









Shoot tips seldom resume growth after they have been injured by growth-regulator herbicides, but laterals continue to grow. The result is a very bushy vine with a shade canopy and poor fruit exposure. Growth-regulator injury is particularly severe when the same grape planting is exposed to multiple incidents over a period of years.

Symptoms of **fanleaf degeneration**, a viral disease, can resemble those caused by growth regulators.

### **Glyphosate and ALS-inhibitor injury symptoms**

Symptoms vary, depending on the timing of the drift incident, and usually take 2 to 3 weeks to appear. The first symptom usually is yellowing of the growing points, followed by necrosis and death of the growing points (Figure 3, page 6). As a result, apical dominance may be broken, resulting in growth of numerous lateral shoots (bushy growth). Other symptoms include arrow-shaped, cupped, and upward-curved leaves, shortened internodes, and occasionally interveinal chlorosis (Figures 3 and 4, page 6).

Fall uptake of glyphosate may result in symptoms the following year, including stunting of early shoot growth, leaf chlorosis and distortion, very short internodes, abundant lateral shoots, and aborted flowers. These early-spring symptoms may be confused with viral or fungal diseases (for example, *Eutypa dieback*).

Grape root injury can occur from either glyphosate or ALS inhibitors, although the long-term implications of this type of root injury are unknown. It is generally believed that root injury is more likely from ALS-inhibiting herbicides than from glyphosate, since glyphosate is rapidly inactivated when it comes in contact with soil.

### **Protection from herbicide drift injury**

Both grape growers and nearby growers of other crops can take steps to reduce the risk of herbicide drift injury to grapevines.

#### **Avoid making herbicide applications during sensitive periods of grape growth and development.**

Everyone who uses potentially injurious herbicide products should know whether and where grapes are being grown in their vicinity and when grapes are in sensitive developmental stages. (The most sensitive stages of grape development start with bud break in early spring through flowering and fruit set.)

#### **Maintain good relations with neighbors.**

Grape producers should make sure that neighbors within approximately a half-mile radius around their vineyard are aware that vines are growing nearby and that they are sensitive to some herbicides. Be sure that state and county highway



Figure 2. Dicamba drift injury symptoms: (A) Leaf cupping downward. (B) Leaf cupping upward.

departments, utility companies, and other agencies that might spray rights-of-way or roadsides know where your vineyard is. If rights-of-way or roadsides run through your property, keep them free of weeds so they are less likely to be sprayed. Encourage your neighbors to use [drift-reduction spray nozzles](#) (nozzles that produce large droplets) and to select herbicides that are less likely to injure grapes.

### Minimize drift injury from herbicides used in the vineyard.

Glyphosate is registered for use in nonbearing and bearing grapes as a directed spray. However, if it is not applied properly, severe damage can occur. To avoid injury, grape growers should observe the following guidelines.

- Avoid glyphosate contact with any green parts of the vine or through drift.
- If possible, avoid summer and fall applications (when grapes are most susceptible to injury).
- Avoid glyphosate applications when shoots begin to trail, especially with downward shoot-training systems.
- Use a shield mounted to a wand for a backpack sprayer application or a commercial shielded sprayer such as a dome sprayer.
- Avoid spraying in windy conditions or during temperature inversions.
- Use drift-reduction nozzles (for example, drift-guard or air induction types) that operate at lower pressure (15 to 30 psi) and produce large droplets.
- Use grow tubes to protect the green shoots of first-year vines from herbicide contact.
- If you practice chemical weed control in your vineyard, begin the weed management program with preemergence herbicides (consult the [PNW Weed Management Handbook](#)) and follow up with postemergence herbicides before bud break.
- In midseason, use a contact herbicide (not systemic) to treat weed escapes. Examples are products such as Gramoxone (paraquat) or Rely (glufosinate).
- If you use 2,4-D in your vineyard, apply it before active shoot growth occurs, use low spray pressures, and be extremely careful to avoid treatment when weather conditions favor drift, such as during high temperatures, breezy conditions, and temperature inversions.



Figure 3. Glyphosate injury symptoms: (A) Distorted leaves. (B) Lateral shoot growth with unusual burst of latent buds on nodes, short internodes, and distorted leaves.



Figure 4. ALS inhibitor injury symptoms from sulfonylurea herbicide spray drift: chlorosis of leaf veins and change in leaf appearance from smooth to crinkled.



## Other herbicide drift resources

*Diagnosing Herbicide Injury on Garden and Landscape Plants*. ID-184-W. Purdue Plant & Pest Diagnostic Laboratory. [http://www.extension.purdue.edu/extmedia/ID/ID\\_184\\_W.pdf](http://www.extension.purdue.edu/extmedia/ID/ID_184_W.pdf)

Leaf Index and Severity Rating, Washington State University. <http://feql.wsu.edu/eb/>

Oregon Department of Agriculture (503-986-4653). Direct investigations of suspected Oregon drift incidents here.

*Questions and Answers About Vineyard Injury from Herbicide Drift*. Kansas State University. <http://www.ksre.ksu.edu/bookstore/pubs/mf2588.pdf>

Washington Pesticide Management Division (Washington Department of Agriculture, 509-225-2647, toll-free 1-877-301-4555). Direct investigations of suspected Washington drift incidents here.

### Use pesticides safely!

- Wear protective clothing and safety devices as recommended on the label. Bathe or shower after each use.
- Read the pesticide label—even if you've used the pesticide before. Follow closely the instructions on the label (and any other directions you have).
- Be cautious when you apply pesticides. Know your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.

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