



# Protecting Pesticide-Sensitive Crops

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*Pesticide-sensitive crops are common in Nebraska's landscape. Examples include fruits, vegetables, and ornamental crops grown on organic or traditional commercial farms. Consumer demand has created markets for these products, and sales of these crops have contributed to Nebraska's agricultural economic diversity. While any crop can be injured by off-target pesticide movement, specialty crops are especially sensitive to pesticides, and injuries to these commodities have the potential to cause significant economic losses. For example, grapes have an annual fruit value of \$4,000 to \$5,000 per acre, and their processed value can be up to 10 times higher. Because of the high value and sensitivity of these crops, it is essential for pesticide applicators to be aware of their surroundings and use all appropriate safety measures before, during, and after each application.*

## Use Pesticides Carefully

When applying pesticides, take extra precautions to avoid impacting nearby sensitive crops. Many plants are sensitive to pesticides, and they may sustain injury when pesticides contact them as a result of off-target movement (drift, runoff), contaminated application equipment, or applicator carelessness.

The availability and adoption of crop varieties with built-in tolerance to certain herbicides has led many growers to increasingly rely on these herbicides to control weeds in their fields, particularly after crops have emerged from

the ground. While this strategy makes economic sense from the grower's perspective, it also comes with significant risks and responsibilities. Hormonal-type herbicides such as 2,4-D and dicamba can cause significant damage to nontarget plants including trees, nontolerant crop varieties, and specialty crops such as organics, nursery stock, and grapevines. When product labels include requirements such as buffer zones, specific weather conditions at the time of application, and equipment settings (e.g., boom height, operating pressure, nozzle selection), it is likely that the product is susceptible to drift or runoff. However, it's important to realize that **any** pesticide has the potential to move off target and cause injury.

## Be Proactive

The nonprofit company FieldWatch, Inc., cooperates with the Nebraska Department of Agriculture (NDA) to maintain four online registries that enable improved communication and stewardship among commercial sensitive crop growers, beekeepers, seed corn growers, and pesticide applicators.

- Commercial growers of sensitive crops, including non-GMO corn and soybeans, can register the locations of their crops on **DriftWatch™**.
- Beekeepers can register the locations of their hives on **BeeCheck™**.

- Seed corn companies can use **SeedFieldCheck™** to show where and when field workers (i.e., detasslers) will be present in seed production fields.
- Pesticide applicators can register on **FieldCheck®** and use it to determine if sensitive crops, beehives, or detasslers are near a planned pesticide application site.

Applicators should use FieldCheck to document known locations of sensitive sites in their application records by printing a map from the website. It is also a good practice to physically scout the surrounding area before a planned pesticide application to become familiar with the landscape: **Listings on DriftWatch and BeeCheck are voluntary, so the registries may not list all sensitive crop or hive locations.** Pesticide applicators should visit with neighbors who may have sensitive crops or beehives to let them know of intended pesticide applications and assure them that every effort will be made to avoid off-target injury, such as by adjusting application method and/or timing. This NebGuide focuses on protecting sensitive crops. For more details about protecting bees from pesticides, see *Bee Aware: Protecting Pollinators from Pesticides* (EC301).

FieldCheck allows applicators to sign up for email notifications when new sensitive locations are registered in their “business area.” Simply register for this service, then designate your business area by selecting statewide or individual counties, or by using the online mapping tool to outline a more specific geographic area.

These registries rely on proactive growers and applicators to be effective. Growers should keep their listings as up to date as possible. In addition, those with sensitive crops should contact their neighbors and/or local pesticide dealers, co-ops, and other pesticide applicators in the area to alert them to the presence of these crops and the potential for pesticide damage. Good communication is the key to avoiding pesticide injury problems.

Learn more about all four registries at:  
<https://www.fieldwatch.com>.

### Strategies to Protect Sensitive Crops

**Use Integrated Pest Management (IPM).** Develop an IPM program that utilizes strategies such as proactively preventing pest infestations, scouting pest populations, setting economic threshold levels, and employing pesticide alternatives (e.g., mechanical controls, sanitation, and biological controls). Consider selecting herbicide-tolerant and/or insect-resistant crop varieties and rotating your

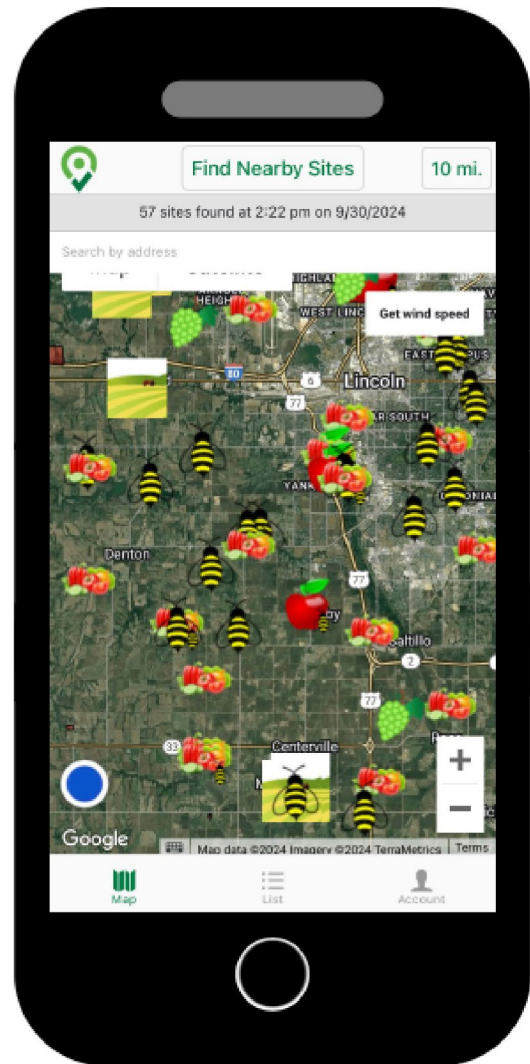


Figure 1. When planning pesticide applications, applicators should consult the FieldCheck app to identify sensitive sites nearby and develop plans to protect these sites from pesticide exposure.

crop plantings to deter pests. By incorporating techniques such as these, you reduce your reliance on chemical controls (pesticides). This, in turn, reduces the risk of your pesticide applications injuring off-target plants.

**Select an appropriate pesticide product.** When it may be necessary to control pests with a pesticide, compare several product labels prior to buying a product to find one suitable for the pest you want to control and labeled for the site on which you plan to apply it. Examine the label language and select the product that appears to have the lowest risk of harming surrounding crops and vegetation. Call your local Extension office if you have questions about selecting pesticide products.

**Read the label.** Remember that the pesticide label is the law; read and follow all its directions and precautions. Apply pesticide products only to sites (e.g., pastures, specific crops) listed on their labels. Applying a pesticide product to a site for which it is not labeled is illegal. Do not exceed the application rate specified on the label; using a rate higher than what the label allows is illegal. The risk of off-target injury to people, livestock, pets, wildlife, and plants is greatly reduced when applicators follow label instructions.

Many labels, especially herbicide labels, have specific requirements for avoiding off-target drift. For example, some labels require buffer or set-back zones to protect specialty crops and sensitive areas. These prohibit application of a pesticide product within a specific distance of certain sites. Additionally, there may be requirements for minimum spray droplet size, nozzle selection, and maximum wind speeds to avoid drift. Read the label when planning every application; new label requirements often appear with little notice. For more information about pesticide labels, see *Understanding the Pesticide Label* (NebGuide G1955).

**Follow all precautions and plan your application.** The pesticide label will list environmental hazards and restrictions for using the product. Become familiar with the application site and ask yourself these questions:

- Are any sensitive or desirable crops/plants nearby?
- Are any streams, ponds, ditches, drainage areas, or other open-water sites nearby?
- Does the weather forecast predict suitable conditions for application?
- Could the wind carry the pesticide to a neighboring property?
- Is my chosen pesticide product likely to volatilize due to high temperatures either on the day of application or the several days following?
- Does the label recommend or require any specific equipment or equipment settings?
- Are any children, pets, or other animals in the area?
- Do I know the amount of pesticide I will need to complete the job, so I don't mix more than necessary?
- Where and how will I mix and load the spray mixture into the application equipment?

**Watch for drift or runoff during the pesticide application.** When environmental conditions change during a pesticide application, adjust your application procedures accordingly. Factors to consider include wind speed and direction, and soil type and saturation. Stop the application if the weather becomes too windy or if you see the product begin running off the target area. You can also prevent off-target injury by reducing your sprayer's ground speed, especially when navigating difficult terrain. This will prevent uneven treatment patterns and wind eddies that can form behind a fast-moving tractor and decrease unwanted movement of the boom.

**Clean equipment thoroughly after applying any herbicide.** Herbicide residue in spray equipment can damage sensitive crops during future pesticide applications. Always clean tanks, nozzles, and other equipment thoroughly after applying herbicides. Always check the label for product-specific sprayer cleanout directions. Some herbicides may require the use of a cleaning agent such as ammonia for effective residue removal. If a product label does not list specific equipment-cleaning directions, the *Guide for Weed, Disease, and Insect Management in Nebraska*, EC130, includes recommended cleaning solutions for various herbicides. Only apply rinsate on label-approved sites.

If several pieces of spray application equipment are available, dedicate one to growth regulator herbicides or one to the specific crop to be treated. If multiple sprayers are not available, clean your equipment extra carefully after each application of a growth regulator to avoid subsequent crop damage. Mixing two quarts of ammonia for every 50 gallons of water and letting it stand in the sprayer overnight is especially effective for cleaning residue from growth regulator herbicides such as 2,4-D (phenoxy) or dicamba. For more information about equipment cleaning procedures, see *Cleaning Pesticide Application Equipment* (NebGuide G1770).

**Follow directions for storing and disposing of unused pesticides and empty containers.** Off-site movement of rinse water or unused pesticides can harm sensitive sites, including sensitive crops. Plan your application carefully so that only the amount of pesticide needed will be mixed, and no extra mixed product will be leftover. If extra spray mixture does remain after an application is completed, dispose of it by applying it to a site listed on the label. Nebraska does not have a statewide pesticide disposal program. Some companies can help dispose of unused or outdated pesticides for a fee, but it is better to plan applications carefully and avoid buying and storing leftover product.

Empty containers should be triple or pressure rinsed and either recycled or disposed of at a landfill according to label directions. See the resources listed under “Additional Information” at the end of this publication for more information about disposal and recycling programs.

Always store pesticides in a cool, dry, locked storage facility away from food, feed, and other supplies. Be sure the storage structure is not located near water resources. Store liquid pesticides on lower shelves in case of spills, and always have a spill kit available. Keep pesticides in their original containers, and when ready to make an application, use the oldest pesticides first. Avoid the temptation to overpurchase pesticides because they are on sale; purchase only the amount you plan to use during the season to minimize the amount you must store.

For more details about storing and disposing of pesticides, see *Safe Transport, Storage, and Disposal of Pesticides* (EC2507).

### Pesticides Can Move Off Target

**Particle Drift.** Small spray droplets from liquid pesticide applications are susceptible to drift and can travel long distances, potentially contacting nontarget plants or animals. To minimize particle drift and the damage it can cause:

- Never make an application when the wind is blowing toward nearby sensitive sites.
- Check the product label for wind speed restrictions. Generally, it is ill-advised to make applications when winds exceed 10 mph.
- Never apply pesticides when a temperature inversion is present. An inversion occurs when a layer of cool, calm air gets trapped near the ground with warmer air above. The inversion reduces air circulation and results in spray particles hanging near the cool/warm air boundary and then moving off site in an unpredictable manner. Wind speeds lower than 3 mph sometimes indicate the presence of an inversion.
- Select spray nozzles that produce the largest label-recommended droplet size for the product being applied.
- Use a rate controller to keep your operating pressure in the lower end of the suggested pressure range for the spray nozzle(s) you are using. Lower pressure produces larger, less drift-prone spray particles.

- Adjust the height of the spray boom so it is as close to the target as possible while maintaining effective spray coverage.
- Use a drift-reducing adjuvant approved for use with the product being applied.
- Consider using a granular or pelletized product instead of a liquid one that must be sprayed.

For more details about pesticide drift and how to prevent it, see *Spray Drift of Pesticides* (NebGuide G1773).

**Vapor Drift.** After a pesticide is applied, the product may volatilize (i.e., become a vapor) and move away from the application site in an unpredictable manner, affecting off-site plants or animals. The volatility of some pesticide products increases as the air temperature rises into the upper 80s and 90s. Check the product label for maximum air temperatures allowed during and after application of the product. To minimize volatilization:

- Use the least volatile formulation of an active ingredient. For example, 2,4-D *amine* is less volatile than 2,4-D *ester*; 2,4-D *choline* is less volatile than both the *amine* and *ester* forms.
  - Some newer, less volatile formulations are on the market. Pesticide manufacturers continue to develop other low-volatility formulations.
- Spray only when temperatures will remain less than 90°F for several days.

**Runoff.** A pesticide product applied to a steep slope, bare ground, or even level ground immediately before a rain can run off the application site and enter streams, rivers, and lakes, severely damaging nontarget vegetation it encounters in the process. Runoff can also kill fish or aquatic invertebrates and/or make the water unsuitable for recreation or human consumption. Some herbicide labels now require runoff mitigation measures to be in place at a site before a product can be applied there. Select a pesticide and application method that will not violate the label or cause damage. For more details about pesticide runoff and runoff prevention, see *Protecting Surface Water Quality* (EC730).

### Herbicide Injury

Any herbicide has the potential to injure unintended plants through particle drift, vapor drift, runoff, or equipment contamination. In general, the amount and type of

injury is dependent on the amount of off-target herbicide movement (or transfer) that occurs, as well as the types of plant present in the affected area.

While Nebraska is primarily known for corn and soybean production, growers in the state actually produce dozens of different crops. Off-target injury to crops or ornamental plants can lead to strained relationships between neighbors and result in significant financial losses for those affected. In some cases, the full extent of these losses may not be known for several years. Communication with neighbors is key. As Nebraska's agricultural economy continues to diversify, it becomes increasingly important to recognize specialty crops as a key source of income for many growers. A few of the pesticide-sensitive crops grown in Nebraska are discussed below.



Figure 2. Soybean leaves showing signs of dicamba injury (Amit Jhala, University of Nebraska-Lincoln).

**Non-GMO corn and soybeans.** Despite the increasing availability of corn and soybeans equipped with herbicide tolerance, producers should be mindful of conventional crop varieties being grown in their area. Drift damage on non-GMO crops can be devastating. When planning applications, never make assumptions about which crop varieties neighbors have chosen to plant.

**Organic crops.** Organic producers adhere to stringent USDA standards in order for their crops to be labeled "Certified Organic." This requires careful, long-term planning and alternative inputs, offset by the increased market value of their certified product. By regulation, crops grown organically cannot be equipped with genetic engineering such as herbicide tolerance traits. In addition, land used for organic production must be free of prohibited material (including synthetic pesticides and fertilizers) for at least 3 years prior to harvest. Pesticide drift can not only damage these vulnerable crops, it can cause a grower to lose their organic certification, which can cost them years of income from the organic market. (Personal communication: Gary Lesoing, former Nebraska Extension Educator)



Figure 3. The USDA Organic Seal may be used only for certified organic agricultural products.

**Trees.** Nebraskans value trees for many reasons: They form windbreaks, produce fruit and nuts, provide shade and privacy as ornamentals, and serve as wildlife habitat. There are well over 3 million acres of trees in the state. Trees sold as nursery stock can take several years to reach saleable sizes, and, in Nebraska, hold an average value of more than \$100 per tree (USDA National Agricultural Statistics Service). Many hold a value much higher. A significant number of trees are inadvertently exposed to herbicides due to drift and root uptake. While injury may sometimes seem minor or superficial, it can easily render nursery stock unsuitable for sale. Repeated exposure over several years can take a heavy toll on the life of a tree. For more information from the Nebraska Forest Service, visit <https://nfs.unl.edu/publications/herbicide-damage-trees>.



Figure 4. A bur oak tree in a nursery with abnormal growth after suspected herbicide drift injury. Note the branch (center, upper left) that has dramatically altered its growing angle. The tree is likely unsaleable (UNL photo).

**Grapes.** Grape production has flourished in Nebraska since the 1990s, and the state has developed a reputation for its viticulture and high-quality wine production. Grapes have an annual fruit value of \$4,000 to \$5,000 per acre. When a vineyard's grapes are processed, that value can be up to 10 times higher. Acreage continues to be converted for commercial grape production across the state. Grapevines are sensitive to many herbicides, most notably growth regulators, which can injure vines at a small fraction of labeled rates. (Personal communication: Stephen Gamet, Nebraska Viticulture Research Technologist)



Figure 5. A young grape shoot injured by 2,4- D (Bruce Bordelon, Purdue University).

**Hops.** The craft beer industry has experienced dramatic growth in the past decade. With this growth has come increased interest among Nebraska brewers in using locally sourced ingredients, such as hops, in their beers. Depending on the variety and post-harvest processing, hops have an annual value of \$15,000 to \$22,000 per acre. Hops are sensitive to a variety of herbicides including glyphosate and growth regulators; they are made even more vulnerable to drift by their 18-foot growing height. (Personal communication: Katie Kreuser, former Nebraska Hops Program Coordinator)

### Reporting Pesticide Violations or Incidents

Applicators and producers alike should be prepared to report pesticide violations or incidents. If you are aware of a pesticide violation, or are concerned about a possible violation, contact the NDA as soon as possible at 402-471-2351. The NDA can help you determine what actions to take, such as photographing perceived damage and carefully keeping records of your observations. Depending on the circumstances, you may wish to submit a formal complaint.

Not all pesticide incidents necessarily result in violations of local, state, or federal pesticide laws. It is possible for pesticides to adversely affect humans, animals, plants, and the environment even when the label is followed to the letter. In any case, consider reporting incidents to the product's manufacturer. The manufacturer is required by law to submit reports of adverse effects to the EPA.

### Summary

Making effective pesticide applications with low potential for off-target movement takes careful planning. This is extremely important for protecting sensitive crops and beehives. Follow pesticide labels, check application equipment, and stay aware of environmental conditions to ensure that the pesticides you apply remain on their target site and have maximum effectiveness on their target pests.

### Additional Information

#### Nebraska Extension Publications

<https://extensionpubs.unl.edu/>

- *Spray Drift of Pesticides*, G1773
- *Nozzles—Selection and Sizing*, EC141
- *How to Spray a Field to Prevent Overlap and Reduce Drift Injury*, G1570
- *Cleaning Pesticide Application Equipment*, G1770
- *Guide for Weed, Disease, and Insect Management in Nebraska*, EC130
- *Protecting Surface Water Quality*, EC730
- *Bee Aware: Protecting Pollinators from Pesticides*, EC301
- *Safe Transport, Storage, and Disposal of Pesticides*, EC2507
- *Understanding the Pesticide Label*, G1955
- *Entender las etiquetas de pesticidas*, G1955S

#### Nebraska Extension Pesticide Safety Education Program

<https://pested.unl.edu/>

- Protecting Water Resources from Pesticides
- Pesticide Container Recycling
- Pesticide Disposal

## NDA's Pesticide Program:

<https://nda.nebraska.gov/pesticide/>

- Nebraska FieldWatch Registries
- Applicator Certification and Training
- Nebraska Pesticide Act and Enforcement
- Water Resources Protection
  - Using Precipitation Forecasts to Comply with Product Labels
  - Runoff Mitigation Measures and Determining Hydrologic Soil Groups
  - Applicator's Map and Guide to Prevent Groundwater Contamination

### More Resources

- *Air Temperature Inversions: Causes, Characteristics and Potential Effects on Pesticide Spray Drift* (<https://bit.ly/NDSUPub1705>)

- *An Introductory Guide to Best Management Practices for Agricultural Runoff Including Herbicide Label-Required Mitigation Measures* (contact Nebraska Extension's Pesticide Safety Education Program to learn more)

**National Pesticide Information Center**, for objective, science-based information about pesticides and pesticide-related topics: (800) 858-7378, <http://www.npic.orst.edu/>

**U.S. Environmental Protection Agency Office of Pesticide Programs** <https://www.epa.gov/pesticides/>

### Disclaimer

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