



Understanding Herbicide Drift Issues

by Michele Warmund

Several reports of herbicide injury on high-value ornamental and specialty crops due to drift from products containing dicamba, glyphosate, and 2,4-D have been in the news lately. Dicamba and 2,4-D are older herbicides used primarily for post-emergent control of broadleaf weeds. Dicamba was first developed in 1942, but not released until 1965. This herbicide is registered for use on several crops, including asparagus, barley, corn, cotton, sorghum, soybean, and wheat. It can also be used in conservation reserve programs, fallow croplands, hay, pasture land, and is found in some lawn care products. 2,4-D was developed during World War II at the Rothamsted Experiment Station in Great Britain and became commercially available in 1946. Unfortunately, some of the older formulations of dicamba and 2,4-D are volatile and can drift onto non-target plants, causing injury. Glyphosate (active ingredient in Roundup) was discovered in 1970 and is widely used for post-emergent control weeds. Over the years, with repeated use of these products, herbicide resistant weeds have evolved, posing a significant threat to corn and soybean production in the Midwest.

Because of the high expense of herbicide development, some crop plants, such as soybean, corn, and cotton, have been genetically-modified, making them tolerant to specific herbicides. Also, new formulations of 2,4-D and dicamba have been developed with reduced volatility. Label instructions direct users to apply these products when the wind speed is 3 to 10 mph using approved nozzles on a boom at a specified height, and to maintain a buffer to protect other sensitive plants. Another precaution against drift is to avoid application of herbicides under conditions favorable for a temperature inversion. A temperature inversion occurs when cold air near the soil surface is trapped below a layer of warm air. When certain

herbicides are applied during a temperature inversion, vertical air movement is restricted, causing the suspended herbicide droplets to remain in a concentrated cloud. This cloud can then move in unpredictable directions due to the variability of wind direction. Temperature inversions commonly occur on clear nights or with limited cloud cover and little wind. Inversions begin to form when the sun sets and continue into the morning, forming foggy conditions.

Various symptoms of dicamba or 2,4-D injury on sensitive crops may include foliar stunting or abnormal elongation, cupping or parallel venation of leaves, foliar chlorosis (yellowing), shortened internodes, or twisting, callusing, splitting or cracking of stems or petioles (Figure 1). Factors influencing the severity of damage include the plant species, time of year, age of the plant, degree of exposure, environmental conditions at the time of herbicide application, and the herbicide applied. Also, injury symptoms may be immediate or delayed for a year. Some herbicide-damaged plants can recover with time. Observations at the University of Missouri indicate that grape, peach, and elderberry are among the more susceptible fruit crops to dicamba damage. Grape, elderberry, viburnum, walnut, and dogwood exhibit sensitivity to 2,4-D + glyphosate.

If you suspect herbicide injury, the date damage was observed and photographs of the affected plants are important. Consider contacting the Missouri Department of Agriculture Bureau of Pesticide Control. Procedures for investigating possible pesticide misuse can be found in the MDA pesticide incident report form (<http://mda.missouri.gov/plants/pdf/PesticideIncidentReport.pdf>). Maps of the affected area, weather details, and plant samples will aid investigators. Plant samples should be taken as soon as possible

since some herbicides dissipate within three weeks after application. Samples can be frozen for later analysis or sent to a lab for verification of herbicide residue. A state investigation might result in fines against the applicator, but doesn't result in compensation for loss of yield or damage.

Figure 1. Dicamba damage on 'Norton' grapevine two weeks after application.



To seek compensation for economic loss resulting from herbicide injury, first contact the individual responsible for the damage. Most commercial pesticide applicators and many farmers carry liability insurance that will cover all or part of the loss. If a satisfactory settlement is not attained, then consider contacting an attorney.

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August Gardening Calendar

Ornamentals

Weeks 1-4

- Continue spraying roses that are susceptible to black spot and other fungus diseases.
- Annuals may appear leggy and worn now. These can be cut back hard and fertilized to produce a new flush of bloom.
- Deadhead annuals and perennials as needed.

Weeks 1-2:

- Divide oriental poppies now.
- Feed mums, asters and other fall-blooming perennials for the last time.
- Roses should receive no further nitrogen fertilizer after August 15th.
- Powdery mildew on lilacs is unsightly, but causes no harm and rarely warrants control, though common rose fungicides will prove effective.
- Madonna lilies, bleeding heart (*Dicentra*) and bloodroot (*Sanguinaria*) can be divided and replanted.
- Divide bearded iris now. Discard old center sections and borer damaged parts. Replant so tops of rhizomes are just above ground level.
- Prune to shape hedges for the last time this season.

Weeks 2-4:

- Order bulbs now for fall planting.
- Evergreens can be planted or transplanted now to ensure good rooting before winter arrives. Water both the plant and the planting site several days before moving.
- If you want to grow big dahlia flowers, keep side shoots pinched off and plants watered and fertilized regularly.

Lawns

Weeks 1-2:

- Zoysia lawns can receive their final fertilizer application now.
- Apply insecticides now for grub control on lawns being damaged by their activity.

Weeks 3-4:

- Lawns scheduled for renovation this fall should be killed with Roundup now. Have soil tested to determine fertility needs.

Week 4:

- Dormant lawns should be soaked now to encourage strong fall growth.
- Verify control of lawn white grubs from earlier insecticide applications.

Vegetables

Weeks 1-4:

- Compost or till under residues from harvested crops.

Weeks 1-3:

- Sow seeds of beans, beets, spinach and turnips now for the fall garden. Spinach may germinate better if seeds are refrigerated for one week before planting.
- Cure onions in a warm, dry place for 2 weeks before storing.

Week 1:

- Broccoli, cabbage and cauliflower transplants should be set out now for the fall garden.

Weeks 2-4:

- Begin planting lettuce and radishes for fall now.

Weeks 3-4:

- Pinch the growing tips of gourds once adequate fruit set is achieved. This directs energy into ripening fruits, rather than vine production.

Fruits

Weeks 1-4:

- Prop up branches of fruit trees that are threatening to break under the weight of a heavy crop.

Weeks 1-3:

- Protect ripening fruits from birds by covering plants with a netting.
- Continue to spray ripening fruits to prevent brown rot fungus.

Week 1:

- Thornless blackberries are ripening now.

Weeks 2-4:

- Watch for fall webworm activity now.
- Cultivate strawberries. Weed preventers can be applied immediately after fertilizing.

Weeks 2-3:

- Spray peach and other stone fruits now to protect against peach tree borers.
- Fall-bearing red raspberries are ripening now.
- Sprays will be necessary to protect late peaches from oriental fruit moth damage.

Miscellaneous

Weeks 1-4:

- Soak shrubs periodically during dry spells with enough water to moisten the soil to a depth of 8-10 inches.
- Once bagworms reach full size, insecticides are ineffective. Pruning off and burning large bags provides better control.

Weeks 1-2:

- Spray black locust trees now to protect against damage by the locust borer.

Weeks 2-4:

- Hummingbirds are migrating through gardens now.

Weeks 2-3:

- Watch Scotch and Austrian pines now for Zimmerman pine moth damage. Yellowing or browning of branch tips and presence of pitch tubes near leaf whorls are indicative. Prune and destroy infected parts.

Weeks 3-4:

- Clean out cold frames to prepare for fall use.
- Monitor plants for spider mite activity. Hose these pests off with a forceful spray of water.
- 2nd generation pine needle scale crawlers may be present on mugo pine now.

Gardening Calendar supplied by the staff of the William T. Kemper Center for Home Gardening located at the Missouri Botanical Garden in St. Louis, Missouri. (www.GardeningHelp.org)

Zinnia: Not the Flower Grandma Grew

David Trinklein

In the search for a durable, colorful annual flower able to handle the rigors of a typical Missouri summer, zinnia ranks high on the list of possibilities. Available in nearly every color of the rainbow, its heat and drought tolerance along with its low-maintenance nature make it a familiar sight in annual beds and borders.

For decades, zinnia's major detractor had been its susceptibility to powdery mildew. Fortunately, plant breeders have made great strides in improving zinnia's ability to tolerate the troublesome disease while improving its desirable qualities. If you haven't grown zinnias recently, you are in for a pleasant surprise. In short, today's zinnia is not the flower grandma used to grow.

The common garden zinnia (*Zinnia elegans*) is a member of the sunflower (*Asteraceae*) family of plants and a native of Mexico. Evidently, the Spanish explorers who first encountered zinnia were not terribly impressed and named it mal de ojos which, literally interpreted, means "sickness of the eye". Fortunately, not everyone shared their opinion of the flower. Thanks to the work of European plant breeders who began selecting zinnias for their desirable characteristics, zinnia was introduced into the gardening world in the 19th century. It is named in honor of Johann Gottfried Zinn, an 18th century botanist and anatomist.

As a garden flower, zinnia first became widely popular in the United States around 1920 when Bodger Seed Company introduced a variety named 'Giant Dahlia'. The name refers to the fact that zinnias come in two flower forms: dahlia and cactus. Dahlia-flowered zinnias have ray florets (petals) that are broad, tightly-packed and extend somewhat downward that their tip. Cactus-flowered zinnias have quill-like petals whose edges are reflexed downward.

Thanks to plant breeding, zinnias are available in every size and color imaginable. It's a bit hard to imagine that towering giants such as 'State Fair Mix' which easily achieves a high of three feet and bears flowers six inches in diameter belong to the same species as diminutive varieties such as 'Thumbelina'. The latter rarely exceeds six inches in height and bears flowers about an inch and one-half in diameter.

Zinnias are great garden flowers for Missouri for several reasons. First, they adore heat—which is a real plus for a garden plant in the "Show Me" state during the months of July and August. Second, they are very versatile in the garden serving equally well in beds or borders, depending upon the cultivar chosen. Additionally, the taller, large-flowered cultivars make excellent, long-lived cut flowers for those interested in enhancing their interior decor. Finally, they are "user-friendly" and not difficult to grow. It is one of the few garden flowers that can be started equally well by planting seeds directly in the garden or by purchasing transplants. If direct seeding is done,

one should wait until the soil has warmed which, in Missouri, means the month of May.

Zinnias prefer a well-drained garden loam of moderate fertility. Space according to variety. Vigorous by nature, they are, however, prone to attack by several pests. Spider mites along with chewing insects such as grasshopper and "bud worms" can be troublesome. Powdery mildew is by far the most frequently encountered disease, however plant breeders have made progress in combating this disease. Several of the newer cultivars (e.g. the 'Magellan®' series) appear to be more tolerant of mildew than are the older ones. In all cases, keeping foliage as dry as possible (do not overhead irrigate) and spacing plants apart for good air circulation can help manage the disease. Fungicides labeled for powdery mildew control also can be used as a preventative measure.

For those wishing to re-acquaint themselves with this willing visitor to Missouri gardens, there are many new varieties to try. The aforementioned 'Magellan®' series comes highly recommended. It boasts vigorous and uniform plants that mature to a height of 12 to 14 inches. Its large, fully-double flowers are vibrant in color and of exceptional quality.

Additional newcomers to the zinnia world include the 'Profusion®' series (*Zinnia x hybrida*) and the 'Zahara®' series (*Zinnia marylandica*). Both bear abundant flowers two to three inches in diameter are available in a variety of colors. Plants are 12-18 inches in height and extremely disease resistant. Although not terribly effective as cut flowers because of their small size, these two series of zinnia provide a virtual riot of color in the garden with minimal care. Both series feature All American Selection (AAS) winners. The latter includes 'Profusion®' orange, white, red, double hot cherry and double deep salmon, as well as 'Zahara®' starlite rose, double fire and double cherry.

Another relatively new zinnia that deserves trying is 'Crystal White'. It, too, is an AAS winner

that is a member of the species known as lance-leaf zinnia (*Zinnia angustifolia*). It has a dwarf, spreading habit and is literally covered with two-inch diameter flowers all summer, making it an ideal choice for edging. Its disease resistance is excellent as is its ability to tolerate heat. Other new and exciting varieties of zinnia exist. When in doubt about which ones to try, look for those that are AAS winners.

When all is said-and-done, few garden plants are as easily grown, enjoyed as much, or come in such a wide diversity of colors, sizes and types as zinnia. If you have not tried this fan of Missouri's hot, humid summers lately, you are in for a pleasant surprise.



Missouri State Approved Soil Testing Labs Manjula Nathan

The Missouri Soil Testing Association (MSTA) Approval Program is designed to assure that results provided by participating public and private labs serving the citizens of Missouri agree with allowable statistical limits. This is accomplished by evaluating the soil testing laboratories in their performance through inter-laboratory sample exchanges and a statistical evaluation of the analytical data. Based on this premise, soil test results from MSTA approved labs will be accepted by the U.S. Department of Agriculture, Farm Service Agency (FSA) and Department of Natural Resources and Conservation Services (NRCS) in federally assisted cost share programs and nutrient management plans in the state of Missouri.

In order to be approved by the Missouri State program, the participating labs should participate in all four quarter exchanges of the NAPT program and submit the MO State data release form each year to the NAPT coordinator. The NAPT coordinator in return sends soil test data from quarterly sample exchanges of the labs participating in MSTA program to the Missouri state coordinator. The MU Soil Testing Lab director serves as the state program coordinator and performs statistical analysis of the data as specified in the MSTA program. If a lab's results fall within the allowable limits, the lab will be placed on the Farm Service Agency's (FSA) list of approved labs. A lab that is not approved may re-apply after a year. An updated listing of Missouri State Approved Soil Testing lab list can be found at: <http://soilplantlab.missouri.edu/soil/msta.aspx>

List of Missouri State Approved Soil Testing Labs, July 2017 to June 2018:

MU Soil and Plant Testing Lab

University of Missouri
23 Mumford Hall
Columbia, MO 65211
Telephone: 573-882-3250
Fax: 573-884-4288

MU Delta Soil Testing Lab

Univ. of Missouri, PO Box 160
Portageville, MO 63873
Telephone: 573-379-5431
Fax: 573-379-3383

Custom Laboratory

204 C St.
Golden City, MO 64748
Telephone: 417-537-8337
Fax: 417-537-8337

Perry Agricultural Lab

PO Box 418
State Highway 54 East
Bowling Green, MO 63334
Telephone: 573-324-2931
Fax: 573-324-5558

Ag Source Laboratories

300 Speedway Circle #2
Lincoln NE 68502
Tel: 402-476-0300
Fax: 402-476-0302

American Agricultural Lab

210 East First St, PO Box 370
McCook, NE 69001
Telephone: 308.345.3670
Fax: 308-345-7880

Midwest Laboratories, Inc.

13611 B St.
Omaha, NE 68144-3693
Telephone: 402-334-7770
Fax: 402-334-9121

Ward Laboratories

4007 Cherry Ave.
PO Box 788, Kearney, NE 68848
Telephone: 308-234-2418
Fax: 308-234-1940

Waypoint Analytical Iowa, Inc.

111 Linn St., PO Box 455
Atlantic, IA 50022
Telephone: 901-213-2400
Fax: 901-213-2440

Ingram's Soil Testing Center

13343 Fitschen Road
Athens, IL 62613
Tel: 217-636-7500
Fax: 217-636-7500

SGS-Toulon Labs

117 East Main St.
Toulon, IL 61483-0518
Telephone: 309-286-2761
Fax: 309-286-6251

SGS-Belleville

1511 East Main St.
Belleville, IL 62221
Telephone: 618-233-0445
Fax: 618-233-2792

Waypoint Analytical Inc.

2906 Clark Road
Champaign, IL 61822
Telephone: 217-359-7680
Fax: 901-213-2440

A&L Great Lakes Laboratory

3505 Conestoga Drive
Fort Wayne, IN 46808
Telephone: 260-483-4759
Fax: 260-483-5274

MVTL Laboratories-New Ulm

1126 North Front St.
New Ulm, MN 56073-0249
Telephone: 507-354-8517
Fax: 507-359-2890

Brookside Lab Inc.

200 White Mountain Drive,
New Bremen OH 45869
Telephone: 419-977-2766
Fax: 419-977-2767

Spectrum Analytical

1087 Jamison Road, PO Box 639
Washington Court House, OH 43160
Telephone: 740-335-1562
Fax: 740-335-1104

Waters Agricultural Laboratories

257 Newton Highway
PO Box 382, Camilla, GA 31730
Telephone: 229-336-7216
Fax: 229-336-0977

Waters Agricultural Laboratories

2101 Old Calhoun Road
Owensboro, KY 42301
Telephone: 270-685-4039
Fax: 270-685-3989

Waypoint Analytical Inc.

2790 Whitten Road
Memphis, TN 38133
Telephone: 901-213-2400
Fax: 901-213-2440

Ag Source Cooperative Services

106 N. Cecil St. PO Box 7
Bonduel, WI 54107
Telephone: 715-758-2178
Fax: 715-758-2620

Note: Approval of soil analysis does not imply approval of fertilizer and limestone recommendations by the individual labs. The approval allows the clients to use the University of Missouri soil fertility recommendations as required by the federal and state agencies for cost share and nutrient management planning programs. In order to use the University of Missouri soil fertility recommendations and get meaningful results, it is recommended that the labs use the soil test procedures required by the MSTA program.