



Protecting Pesticide Sensitive Crops

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Sensitive crops are becoming more common in the landscape. Examples include grapes in vineyards, and 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. Any agricultural crop can be damaged by pesticide drift. However, these crops are especially sensitive to injury by pesticides, and the potential for economic loss is significant. For example, grapes have an annual fruit value of \$4,000 to \$5,000 per acre and the 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 any and all appropriate safety measures before, during, and after each application.

Use Pesticides Carefully

When applying pesticides, take extra precautions to avoid damaging nearby sensitive crops. Many plants are sensitive to pesticides and may be harmed by particle drift, vapor drift, or pesticides that run off targeted areas.

Crops with glyphosate- and dicamba-resistant

technologies continue to pervade the market, with other herbicide-resistant crop technologies on the horizon. As this occurs, these herbicides are increasingly relied upon for weed control. Hormonal-type herbicides like 2,4-D and dicamba can cause significant damage to nontarget plants including grapes, organics, nondicamba-resistant soybeans, and trees. Product-specific label requirements such as buffer zones, specific weather conditions at time of application, and equipment settings are good indications that a pesticide is susceptible to drift or runoff. However, it's important to realize that **any** pesticide has the potential to move off-site and cause injury.

Be Proactive

The nonprofit company FieldWatch, Inc., cooperates with the Nebraska Department of Agriculture (NDA) to maintain three online registries that enable improved communication and stewardship among commercial sensitive crop growers, beekeepers, and pesticide applicators. Commercial growers of sensitive crops are encouraged to register locations of their crops on **DriftWatch™**; beekeepers are encouraged to register locations of their hives

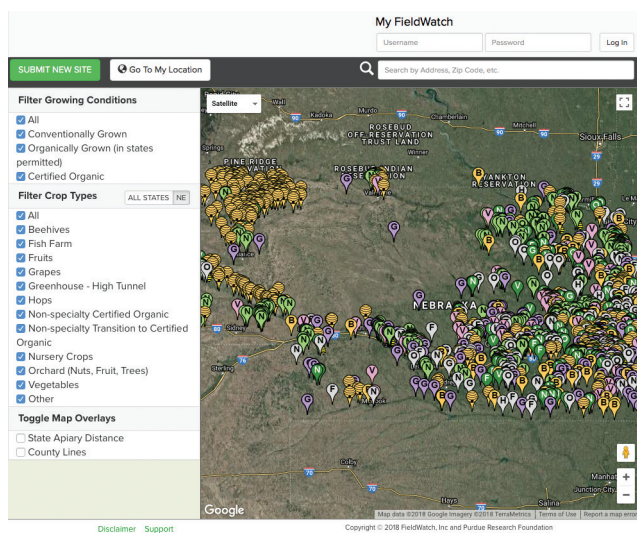


Figure 1. FieldWatch, DriftWatch, and BeeCheck allow for increased communication between pesticide applicators and commercial specialty crop growers and beekeepers.

on **BeeCheck™**; pesticide applicators are encouraged to register on **FieldWatch®** and use it to determine if sensitive crops or beehives are near a planned pesticide application site. If a sensitive crop site is identified, applicators should adjust pesticide application procedures, including timing and/or application methods, accordingly.

Applicators are encouraged to use FieldWatch and document known locations in application records, or print a map from the website and incorporate it into application records. It is also a good practice to scout the area before the 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 and dealers 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. This NebGuide focuses on protecting sensitive crops. For more details about protecting bees from pesticides, see *Bee Aware: Protecting Pollinators from Pesticides* (EC301).

FieldWatch allows applicators to sign up for email notifications when new locations are entered in their “business area.” Simply register for this service, then choose a business area by selecting statewide or individual counties, or use the online mapping tool to outline a geographic area.

These registries rely on proactive growers and applicators to be effective. Growers should update or submit new information as soon 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 potential for pesticide damage. Good communication is the key to avoid pesticide injury problems.

All three registries can be found at <http://www.fieldwatch.com>

Strategies to Protect Sensitive Crops

Use Integrated Pest Management (IPM). Before each application, review and consider using a variety of IPM methods, including pest prevention, scouting to monitor pest populations, economic threshold levels, and pesticide alternatives such as mechanical controls, sanitation, and biological controls. Prior to the field season, consider crop rotation and selecting herbicide- and/or insect-resistant varieties. By incorporating a variety of management techniques, you reduce your reliance on chemical controls (pesticides). This, in turn, reduces the risk of injuring off-target plants.

Select an appropriate pesticide product. If using a chemical, read product labels to find one suitable for the pest you want to control. Consider the toxicity and potential hazard of the product; select one with the lowest risk of harming sensitive crops. Make sure the target site or crop is listed on the label.

Read the label. Remember that the pesticide label is the law. Read and follow all directions and precautions. Apply pesticides only on sites (crops, pastures, or other areas) listed on the label. Applying a pesticide to a site not listed on the label is illegal. Do not exceed the rate specified on the pesticide label; using a rate higher than that given on the label is illegal. The risk of off-target injury to people, livestock, pets, wildlife, and plants will be greatly reduced by following label instructions.

Many labels have instructions to avoid drift. Some labels include buffer or set-back zones to protect specialty crops and sensitive areas. Additionally, there may be information regarding droplet size, nozzle selection, and maximum wind speeds to avoid drift. Restrictions or requirements are often added to labels over time as new information becomes available. Read the label when planning every application. For more details about the pesticide label, 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 plants nearby?

- Are any streams, ponds, ditches, drainage areas, or other open-water sites close by?
- 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 next several days?
- Are any children, pets, or other animals in the area?
- Do I know the amount of pesticide needed to complete the job so I don't mix more than necessary?

Watch for drift or runoff during the pesticide application. It's good practice to adjust pesticide applications when conditions may increase drift or runoff. Factors to consider include wind speed and direction, and soil type and saturation. Stop applying if the weather becomes too windy or if the product starts to run off the target area. You can also reduce off-target injury by reducing your field speed when navigating difficult areas and if near sensitive crops. 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. In the case of some herbicides, this may be done by adding one-half tank of water, then flushing all parts of the tank for five minutes through both agitation and spraying. Other herbicides may require more exhaustive cleaning procedures, such as triple-rinsing. Always check the label for product-specific sprayer cleanout directions. Always spray rinsate on an appropriate site.

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 not, extra careful cleaning following each application of a growth regulator is necessary 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 details about cleaning pesticide application equipment, 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 left over. However, if extra product remains after an application is completed, dispose of the remainder by applying to a site mentioned on the label. Nebraska does not have a statewide pesticide disposal program. Some companies can help dispose of unused or outdated pesticide for a fee, but it is better to plan ahead and avoid having leftover pesticide.

Empty containers should be triple- or pressure-rinsed and either disposed of at a landfill according to label directions, or recycled. 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 or sensitive sites. 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 do an application, use the oldest pesticides first.

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

Pesticides Can Move Off-Target

Particle Drift. Small spray droplets are susceptible to drift during a pesticide application and could travel long distances to damage nontarget plants or animals. To help prevent drift, use larger spray droplets and lower pressures; select nozzles designed to reduce drift, and use the appropriate boom height. Make sure the wind speed is low and blowing away from sensitive areas.

Spray drift can be reduced by doing the following:

- Spray when wind speeds are between 3 and 10 mph.
- Avoid applying pesticides when there is a temperature inversion. An inversion occurs when cool, calm air is near the surface with warmer air above. The inversion reduces air circulation and results in spray particles concentrating at the cool/warm air boundary and then moving off-site in an unpredictable manner.
- Select a nozzle that produces the largest label-recommended droplet size for the product being applied.
- Use a rate controller to spray at the lower end of the suggested pressure range for a given spray nozzle.

- Adjust the height of the 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.

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 from the application site and move in an unpredictable manner, affecting off-site plants or animals. The volatility of some pesticide products increases as the temperature rises into the upper 80s and 90s. The product label will warn you not to apply the product if a certain temperature is expected in the next few days.

Volatilization can be reduced by doing the following:

- Switch to a less volatile formulation. 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 and enter streams, rivers, and lakes, or severely damage other plants. Runoff can kill fish or aquatic invertebrates and/or make the water unsuitable for recreation or human consumption. 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, or runoff. In general, the amount and type of injury is dependent on the amount of drift/runoff that occurs as well as the species of crop in the area affected by off-target movement.

Off-target damage can lead to strained relationships between neighbors and/or result in significant financial losses for those whose sensitive crops are affected. In some cases, the full extent of these losses may not be known for several years. Communication is key. As Nebraska's agricultural economy continues to diversify, it becomes more important to recognize specialty crops as a key source of income for many growers.

Non-GMO Soybeans. Despite the continued influx of soybeans equipped with herbicide-resistant technology, producers should be mindful of conventional soybean varieties grown in their area. Drift damage on non-GMO soybeans can be devastating. When planning applications, never make assumptions about which bean varieties neighbors have chosen to plant.



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

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 increased market value of their certified product. By regulation, crops grown organically cannot be equipped with genetic engineering, such as herbicide-resistance 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, Nebraska Extension Educator)



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

Trees. Trees are valued for many reasons in Nebraska. They form windbreaks, produce fruit and nuts, and serve as ornamentals, to name a few. 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)

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. Acreage devoted to hop production in Nebraska has steadily increased



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

in recent years. 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, 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 NDA as soon as possible at 402-471-2351. 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 drift potential takes careful planning. This is extremely important for protecting sensitive crops and beehives. Follow pesticide labels, check application equipment, and be aware of environmental conditions to make sure the products are applied where they are intended and have maximum effectiveness.

Additional Information

Nebraska Extension Publications

<http://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

Nebraska Extension Pesticide Safety Education Program

- Pesticide Container Recycling: <https://pested.unl.edu/recycling>
- Pesticide Disposal: <https://pested.unl.edu/disposal>

NDA's Pesticide Program:

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

- Nebraska DriftWatch
- Integrated Pest Management
- Applicator Certification and Training
- Nebraska Pesticide Act and Enforcement

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 www.epa.gov/pesticides/

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