Annual and perennial weeds	
Glyphosate*	Roundup, touchdown	Broadleaf, herbaceous, and woody perennial weeds	
Sethoxydim*	Poast	Grasses	
Fluazifop-p butyl	Fusillade	Grasses	
Clethodim*	Select	Grasses	

## Fungicides and Non-Toxic Alternatives Recommended by University of Maine Cooperative Extension

Active Ingredient	Common trade names	Used to control	Nontoxic alternatives
Triforine*	Funginex		Efficient harvesting techniques can reduce the number of disease infected fruit left on the ground.
Propiconazole*	Orbit	Mummyberry	
Benomyl	Benlate		Good weed control.
Captan*	Captec	Mummyberry, powdery mildew, blossom and twig blight	Disposal of winnower refuse. Regular fire pruning.
Chlorothalonil*	Bravo	Mummyberry, leaf spot	
Pyraclostrobin	Pristine, cabrio	Mummyberry, powdery mildew, leaf spot, blossom and twig bligh	
Cyprodinil	Switch	Blossom and twig blight	
Fludioxonil	Switch	Blossom and twig blight	
Fenbuconazole*	Indar	Mummyberry	

\*known to be regularly used by commercial blueberry growers in Maine.



# ■ Appendix B: Health and Environmental Comparison of Blueberry Pesticides

## Insecticides

### **Azinphos-methyl (Guthion, Sniper)**

First registered for use in 1959 in the U.S. and subject to reregistration in October of 2001,<sup>100</sup> azinphos-methyl is one of the most acutely toxic pesticides used on Maine blueberries. In 2001, the EPA cancelled 28 crop uses for this pesticide without any phase out period for its use because safer alternatives were available.<sup>101</sup> The EPA phased out seven other crop uses over four years, and it issued time-limited registrations for eight crop uses, in order to give time to develop safer alternatives. Blueberries are one of only eight crops for which azinphos-methyl is still approved.<sup>102</sup>

**Effects on human health:** This insecticide is highly toxic to humans, and acute exposure can occur through various routes, each with their own symptoms.<sup>103</sup> Inhalation may cause wheezing, tightness in the chest, blurred vision and tearing of the eyes. Azinphos-methyl is also easily absorbed by the skin and lethal amounts can build up in the body after exposure; symptoms of dermal exposure include nausea, vomiting, blurred vision and muscle cramps. Ingestion of azinphos-methyl can cause dimness of vision, salivation, excessive sweating, stomach pain, unconsciousness and death. Eye contact may cause pain, blurring, tearing and other problems. An organophosphate insecticide, azinphos-methyl is known to inhibit the production of cholinesterase, an enzyme that is essential to proper nervous system function. Long-term exposure can impair concentration and memory, and can cause headache, irritability, nausea, vomiting, muscle cramps and dizziness. Like many other pesticides, little is known about this chemical's impacts on human development and reproduction or the endocrine system.

**Environmental effects:** The EPA identified that “there is a potential for spray drift and runoff into water bodies, with the most drift being associated with aerial applications.”<sup>104</sup> Azinphos-methyl is very highly toxic to both marine and freshwater fish, and it poses a significant risk to birds, mammals and bees.<sup>105</sup>

### **Phosmet (Imidan)**

**Effects on human health:** First registered for use in the U.S. in 1966,<sup>106</sup> phosmet causes concern because it is a possible carcinogen.<sup>107</sup> An organophosphate, phosmet is also known to be a cholinesterase inhibitor, affecting the nervous system adversely.<sup>108</sup> While there is no clear picture yet available about phosmet's impact on the endocrine or reproductive systems, induced maternal toxicity in rabbits resulted in skeletal variations of the fetuses.<sup>109</sup> The EPA expressed concern for workers exposed through dermal routes, for homeowners using phosmet on ornamental plants and trees, and for children's exposure to phosmet-treated dogs; as a result, uses in and around the home or on pets were voluntarily cancelled.<sup>110</sup>

**Environmental effects:** Phosmet poses a chronic exposure risk to birds and freshwater invertebrates and a high chronic exposure risk to mammals and honeybees.<sup>111</sup>

Additionally, it may have a propensity to drift when applied by air.<sup>112</sup>

## Fungicides

### Propiconazole (Orbit)

In 2004, propiconazole was not registered for use on blueberry crops, though it has been used in Maine since 1998 under Section 18 emergency exemptions.<sup>113</sup>

**Effects on human health:** Evidence exists that propiconazole may be a human carcinogen, and it is known to cause developmental and reproductive problems.<sup>114</sup>

**Environmental effects:** Propiconazole is a known groundwater contaminant in Maine.<sup>115</sup> It is moderately toxic to fish.<sup>116</sup>

### Fenbuconazole (Indar)

**Effects on human health:** Fenbuconazole, available for use on blueberries until June 15, 2004 in Maine under a Section 18 emergency exemption<sup>117</sup> to combat mummyberry disease,<sup>118</sup> is a possible carcinogen and a suspected endocrine disruptor.<sup>119</sup> Still, much remains unknown about its effect on reproductive systems or human development.

**Environmental effects:** Fenbuconazole is moderately toxic to fish (acute toxicity to an organism is measured according to the LC<sub>50</sub> standard; it is defined as the micrograms of pesticide present per liter of aqueous solution that is lethal to 50 percent of the test organisms within the stated study time. Moderate toxicity represents LC<sub>50</sub> concentrations ranging from 1,000-10,000 ug/L), and it may be a groundwater contaminant.<sup>120</sup>

### Benomyl (Benlate)

First registered for use in the U.S. in 1969, Benomyl was scheduled for reregistration by the EPA in 2002, but prior to completion, the registrants requested voluntary cancellation.<sup>121</sup> All registrations were cancelled in early 2002, though sales and distribution of existing stocks were permitted until the end of 2002, and use of the pesticide is allowed until stocks are depleted.<sup>122</sup>

**Effects on human health:** Benomyl and its metabolite, carbendizim, are both listed as possible carcinogens by the EPA.<sup>123</sup> It is also a known reproductive toxin (especially in men)<sup>124</sup> and a suspected endocrine disruptor.<sup>125</sup> Additionally, according to the EPA, health effects from exposure include liver toxicity, developmental toxicity such as fetal eye and brain malformations and increased mortality.<sup>126</sup> Benomyl has been severely restricted for use in Sweden because it is listed as carcinogenic and there had been evidence of fetal and genetic disturbances and increased incidence in tumors in experimental animals.<sup>127</sup> The real problem with this fungicide is that it is a systemic fungicide, meaning that it infiltrates plants at the cellular level, and for humans, this means that it cannot be washed off the food crops that are sprayed with it.<sup>128</sup>

**Environmental effects:** Very little is known.

### **Captan (Captec)**

Captan was reregistered for use in the U.S. in September of 1999,<sup>129</sup> even though seven countries have banned, cancelled, or severely restricted use of this pesticide because it is carcinogenic and because of the dangers it poses to human health and the environment.<sup>130</sup>

**Effects on human health:** Captan is a dangerous pesticide. It has a high acute toxicity rating and is classified as a probable human carcinogen by the EPA<sup>131</sup>; however, it is unknown what effects it may have on developmental, reproductive, or hormonal systems.

**Environmental effects:** Captan is highly acutely toxic to freshwater fish.<sup>132</sup>

### **Chlorothalonil (Bravo)**

EPA reregistered chlorothalonil for use in the U.S. in September of 1998.<sup>133</sup>

**Effects on human health:** Although chlorothalonil is not considered to be acutely toxic to humans, it has caused severe allergic reactions in people.<sup>134</sup> It also is a probable human carcinogen.<sup>135</sup> In laboratory tests has caused liver damage<sup>136</sup>, mild anemia<sup>137</sup>, kidney damage<sup>138</sup>, embryo loss during pregnancy<sup>139</sup>, damage to cells' genetic material<sup>140</sup>, and cancers of the kidney and forestomach.<sup>141</sup> Sweden has banned chlorothalonil because it is carcinogenic.<sup>142</sup>

**Environmental Effects:** Chlorothalonil has affected reproduction in fish.<sup>143</sup> It has been found in the air a mile from its target and in the groundwater of four states, one of which is Maine.<sup>144</sup>

### **Fenhexamid (Elevate)**

**Effects on human health:** Fenhexamid is a fairly new fungicide; EPA registered it for use beginning in 1999.<sup>145</sup> As a result, we have very little information about it, apart from the studies conducted to achieve registration. Those studies show very little toxicity to animals and no problems with carcinogenicity or developmental problems.<sup>146</sup> Time alone will tell what effects the use of this pesticide has on human health.

**Environmental effects:** Very little is known.

### **Triforine (Funginex)**

All Funginex formulations of triforine registrations were cancelled for use in the United States, though the active ingredient is still registered for use in other formulations.<sup>147</sup> The EPA has scheduled a reregistration decision for triforine for September of 2008.<sup>148</sup>

**Effects on human health:** Triforine is known to harm developmental and

reproductive systems, but it is unknown whether it is a carcinogen or an endocrine disruptor.<sup>149</sup>

**Environmental effects:** Unknown.

## Herbicides

### **Clethodim (Select)**

**Effects on human health:** Little is known about this pesticide. It is rated as having a moderate acute toxicity to humans,<sup>150</sup> but its long term effects are unknown. For instance, it is unknown whether it is a carcinogen, a developmental or reproductive toxin, or an endocrine disruptor.

**Environmental effects:** Again, little is known. It is listed as a potential groundwater contaminant, and it is known to be somewhat toxic to fish.<sup>151</sup>

### **Diuron (Karmex)**

Initially registered for use in the U.S. in 1967, EPA issued a reregistration eligibility decision for diuron in September of 2003.<sup>152</sup>

**Effects on human health:** Diuron is a known carcinogen because it has caused bladder cancer, kidney cancer, and breast cancer in studies with laboratory animals.<sup>153</sup> In other tests, diuron has caused genetic damage<sup>154</sup>, decreased the production of substances necessary for normal immune system function<sup>155</sup>, and caused reduced birth weights.<sup>156</sup> Reported acute exposure symptoms include eye and skin irritation, nose and throat irritation, headache, shortness of breath, itchy rashes and nausea; also affected is the circulatory system and the blood supply.<sup>157</sup> Diuron has been banned in Angola for health and environmental reasons and it has been cancelled in Sweden because classified as carcinogenic.<sup>158</sup>

Some of the inerts commonly used Diuron compounds are publicly known. Below is a list of some of these publicly-known inerts and the adverse effects on humans they are known to cause.

- **sodium salt of lignosulfonic acid:** prevents sperm from fertilizing eggs<sup>159</sup>
- **ethylene glycol:** causes throat and upper respiratory tract irritation, kidney toxicity, and liver effects, as well as increased incidence of fetal malformations<sup>160</sup>
- **sodium polyphosphate:** causes eye irritation and respiratory irritation, nausea, vomiting, and diarrhea<sup>161</sup>
- **kaolin:** occupational exposure to dust containing kaolin increased lung cancer risk<sup>162</sup>

**Environmental effects:** Diuron is a widespread groundwater contaminant; a United States Geological Survey national study found diuron in 20 percent of the rivers and streams sampled.<sup>163</sup> Germany has stopped using diuron on railroad rights of way because of high levels of groundwater contamination.<sup>164</sup> Water contamination from commercial diuron products containing surfactants and solvents are more polluting than

diuron alone because studies have shown that these inerts increase the mobility of diuron in the soil.<sup>165</sup> Although described as only moderately toxic to fish<sup>166</sup>, the following effects on fish have been documented: behavioral changes<sup>167</sup>, reduced survival of juvenile fish<sup>168</sup>, inhibition of the nervous system<sup>169</sup>, anemia<sup>170</sup>, and reduction in food sources.<sup>171</sup> Diuron is moderately to highly persistent in soils and may increase the susceptibility of some plants to some diseases.<sup>172, 173</sup>

### **Hexazinone (Velpar, Pronone)**

Hexazinone, first registered for use in the U.S. in 1975, and was reregistered by the EPA in September of 1994.<sup>174</sup>

**Effects on human health:** What we know about Hexazinone is sufficient to cause great concern. What we don't know about it should cause us more, since Hexazinone is a widely used blueberry herbicide. "Hexazinone generally is of relatively low acute toxicity but is a severe eye irritant."<sup>175</sup> Data collected regarding the chemical's cancer-causing properties are too ambiguous to tell whether it's a carcinogen or not.<sup>176</sup>

**Environmental effects:** Hexazinone is persistent and mobile in soil and water; for this reason, EPA has said, "hexazinone use is likely to have a significant impact on groundwater quality."<sup>177</sup> Hexazinone is a known contaminant of groundwater in Maine;<sup>178</sup> because of similar groundwater contamination problems, it has been banned in Denmark<sup>179</sup> and Norway for nearly a decade.<sup>180</sup> Slovenia also banned it in 1999 for a broader array of adverse effects on human health and the environment.<sup>181</sup>

In 1994, the Maine Board of Pesticides Control conducted a statewide groundwater study and found that significant numbers of private wells in blueberry growing areas had hexazinone detections; simultaneously, a citizen petition drive got underway to cancel the registration for hexazinone.<sup>182</sup> The Board of Pesticide Control nevertheless continued to allow registration of hexazinone, though it developed a "Hexazinone State Management Plan for the Protection of Groundwater," which was adopted by the state in 1996, requiring continued assessment of private wells on a four year basis.<sup>183</sup> Hexazinone now is a restricted-use pesticide in the state;<sup>184</sup> however, it is still widely used on blueberry fields even though it is routinely detected in groundwater and streams in blueberry areas.<sup>185</sup>

### **Glyphosate (Roundup, Touchdown)**

Glyphosate, reregistered for use in the U.S. in September of 1993,<sup>186</sup> is available over the counter, making it one of the most widely used and well-known pesticides on the market. Glyphosate is the second most commonly used active ingredient in conventional pesticide in the U.S., and the most commonly used in pesticides in agriculture.<sup>187</sup> Glyphosate herbicides are marketed as benign, yet in the state of California in 2003, five definite illnesses and five possible illnesses were linked to Glyphosate.<sup>188</sup> The synergistic effect between Glyphosate and certain inert ingredients found in commercial pesticides render them even more toxic. Roundup, containing Glyphosate and the surfactant polyoxyethyleneamine (POEA), is about three times more acutely toxic than Glyphosate itself.<sup>189</sup>

**Effects on human health:** Symptoms of acute exposure include eye and skin irritation, nausea, headache, numbness, elevated blood pressure, and heart

palpitations.<sup>190</sup> Exposure also has been linked to the cancer, non-Hodgkin's lymphoma<sup>191</sup> and an increased risk of miscarriages, premature birth.<sup>192</sup> Glyphosate exposure has also been linked to a number of reproductive problems in humans.<sup>104</sup>

Some of the inert ingredients commonly used in glyphosate compounds are publicly known. Below is a list of some of these publicly-known surfactants and their adverse effects on humans:

- **potassium hydroxide:** causes irreversible eye injury, deep skin ulcers, severe digestive tract burns and respiratory tract irritation,<sup>193</sup>
- **sodium sulfite:** may cause eye and skin irritation, vomiting and diarrhea<sup>194</sup>
- **sorbic acid:** may cause severe skin irritation, nausea, vomiting, chemical pneumonitis, and sore throat<sup>195</sup>
- **isopropylamine salt of glyphosate:** extremely destructive to mucus membrane tissue, symptoms of exposure include wheezing, laryngitis, headache, and nausea<sup>196</sup> (technically, isopropylamine is not an inert ingredient; I recommend deleting this)
- **ammonium sulfate:** causes eye irritation, nausea, diarrhea<sup>197</sup>
- **benzisothiazolone:** causes eczema, skin irritation,<sup>198</sup> in some people a light-induced allergic reaction<sup>199</sup>
- **3-Iodo-2-propynyl butyl carbamate:** severely irritating to eyes and increases incidence of miscarriages in laboratory tests<sup>200</sup>
- **isobutane:** causes nausea, nervous system depression, difficulty breathing, is a severe fire hazard<sup>201</sup>
- **methyl pyrrolidinone:** causes severe eye irritation,<sup>202</sup> has caused fetal loss and reduced fetal weights in lab animals<sup>203</sup>
- **pelargonic acid:** causes severe eye and skin irritation and may cause respiratory tract irritation<sup>204</sup>

**Environmental effects:** Glyphosate is extremely persistent in the environment. Aerial drift of this pesticide is a significant concern because of its persistent and widespread use.<sup>205</sup> Glyphosate is a broad spectrum herbicide, meaning that most plant species are affected when sprayed. These effects may include harm to endangered plant species<sup>206</sup>, reduced seed quality<sup>207</sup>, reduced ability to fix nitrogen<sup>208</sup>, increased susceptibility to disease<sup>209</sup>, and harm to beneficial fungi.<sup>210</sup> Widespread glyphosate use may be detrimental to many beneficial insects<sup>211</sup>, birds<sup>212</sup>, and small animal populations.<sup>213</sup> Glyphosate products are also acutely toxic to many fish.<sup>214</sup>

The EPA noted that “there have been a number of reported incidents of spray drift damage to non-target crops.”<sup>215</sup> In 2001, a broccoli farmer in Caribou, Maine applied glyphosate to his crop and drift from the application prompted complaints by 5 neighbors that the herbicide had destroyed a horse pasture, a potato field, three vegetable gardens, many trees and a berry patch.<sup>216</sup>

### **Sethoxydim (Poast)**

Sethoxydim is scheduled for reregistration assessment in January of 2006.<sup>217</sup>

**Effects on human health:** Sethoxydim is only slightly acutely toxic to humans.<sup>218</sup> It is unknown whether sethoxidim is a carcinogen, an endocrine disruptor, or a reproductive toxin.

**Environmental effects:** Sethoxidim is a potential groundwater contaminant.<sup>219</sup>

### **Terbacil (Sinbar)**

Terbacil was first registered for use in the U.S. in 1966 and was reregistered in 1998.<sup>220</sup>

**Effects on human health:** Terbacil is a known developmental toxin to humans and may be an endocrine disruptor.<sup>221</sup>

**Environmental effects:** EPA's reregistration decision reports that terbacil is likely to be a groundwater and surface water contaminant because it is persistent and mobile in terrestrial environments.<sup>222</sup> It was banned in Sweden due to adverse environmental effects.<sup>223</sup>

## **Insecticides**

### **Carbaryl (Sevin)**

Carbaryl was first registered in 1959 for use on cotton; in 2002-2003 EPA assessed it for reregistration.<sup>224</sup> The EPA granted carbaryl reregistration eligibility, as it does many pesticides, on a provisional basis, as long as registrants complied with the dictates of the Interim Reregistration Eligibility Decision (IRED), including risk mitigation measures such as lowering some tolerances, canceling some uses, and requiring application methods that mitigate risks to workers and homeowners.<sup>225</sup> Carbaryl has been banned in Austria, Germany, Sweden, and Angola because of the dangers it poses to human health and the environment.<sup>226</sup> (Note: the final decision regarding Carbaryl's reregistration is still being evaluated by the EPA; the comment period ended May 25, 2005).

**Effects on human health:** Carbaryl is a carbamate pesticide that operates by inhibiting cholinesterase and disrupting nerve impulses.<sup>227</sup> It has a number of other adverse human health effects as well. It is classified "likely to be carcinogenic to humans" by the EPA.<sup>228</sup> Symptoms of acute exposure to carbaryl include blurred vision, nausea, headache, salivation, breathing difficulty and muscle twitching.<sup>229</sup> Long term adverse effects include liver and kidney toxicity<sup>230</sup>, damage to ovaries and testes<sup>231, 232</sup> and behavioral problems in animals.<sup>233</sup> Additionally, carbaryl interferes with normal immune system function in animals, affects reproduction, and may cause genetic damage.<sup>234</sup>

**Environmental effects:** EPA expresses concern for and requires mitigation of risks posed to birds by chronic exposure to carbaryl.<sup>235</sup> It also expressed concern for acute and chronic risks to mammals.<sup>236</sup> Carbaryl additionally has a high toxicity to insects, including honeybees, and poses risks to freshwater fish and amphibians.<sup>237</sup> Synergistic reactions with other pesticides including 2,4-D, rotenone, and pentachlorophenol have been documented in trout.<sup>238</sup>

### **Diazinon**

First registered in 1956, diazinon is a dangerous pesticide because a variety of chemicals interact synergistically with it; these include many other pesticides, including those used on blueberries, such as captan and carbaryl.<sup>239, 240</sup> If a diazinon-containing product makes contact with water, some of the product will break down into two extremely potent chemicals, one of which is 14,000 times more toxic than diazinon itself.<sup>241</sup> All indoor and residential use registrations were cancelled and retail sales ended in December of 2002, and all outdoor residential uses must be cancelled and sales end by the end of 2004.<sup>242</sup> In May of 2004, the EPA issued its Interim Reregistration Eligibility Decision (IREED) for diazinon, which required additional mitigation measures to lessen diazinon's risks to agricultural workers and wildlife.<sup>243</sup> These measures include a ban on aerial spray of the chemical on almost all crops, limiting applications to one per growing season, cancellation of some crop uses, and required application controls.<sup>244</sup>

**Effects on human health:** Though classified “not likely” to be a carcinogen by EPA, diazinon exposure has been associated with an increased risk of brain cancer in children and non-Hodgkin's lymphoma in farmers.<sup>245</sup> Animal testing also has demonstrated that the insecticide can cause a variety of reproductive problems, including damage to the developing nervous system, delays in sexual development, stillbirths, and birth defects.<sup>246</sup> Diazinon is highly toxic to the nervous system and can cause headache, nausea, dizziness, tearing, sweating, blurred vision, and memory problems in adults, as well as seizures and inflammation of the pancreas.<sup>247</sup> Between 1985-1992, diazinon was responsible for 23 percent of reported insecticide poisonings; nearly half of those reported poisonings involved children under 6.<sup>248</sup>

Some of the inert ingredients commonly used in diazinon compounds and their adverse effects on humans are publicly known:

- **benzisothiazolin-3-one:** a preservative that has caused allergic skin reactions<sup>249</sup>
- **calcium silicate:** causes genetic damage<sup>250</sup>
- **cumene:** eye and skin irritant that depresses the central nervous<sup>251</sup>
- **diethylenetriamin:** potent skin irritant, can cause eye irritations, asthmatic breathing, and nausea, as well as possible genetic damage<sup>252</sup>
- **ethylbenzene:** can cause severe lung injury if inhaled<sup>253</sup>
- **isobutene:** depresses the central nervous system, also extremely flammable and can be an explosion hazard<sup>254</sup>
- **polyvinyl alcohol:** causes anemia<sup>255</sup>
- **propane:** flammable, extreme explosion hazard<sup>256</sup>
- **silica:** carcinogenic to humans, also causes emphysema and obstructive airway disease<sup>257</sup>
- **sodium sulfite:** can cause eye and skin irritation, vomiting and diarrhea<sup>258</sup>
- **1,2,4-Trimethylbenzene:** damages the central nervous system and irritates eyes, skin and upper respiratory tract<sup>259</sup>
- **xylenes:** depresses central nervous system, causes eye and skin irritation, headaches, nausea, and confusion, also has caused kidney damage and birth defects in lab tests.<sup>260</sup>

**Environmental effects:** Diazinon is notorious for being highly toxic to birds and according to the EPA has caused widespread and repeated mortality, also reducing the number and survival of eggs and nestlings.<sup>261</sup> These hazards to birds led to the cancellation of diazinon in 1988 for use on golf courses, where bird kills were frequent.<sup>262</sup> It is also highly toxic to many kinds of fish. In a national US Geological Survey study,



diazinon was the most frequently detected insecticide in urban and agricultural watersheds, contaminating numerous rivers and streams.<sup>263</sup> It is often found in wastewater treatment plant effluent because diazinon is not removed from wastewater by the standard techniques used at wastewater treatment plants.<sup>264</sup> Diazinon is also a frequent air contaminant that has been known to travel by air 25 km from application site—in 1998 USGS compiled state and national air monitoring studies to conclude that nearly 90 percent of samples were contaminated with diazinon, making it the 5<sup>th</sup> most frequently detected pesticide in air.<sup>265</sup> Diazinon is also highly toxic to bees, frogs, and earthworms, and is very highly toxic to aquatic insects and crustaceans, and, unusual for an insecticide, diazinon can also reduce plant growth and cause genetic damage in plants.<sup>266</sup> Because of many of these environmental repercussions, Denmark banned the use of diazinon in 1997.<sup>267</sup>

## ■ Appendix C: Summaries of Board of Pesticides Control Drift Studies<sup>268</sup>

**1999** – A water sample from each of 13 sites was collected in July within 24 hours of aerial application of insecticides to the blueberry crops. Only hexazinone and terbacil were detected, two products that were not aerially applied. Two samples were collected on the main stem of the Narraguagus River, and three samples were collected from tributaries to the Narraguagus River. Three samples were collected from the main stem of the Pleasant River, and five samples were from tributaries to the Pleasant River.

**2000** - Five sites in the Narraguagus River watershed and four sites in the Pleasant River watershed were assessed for the occurrence of off-target phosmet using a combination of drift cards and water samples. Effort was given to working with spray coordinators at Jasper Wyman and Sons, Inc. and Cherryfield Foods, Inc. to better select sites based on proximity to specific fields being treated with pesticides. Phosmet was detected in water samples at three sites ranging in concentration from 0.08 to 0.52 ppb. Phosmet was found on drift cards at four sites ranging in concentration from 0.675ug to 21.978ug. Four sites of the nine sites for 2000 showed positive detections of phosmet either in water or on drift cards. Hexazinone in water samples was the only other pesticide detected.

**2001** – BPC continued to work with spray coordinators at Jasper Wyman and Sons, Inc. and Cherryfield Foods, Inc. In 2001, an Isco auto sampler was used two sites to automatically grab samples over an interval of time. Three sites in the Narraguagus River watershed were sampled for propiconazole and later in the summer for phosmet, and three sites in the Pleasant River watershed were sampled for chlorothalonil (trade name Bravo) and later in the summer for phosmet. Propiconazole was detected on drift cards, but not in water, at three of three sites where it was applied. Chlorothalonil was detected in water at three of three sites where it was applied, and two of those sites also had a positive detection on a drift card. Overall, phosmet was found in water at two of seven sites and on drift cards at three of seven sites. Phosmet was found in water or on drift cards at five of seven sites. Hexazinone in water samples was the only other pesticide detected.

**2002** – Not as many samples were collected because of BPC staffing changes. The few samples that were analyzed show phosmet in three water samples at Ingersol Stream Eastern Branch (a tributary of the Pleasant River) ranging in concentration from 0.199 to 0.815 ppb. All three of these samples were taken on the morning of 7/21/02. Two drift cards from the same site were non detect and one water sample from the Pleasant River was non detect.

**2003** – The BPC worked with Jasper Wyman and Sons, Inc. in order to determine whether aerially applied pesticides land directly in surface waters. On several occasions, the BPC contacted Wyman personnel to learn when and where aerial applications of pesticides would take place, and monitoring equipment was placed in and next to surface water bodies. The results from these studies showed that aerial spraying by Wyman resulted in discharges to several navigable waters. Phosmet and Propiconazole, among others, were detected in the Great Falls Branch, the Crotch Camp Brook, and the Narraguagus River.

## ■ Appendix D: What to Do if You are a Victim of Pesticide Drift

If you know or think you have been sprayed, here are some immediate ways of coping with the situation and taking care of yourself.<sup>269</sup> Immediately after the incident, take care of your personal health. Wash yourself. Remove and save contaminated clothing and other contaminated objects as evidence.

Be aware that there is a wide range of pesticide poisoning symptoms, some that may not surface for some time. To be safe, have a medical examination right away. A clear diagnosis of pesticide poisoning will be very helpful if you intend to take legal action in the future. If possible, bring the label of what was sprayed to the doctor as well as a list of symptoms, including their severity and occurrence. The EPA has published a resource for doctors treating and diagnosing pesticide poisonings.<sup>270</sup>

Other important steps to take include:

- Report the incident to your state department of agriculture (in Maine, the Board of Pesticides Control can be reached at 207-287-2731). If calling, follow up with a letter describing the incident and keep copies of all correspondence. If state officials are unwilling to document your incident (by collecting and analyzing samples of soil, vegetation, or personal items for residues) consider having samples analyzed by a private laboratory.
- If possible, find out what was sprayed then get a copy of the label (the pesticide user should have this, or contact the manufacturer). Try to determine based on the label if a violation has occurred. Any use that is inconsistent with the label is a violation of the law.
- Photograph or videotape anything you can that is related to the incident. Attention to detail is essential. Note who took the photos, where they were taken, the date and time of day. If fortunate enough to have advance warning of a spraying, take “before” shots (be sure to capture “who”—vehicles, logos, etc., “what”—equipment, products, labels, and warnings, “how”—action shots in order to capture the fog or pesticide haze, and “where”—highlighting your property line, landmarks, street signs, etc.)<sup>271</sup>
- Get competent, experienced legal help. For an expert referral, contact Toxics Action Center at 207-871-1810.
- Talk to your neighbor. Reducing drift problems is in everyone’s best interest, and a pesticide-using neighbor will likely realize that drift adds up to wasted money. If drift is hitting your land, it is not hitting its target and your neighbor may be very interested to know that. Negotiate with your neighbor about ceasing or drastically reducing his amount of pesticide use. Discuss alternative methods of application, setting up buffer zones between your property and his, and giving you advance notice of planned spraying.
- Promote pesticide alternatives. The only way to do away with drift problems is to adopt widespread sustainable, non-chemical alternatives to pest control practices.

## ■ Appendix E: Resources

### Maine

#### Federal Aviation Administration

Flight Standard District Office – 05  
2 Al McKay Avenue  
Portland, ME 04102  
Phone: 207-780-3263  
Fax: 207-780 3296

#### Maine Board of Pesticides Control

28 State House Station  
Route 9, AMHI Campus, Deering Bldg.,  
Rm. 333  
Augusta, ME 04333-0028  
Phone: 207-287-2731  
Fax: 207-287-7548  
<http://www.state.me.us/agriculture/pesticides/>

#### Maine Drinking Water Program

11 State House Station  
161 Capital Street  
Augusta, ME 04333  
Phone: 207-287-2070  
Fax: 207-287-4172  
<http://www.state.me.us/dhs/eng/water>

#### Maine Organic Farmers and Gardeners Association

PO Box 170  
Unity, Me 04988  
Phone: 207-568-4142  
Fax: 207-568-4141  
Email: [mofga@mofga.org](mailto:mofga@mofga.org)

#### Toxics Action Center

39 Exchange Street, Suite 301  
Portland, ME 04101  
Phone: (207) 871-1810  
<http://www.toxicsaction.org>

#### Wild Blueberry Extension Office, University of Maine Cooperative Extension

5722 Deering Hall  
Orono, ME 04469-5722  
Phone: (207) 581-2923 or 1-800-897-0757  
(in Maine)  
Fax: (207) 581-2941  
<http://wildblueberries.maine.edu/>

### National

#### Beyond Pesticides

701 E Street SE #200  
Washington DC 20003  
Phone: (202) 543-5450  
Fax: (202) 543-4791  
Email: [info@beyondpesticides.org](mailto:info@beyondpesticides.org)  
<http://www.beyondpesticides.org>

#### Environmental Protection Agency

Office of Pesticide Programs  
USEPA Headquarters  
Ariel Rios Building (7501C)  
1200 Pennsylvania Avenue, N.W.  
Washington, DC 20460

#### National Pesticide Information Network

1-800-858-7378

#### Northwest Coalition for Alternatives to Pesticides

Publishers of *Journal of Pesticide Reform*  
PO Box 1393  
Eugene, OR 97440  
Phone: (541) 344-5044  
<http://www.pesticide.org/>

#### Pesticide Action Network of North America (PANNA)

116 New Montgomery Street, Ste 81  
San Francisco, CA 94105  
Phone: (415) 541-9140  
<http://www.panna.org>

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- <sup>2</sup> University of Maine Cooperative Extension. "Wild Blueberry Culture in Maine" (Fact Sheet 220)
- <sup>3</sup> US Department of Agriculture Economic Research Service "Maine State Fact Sheet" (2005). Available on the web at <http://www.ers.usda.gov/statefacts/ME.htm>
- <sup>4</sup> US Department of Agriculture Economic Research Service "Maine State Fact Sheet" (2005). Available on the web at <http://www.ers.usda.gov/statefacts/ME.htm>
- Blueberries take two years to produce fruit so only half the crop accounts for the yield of a given year.
- <sup>5</sup> "The Wild Blueberries of Maine Facts and Figures," Wild Blueberry Commission of Maine fact sheet.
- <sup>6</sup> University of Maine Cooperative Extension Blueberry Specialist and Professor of Horticulture, Dave Yarborough.
- <sup>7</sup> Ibid.
- <sup>8</sup> Ibid.
- <sup>9</sup> Ibid.
- <sup>10</sup> *Nate Pease, et al v. Jasper Wyman & Son, Inc., et al*. Civil Action No. 00-015 (Knox County, Maine).
- <sup>11</sup> University of Maine Cooperative Extension, "Wild Blueberry Culture in Maine" (Fact Sheet 220)
- <sup>12</sup> University of Maine Cooperative Extension Fact Sheet 219 "2004 Disease Control Guide for Wild Blueberries."
- <sup>13</sup> University of Maine Cooperative Extension Blueberry Specialist, David Yarborough
- <sup>14</sup> University of Maine Cooperative Extension Fact Sheet 236 "Weed Management in Wild Blueberry Fields."
- <sup>15</sup> University of Maine Cooperative Extension Blueberry Specialist, David Yarborough
- <sup>16</sup> Ibid.
- <sup>17</sup> Ibid.
- <sup>18</sup> University of Maine Cooperative Extension Fact Sheet 236 "Weed Management in Wild Blueberry Fields." Though pre-emergence herbicides are considered an integral part of an effective IPM program, this may be one area in which blueberry growers could cut back on their use of pesticides. The very nature of preventative, pre-emergence herbicide use seems inconsistent with a policy of scouting out pest problems before determining the appropriate, least-toxic solution.
- <sup>19</sup> University of Maine Cooperative Extension Fact Sheet 236 "Weed Management in Wild Blueberry Fields."
- <sup>20</sup> Ibid.
- <sup>21</sup> Ibid.
- <sup>22</sup> Ibid.
- <sup>23</sup> Fact Sheet 209 "2004 Insect Control Guide for Wild Blueberries."
- <sup>24</sup> Ibid.
- <sup>25</sup> Ibid.
- <sup>26</sup> Ibid. Specifically, see chart entitled "Chemical Insect Control for Wild Blueberries," listing specific chemical formulations and their use requirements.
- <sup>27</sup> The term "pesticide" encompasses a number of pest-control substances including insecticides (substances that kill insects), fungicides (substances that kill fungi and molds), herbicides (substances that kill unwanted plants and weeds), rodenticides (substances that kill rodent pests), and antimicrobials (substances that kill viruses and bacteria).
- <sup>28</sup> 22 M.R.S.A 1471 (G) (2) (2003)
- <sup>29</sup> IPM, requiring least toxic methods of pest control to be utilized first, is recommended but not required of blueberry growers in the state.
- <sup>30</sup> Maine Board of Pesticides Control 2001 and 2002 Crop Usage Surveys.
- <sup>31</sup> Donaldson, D. et al. *2000-2001 Pesticide Market Estimates*, U.S. Environmental Protection Agency (May 2004). Available on the web at: [http://www.epa.gov/oppbead1/pestsales/01pestsales/table\\_of\\_contents2001.html](http://www.epa.gov/oppbead1/pestsales/01pestsales/table_of_contents2001.html)
- This data represents the most recent data regarding market estimates through the EPA. The data for 2002-2003 is not to be released until the Fall of 2005.
- <sup>32</sup> The BPC used to compile sales data every five years, but stopped the practice after 2000 due to staff constraints. Moreover the sales report from 2000 was not comprehensive enough to adequately assess the market, rendering the 1995 report more relevant for market estimates. The author of the 2000 report, Julie Chizmas, identified the lack of a law requiring farmers to report their pesticide use annually necessary to generate a more meaningful picture of pesticide sales and use in the state. This is required by the State of California, but not any other.
- <sup>33</sup> Maine Board of Pesticides Control 1995 Agricultural Pesticide Sales Data (listing total sales by pounds of active ingredient).

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<sup>34</sup> <http://www.pesticideinfo.org/Index.html>. This webpage allows one to insert tradenames and active ingredients into a search for health and environmental information. Much of this information is taken from labels and material safety data sheets.

<sup>35</sup> Ibid.

<sup>36</sup> Ibid.

<sup>37</sup> "Pesticides and their toxicity," Maine Farm Safety Program, Bulletin #2359, March 2003, <<http://www.umext.maine.edu/onlinepubs/htmpubs/farmseries/2359.htm>> (7 March 2005).

<sup>38</sup> "Pesticides and their toxicity," Maine Farm Safety Program, Bulletin #2359, March 2003, <<http://www.umext.maine.edu/onlinepubs/htmpubs/farmseries/2359.htm>> (7 March 2005).

<sup>39</sup> Environmental Health Association of Nova Scotia. "Guide to Less Toxic Products." 2004, <<http://www.lesstoxicguide.ca/index.asp?fetch=hazards>> (24 February 2005).

<sup>40</sup> Environmental Health Association of Nova Scotia. "Guide to Less Toxic Products." 2004, <<http://www.lesstoxicguide.ca/index.asp?fetch=hazards>> (24 February 2005).

<sup>41</sup> Aquatic toxicity information can be found U.S. EPA AQUIRE database which currently contains close to 215,000 study results.

<sup>42</sup> University of Maine Cooperative Extension Blueberry Specialist, David Yarborough

<sup>43</sup> Ibid.

<sup>44</sup> Ibid.

<sup>45</sup> University of Maine Pesticide Education Manual: A Guide to Proper Use and Handling at 117 (2003 revision).

<sup>46</sup> Ibid at 118.

<sup>47</sup> Ibid at 118.

<sup>48</sup> Ibid at 118.

<sup>49</sup> See information on individual blueberry pesticides for more detailed information about the health effects of exposure.

<sup>50</sup> University of Maine Cooperative Extension fact sheet #303 ("Minimizing Off Target Deposition of Pesticide Applications") April, 2002.

<sup>51</sup> National Research Council. Board on Agriculture. Committee on Long-Range Soil and Water Conservation. 1993. Soil and water quality: An agenda for agriculture. Washington, D.C.: National Academy Press. Pp. 323-324.

<sup>52</sup> U.S. EPA "Spray Drift of Pesticides." December, 1999.

<http://www.epa.gov/pesticides/factsheets/spraydrift.htm#2>

<sup>53</sup> University of Maine Cooperative Extension Fact Sheet 303 "Minimizing Off-Target Deposition of Pesticide Applications" April, 2002.

<sup>54</sup> Ibid.

<sup>55</sup> see below for more information regarding the human health effects of pesticides used in blueberry production.

<sup>56</sup> Board of Pesticides Control drift studies.

<sup>57</sup> Glantz, C.S., M.N. Schwartz, and P.J. Perrault. 1989. An assessment of the meteorological conditions associated with herbicide drift in the Horse Heaven hills/Badger Canyon/Tri-Cities Area during the period from August 6 through 11, 1988.

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<sup>58</sup> Information regarding drift complaints from Henry Jennings, Chief of Compliance at the BPC.

<sup>59</sup> Ibid.

<sup>60</sup> Ibid.

<sup>61</sup> Ecobichon DJ. Toxic effects of pesticides. In: Klaassen CD, Doull J, Eds. Casarett and Doull's toxicology, 5<sup>th</sup> Ed., NY; 1996, pp 643-689.

<sup>62</sup> Waddell et al. Agricultural use of organophosphate pesticides and the risk of non-Hodgkin's lymphoma among male farmers. *Cancer Causes Control* 2001; 12:509-517.

<sup>63</sup> *Annals of Epidemiology* (vol. 12, no. 6, pages 389-394). "Pesticide Poisoning and Depressive Symptoms Among Farm Residents"

<sup>64</sup> Organophosphate pesticides are nerve poisons, which affect humans in much the same way as they affect the target insects; the EPA admits that some are "very poisonous," as evidenced by their use in World War II as nerve agents. <http://www.epa.gov/pesticides/about/types.htm>.

<sup>65</sup> See <http://www.epa.gov/pesticides/factsheets/kidpesticide.htm> for more information on human health risks and what the EPA is doing to protect children from exposure to organophosphate pesticides.

<sup>66</sup> Board of Pesticides Control complaints files.

<sup>67</sup> Henry Jennings, BPC Chief of Compliance. See below for more information on residue standards.

<sup>68</sup> Henry Jennings, BPC Chief of Compliance.

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- <sup>69</sup> Jackson, H., Board of Pesticides Control Water Quality Specialist. "2003 Drift Study of Two Aerially Applied Blueberry Pesticides" December, 2003.
- <sup>70</sup> Ibid.
- <sup>71</sup> Ibid. Little data exists from 2002 due to staffing changes. See appendix for summaries of 1999, 2000, 2001, and 2002 BPC studies.
- <sup>72</sup> "Inert Ingredients in Pesticide Products." *U.S. Environmental Protection Agency*, <<http://www.epa.gov/opprdo01/inerts/>> (1 December 2004).
- <sup>73</sup> "The Secret Hazards of Pesticides: Inert Ingredients." Attorney General of New York, *Environmental Protection Bureau*, February 1996. <<http://www.oag.state.ny.us/environment/inerts96html>> (2 December 2004).
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- <sup>78</sup> Jackson writes, "detailed communication with the blueberry growers and/or the spray crew is essential, and although there is a spirit of cooperation, applications did not always occur as anticipated" (7).
- <sup>79</sup> Jackson, H., Board of Pesticides Control Water Quality Specialist. "2003 Drift Study of Two Aerially Applied Blueberry Pesticides" December, 2003
- <sup>80</sup> Ibid at 8.
- <sup>81</sup> Yarborough, D. and Jemison, J. 1997. "Developing Best Management Practices to Reduce Hexazinone in Ground Water in Wild Blueberry Fields." *Acta Horticulturae* 446: 303-307.
- <sup>82</sup> The University Cooperative Extension and the Maine Board of Pesticides Control both study groundwater for hexazinone contamination. The BPC's 1999 Groundwater Study is the most recent. These statewide studies are conducted by the BPC every five to seven years. The Cooperative Extension does annual studies.
- <sup>83</sup> EPA's Office of Drinking Water issued Health Advisory for hexazinone in August of 1988. EPA set the limit at 200 ppb for an adult. (United States EPA, "Hexazinone Reregistration Eligibility Decision" (1994).) According to tests conducted by the Cooperative Extension, hexazinone detections in Maine ranged from n/d to 10.9 ppb in 2003, similar to detection levels in previous years. These levels vary from well to well based on location and timing of sampling. Cooperative Extension takes monthly samples at a variety of drilled wells, test wells, and surface water locations from May to October annually.
- <sup>84</sup> see section entitled "Blueberry Pesticide Facts" below for more information about the known dangers of hexazinone.
- <sup>85</sup> These studies available from Cooperative Extension by contacting David Yarborough @ 1-800-897-0757.
- <sup>86</sup> Yarborough water sample spreadsheet, May and June 2004.
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- <sup>92</sup> BPC's groundwater studies can be viewed by contacting Heather Jackson, Water Quality Specialist at BPC.
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- <sup>98</sup> 22 M.R.S.A. § 1471-X (2003)
- <sup>99</sup> University of Maine Cooperative Extension Fact Sheets 209 ("2004 Insect Control Guide for Wild Blueberries"), 219 ("2004 Disease Control Guide for Wild Blueberries"), and 239 ("2004 Weed Control Guide for Wild Blueberries").
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- <sup>111</sup> Ibid.
- <sup>112</sup> Phosmet was detected in the BPC's 2003 drift study on both drift cards and in water samples collected by the state in blueberry areas. BPC also found detections in its 2000 and 2001 drift studies. See appendix for more information about these studies.
- <sup>113</sup> U.S. E.P.A. FIFRA Section 18 database at <http://cfpub1.epa.gov/oppref/section18/searchresult.cfm>. State agricultural agencies, when prompted by growers, can request an exemption under section 18 of FIFRA for the short-term (up to one year) use of a pesticide for a particular unregistered use, to deal with a pest problem for which there is currently nothing effective available. The EPA issued Maine a section 18 exemption for the use of fenbuconazole on blueberries in 2004, to be used instead of propiconazole.
- <sup>114</sup> U.S. EPA Toxic Release Inventory (TRI). "Chronic (Non-Cancer) Toxicity Data for Chemicals Listed under Epcra Section 313." August, 1 1995. [http://www.epa.gov/tri/chemical/hazard\\_chronic\\_non-cancer95.pdf](http://www.epa.gov/tri/chemical/hazard_chronic_non-cancer95.pdf)
- <sup>115</sup> Propiconazole was found in groundwater samples taken by David Yarborough from Cooperative Extension in blueberry areas in the summer of 2003.
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- <sup>117</sup> see label for Indar
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