



# Chlorpyrifos and Agricultural Insecticide Best Management Practices for Water Quality Protection

Minnesota Department of Agriculture

# Chlorpyrifos

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- Organophosphate insecticide
- Both soil or foliar applications
- Labeled for control of many insect pests on a variety of crops
- Highly toxic to fish

# *Chlorpyrifos*

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- 15 companies with crop product registrations.
- Common trades names include:



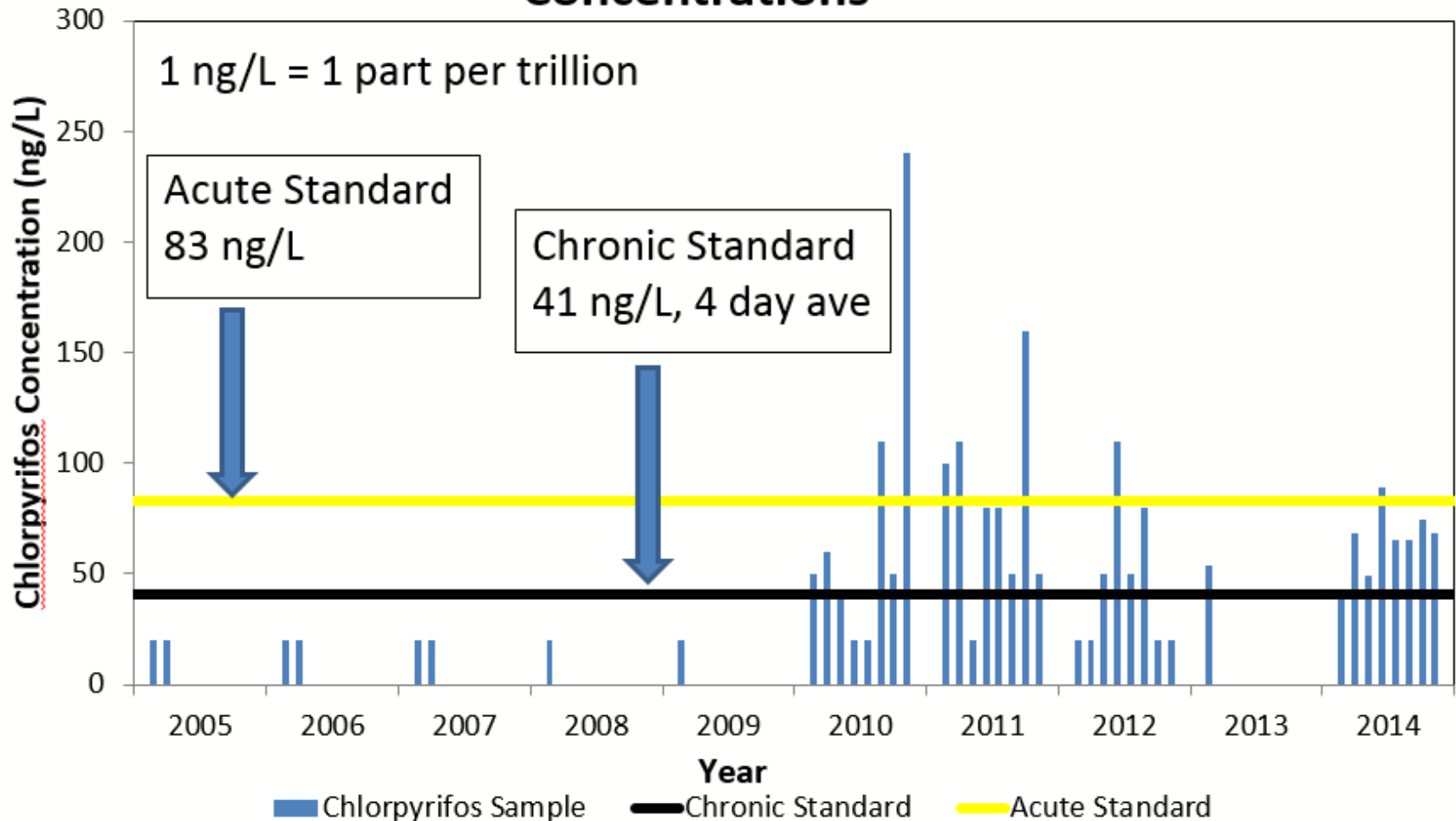


Grab Sampling

Automatic Sampling

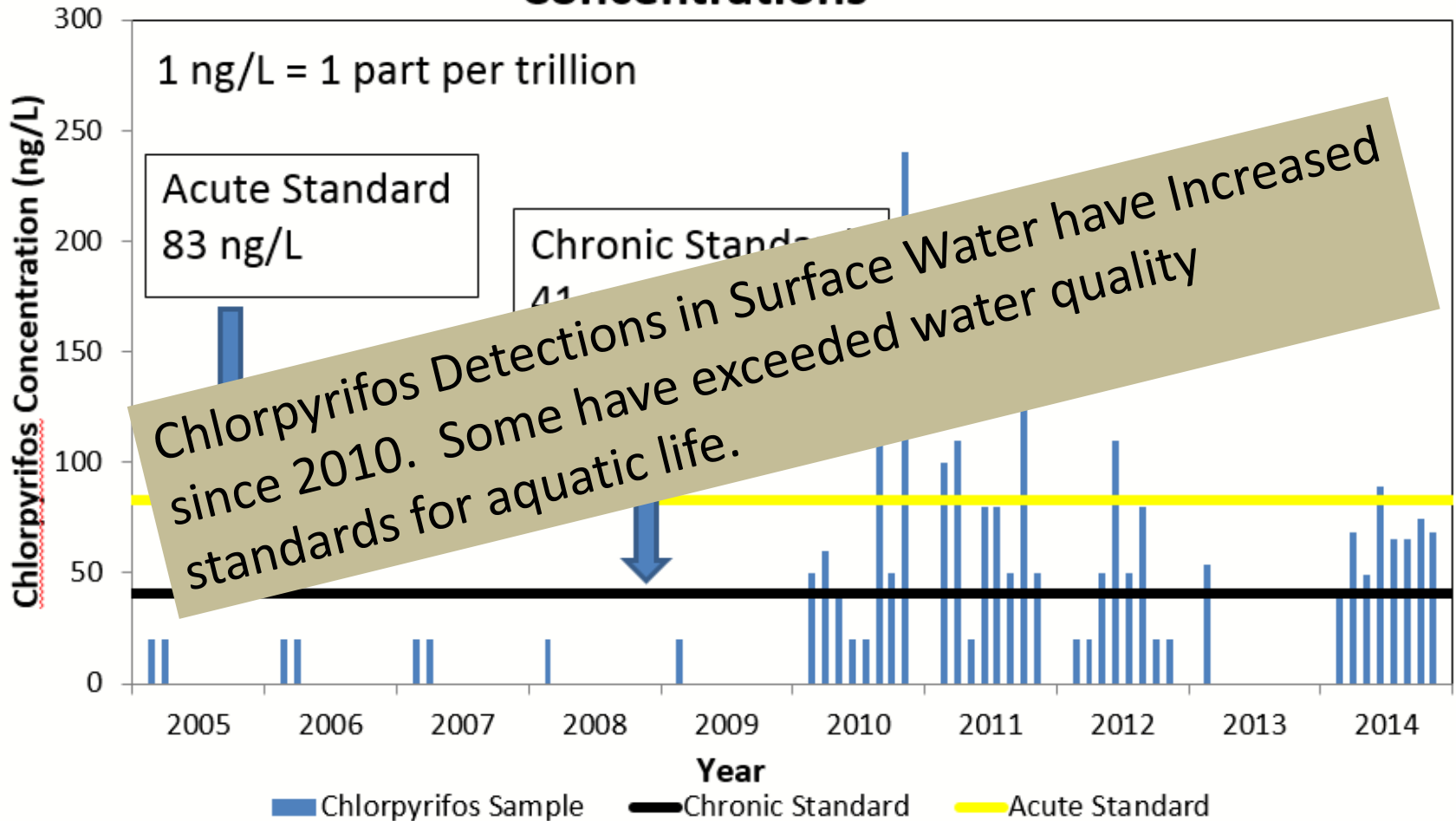


## 2005-2014 MDA Statewide Chlorpyrifos Sample Concentrations

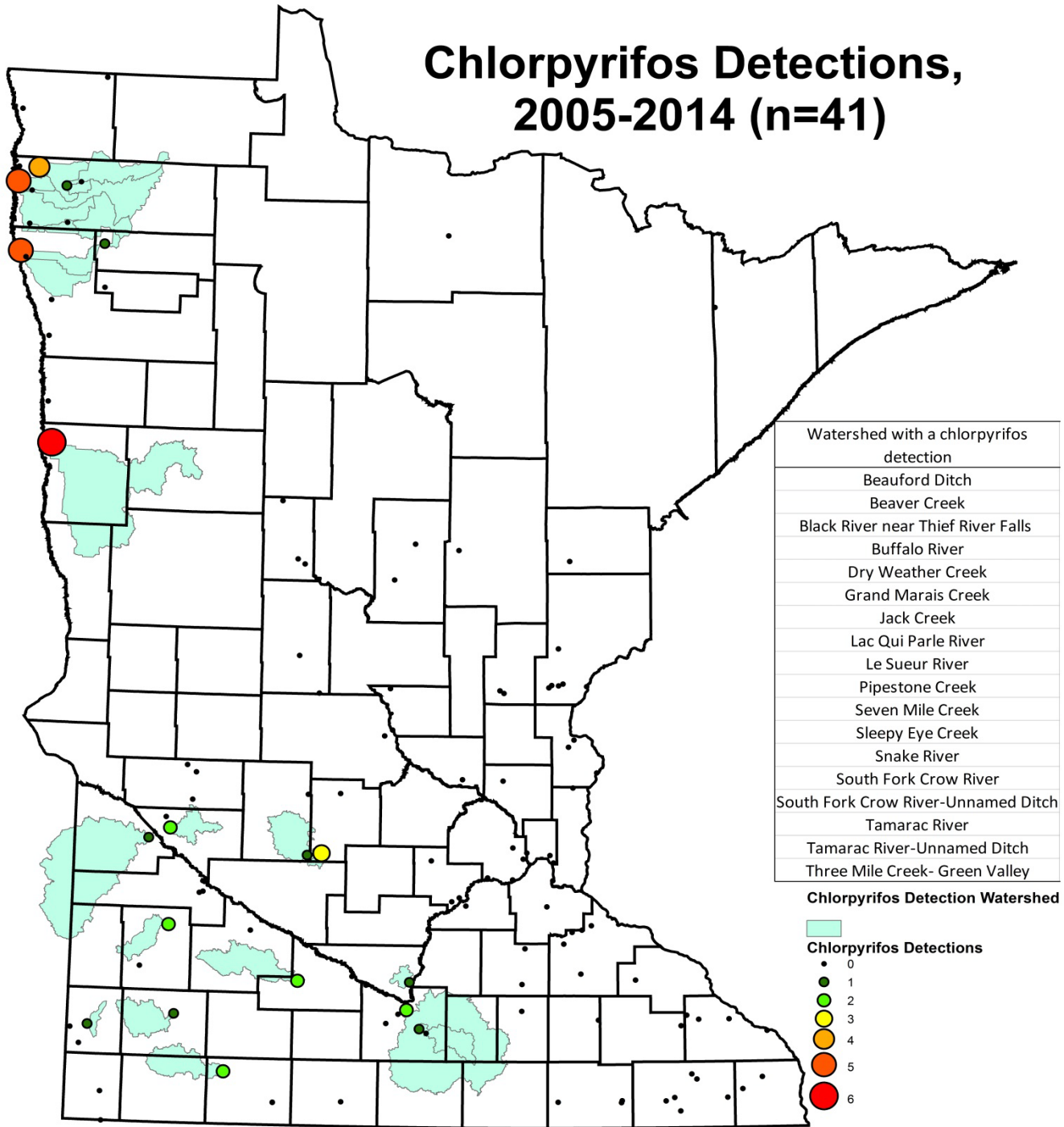




## 2005-2014 MDA Statewide Chlorpyrifos Sample Concentrations



# Chlorpyrifos Detections, 2005-2014 (n=41)



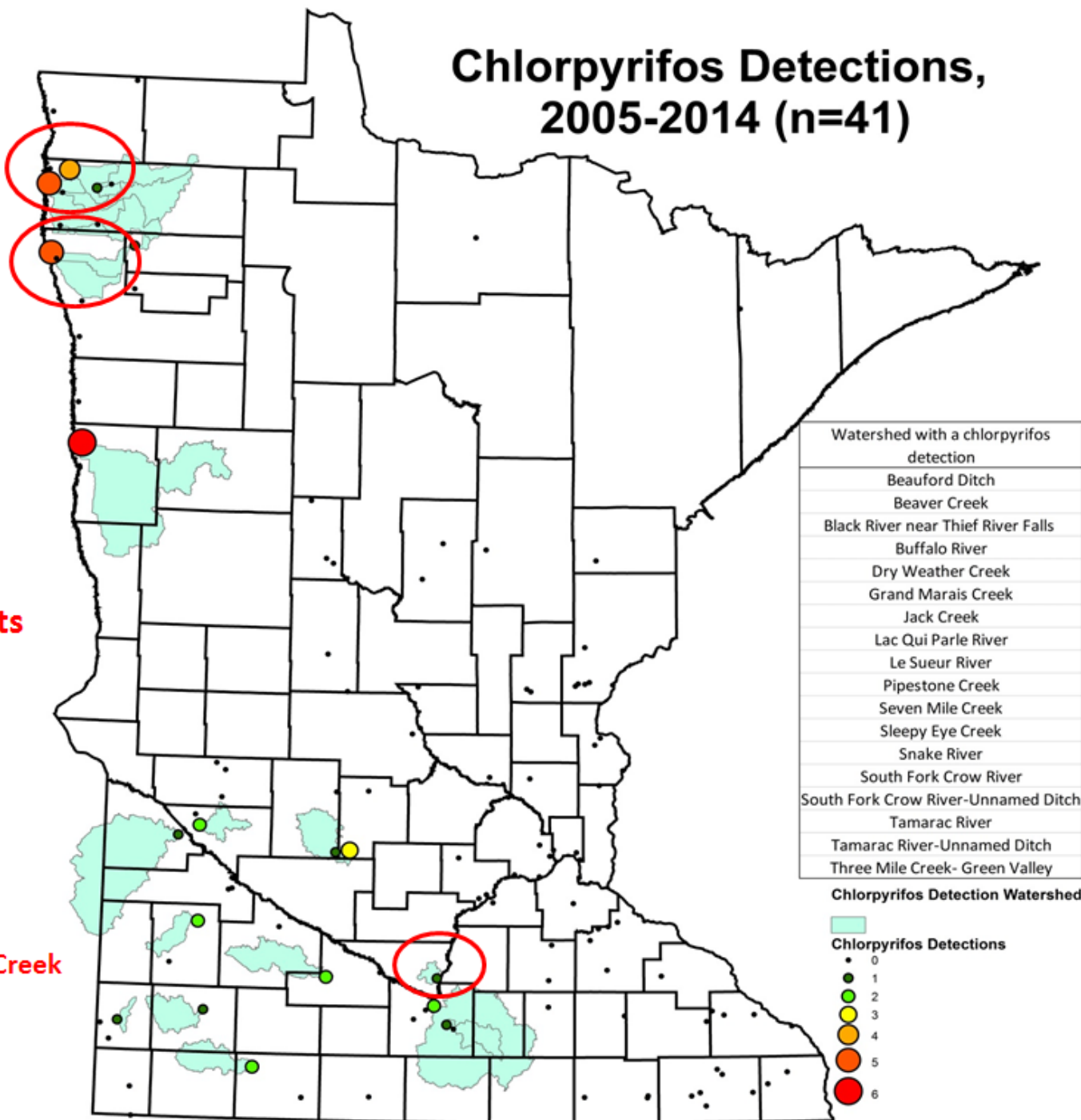
# Chlorpyrifos Detections, 2005-2014 (n=41)

Tamarac River

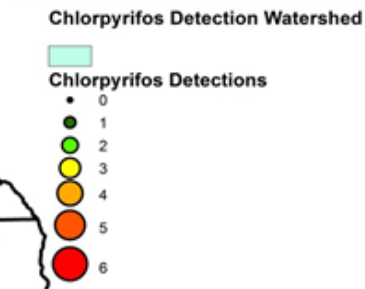
Grand Marias Creek

Water Quality Impairments

Seven Mile Creek

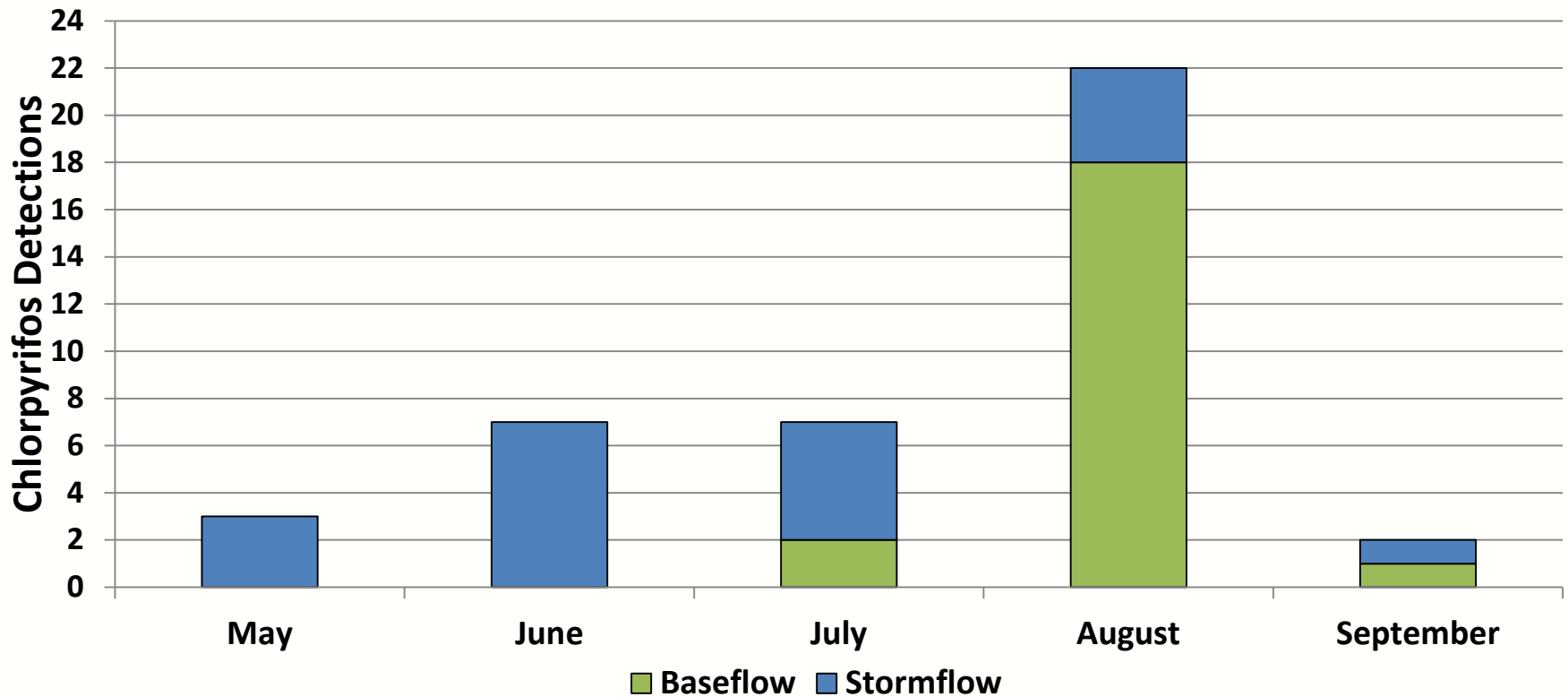


Watershed with a chlorpyrifos detection
Beauford Ditch
Beaver Creek
Black River near Thief River Falls
Buffalo River
Dry Weather Creek
Grand Marais Creek
Jack Creek
Lac Qui Parle River
Le Sueur River
Pipestone Creek
Seven Mile Creek
Sleepy Eye Creek
Snake River
South Fork Crow River
South Fork Crow River-Unnamed Ditch
Tamarac River
Tamarac River-Unnamed Ditch
Three Mile Creek- Green Valley



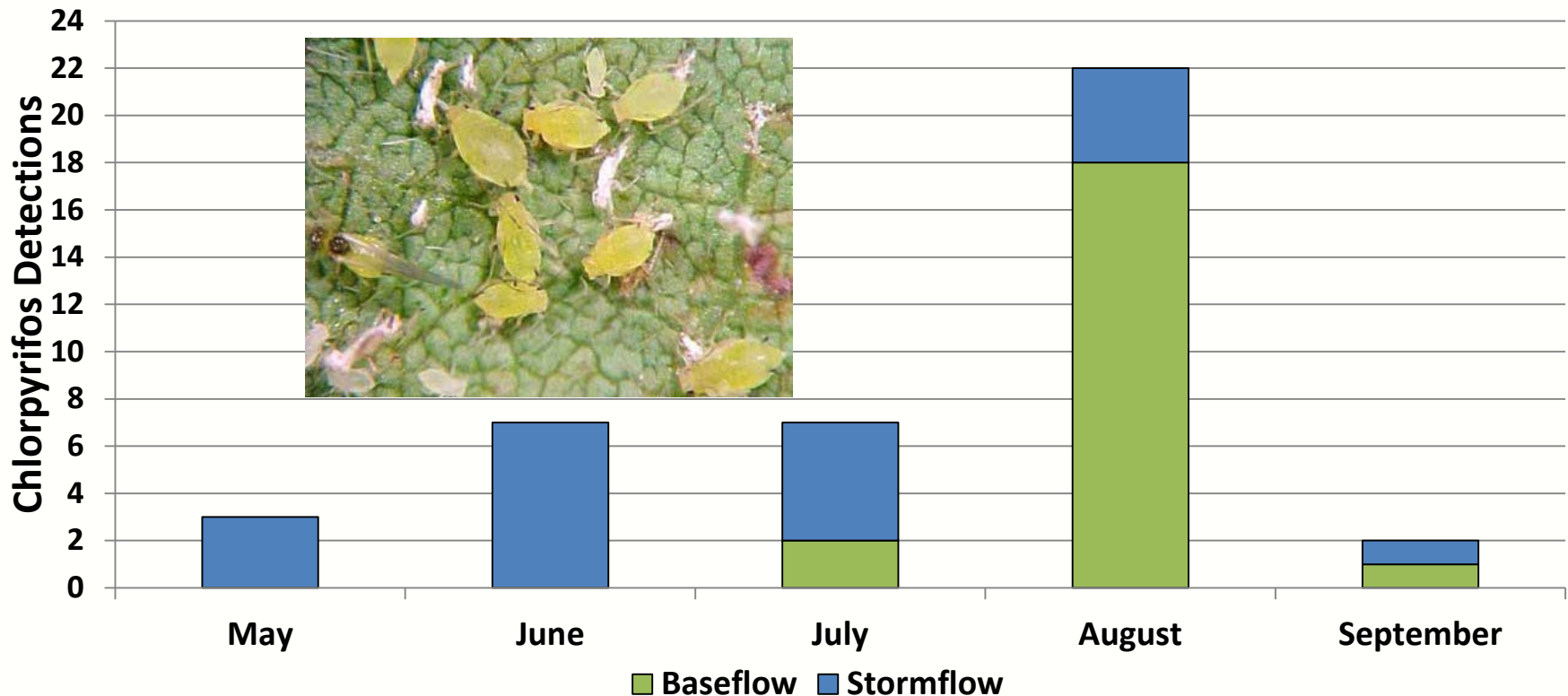


## 2005-2014 Statewide MDA Chlorpyrifos Detections by Month (n=41)



Increased detections in mid-late summer

## 2005-2014 Statewide MDA Chlorpyrifos Detections by Month (n=41)



Increased detections in mid-late summer  
likely due to soybean aphid treatment

# Chlorpyrifos BMPs

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- Due to repeated detections and associated concentrations in recent years, the MDA listed chlorpyrifos as a surface water pesticide of concern.
- This lead the MDA to develop Water Quality Best Management Practices.

# Water Quality BMPs for “All Agricultural Insecticides” and “Chlorpyrifos”

## Water Quality **Best Management Practices** for All AGRICULTURAL INSECTICIDES

July, 2014

In order to protect Minnesota's water resources, the Minnesota Department of Agriculture (MDA), in cooperation with the University of Minnesota Extension Service and other interested parties, developed a set of core Best Management Practices (BMPs). These core voluntary BMPs should be adopted when applying agricultural insecticides in Minnesota. The BMPs may also refer to mandatory label use requirements. Always read and follow product labels. Sources of additional information are listed in these BMPs.



Insecticides are designed to control target insect pests. Non-target insects, fish, and other wildlife can be exposed to insecticides lost from fields by surface runoff, drift, volatilization, or leaching. Applicators are required to control potential impacts by carefully following label instructions, including use of mandatory application setbacks from water bodies. Impacts to aquatic organisms can be further managed through adoption of voluntary BMPs. The MDA has also developed BMPs (published separately) for use with specific crop insecticides.

Careful and prudent insecticide use, as part of an Integrated Pest Management plan, can help protect water resources from future contamination and reduce levels of insecticides found in Minnesota's waters. Planning also promotes the efficient and economical use of insecticides which may improve efficacy, increase yields, result in reduced application rates, and reduce production costs.

State and federal law can require that the use of an insecticide be limited due to the potential for adverse impacts on humans or the environment. The Minnesota Pesticide Control Law (Minn. Stat. 18B) specifies state regulatory authority to prevent these impacts. The Clean Water Act outlines a process that can lead to greater oversight of insecticide use in certain watersheds. Adopting BMPs and using pesticides properly will help growers maintain access to a variety of insecticides as important and diverse tools in the effort to control insect pests and protect water resources. For information on monitoring results for a variety of insecticides in Minnesota's water resources, refer to the [MDA's Monitoring and Assessment webpage](#).

### Best Management Practices (BMPs) for insecticide use

- The purpose of BMPs is to prevent and minimize the degradation of Minnesota's water resources while considering economic factors, pest control availability, technical feasibility, effectiveness, and environmental effects.
- These BMPs are intended to reduce the loss of insecticides to the environment and to encourage the efficient use of insecticides, chemistry-rotation, and non-chemical insect pest control measures as part of an Integrated Pest Management program to protect crops, save costs, reduce development of insecticide resistance, and increase profitability.
- Some insecticides are "Restricted Use Pesticides" and can only be bought and applied by a Minnesota Certified Pesticide Applicator.

**Integrated Pest Management (IPM)**  
Reducing crop losses by integrating multiple tactics (e.g., cultural, chemical, biological and mechanical) in ways that favor the crop and suppress insect populations. See "Additional Information & References" for more details and practical examples.

## Water Quality **Best Management Practices** for CHLORPYRIFOS

July, 2014

The Minnesota Department of Agriculture (MDA), in cooperation with the University of Minnesota Extension Service and other interested parties, has developed voluntary Best Management Practices (BMPs) to address the presence of chlorpyrifos in Minnesota's surface water from normal agricultural use (see reverse side of page). If the voluntary BMPs are proven ineffective, mandatory restrictions on chlorpyrifos use and practices may be required. The BMPs may refer to mandatory label use requirements. Always read and follow product labels. For information on monitoring results for chlorpyrifos and other pesticides in Minnesota's water resources, refer to the [MDA's Monitoring and Assessment webpage](#).

Example trade names for products and package mixtures containing chlorpyrifos. List is not all-inclusive and can change with the introduction of new products; always check the label, or consult MDA's product registration database at <http://state.ceris.purdue.edu/>, select Minnesota, and search for Active Ingredient.\*

Chlorpyrifos	Gowern	Pilot
Cobalt	Hatchet	Vulcan
Cobalt Advanced	Lorsban	Warhawk
Dursban	Lorsban Advanced	Whirlwind
Easer	Nufos	Yuma

\* Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement is implied.

The chlorpyrifos BMPs are companions to a set of core [water quality BMPs](#) for use with all agricultural insecticides. If using chlorpyrifos for crop production, consult these BMPs prior to application. State and federal law can require that the use of a pesticide be limited or curtailed due to the potential for adverse impacts on humans or the environment.

### Information about CHLORPYRIFOS

- Chlorpyrifos, a broad-spectrum insecticide, was first registered in 1965 and was widely used for agricultural and home pest control. Most indoor, pet, and homeowner uses were withdrawn in 1997.
- Chlorpyrifos is used to control foliar and soil-borne insect pests on a variety of crops including soybeans, corn, alfalfa, sugar beet, and a number of fruit and vegetable crops. It is also used as a seed treatment.
- Most chlorpyrifos products are "Restricted Use Pesticide" which indicates that they can only be bought and applied by a Certified Pesticide Applicator.
- Chlorpyrifos belongs to the organophosphate class of insecticides (Mode of Action Group 1B) and controls insects by disrupting normal nervous system function.
- Chlorpyrifos is highly toxic to bees and other beneficial insects exposed to direct treatment or residues on blooming crops or weeds. It is also toxic to fish, aquatic invertebrates, and birds. It is moderately toxic to mammals.



Pesticide applications near water bodies and in certain regions/watersheds are more likely to result in potential water quality impacts from runoff, drift, and volatilization. Other sensitive areas include those that provide runoff to surface water systems, areas near tile surface inlets, highly erodible soils, areas with seasonally high water tables, and highly permeable soils. Note: Many fields are adjacent to water bodies, and portions of every

Minnesota county may contain sensitive soils, water tables, and geology.

Contact your Natural Resources Conservation Service or Soil & Water Conservation District for further information on specific soil and water resource conditions on and near your farm. Then work with Extension educators, crop consultants, and other agricultural advisors to select and adopt the Best Management Practices that are appropriate for your field and farm.

# Chlorpyrifos Requires Setbacks for Drift to Both:

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Water bodies & Sensitive Sites





# Chlorpyrifos BMPs

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- Maintain required application setbacks from permanent water bodies.

<u>Application Method</u>	<u>Setback (ft)</u>
Ground boom	25
Chemigation	25
Orchard airblast	50
Aerial	150

- Label does not require vegetative buffers.

# Typical chlorpyrifos application setbacks

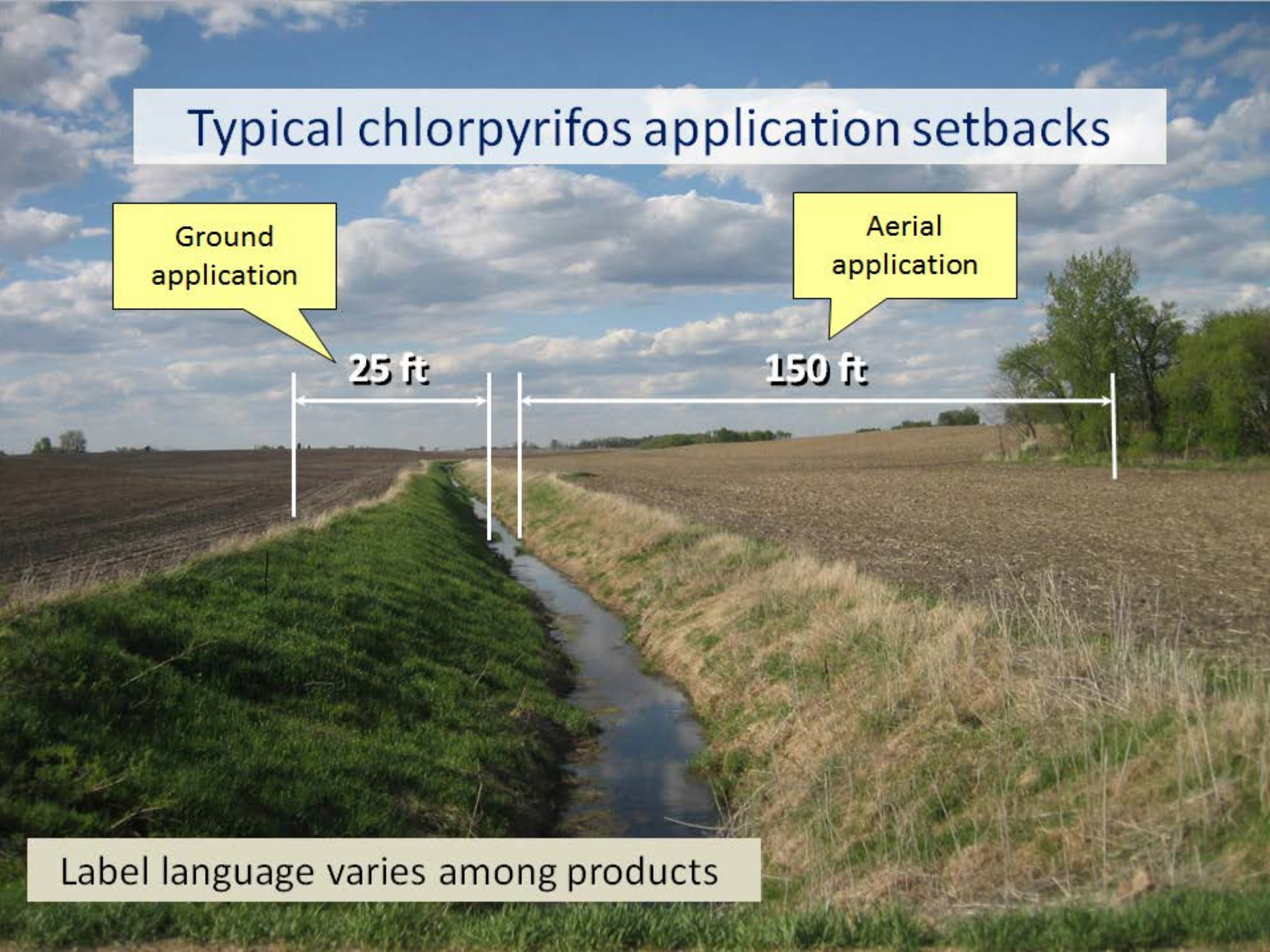
Ground application

25 ft

Aerial application

150 ft

Label language varies among products



# Chlorpyrifos setbacks from sensitive sites including:

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- bystanders
- residential lawns
- homes
- sidewalks
- recreation areas
- buildings that are typically occupied





## Chlorpyrifos setbacks from sensitive sites is based on:

- application rate
- spray droplet size
- sprayer type
- chart is available on labels

Application Rate (lb ai/A)	Nozzle Droplet Type	Required Setback (Buffer Zones) (feet)		
		Aerial	Airblast	Ground
>0.5 – 1	coarse or very coarse	10	10	10
>0.5 – 1	medium	25	10	10
>1 – 2	coarse or very coarse	50	10	10
>1 – 2	medium	80	10	10
>2 – 3	coarse or very coarse	80 <sup>1</sup>	10	10
>2 – 3	medium	100 <sup>1</sup>	10	10
>3 – 4	medium or coarse	NA <sup>2</sup>	25	10
>4	medium or coarse	NA	50	10



# General Pesticide BMPs

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- Use Cultural and Biological Controls
  - crop rotation
  - tillage
  - change plant or harvest timing
- Select resistant/tolerant crop varieties.





# General Pesticide BMPs

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- Use labeled application rates, additives . . .
- Choose Low Volatility Pesticides
- Limit spray drift by following label recommendations concerning:

droplet size  
boom height  
spray pressure



# General Pesticide BMPs

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- Calibrate sprayer at beginning and periodically during the season.
- Rotate use of pesticides with different chemistries/modes-of action to reduce resistance selection.
- Dispose of unused pesticide properly.



# General Pesticide BMPs

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## Use Integrated Pest Management

- Scout fields for pests and beneficial insects.
- Utilize treatment thresholds.



# General Pesticide BMPs

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Use sound agronomic practices to improve crop growth and insect tolerance.

- soil fertility
- reduce soil compaction
- soil drainage
- irrigation



# Other Water Quality BMPs

Available on the MDA webpage:

[www.mda.state.mn.us/protecting/bmps](http://www.mda.state.mn.us/protecting/bmps)

July 2014

### Water Quality **Best Management Practices** for All AGRICULTURAL INSECTICIDES

In order to protect Minnesota's water resources, the Minnesota Department of Agriculture (MDA), in cooperation with the University of Minnesota Extension Service and other interested parties, developed a set of core Best Management Practices (BMPs). These core voluntary BMPs should be adopted when applying agricultural insecticides in Minnesota. The BMPs may also refer to mandatory label use requirements. Always read and follow product labels. Sources of additional information are listed in these BMPs.

Insecticides are designed to control target insect pests. Non-target insects, fish, and other wildlife can be exposed to insecticides lost from fields by surface runoff, drift, volatilization, or leaching. Applications are required to control organisms that can be further managed through adoption of BMPs (published separately) for use with specific crop in Minnesota.

Careful and prudent insecticide use, as part of an Integrated Pest Management to determine appropriate insecticide application, can reduce insecticide application rates, reduce insecticide application costs, and reduce insecticide application risks. Planning also promotes the efficient and economical use of insecticides. Insecticide use in Minnesota is regulated by State and federal law. Careful and prudent insecticide use, as part of an Integrated Pest Management to determine appropriate insecticide application, can reduce insecticide application rates, reduce insecticide application costs, and reduce insecticide application risks. Planning also promotes the efficient and economical use of insecticides. Insecticide use in Minnesota is regulated by State and federal law. Careful and prudent insecticide use, as part of an Integrated Pest Management to determine appropriate insecticide application, can reduce insecticide application rates, reduce insecticide application costs, and reduce insecticide application risks. Planning also promotes the efficient and economical use of insecticides. Insecticide use in Minnesota is regulated by State and federal law.

**Best Management Practices (BMPs) for insecticide use**

- The purpose of BMPs is to prevent and minimize the degradation of Minnesota's water resources while considering economic factors, pest control availability, technical feasibility, effectiveness, and environmental effects.
- These BMPs are intended to reduce the loss of insecticides to the environment and to encourage the efficient use of insecticides, chemistry rotation, as part of an Integrated Pest Management program to prevent insecticide resistance, and increase profitability.
- Some insecticides are "Restricted Use Pesticides" and Certified Pesticide Applicator.

Core Practice	Description	Benefit
1. Use Integrated Pest Management to determine appropriate insecticide application. Consider all control options.	<ul style="list-style-type: none"> <li>Local trials to determine populations of pests and beneficial insects. Use herbicides to determine if insecticide rotation is needed in insecticide application. Consult resources on the following page for timing, rates, and thresholds.</li> <li>Use cultural controls such as crop rotation, tillage, and changing harvest or planting schedules to reduce pest populations.</li> <li>Consider biological control options as appropriate.</li> <li>Consider the use of resistant crop varieties well adapted to area growing conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Maximize production, conserve water resources, and allow quick and accurate response to insect problems.</li> <li>Less selection for insecticide resistance.</li> <li>Resistant varieties can also reduce cultural practices.</li> <li>Reduces crop insecticide application and damage caused by insect pests.</li> <li>Reduces need for insecticide treatments.</li> </ul>
2. Use second generation insecticides to increase crop tolerance to pests.	<ul style="list-style-type: none"> <li>In general, vigorous crop growth increases tolerance to some insects. Factors such as soil fertility, drainage, soil moisture, and crop rotation impact crop vigor.</li> <li>Use tolerant (2nd gen) insecticides (e.g., 2nd gen). Wind speed &gt; 3 mph can inhibit a temperature inversion. Temperature inversions occur during very calm conditions (usually on early morning or late evening) where wind is light or missing, and cool air is trapped below warmer air. This can cause small spray droplets to remain suspended in the air and eventually reach well beyond the intended area or concentrated cloud.</li> <li>High temperature (&gt; 80°F) and low relative humidity (&lt; 50%) increase evaporation of spray droplets before they reach their target. Favor cool, low humidity which increases drift potential.</li> </ul>	<ul style="list-style-type: none"> <li>Keeps more insecticide in the field to control pests, maximizing their effectiveness.</li> <li>Reduces off-target impact on nearby water bodies, livestock, and the environment.</li> </ul>
3. Avoid weather conditions that result in spray drift.	<ul style="list-style-type: none"> <li>Use insecticide sprayers, generators, and nozzles to provide uniform coverage and reduce off-target drift. Reducing production of a small spray droplet (&lt; 75 microns) decreases spray drift potential.</li> <li>Low drift and an induction nozzle reduce production of small droplets and are necessary for some insecticide applications. Although wide angle nozzles produce more fine droplets, they are not used for general spraying and periodically during the season. California's California Air Resources Board (CARB) requires that nozzles be used for general spraying.</li> <li>Monitor spray equipment regularly. Good maintenance of nozzles, sprayer, and generator is essential. Check valves, gauges, hoses, and other components.</li> </ul>	<ul style="list-style-type: none"> <li>Results in uniform pesticide application at the correct rate, and reduces potential for drift to nearby water bodies.</li> <li>During drift, diameter size in half results in eight times the number of droplets and increases drift potential.</li> <li>Results in less total insecticide use.</li> <li>Conserves natural resources.</li> </ul>
4. Properly setup, calibrate, operate, and maintain insecticide application equipment to apply the correct rate.	<ul style="list-style-type: none"> <li>Document insecticide use.</li> <li>Rotate use of insecticide with different modes of action, such as synthetic pyrethroids, organophosphates, insect growth regulators, neonicotinoids, carbamates, and botanicals.</li> <li>Use an air-catch device or an air gap when filling sprayers.</li> <li>Do NOT pour leftover insecticide down a drain or in a water body in a field.</li> <li>Do NOT pour leftover insecticide down a drain or in a water body in a field.</li> <li>Do NOT pour leftover insecticide down a drain or in a water body in a field.</li> </ul>	<ul style="list-style-type: none"> <li>Delays insecticide resistance and reduces water quality impact from insecticide applications of individual insecticides.</li> </ul>
5. Protect surface water, ground water, and sensitive areas from insecticide drift and runoff.	<ul style="list-style-type: none"> <li>Control insecticide to reduce the loss of soil attached particles.</li> <li>Use an air-catch device or an air gap when filling sprayers.</li> <li>Do NOT pour leftover insecticide down a drain or in a water body in a field.</li> <li>Do NOT pour leftover insecticide down a drain or in a water body in a field.</li> <li>Do NOT pour leftover insecticide down a drain or in a water body in a field.</li> </ul>	<ul style="list-style-type: none"> <li>Reduces use of insecticides from water bodies by drift, runoff, leaching, and spill.</li> </ul>
6. Dispose of excess insecticide properly.	<ul style="list-style-type: none"> <li>Do NOT pour leftover insecticide down a drain or in a water body in a field.</li> <li>Do NOT pour leftover insecticide down a drain or in a water body in a field.</li> <li>Do NOT pour leftover insecticide down a drain or in a water body in a field.</li> </ul>	<ul style="list-style-type: none"> <li>Reduces the potential for surface water and groundwater contamination.</li> </ul>

For practices related to the use of specific insecticides refer to Water Quality Best Management Practices, Minnesota Department of Agriculture. All BMPs are available on the [MDA webpage](http://www.mda.state.mn.us/protecting/bmps). See "Additional Information & References" for more information.





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