



Water Quality Best Management Practices for Agricultural Use of Clothianidin & Imidacloprid

The Minnesota Department of Agriculture (MDA), in cooperation with the University of Minnesota Extension and other interested parties, has developed voluntary best management practices (BMPs) to address the presence of two neonicotinoid insecticides, clothianidin and imidacloprid, in Minnesota’s surface water from normal agricultural use. The purpose of BMPs is to prevent and minimize the degradation of water resources while considering economic factors, pest control availability, technical feasibility, effectiveness, and environmental effects. In addition to voluntary actions, BMPs may refer to mandatory label requirements. **Always read and follow product labels and insecticide-treated seed bag labels.**

The water quality BMPs for agricultural use of clothianidin and imidacloprid are a companion to the “[Water Quality Best Management Practices for All Agricultural Insecticides](#).” The MDA has also developed stewardship guidelines and BMPs for the neonicotinoid class of insecticides, which includes clothianidin and imidacloprid, to protect insect pollinators. All pesticide BMPs are available on the [MDA’s BMP webpage](#).

State and federal law can require that the use of a pesticide be limited or curtailed due to the potential for adverse impact on humans or the environment. If the voluntary BMPs are proven ineffective, mandatory restrictions on clothianidin and/or imidacloprid use and practices may be required.

Information about CLOTHIANIDIN & IMIDACLOPRID

- Clothianidin and imidacloprid are systemic, neonicotinoid insecticides used to manage insect pests on a variety of agricultural crops (e.g., soybean, corn, sugar beet, and potatoes) as well as non-agricultural sites (e.g., residential lawns, trees, and ornamentals). These insecticides can be applied through foliar sprays, soil treatments, chemigation, and seed treatments.
- Clothianidin and imidacloprid are highly soluble in water and are both mobile and persistent in soil. They have the potential to leach down to groundwater and can enter surface water through spray drift, runoff, or movement through tile drains. Contamination of surface water can also occur from abraded dust from treated seed during planting. Additionally, clothianidin may be present in the environment as a breakdown product of another neonicotinoid insecticide, thiamethoxam.
- Both clothianidin and imidacloprid are highly toxic to aquatic invertebrates and have been found at concentrations above the Environmental Protection Agency’s chronic [aquatic life benchmarks](#) for aquatic invertebrates in Minnesota surface waters. In 2020, the Commissioner designated clothianidin and imidacloprid as “Surface Water Pesticides of Concern” in accordance with the [Minnesota Pesticide Management Plan](#). The MDA’s monitoring results for clothianidin, imidacloprid, and other pesticides in groundwater and surface water are available on the [MDA’s Monitoring and Assessment webpage](#).

The following BMPs were developed to prevent the contamination of groundwater and surface water by clothianidin and imidacloprid. The listed practices can help protect waters by reducing the total amount of insecticide entering the environment and minimizing the movement of the insecticide off target through drift, runoff, or leaching.

Example Trade Names for Products and Package Mixtures	
CLOTHIANIDIN	IMIDACLOPRID
Arena	Admire
Belay	Gaucho 600 Flowable
Lumisure	Raxil Pro Shield
Nipsit	Skyraider
Poncho 600	Tempest Dual Action

List is not all-inclusive and is subject to change. A current, full list of products registered in MN can be accessed at www.kellysolutions.com/MN/searchbychem.asp.

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

The following table presents a series of voluntary practices and may also include reminders of mandatory label use requirements. Select 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 or seed bag label. Label use requirements are legally enforceable.

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To be Used in Conjunction with MDA's Core ["BMPs for All Agricultural Insecticides"](#)

Practice	Description	Benefit
<p>1. Use integrated pest management (IPM)</p> <p>Reducing crop losses by integrating multiple tactics in ways that favor the crop and suppress insect populations</p>	<ul style="list-style-type: none"> Use cultural, physical, and biological controls and select insect resistant/tolerant crop varieties to avoid or reduce pest risk. Use information on field risk from insect pests, such as previous monitoring data and weather data, to target use of seed treatments. When possible, if risk is low, consider using seed that is not treated with clothianidin/imidacloprid. Scout fields regularly and use economic thresholds to help determine if, when, and where to apply clothianidin/imidacloprid. Time applications to target the most vulnerable life stage of the target pest. For example, seedcorn maggot can be managed by targeting early instar maggots through preventive seed or broadcast treatments. Use hot-spot spraying and banding where appropriate to reduce the amount of pesticide applied. 	<p>Protects water resources by minimizing the need for clothianidin/imidacloprid and the total amount entering the environment. Decreases selection pressure, allows quick and accurate response to insect problems, and may reduce production costs.</p>
<p>2. Follow label application rates and directions for use</p>	<ul style="list-style-type: none"> Use the lowest labeled application rate that will effectively control the pest. Recommended application rates vary with the target pest species. Avoid applying below labeled rates which can compromise efficacy and favor the development of insecticide resistance. Follow label restrictions for the maximum amount of clothianidin/imidacloprid allowed per acre, per application, per season, or per year. Pesticide applied as seed treatments counts toward maximum application rates. Always follow all label directions and adopt proposed risks mitigation practices when possible. Consider using precision application technology (e.g., auto-steer, auto-boom shutoff, and variable rate sprayer) to avoid overspray, spray overlap, and higher than recommended application rates. 	<p>Protects water resources by minimizing the total amount of clothianidin/imidacloprid entering the environment and maintains product efficacy by preventing pest resistance. Improves safety and efficiency of application.</p>
<p>3. Minimize dust generation and drift from treated seed</p>	<ul style="list-style-type: none"> Handle seed bags with care during transport and loading to reduce abrasion and dust generation. Avoid planting treated seed during windy conditions (>15 mph) and when the wind is blowing toward nearby waterbodies. Use appropriate, label-approved dust-reducing lubricants and ensure that the planter is calibrated and functioning properly. Fill planter at least 10 yards inside the field to be planted and avoid shaking out dust from the bottom of the seed bag when filling. Re-configure planters so that only clean air enters the seed metering devices and check if pneumatic planters can be modified to minimize dust drift. Clean planting equipment away from waterbodies and minimize any aerial movement of contaminated dust on the filters/deflectors. Do not clean using compressed air. 	<p>Ensures treatment remains on the seed for pest protection and reduces the potential for drift of contaminated dust to nearby waterbodies.</p>
<p>4. Prevent drift from spray applications</p>	<ul style="list-style-type: none"> Select nozzles that produce medium or coarser droplet sizes (200-400 microns, ASABE S572.1). Use the coarsest droplet size possible without compromising the efficacy. Monitor weather and apply during favorable conditions (wind speeds 3 to 15 mph, temperatures <85°F, relative humidity >50%, no temperature inversions). Real-time weather data is available through resources such as the North Dakota Agricultural Weather Network (NDAWN). Maintain at least a 25 ft spray buffer zone between the application area and surface water for ground applications and a 150 ft spray buffer zone for aerial applications. Spray buffers are a requirement on many product labels. Maintain a boom height no more than 4 ft above the canopy for ground applications and no more than 10 ft above the canopy for aerial applications. Consider using drift retardants or spray additives within label guidance. Consider using shielded sprayers if shields do not compromise uniform deposition. 	<p>Keeps insecticide on target to control pests and maximize its effectiveness. Reduces off-target impacts on nearby waterbodies, bystanders, and the environment.</p>
<p>5. Minimize runoff and leaching</p>	<ul style="list-style-type: none"> Avoid applying during rain or when soil is saturated which favors runoff. Avoid foliar applications if rain is predicted in the next 24 or 48 hours. Construct and maintain a vegetative filter strip at least 10 ft wide between the field edge and nearby down gradient aquatic habitat. Check product labels for exact width requirements, which may vary. Maintain grass or vegetation buffers near tile outlets, in drainage ways, and along field boundaries. Ensure all treated seed is planted at the appropriate depth and covered by soil. Consider residue management practices such as adopting conservation tillage and planting a cover crop to help slow runoff. Avoid practices that lead to soil compaction (e.g., tillage of wet soil) and, in turn, increase runoff. Use soil moisture monitoring techniques, such as sensors, to avoid over-irrigation and runoff. 	<p>Keeps the applied insecticide on the target site for maximum effectiveness and protects vulnerable waterbodies from clothianidin/imidacloprid runoff.</p>
<p>6. Rotate with other insecticide classes</p>	<ul style="list-style-type: none"> Rotate clothianidin and imidacloprid with other insecticides with different mode of action, such as synthetic pyrethroids, organophosphates, and insect growth regulators that are known to be effective. Avoid a sequential foliar application of clothianidin/imidacloprid following a seed, soil, or foliar application of clothianidin/imidacloprid. 	<p>Reduces the amount of clothianidin/imidacloprid entering the environment and prevents the development of resistance.</p>
<p>7. Prevent spills and dispose of pesticides and treated seed properly</p>	<ul style="list-style-type: none"> Mix and load pesticides away from waterbodies and ditches and use a designated spill containment surface. If a containment pad is unavailable, maintain a 25 ft distance from potential surface to groundwater conduits. Be prepared for potential spills by developing and maintaining an incident response plan. Plans are recommended for all applicators and may be legally required for some businesses including those involved in commercial and non-commercial pesticide application. Take precautions to prevent spillage of clothianidin/imidacloprid-treated seed during transport, loading, and planting. Follow the directions on the seed bag label to either cover or collect and dispose of any spilled seed. Plant unused clothianidin/imidacloprid-treated seed on fallow ground or on an unused parcel of land in accordance with the label directions. If the label allows burial of unused treated seed, bury away from bodies of water and tile drainage areas, especially near tile inlets. To dispose of unused treated seed offsite, contact your local landfill or the Minnesota Pollution Control Agency for guidance. Use the MDA's Waste Pesticide Collection Program to dispose of old or unused pesticide products. DO NOT pour leftover pesticide down a drain or in a single spot in a field. 	<p>Reduces the potential for surface water and groundwater contamination. Reduces the potential for accidental exposure of humans and wildlife to clothianidin/imidacloprid including incidental consumption of treated seed by wildlife.</p>

For core practices and practices related to the use of other specific insecticides, visit the [MDA's Best Management Practices webpage](#).

Additional Information & Resources

MDA Resources

- [Pesticide Best Management Practices](#)
- [AgBMP Loan Program](#)
- [Pesticide Water Quality Monitoring](#)
- [Minnesota Agricultural Water Quality Certification Program](#)

Integrated Pest Management (IPM) and Scouting

- [How to Practice IPM - MDA](#)
- [Crop Production Website - University of Minnesota Extension](#)
- [Aphid-resistant Soybean Varieties for Minnesota - University of Minnesota Extension](#)
- [Pest Management Tips & Resources - University of Minnesota Extension](#)
- [AgWeather Thermal Models – University of Wisconsin, Weather-based forecasting models for different pests](#)
- [North Dakota Field Crop Insect Management Guide – North Dakota State University Extension](#)

Treated Seed

- [Safe Handling of Treated Seed - University of Minnesota Extension](#)
- [The Guide to Seed Treatment Stewardship – American Seed Trade Association and Crop Life America](#)
- [Guide to Seed Treatment Stewardship – Canadian Seed Trade Association](#)
- [Disposal of Treated Seed – Minnesota Pollution Control Agency](#)

Spray Drift Management

- [North Dakota Agricultural Weather Network \(NDAWN\) - North Dakota State University](#)
- [AgWeather Weather – University of Wisconsin](#)
- [Understanding Air Temperature Inversions Relating to Pesticide Drift - North Dakota State University](#)
- [Are Inversions Really That Common? - University of Minnesota Extension](#)
- [Nozzles: Selection and Sizing – Virginia Cooperative Extension](#)
- [Adjuvants and the Power of the Spray Droplet – Purdue Extension](#)
- [Managing Pesticide Drift – University of Florida Extension](#)
- [Spray Drift of Pesticides – University of Nebraska Extension](#)

Insecticide Rotation

- [Mode of Action Classification – Insecticide Resistance Action Committee \(IRAC\)](#)

Spills and Disposal

- [Preparing for a Spill \(Incident Response Plan\) – MDA](#)
- [Waste Collection Program – MDA](#)