



University of
Massachusetts
Amherst

2023 Pesticide Safety: Groundwater Protection and Zone II

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Pesticides and Ground Water Protection

Hotze Wijnja, Ph.D.

Division of Crop and Pest Services
Massachusetts Department of Agricultural Resources



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Pesticides & Water in the News

USGS
science for a changing world

SCIENCE PRODUCTS NEWS CONNECT ABOUT

Identifying pesticides and their degradates in our groundwater

Study is first national assessment of pesticide degradates of this scope

[Access the Study](#)

Public-supply wells sampled

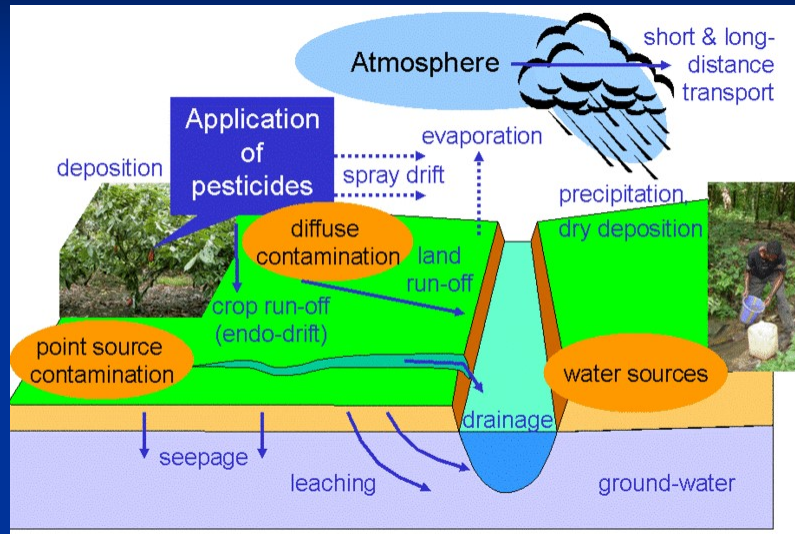
Drinking-water aquifers represented

| Category | Percentage |
|-----------------|------------|
| No detections | 59% |
| Pesticides only | 11% |
| Degradates only | 10% |
| Both | 20% |

1.6% approaching concentrations of potential human-health concern

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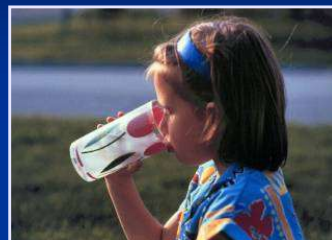
Pesticide Fate



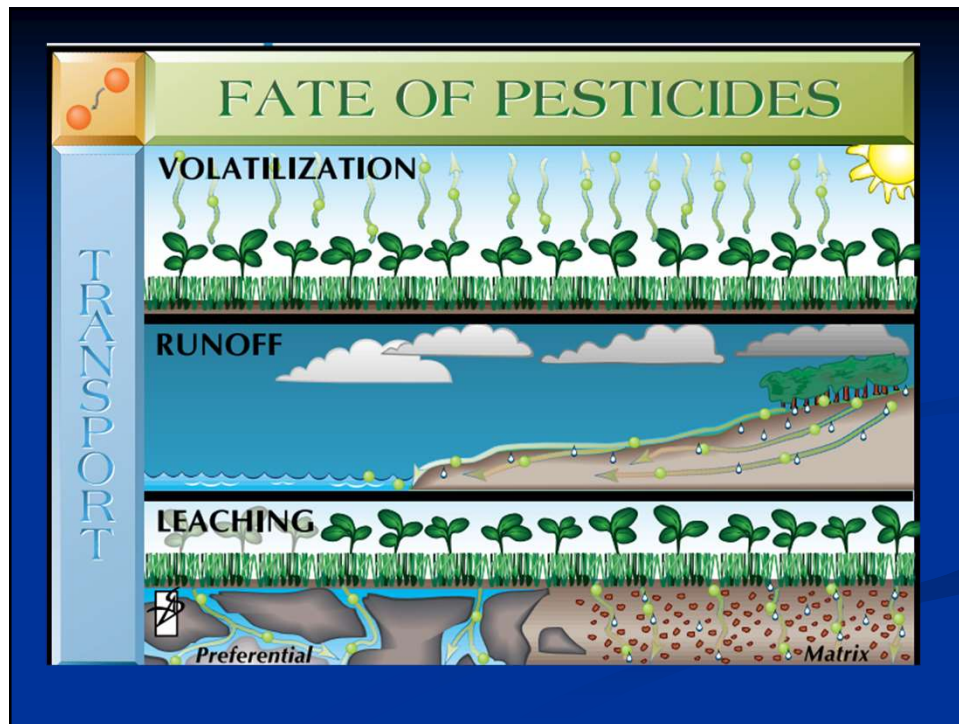
3

Potential Impacts of Pesticides

- Minimize risks:
 - Risk Assessments
 - Regulatory Requirements
 - Education/Outreach
 - Practices to minimize impacts from pesticides



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Pesticide Movement: Leaching

- Water-soluble pesticides more susceptible
- Pesticides with low adsorption affinity are susceptible
- Pesticides that are also persistent are even more susceptible



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Ground Water Exposure Assessments

- Part of Environmental Fate and Exposure Assessments by EPA
- Potential Groundwater Exposure is assessed
 - Water exposure models are used to estimate worst-case scenarios
 - If needed, special leaching studies will be required
 - Drinking water exposure: used dietary assessments
- Groundwater-specific labeling
 - advisories or restrictions relative to rates, soil type, conditions and setbacks

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Label Language addressing Leaching

Environmental Hazards

This pesticide is toxic to marine/estuarine invertebrates. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff may be hazardous to terrestrial and aquatic plants in neighboring areas. Do not contaminate water when disposing of equipment washwaters or rinsate.

Groundwater advisories: This chemical is known to **leach** through soil into groundwater under certain conditions as a result of label use. Use of this chemical in areas where soils are **permeable**, particularly where the **water table is shallow**, may result in groundwater contamination.

Do not use on **coarse soils** classified as sand, which have **less than 1% organic matter**.

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Protect Our Groundwater



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Keep Pesticides Out of Groundwater!

- Use IPM
- Consider the local geology/hydrology
 - Depth of water table?
- Consider soil characteristics:
 - Sandy and/or gravelly?
- Select pesticides carefully
 - Is it susceptible to leaching?
- Follow label directions!

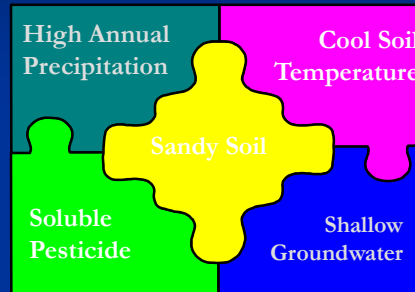


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Select Product after Assessing the Application Site

- Concern for leaching or the site is vulnerable:
 - select a product that poses low potential for leaching

- Little or no concern for leaching:
 - Product selection is broader



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Keep Pesticides Out of Groundwater!!

- Identify vulnerable areas
 - Sandy soils
 - Sinkholes
 - Wells
 - Streams
 - Ponds
 - Shallow groundwater
- Mixing/handling: ensure pesticide or wastes do not contaminate soils



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Keep Pesticides Out of Groundwater!!

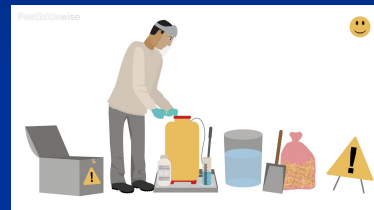
- Calibrate accurately and check for leaks!
- Measure accurately and do not overapply



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Keep Pesticides Out of Groundwater!!

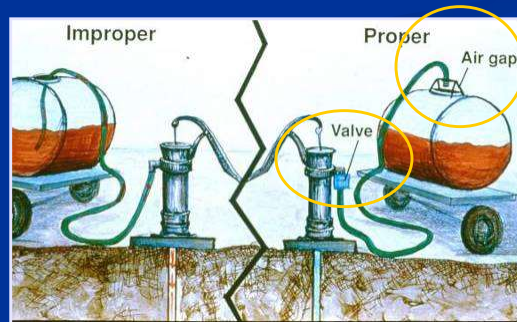
- Mix Location
 - Do not mix and load near water or drains; consider a mix/load pad
 - Don't mix at the same location each time; unless you have a mix/load pad



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Keep Pesticides Out of Groundwater!!

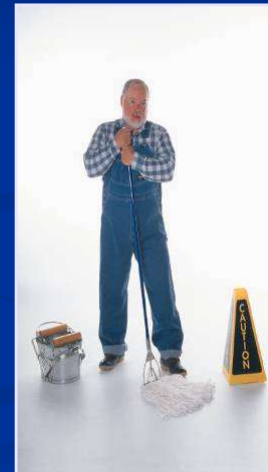
- Air gap: keep the water supply above the level of the mixture
- Install a back-siphon valve (check valve)



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Keep Pesticides Out of Groundwater!!

- Clean up and avoid spills
- Dispose of wastes properly
 - Triple rinse containers; use the rinse water in spray tank
- Store pesticides away from water sources
- Comply with Groundwater Protection Regulations



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Groundwater Protection Program

- Regulation: 333 CMR 12.00 Protection of Groundwater Sources of Public Drinking Water Supplies from Non-Point Source Pesticide Contamination
- Applies to products with active ingredients on Groundwater Protection List
- Ground Water Protection List
 - Active ingredients with potential to cause groundwater contamination
 - Assessment based on leaching potential and toxicological concerns



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MA Groundwater Protection List

Groundwater Protection List

List of pesticide active ingredients that could affect groundwater

The Groundwater Protection List refers to a list of pesticide active ingredients that could potentially impact groundwater due to their chemical characteristics and toxicological profile.

[Search for registered products in Massachusetts](#)

Active Ingredients by Category

| Herbicides | Insecticides | Fungicides |
|---|---|---|
| <ul style="list-style-type: none"> • Acetochlor* • Acifluoren • Alachlor | <ul style="list-style-type: none"> • Aldicarb • Carbofuran • Dinotefuran | <ul style="list-style-type: none"> • Chlorothalonil • Cyflufenamid • Cyproconazole |

CONTACT

Hotze Wijnja

Phone

617-626-1771

Online

Hotze.Wijnja@mass.gov

RELATED

[How do I Comply with Groundwater Protection Regulations](#) →

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MA Groundwater Protection List

Active Ingredients by Category

| Herbicides | Insecticides | Fungicides |
|--|---|---|
| <ul style="list-style-type: none"> • Acetochlor* • Acifluoren • Alachlor • Aldicarb • Atrazine • Bentazon • Bromacil • Cyanazine • Chlorthal-Dimethyl** • Dimethanamid • Diuron • Flufenacet • Fluthiacet-methyl • MCPA • Metolachlor | <ul style="list-style-type: none"> • Aldicarb • Carbofuran • Dinotefuran • Disulfoton • Fenamiphos • Fonofos • Lindane • Methoxyfenozide • PCP • Propoxur • Terbufos • Thiamethoxam | <ul style="list-style-type: none"> • Chlorothalonil • Cyflufenamid • Cyproconazole • Folpet • Kresoxim-Methyl • Triticonazole • Sedaxane |

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Groundwater Protection List Criteria

- Leaching Potential
 - Water solubility greater than 3 ppm, or
 - Organic matter-Water Partitioning less than 1900, or
 - Soil-water partitioning constant less than 20, and
 - Soil half-life greater than 7 days

AND

- Toxicological Concern
 - Maximum contaminant level less than 20 ppb, or
 - Known or probably human carcinogen

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Regulations

- Webpage: <https://www.mass.gov/pesticides-and-water-supply-protection>

LIVING ▾ WORKING ▾ LEARNING ▾ VISITING & EXPLORING ▾ YOUR GOVERNMENT ▾


Pesticides and Water Supply Protection

Find out if a pesticide can be applied in a primary drinking water recharge area

To protect water supply wells from pesticide contamination, the use of certain pesticides is restricted in primary recharge areas. The information on this page allows applicators to determine if restrictions apply and notify the Department about pesticide applications or apply for a Pesticide Management Plan.

OFFERED BY
Massachusetts Department of Agricultural Resources →

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GROUND WATER

Pesticides and Water Supply Protection | Mass.gov

(https://www.mass.gov/pesticides-and-water-supply-protection)

What would you like to do?

Top tasks

How do I Comply with Groundwater Protection Regulations? →

Is Pesticide on the Groundwater Protection List? →

All other tasks


Are you in Compliance with Groundwater Protection Regulations? →

Submit a Pesticide Management Plan →

Notify Use of Pesticide on Groundwater Protection List →




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The diagram on the left shows a cross-section of the ground. At the top, a sun is shining over a landscape with trees and a house. Below the surface, there are layers of soil and rock. A red arrow points down from the surface into the ground, labeled 'GROUND W/ THROUGH'. A blue arrow points up from the ground towards the surface, indicating recharge. A small icon of a person is shown near the surface, and a small icon of a person is shown near the ground level.

- ◆ Are you using a product on the Groundwater Protection List ?
- ◆ Are you in a **regulated** primary recharge area ?
- ◆ How do you ensure that you are in compliance with the regulations ?




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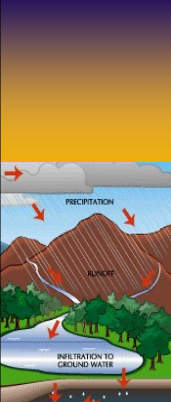
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Groundwater Protection List

- ◆ Pesticides identified as Potential Groundwater Contaminant
 - Leaching potential & toxicological concerns
- ◆ All restricted use products:
 - Only available to licensed professionals
- ◆ If possible, avoid use of listed pesticides in regulated recharge areas (Zone II's)
 - In certain specific situations, use of a product will be allowed



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Primary Recharge Areas

Are you using a product on the Groundwater Protection List ?

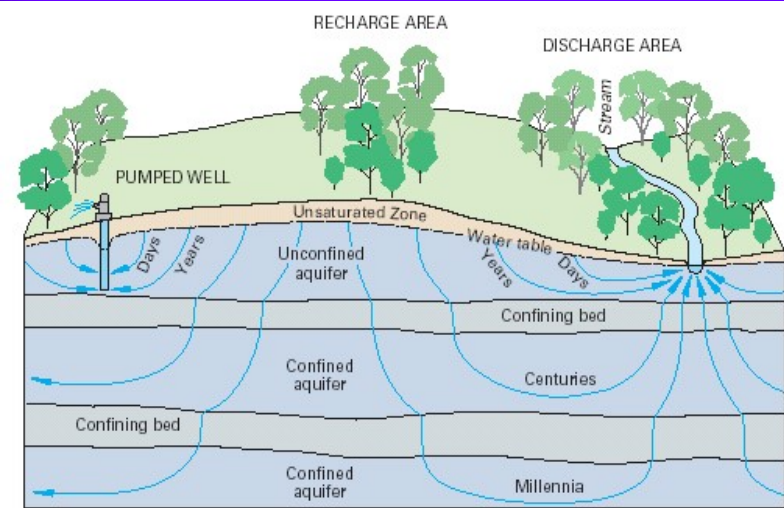
Are you in a regulated Primary Recharge Area?

Are you applying to an area with greater than or less than 50% foliar cover ?



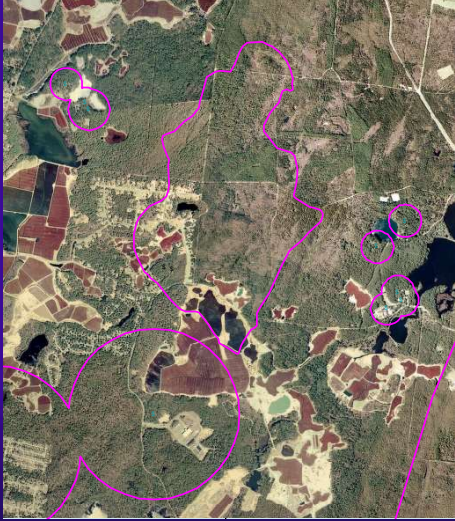
25

What is a primary recharge area ?



Source: United States Geological Survey

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ZONE II

- ◆ 100,000 gpd
- ◆ scientific delineation

IWPA


- ◆ Interim Wellhead Protection Area
- ◆ 0.5 mile radius

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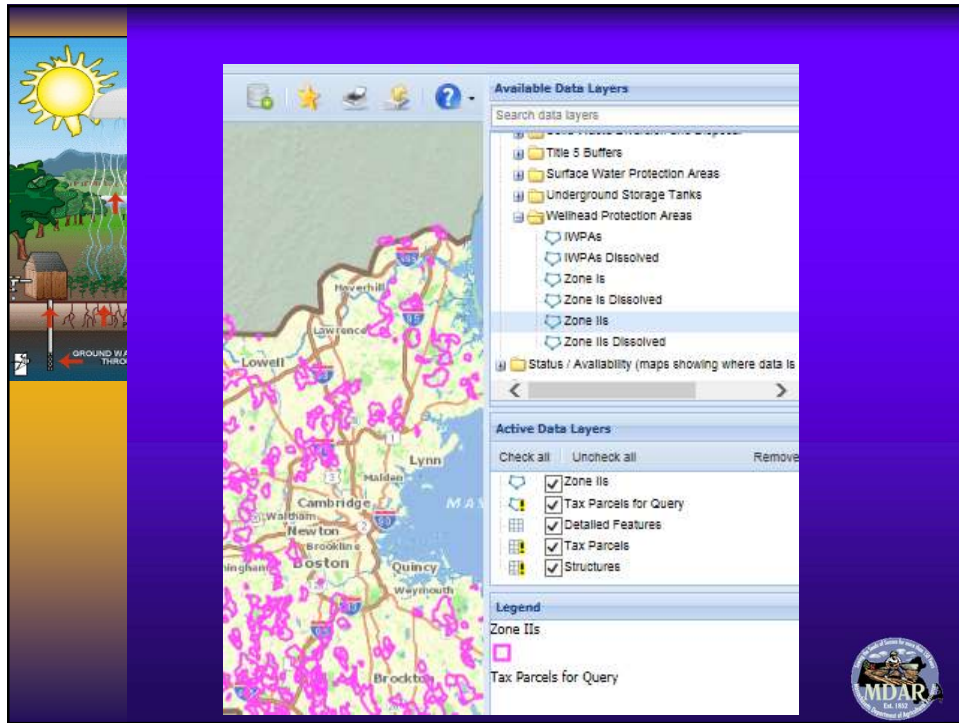


Are you in a Primary Recharge Area?

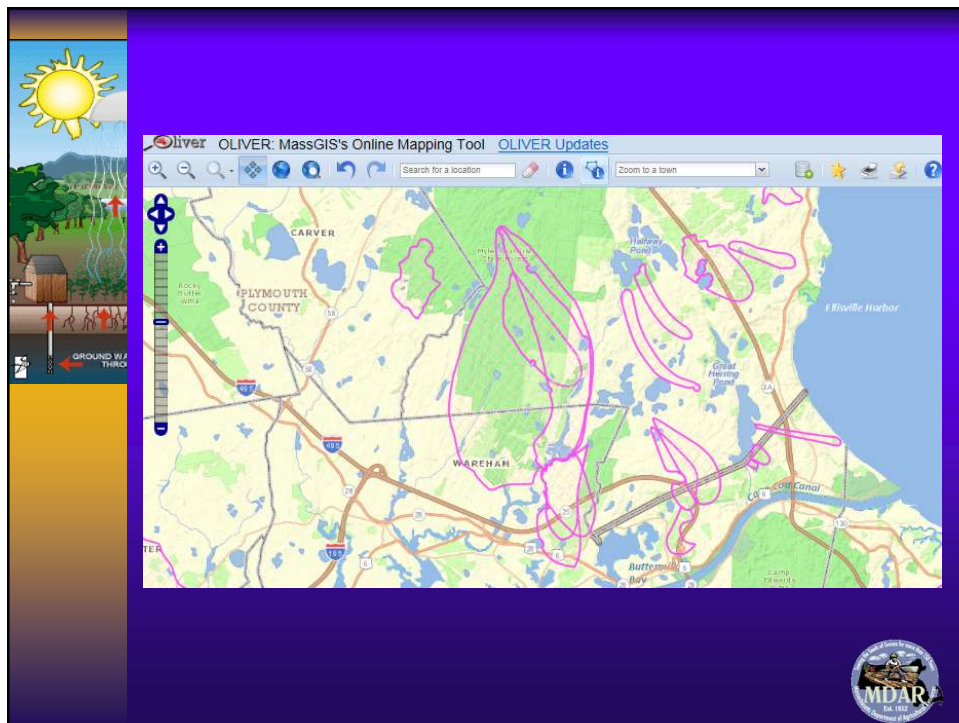
- ◆ **Online Resources**
 - MDAR website: Pesticides and Water Supply Protection
- **Other Resources**
 - DEP Title V maps (Board of Health)
 - DEP SWAP maps (Water Supplier)
 - Regional DEP Offices




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The diagram shows a cross-section of the ground. At the top, a sun is visible. Below it, there are trees and a house. Red arrows indicate precipitation falling on the ground and infiltrating into the soil. A layer of soil is labeled 'GROUND W/ THROUGH'. Below that, a layer of water is labeled 'GROUND WATER'. A red arrow points from the 'GROUND W/ THROUGH' layer down into the 'GROUND WATER' layer, indicating recharge.

Review

- ◆ Are you using a product on the Groundwater Protection List ?
- ◆ Are you in a regulated primary recharge area ?
- ◆ What do you do next ?
 - Contact UMass Extension specialist for no-viable alternative assessment
 - In certain situations, application of listed pesticide may be allowed and MDAR must be notified.



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The diagram shows a landscape with mountains, a river, and trees. Red arrows indicate precipitation falling on the mountains and the ground. Some arrows show runoff into a river, while others show infiltration into the ground. A layer of water is labeled 'INFILTRATION TO GROUND WATER'.

50% Foliar Cover ?

- Are you using a product on the Groundwater Protection List ?
- Are you in a regulated Primary Recharge Area?
- Are you applying to an area with greater than or less than 50% foliar cover ?



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◆ **Application Scenario I:**


- 50% or more foliar cover

◆ **Application Scenario II**

- less than 50% foliar cover or soil applications




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General Requirements

◆ There must be no viable alternative to the use of the product

◆ The applicator must be using an IPM Program from a Department-approved source




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No viable alternative

- ◆ A letter or statement from the appropriate University of Massachusetts agroecology team member stating that:
 - there is no viable alternative to the use of product on the Groundwater Protection List to control the particular pest problem
 - Retain copy of letter with application records



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IPM program from approved source


These include:

- ◆ Use of the current "Cranberry Chart Book" published by the UMass Cranberry Station.
- ◆ UMass Extension generated fact sheets that outline IPM practices specific to the pest problem.
- ◆ IPM Programs specifically developed to meet the requirements of the Groundwater Protection Regulations

Contact UMass Extension Specialist or MDAR



- ◆ NO NEED TO SUBMIT PLAN TO MDAR
 - KEEP FOR RECORDS



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◆ Application Scenario I:

- 50% or more foliar cover:

- Notify the Department
 - Online Notification Form
 - OR
 - Submit Hardcopy by Mail



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Online Notification

◆ MDAR website: Pesticides and Water Supply Protection

Groundwater Protection Program Notification Form

You must notify us when you apply a pesticide product which is listed on the groundwater protection list. Notifications must be made within ten days of the end of the calendar month. Please submit one form per site.

CONTACT

Hotze Wijnja

Phone
617-626-1771

Online

TELL US WHAT YOU THINK

Fields marked with an * are required.

Name*

First Name

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Application Scenario II

- ◆ Less than 50% foliar cover,
- ◆ soil applications,
- ◆ fumigations,
- ◆ injection,
- ◆ soil treatment,
- ◆ soil drench in seed furrow or
- ◆ mixed into the soil
- ◆ Requires a Pesticide Management Plan (PMP)!
 - Requires additional information and date on application, site
 - Review by several state agencies
 - Monitoring of pesticide residues in ground water




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Summary

- ◆ Regulations to protect groundwater used for public drinking water supplies
- ◆ Important for you to understand them
- ◆ Only in certain situations, GWP listed products can be used



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Specific Pesticides

- Zeus XC – Spartan 4F (Sulfentrazone)
 - SLN for control of moss and other susceptible weeds. SLN labels for Spartan/Zeus expires December 31, 2024.
 - Use up existing stock of Zeus XC before end of 2024

- Intrepid (Methoxyfenozide):
 - Alternatives available (Altacor, Confirm, Delegate)
 - In special cases permission may be given for management of black-headed fireworm or Sparganothis fruitworm infestations during bloom. Contact Cranberry Station.



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Specific Pesticides

- Actara (Thiamethoxam) :
 - May be permitted for weevil that are resistant to Avaunt or you are targeting the summer generation.
 - Contact Cranberry Station
- Bravo (Chlorothalonil):
 - Permitted if meeting specific conditions and there are no viable alternatives.
 - Contact Cranberry Station
- Simazine (4L) (Simazine):
 - Alternatives available, cannot be used in Zone II areas.

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Specific Pesticides

- Safari/Scorpion (Dinotefuran):
 - Alternatives are available (Altacor, Avaunt, Delegate, Diazinon).
 - Cannot be used in Zone II's

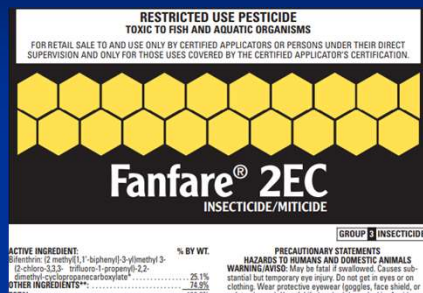
- Kerb SC (Pronamide)
 - Section 18 Emergency Exemption use for dodder control
 - For use in Zone II, contact UMass Cranberry Station



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Specific Pesticides

- Fanfare 2EC (Bifenthrin):
 - Not on MA GWPL
 - Fanfare is recommended for insecticide-resistant cranberry weevil (FIFRA 2EE recommendation)
 - Bifenthrin is typically immobile in soils and does not leach
 - Is fairly persistent in soil



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MDAR Monitoring: Pesticides in Cranberry Bog Systems

- Monitoring for pesticides on Groundwater Protection List
- Targeted monitoring based on Notifications
- 2018: Three bog systems; Sampling of bog ditches



| Pesticide | Highest Detection (ppb) | Human Health Standard (ppb) |
|-----------------|-------------------------|-----------------------------|
| Chlorothalonil | 0.022 | 500 |
| Methoxyfenozide | 3.54 | 600 |
| Thiamethoxam | 0.044 | 77 |

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What is Found in Water Resources

- Monitoring studies to determine the occurrence of pesticides in water resources
- USGS studies



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USGS Study on Pesticides Detected in Groundwater

Pesticides and Pesticide Degradates in Groundwater Used for Public Supply across the United States: Occurrence and Human-Health Context

Laura M. Bexfield*, Kenneth Belitz, Bruce D. Lindsey, Patricia L. Toccalino, and Lisa H. Nowell

Cite this: *Environ. Sci. Technol.* 2021, 55, 1, 362–372

Publication Date: December 14, 2020
<https://doi.org/10.1021/acs.est.0c05793>

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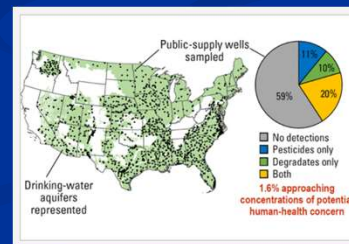
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LEARN ABOUT THESE METRICS

- Atrazine, hexazinone, prometon, tebuthiuron, four atrazine degradates, and one metolachlor degradate were each detected in >5% of wells.
- Although pesticide compounds occurred frequently, concentrations were low



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Take-Home Message

- Addressing the environmental exposure issues:
 - ➡ Important for minimizing impacts to resources, including groundwater and other drinking water resources.
- Applicators/growers role:
 - Selection of methods and products
 - Apply according to label instructions
 - Compliance with applicable regulations
 - Use professional judgement
- Protect human health and environment while keeping sufficient pest control methods and tools available



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Hotze Wijnja, Ph.D.

Environmental Chemist
 Massachusetts Department of Agricultural Resources
 Phone: 617-626-1771
Hotze.Wijnja@mass.gov
www.Mass.gov/AGR



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Poll Session

1. For a bog in Zone II, the product you consider applying contains an active ingredient that is on the Massachusetts Groundwater Protection List. What should you consider as the next step?

1. Reach out to the Regional MassDEP Office for approval
2. Go forward with the application and submit notification to MDAR
3. Reach out to UMass Cranberry Station specialist for an evaluation
4. Check the product label for guidance on the use in a Zone II

2. True/False: Application of **ANY** pesticide product/active ingredient on a site in a Zone II area requires notification to MDAR

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