Water Quality Best Management Practices for Chlorothalonil

DEPARTMENT OF AGRICULTURE

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The Minnesota Department of Agriculture (MDA), along with University of Minnesota Extension and other interested parties, have developed the following best management practices (BMPs) to minimize the risk of the fungicide chlorothalonil and its breakdown products from entering surface water and groundwater from normal use. The BMPs may refer to mandatory label use requirements as well as voluntary practices. In addition to implementing BMPs, always read and follow product labels.

Below are example trade names for products and package mixtures registered in Minnesota that contain chlorothalonil. Always check that pesticide products are registered in Minnesota prior to use.

Chlorothalonil* is an Active Ingredient in:	
Andiamo Advance	Initiate ZN
Bravo Weather Stik	Quadris Opti
Daconil Weather Stik	Ridomil Gold Bravo SC
Echo ZN	Zing!

**This list is not all-inclusive and is subject to change. Reference to commercial products or trade names is made with the understanding that no discrimination is intended, and no endorsement is implied.*

Numerous agricultural (e.g., corn, soybean, dry bean, potato) and non-agricultural (e.g., turf, ornamentals) crops can be affected by a wide range of fungal diseases, which can be controlled or prevented by chlorothalonil. Diseases such as **late blight** *(Phytophthora infestans)* in potato and **dollar spot** *(Clarireedia jacksonii)* in turfgrass are common in Minnesota and can greatly impact yield and plant health. While cultural practices can be used to reduce the risk and severity of these diseases, fungicides like chlorothalonil are often used as a part of an integrated management plan to prevent and control disease.

Chlorothalonil is a broad spectrum contact fungicide that was first registered in 1966 and provides a high level of efficacy on a wide range of diseases and crops. The chemical has a multi-site mode of action (group M05) with a low risk of resistance development. It is used as a foliar treatment that can be applied by ground, air, or chemigation.

Even with normal use, fungicides have the potential to move offsite through leaching and runoff to reach groundwater and surface water, respectively. Some fungicides can also move off-target via spray drift and volatilization, which can lead to contamination of nearby surface waters. Chlorothalonil has rarely been found in Minnesota surface water, such as streams, rivers, or lakes, or groundwater. However, a breakdown product of chlorothalonil called 4-hydroxychlorothalonil (4-HDC) has been detected in groundwater, specifically in Minnesota's Central Sands region. BMPs encourage adoption of an Integrated Pest Management (IPM) program to utilize cultural and biological control practices, optimize fungicide use by reducing the number of and increasing the interval between applications, reduce costs, and prevent development of fungicide resistance.

State law allows the MDA to regulate pesticides to address unreasonable adverse impacts on human health or the environment. Adopting these chlorothalonil BMPs may help growers maintain access to important and diverse fungicide options for disease management while minimizing the need for increased regulation.

For information on pesticide monitoring results in Minnesota's water resources, refer to the **MDA Pesticide Water Quality Monitoring StoryMaps** or **MDA Water Monitoring Reports and Resources**.

Best Management Practices for Chlorothalonil Use

- Voluntary BMPs are designed to prevent and minimize the degradation of Minnesota's water resources while considering economic factors, availability, technical feasibility, ease of implementation, efficacy, and environmental impacts.
- Specifically, these BMPs are intended to reduce off-target movement of chlorothalonil and to encourage the efficient use of fungicides, resistance management, and when available, use of non-chemical approaches to disease control.
- For plant diseases to develop, a pathogen, a susceptible host, and favorable environmental conditions must be present simultaneously.

BMPs in the following table include mandatory label requirements and voluntary practices. Select voluntary practices most appropriate for a given farming operation, soil type, geography, tillage and cultural practices, and irrigation and runoff management. The MDA encourages the use of integrated pest management on every Minnesota farm. Always read and follow the product label.

Water Quality Best Management Practices for CHLOROTHALONIL

Practices*	Description	Benefit

1. Establish an IPM program to minimize fungicide use and apply fungicides only when necessary.	• Work with professionals to establish an **IPM program**. When possible, use cultural control options, resistant cultivars, certified seed (potato), and crop rotations (at least 3 years for potato) to non-host crops to break disease cycles.
	• Scout fields and maintain records of rotational crops, pest issues, and management options used for pests on primary and rotational crops. Apply appropriate fungicides only when necessary, using treatment thresholds if available. If possible, limit chlorothalonil use in successive seasons or successive applications within a season.
	• When appropriate, use cover crops and green manures to increase organic matter, especially on coarse or sandy soils.
	• Identify high-risk fields or turf areas that are slow drying, shaded, or poorly ventilated and plant resistant cultivars when possible.
	• Monitor nearby fields and gardens for potential disease sources such as late blight in tomatoes near potatoes.
	• Practice sanitation by promptly removing cull piles of potatoes and weeds that can serve as sources of inoculum.
	• Fungi spread via water, wind, dew, insects, contaminated equipment, and diseased plant material. Avoid practices that encourage these conditions and **clean equipment** when moving between high-risk fields or infected fields.
	• Optimize fungicide timing by using agricultural weather networks and disease prediction models such as:
	  • **NDAWN Potato Late Blight, Early Blight**, and
	  • **P-Days**, **Michigan State University GDD Tracker for Turf pests**, or
	  • **University of Wisconsin Vegetable Disease and Insect Forecast Network**.
		Early disease detection and understanding of weather conditions allows for more effective and better-timed fungicide applications.
		Increases in organic matter in soils can help minimize leaching of fungicides.
		Crop rotation with non-host crops can reduce the level of soil inoculum, reducing disease pressure and the need for fungicides. An overall reduction in fungicide use can help protect water resources.

2. Follow recommendations on fungicide labels.	• Apply the appropriate label rate which may depend on the disease present, its severity, and current environmental conditions. • Do not exceed single and annual application rate limits or number of applications per season. • Follow label required application intervals and increase intervals when conditions do not favor disease development. • Use recommended surfactants and spray additives.	Use of proper rates and application intervals promotes effective disease control and protects water quality.
3. Reduce runoff, leaching, and drift by following label requirements and recommendations.	• Determine if soils are classified as "vulnerable" (all three must be present: coarse soils, <2% organic matter, and water table ≤30ft) and if so, adhere to label rates for vulnerable soils. • Establish and maintain vegetative filter strips to minimize fungicide movement to surface water in runoff. • Do not make applications to saturated soils or within 48 hours of irrigation or forecasted rainfall. • Maintain label required setbacks/restrictions from sensitive areas. • Do not apply near wells, including active, abandoned, or drainage wells. • Do not apply if there is potential to drift to adjacent waterbodies and use recommended drift control adjuvants.	Compliance with label directions is essential to mitigate off-site fungicide movement. Practices that reduce drift, surface runoff and leaching of pesticides, protects water quality.
4. Develop an irrigation water management plan.	• For irrigated crops, manage water use based on water content in the soil, water holding capacity, infiltration rate, rainfall, irrigation amount, crop water use estimates, and a soil water balance technique. • **Manage irrigation** to minimize the duration of leaf wetness and limit water movement through or across the soil surface.	Apply irrigation uniformly and adequately, to enhance water use efficiency, prevent runoff, limit leaching to groundwater, and reduce fungal disease.
5. Apply with appropriate spray equipment, calibration, and weather conditions.	• Adhere to label directions regarding spray volume, pressure, droplet size, and boom height. Boom width and nozzle orientation are specified on the label for aerial application. • Consider wind speed and direction, as drift risk is lowest at 2-10 mph but possible at any speed. Avoid applications when wind is blowing towards sensitive areas like residential areas and bodies of water.	Calibration ensures proper application rate. Correct spray droplet size and suitable weather conditions enhance canopy coverage, reduce drift to non-target sites, and protect water resources.
6. Rotate fungicide modes of action.	• Alternate fungicide modes of action to minimize development of resistance. For more information, consult the Fungicide Resistance Action Committee website, **www.frac.info**.	Alternating modes of action prevents resistance and preserves key fungicides for disease control.

*For practices related to the use of other pesticides, visit **MDA's Best Management Practices webpage**: **www.mda.state.mn.us/pesticide-fertilizer/best-management-practices-bmps**

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