



## Water Lilies: Easier than you think

by David Trinklein



Loved by most, but grown by few, water lilies suffer from the perception they are difficult to grow. Such is not the case. The special conditions needed to allow these aquatic beauties to grace one’s garden are not all that complex to provide. Once established, water lilies flower well into the summer and provide an exotic addition to any landscape.

Although large pools with fountains and waterfalls are impressive, beginners to water gardening would benefit by growing water lilies in a smaller space. Either a small, pre-formed pool or large tub set into the ground are good ways for neophytes to delve into water gardening. The edge of the pool or tub can easily be concealed with flat stones or plants. Pre-formed pools usually are made of plastic or fiberglass and should be set on sand to prevent damage which could result in leakage.

Water lilies need abundant sunlight to perform well. Therefore, water gardens should be located where they will receive a minimum of six hours of direct sunlight every day. Although water lilies will survive in less light, their flowering will be diminished. As a general rule, the more sunshine the better for water lilies.

*(continued on pg. 9)*

### In This Issue

Water Lilies: Easier than you think . . . . .	1
Herbicide Drift: What to do? . . . . .	2
Frequently Asked Questions About Handling Flooded Produce . . . . .	9
Plant Bugs Damaging Elderberry Plants. . . . .	14
June Gardening Calendar . . . . .	15



# Herbicide Drift: What to do?

by Dean Volenberg

When your vines experience herbicide drift be responsive and follow a reasonable response plan but don't forget about using the incident as means to implement a proactive prevention plan.

Herbicide drift is off-site movement and can result in non-target plant injury. Off-site movement of herbicides can occur by volatilization or physical drift.

Volatilization is the conversion from a liquid or solid state to a gas or vapor state after the herbicide has been applied to the intended site. The herbicide in the gas or vapor phase may then move off-site and is affected by air temperature, wind speed, and moisture. Herbicides with high vapor pressures are considerably more volatile than herbicides with low vapor pressures. As an example, ester formulations of 2,4-D have higher vapor pressure and tend to volatilize more than amine formulations. The volatility can increase during hot dry weather.



Common symptoms on grapevines of herbicide drift from growth regulating herbicides include; cupped leaves, downward bending of the shoots, yellowing of the leaves, and fingering of the leaf margins.

Physical drift is the off-site movement of herbicide droplets prior to deposition at the intended site. Both environmental conditions and application equipment setup can play a role in physical drift. Wind speeds over 10 mph coupled with high temperatures and low humidity can cause spray droplets to evaporate quickly before deposition. These smaller herbicide-laden water droplets can then move from the intended site of application. Although spray equipment set-up is important and includes; nozzle selection, spray pressure, and boom height, physical drift can often be avoided if applications

are avoided during high winds, low humidity, and high temperatures.

## Reasonable Response to Herbicide Drift

### Action Steps

1. Document the damage using pictures and record the date the damage was first noticed. Also record the number of grape vines damaged, age of vines, and cultivars damaged. In addition document the phenology of when the damage occurred. For example, 3-inch shoots, 10-inch shoots, immediate pre-bloom, bloom etc.
2. Try to identify the potential source of herbicide drift and types of herbicide(s). Be neighborly and try to resolve the problem without accusations. Remember that there are many potential sources of herbicide drift, including custom pesticide applicators, home owners, lawn care professionals, golf course managers, highway crews, etc.
3. Contact the Missouri Department of Agriculture if you want to formalize a complaint. **The Pesticide Incident Report** should be filed within 30-days of when the damage was alleged to have occurred.  
Daryl Slade  
Pesticide Enforcement/Pesticide Use Complaints  
573-751-5511  
Missouri Department of Agriculture Enforcement and Inspections <http://agriculture.mo.gov/plants/pesticides/pesticides.php>
4. Document the progression of the damage over time using pictures. Consider identifying 4 to 5 vines and identifying them with flagging tape and taking pictures on a weekly schedule. Try to take the pictures on the same day of the week to document the damage progressively.
5. Document and record yield and continue to document damage the following season(s).

Auxiliary Step: For those that want to go the extra step and fully document what herbicide(s) may be causing the damage, the affected tissues can be screened for the presence of herbicides. **Contact SGS Analytical**

(continued on pg. 3)

**Services** <http://www.sgsgroup.us.com/en/Agriculture-Food/Commodities/Analytical-Services.aspx> for pricing and sample submission. If interested in this service be sure to collect a sample when symptoms first appear because over time the grape plant will metabolize the active ingredient into metabolites. I do not endorse this lab over any others.

Another Consideration. Also be aware that if a herbicide residue is found within a crop in which the product is not labelled that there is the potential that the crop may not be able to be harvested. For example, if 2,4-D residues are found within grape leaves that would be off label as 2,4-D is not labelled to be used in grapes. Even though the product was not applied but drifted onto the grape crop.

### Proactive Prevention of Herbicide Drift

- Site selection is your best tool to avoid herbicide drift. Select a vineyard site that is not in close proximity to row-crop agriculture, or other areas where phenoxy herbicides are used regularly such as golf courses, right-of-ways, and housing subdivisions.
- Create awareness of your vineyard to neighbors and educate neighbors about the sensitivity of grape vines to phenoxy herbicides. Explain alternative practices that can reduce the potential

of herbicide drift. For example, using 2,4-D amine instead of ester formulations of 2,4-D, applying phenoxy herbicides when the air temperature is below 80°F, using spray nozzles that increase droplet size such as air induction nozzles, applying pesticides when the wind speeds are 3 to 10 mph and the wind is not blowing towards the vineyard, and using appropriate sprayer boom height.

- Consider planting buffer zones of trees to limit drift into your vineyard. If planting trees for a buffer zone, do not plant trees that will limit cold air drainage.
- Register your vineyard on the Drift Watch website <https://mo.driftwatch.org/>. This creates more awareness for your vineyard and also allows pesticide applicators to know the exact location. Many commercial applicators use the Drift Watch site to identify sensitive crop locations.

### Herbicides Causing Grape Injury

Grapevines are sensitive to a number of herbicides. Many grape growers are familiar with the damage caused by 2,4-D. The herbicide 2,4-D is classified as a phenoxy herbicide. There are a number of herbicides that can cause similar symptomology as 2,4-D on grapes. All of these herbicides are classified as auxin growth regulators (Table 1).

**Table 1. Common auxin growth regulator herbicides that can cause injury to grape vines.**

Herbicide Class	Common name	Active ingredient	Trade name
Phenoxyacetic	2,4-D	Dimethylamine salt of 2,4-dichlorophenoxyacetic acid	2,4-D
	MCPA	Dimethylamine salt of 2-methyl-4-chlorophenoxyacetic acid	MCPA
Benzoic Acids	dicamba	3,6-dichloro-2-methoxybenzoic acid	Banvel, Clarity
Picilinic Acids (Pyridines)	picloram	4-amino-3,5,6-trichloropicolinic acid	Tordon, Grazon1
	clopyralid	3,6-dichloro-2-pyridinecarboxylic acid	Stinger, Transline
	triclopyr	2,5,6-trichloro-2-pyridinyloxyacetic acid	Crossbow2, Garlon

1 Grazon is a premix and also contains 2,4-D.

2 Crossbow is a premix and also contains 2,4-D as a butoxyethyl ester.

*(continued on pg. 4)*

Some of these herbicides are used in agricultural row-crops to control broadleaf weeds. However be aware that 2,4-D, MCPA, and dicamba are also available in premixes to control many broadleaf weeds in lawns or turf. The picolinic acids and pyridines that includes products containing picloram, clopyralid or triclopyr are often used to control woody vegetation in ditches, fence lines, right-of-ways, and grass pastures. All the herbicides listed in Table 1 have the potential to volatilize and lift off the intended target site after application.

Although the growth regulator herbicides are often reported as causing injury to grapes there are also a number of other herbicides that can cause herbicide injury to grapevines. Glyphosate the active ingredient in a number of herbicides (Roundup Ultra, Weathermax, Touchdown etc.) can cause substantial damage to grapevines if it comes in contact with green tissue.

The Weathermax label specifically states to keep the spray mixture off green grape tissues such as leaves, shoots, suckers, and green trunks. Glyphosate is a systemic herbicide and is readily translocated to growing points in the roots and shoots causing cell death. A number of glyphosate containing products are used both in row-crop agriculture, right-of-ways, and by homeowners. Although glyphosate does not have the propensity to volatilize like the growth regulator herbicides, the spray mixture can move off-target if not applied in accordance with the label.

## **Symptomology on grapevines from growth regulating herbicides**

In the immediate future grape vineyards throughout the Eastern corn and soybean belt will likely be exposed to a very toxic combination of herbicides. Both Monsanto and Dow AgroSciences will be releasing corn

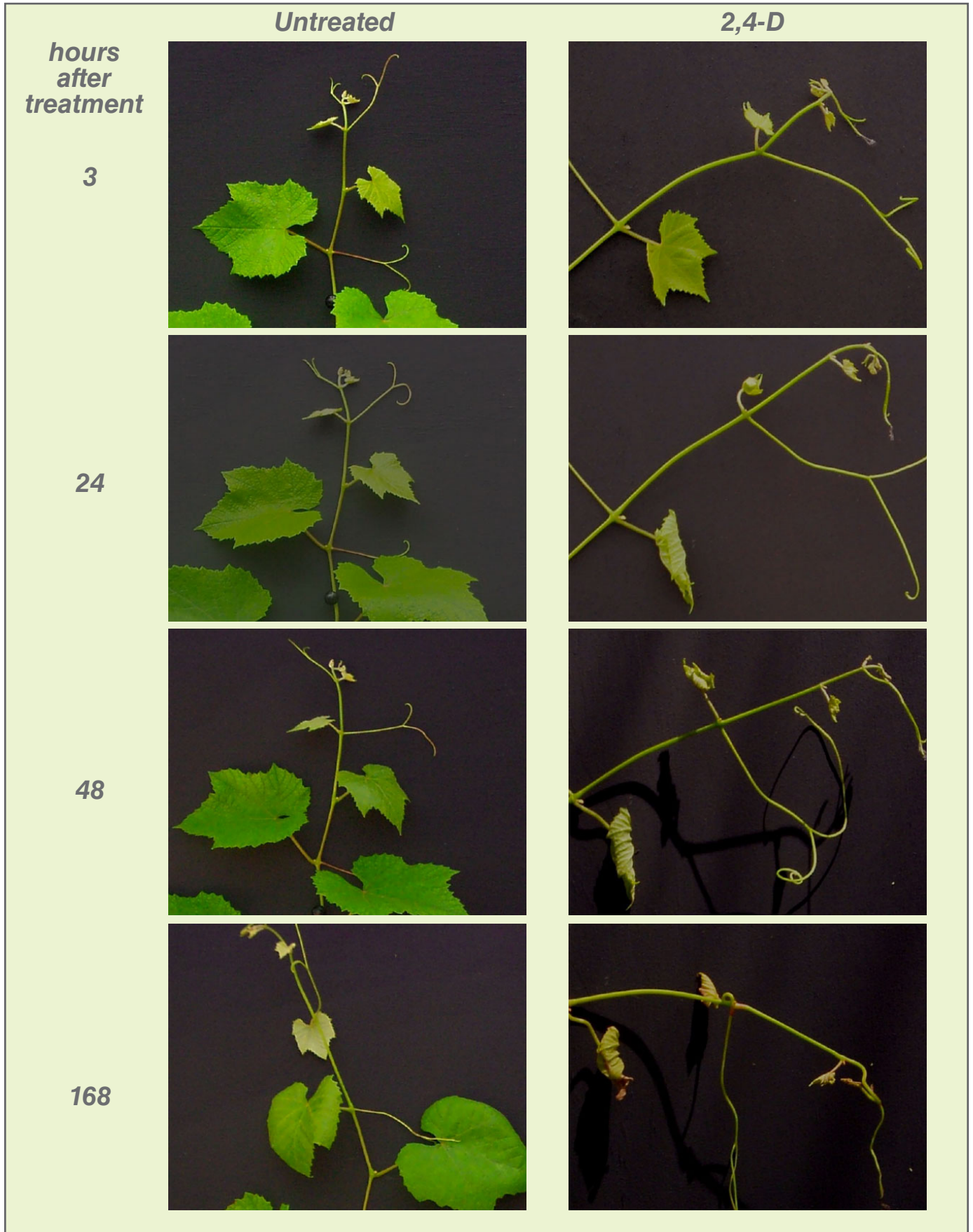
and soybeans that are resistant to both glyphosate and phenoxy herbicides. The phenoxy herbicide resistance will be to dicamba in Monsanto's Xtend products and 2,4-D in Dow AgroSciences Enlist products.

### ***Greenhouse grown grapevines treated with 1/100th the label use rate of 2,4-D show symptoms within hours after treatment***

Recognizing herbicide drift symptomology is the first step in diagnosing a potential drift incident. Although glyphosate combined with dicamba or 2,4-D is very damaging to grapevines, previous research has provided limited herbicide combination symptomology that has practical diagnostic application (AL-Khatib et al. 1993).

Current research by my colleagues and me documented herbicide symptomology using time lapse photography <https://www.youtube.com/playlist?list=PLFbZqcJroa9mSaQkukLvb719qzJr7gwb4> on greenhouse grown Norton grapevines to foliar applications of glyphosate, dicamba, 2,4-D, and the combinations of glyphosate + dicamba and glyphosate + 2,4-D. The herbicide rates applied represent 1/100 the recommended use rate of 2,4-D, dicamba, glyphosate, 2,4-D + glyphosate and dicamba + glyphosate. Additionally an untreated control. The rates applied were 0.01 lb/acre 2,4-D, 0.005 lb/acre dicamba, 0.01 lb/acre glyphosate, 0.01 lb/acre 2,4-D + 0.01 lb/acre glyphosate, 0.005 lb/acre dicamba + 0.01 lb glyphosate, and an untreated control. The experiment was conducted within greenhouses and time-lapse cameras took photographs every 10 minutes over a period of 21 days after treatment. Below are some selected time points showing the development of symptomology from 1/100 the recommended use rate of 2,4-D.

*(continued on pg. 5)*



(continued on pg. 6)

## Herbicide damage symptomology on grapes caused by growth regulator herbicides such as 2,4-D.



First, a fan shaped, chlorotic leaf and fingering of leaf margins, classic injury symptoms of growth regulator herbicides. Next, cupped leaves with fingering of the leaf margin caused by growth regulator herbicides. Last, a close up of fingering of the leaf margin. Note, compare to normal leaf margin.



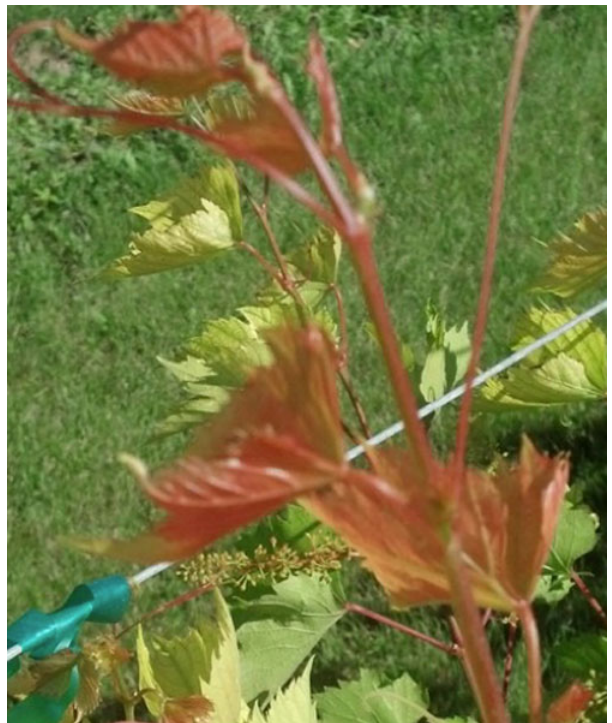
The grape vine pictured above was in a urban setting in which Weed-and-Feed had been applied to the lawn in the vineyard. The vines are showing all the classic symptoms of growth regulator herbicide injury that includes; chlorosis, fan shaped leaves, fingering of leaf margins, and flower abortion.

*(continued on pg. 7)*

## A look at other herbicides and their symptomology on grapes.



This vineyard received herbicide drift from a herbicide product containing the active ingredient glyphosate. The symptoms of glyphosate damage are stunted shoot growth, strapped leaves, chlorosis (as in the close up picture) and the following spring the vines typically will break multiple buds.



This vineyard received herbicide drift from two herbicide products; 2,4-D and mesiotrione. Mesiotrione is the active ingredient in Callisto herbicide. These herbicides are classified as "bleachers" and inhibit an enzyme involved in carotene synthesis. This results in chlorophyll not being protected from sunlight and the chlorophyll breaks down. In the close up image, chlorophyll has broken down and anthocyanin pigments are seen in the red coloration of the leaves.

## ... Water Lilies: Easier than you think, continued from page 1.

Additionally, water lilies grow best in tranquil water warmed by the sun. Larger pools with features such as fountains or water falls that create turbulent water reduce water lily performance. Pools that might be replenished frequently with cool water are equally unsatisfactory.

There are two basic types of water lilies: hardy and tropical. Hardy water lilies produce rhizomes and are best suited for our geographic region. They may be left in the pool year-around if the water does not freeze solid. In Missouri, pools should be at least 24 inches in depth to assure the presence of free water below a top layer of ice. Shallow pools may be equipped with water heaters to prevent freezing, but this adds to the expense of ownership.

Tropical water lilies grow from tubers and are not winter hardy in Missouri. Therefore, they must be removed from the water garden every fall and stored for the winter indoors under moist conditions. They should not be planted until water in the pool is quite warm (65° F, or above). This often is mid- to late June at our latitude, resulting in a longer wait to enjoy water lily flowers in the landscape.

The flowers of tropical water lilies are often larger and more spectacular than the hardy types, although a great deal of progress has been made in improving the latter. However, tropical types hold their blooms well above the surface of the water and are available in a wide array of colors including shades of blue. Additionally, most tropical types are pleasantly fragrant.

Hardy water lilies are day blooming and most flowers close in late afternoon. On the other hand, tropical water lilies come in two types relative to blooming habit. Day bloomers, like the hardy types, open in mid-morning and remain open until late afternoon. Night bloomers open at dusk and remain open until mid-morning of the following day. This is an added benefit for gardeners who work away from home during the day and wish to enjoy their water garden in the evening.

Water lilies should not be crowded. If the pool or tub is small, plant only one or use dwarf varieties. Crowding water lilies not only reduces the number of blooms, but the abundant number of lily leaves may entirely cover the surface of the water. Exposed water not only makes the pool more attractive, it is necessary for good air exchange if fish are kept in the pool. If excessive foliage develops, it should be cut and removed. Always remove older leaves and stems first and allow about 40 percent of the water's surface to be exposed.

May is an ideal month to plant hardy water lilies. Do not plant water lilies directly on the bottom of the pool. This makes them more difficult to maintain. Instead, plant them in tubs or containers that are then submerged into the pool. For standard types, a container that holds about one cubic feet of soil is ideal. For dwarf varieties, a container 9 to 10 inches in diameter is adequate.

When planting, handle water lily rhizomes and tubers along with their roots carefully, since they are quite brittle. After the rhizome or tuber has been planted, the container should be placed into the pool so that the crown is 10 to 12 inches below the surface of the water. Dwarf varieties should be located so they are five inches below the water's surface. Blocks or bricks may be placed under the container to position it properly.

Water lilies grow well in fairly heavy clay soils low in organic matter. They are, however, heavy feeders. Special fertilizer tablets formulated for water lilies are available at nurseries or garden centers that stock water garden supplies. Alternatively, they can be ordered online. Water lily tabs are made from slowly soluble materials that are not quickly released in water. Fertilizer tabs should be placed in the soil before placing the plants into the pool and, later, according to label directions.

Before the danger of frost in the fall, tropical varieties, as well as hardy types in shallow pools or tubs, should be removed from the water garden. During the winter, they should be kept moist and, in the case of the tropical types, relatively warm. The latter can be accomplished by removing the soil to expose the plant's roots and tuber. After dusting with a fungicide, place the roots/tuber in moist sand and maintain at 60° F. Alternatively, the entire plant and container can be brought indoors. After trimming back most of the leaves, place the container in a large aquarium or small plastic pool maintained at 60° F.

Water lilies are afflicted by very few diseases and pests. Dogs do not eat water lilies but often harm them when taking a dip in the water garden. Turtles tend to snack on lily foliage and produce scissors-like cuts in their leaves. Koi have been known to nibble on lily foliage as well.

Hardy (rhizomatous) water lilies should be divided when they become crowded in their container. Normally, it takes four or five years for this to occur, depending on the vigor of the plant. Key indicators that it is time to divide include reduced blooming or leaves pushing out above the surface of the water.



# Frequently Asked Questions About Handling Flooded Produce

The information in this document reflects our best effort to interpret federal food safety guidance and related scientific research, and to translate this into practical management options. However, growers are fully responsible for their own management decisions, for the quality and safety of the food they sell, and for compliance with all applicable laws and regulations.

## Where the FDA stance is clear

- 1. Does flooded produce have to be discarded?**  
**Yes**, if the edible portion has come in contact with flood waters the produce must be discarded due to the high risk of contamination from chemicals and microbial pathogens in flood water.
- 2. My field of carrots/potatoes/parsnips/other root crop is still young and several months from harvest, can I sell the crop?** **No**. The FDA is clear that any edible portion of a crop that comes in contact with flood water may not be sold, even if you leave it in the ground afterwards for a long time. There is evidence that potatoes can uptake pathogens through their lenticels and carrots can take them up through their crowns.
- 3. I had a planting of leafy greens (lettuces, spinach, Swiss chard, etc.) that did not germinate before the flood but now that the waters have receded it has emerged and looks great. Can I sell it?** **No**, this is a high risk. As they grow, the leaves will be in contact with flooded soil as this crop grows and thus could get contaminated with soil-borne chemical and/or microbial contaminants such as *E. coli*, *Salmonella*, etc. from wastes that were in flood water. Once attached, washing even with disinfectants cannot remove the pathogens.
- 4. Can I peel and/or cook flooded produce (particularly root crops and winter squash) and then sell it?** **No**. Although peeling and cooking will greatly reduce the microbial load, and will reduce some of the surface chemical contamination, any flooded produce - regardless of how it is processed - is still considered adulterated by the FDA and not allowed for sale. Unfortunately, because of the uncertainty as to the type and extent of microbial and chemical contaminants, further processing does not necessarily provide an assurance of safety. If there is contamination on the outside peel of the product, it would be hard to prevent some cross-contamination occurring with the flesh during the peeling process.
- 5. There was a lot of water standing on my field after the storm but it was just rainwater; it did not come from a river, stream or other surface water. Can I sell my produce?** **Yes**. Pooled water from rainwater alone is not considered to be flood water and the produce should be OK for sale. However, if there is evidence of contamination due to significant runoff from an adjacent area where livestock, manure, or compost are kept, then the produce may be contaminated if it was in contact with the contaminated water and should not be sold for human consumption.
- 6. My crop was flooded but I have tested it for bacteria after treating it with a chlorine sanitizer and the results show it is not contaminated, is it legal to sell?** **No**. Neither post-harvest cleansing of flooded crops, nor testing of flooded produce is accepted by FDA as a means of ensuring the safety of flooded produce for human consumption. This is partially because the produce could also be contaminated with unknown chemicals that are more difficult to test for, and partly because the microbial contaminants may not be evenly distributed throughout the field.
- 7. I have a buyer that says if I provide a test showing my produce is not contaminated with *E. coli* he will purchase it. Can I sell it to him?** **No**. Produce buyers must follow the law, too. Further, *E. coli* is not the only contaminant of concern in flooded produce. Testing for microbial pathogens in this situation cannot ensure the safety of the produce, as there are too many pathogens that can cause food borne illness to test for feasibly. Pathogens are often deposited unevenly on fields in flood situations, and it is not possible to take enough of these tests to have any reasonable certainty that all the food is safe for sale.
- 8. Can flooded produce be fed to livestock?** **No**. Upstream farms, sewage treatment plants, industrial plants, hazardous waste sites, etc. means that



floodwaters almost always will contain contaminants which can stay on the produce and this can harm livestock health if consumed. The FDA is also concerned about residues from some contaminants being transferred to animal products for human consumption (meat, milk and eggs).

9. **Can I replant my greenhouse this fall to a crop of salad greens even though it flooded in the summer?** **No.** You should not replant flooded soils in greenhouses to leafy greens. There is just too much risk of microbial contamination from the soils getting onto these crops that are low to the ground. In general, you should avoid planting any crops consumed raw this fall. A reasonable way to reduce the risk of contamination would be to build raised beds at least 6 inches high, and bring in non-flooded soil/compost to fill them, then avoid cross contamination from soil in greenhouse walkways by covering them with landscape fabric or straw, etc.
10. **What about other perennial crops that were under flood waters but that I won't be harvesting until next year, such as Echinacea, burdock, or other herbs grown for their roots?** Crops that have been exposed to flooded soils are deemed adulterated by the FDA. Even though these crops will not be harvested for quite a while, that is the law. We do not know whether, or to what extent, these crops may take up pathogens or chemical contaminants. If they are internalized by crop tissues then waiting until the next season and allowing a winter to pass before harvesting will not avoid contamination of the crop.
11. **What kind of soil tests should I do before I plant again?** Biological contaminants (those that are carbon-based) will break down over time in the soil, and it is difficult to conduct meaningful tests for these due to their variety and spatial distribution. Heavy metals, however, will not break down over time, and can be tested for more easily using traditional soil sampling methods. You can contact the KSU Soil testing lab in Manhattan at 785-532-6101 or the MU Soil and Plant Testing lab in Columbia at 573-882-0623 for more information on their testing services.
12. **My field has large depositions of silt and debris. Do I need to remove this, test it, or can I till it in?** Large debris in your fields should be removed, but the silt deposited by flood water and smaller debris do not need to be removed. Soils should be allowed to dry sufficiently and then

tilled to at least six inches deep before planting crops. Adding compost or other organic matter when tilling will be beneficial to the soil's biological activity, which can promote decomposition of some contaminants. To protect the soil from erosion after tilling, it is advisable to plant a cover crop, which will also stimulate biological activity. In the fall, consider planting small grains such as oats or winter rye with or without hairy vetch for adding nitrogen.

13. **Should I test my water?** If your wellhead was submerged under flood water, your well water should be retested to ensure that it is potable. Only potable water should be used to wash produce after harvest. In Kansas, you can contact either your local health department, a local sanitarian, or a Kansas Department of Health and Environment District Office for assistance and before collecting any well samples. In Missouri, contact the State Public Health Lab. Private certified labs are also available for water testing.
14. **What precautions should I take during clean-up?** Workers should wear protective clothing such as rubber boots, rubber gloves and an N-95 respirator mask when working in fields that were flooded. Mark the highest locations that flood waters reached using flags, etc. FDA recommends leaving a 30 foot buffer between flooded areas of fields and areas with crops to be harvested for human consumption; this is to accommodate a generous turn-around distance for equipment to prevent crop contact with flooded soil to avoid cross-contamination. Try to minimize dust and tracking dirt and sediment from flooded areas into non-flooded areas (such as packing sheds) as much as possible to reduce the chances of cross-contamination.
15. **My fields sometimes flood in the spring, but some springs they don't. Now that I know I have to destroy flooded crops - what should I plant in areas that are likely to flood?** I don't want good land that may or may not flood go to waste. Avoid planting root crops, leafy greens and any other crops that are ready-to-eat (normally not cooked) and any crops that grow very close to the ground. Instead, consider planting taller crops such as sunflowers or sweet corn or even fruit trees; non-edible cash crops such as biofuel crops: corn, sunflowers, or canola are an option if you have the equipment



to harvest them and necessary processing equipment and a market to sell them.

16. **How does flooding affect the organic certification of my land?** You will need to discuss this with your organic certifier. The organic regulations require that “prohibited substances” cannot be applied to land for at least three years prior to harvesting an organic crop. Floodwaters could contain many potential contaminants that would be considered “prohibited substances”. Fortunately, the volume of water during flooding events often dilutes the contaminants. In most cases, low levels of contaminants would be considered unavoidable residual environmental contaminants and would not affect the certification of the land. However, there are instances where prohibited residues would be of greater concern and farmers should contact their organic certifier to discuss next steps. If your farm is directly downstream from a source of concentrated prohibited substances, for example, a sewage treatment facility, or if there is evidence of contamination, for example an oily residue on your fields or an empty propane tank, the organic certifier may decide to test for likely contaminants and continued certification of the affected field will be based on the outcome of the tests and on-site inspection. Note that if your wellhead was submerged, your water should be retested to ensure that it is potable. Only potable water should be used to wash organic produce. You will need to provide your organic certifier with a copy of your completed water test.

## Where the FDA does not give clear guidance

Choosing to harvest crops under the following conditions appears to be allowed by the FDA but there is still a risk of contamination. It is up to the grower to decide if the level of risk is low enough to grow and harvest food crops. No one wants to be responsible for making anyone ill. Growers should carefully consider the level of risk associated with harvesting a crop near flooded areas or one that is grown in flooded soils after the waters recede. A food borne illness event associated with Kansas or Missouri produce and even the potential lack of consumer confidence from the uncertainty of the safety of potentially flooded produce would have serious ramifications for growers throughout both states. If you do choose to harvest crops in situations described below, keep records of what factors you considered when

making that decision and the steps you took to avoid cross-contamination.

17. **If the edible portion of a crop was above the flood water can it be sold? Yes, but only if the risk is low.** Growers will have to make their own case-by-case analysis of this situation. (See the FDA’s notice to growers about the safety of food affected by hurricanes and flooding). Although the edible portion of the plant may not have been in direct contact with flood water, there is still risk of it becoming contaminated. Contaminants that remain on the stem can be transferred to the flower or fruit, or contaminants in the soil may be splashed up onto the fruit. The risk of cross-contamination through indirect sources is of particular concern in that the produce can become contaminated during the harvest or post-harvest handling process if it comes in contact with contaminated water, soil on hands, or other contact surfaces. Because fruits and vegetables have irregular surfaces, once contaminants become attached to the cracks and crevices on the surface of produce, it is not considered possible to disinfect the edible portion.

### Questions to consider to assess the level of risk include:

- Are you confident that there are no major sources of contamination upstream (see description below for how to assess sources of contamination)?
- Were the flood waters only a few inches up on the plant and the plant is tall (For example, sweet corn, tall staked tomatoes, tree fruit and other crops where the edible portion is high on the plant and could be well above flood water even though the soil surface was flooded)?
- Is there any evidence of splashing of flood water onto the crop?

18. **How can I determine if there were sources of contamination upstream of my field(s)?** To assess potential upstream sources of contamination, several things should be considered such as the location of malfunctioning wastewater treatment facilities, manure storages, potentially damaged septic systems, or hazardous waste sites in the watershed upstream of your farm.



19. **If the edible portion of a crop had not yet formed, can I leave the flooded crop in place and sell it later?** This may be possible for some crops. If soils were flooded, edible portions will be developing in the window where pathogens might still be present (some can persist in the soil or on plants for months) and the risk of cross-contamination occurring during harvesting or handling is still there. The risks of food borne illness are greatest with any crops that might be eaten raw. With potatoes and winter squashes: if the edible part had not formed but there is reason to suspect the soil is contaminated and the edible portion of the crop will eventually come in contact with the soil once it appears, then the FDA is clear that the product should not be harvested and consumed. However, these crops, because they are cooked by consumers, have less risk than other types of crops that will be allowed to develop after a flood. Questions to consider when evaluating the crop can include: upstream sources of potential contamination, the time it took flood waters to recede, time it took the field to dry out, and the time until harvest. In general, the longer that the crop has been exposed to the sun and drying conditions, the better.

Fruiting plants that were in contact with flood waters but had no fruit on them at the time (tomatoes, beans, peas, peppers, etc.) or other plants with edible portions that had not yet formed at the time of flooding (broccoli, cabbage, Brussels sprouts etc.), may be allowed to form the edible part and then harvested after you have considered the above questions. However, do not sell these crops if the heads had started to form prior to the flood and were exposed to flood water as contaminants can get trapped within the folds of the heads and persist.

Kale and similar crops that can regrow new edible portions after flooding may be harvested if all leaves that might have come in contact with the flood waters are removed and then new growth that is harvested is triple washed and rinsed with a disinfectant (see below for information on how to disinfect produce). Keep in mind however, that sanitizer in the wash water will not remove the contaminants once they have attached to the produce.

*All crops harvested as described above should be triple washed using a disinfectant prior to sale, even if you do not normally wash them.*

20. **I have parsley growing on black plastic that was flooded. If I mow off the plants and allow them to regrow is it OK to harvest and sell them?** Only if you are sure that the parsley has not come in contact with flooded soil. In other words, the plastic must not have flooded soil or sediment remaining on top of it, and the holes in the plastic must be small enough to prevent soil splashing up during rain, etc. Parsley, cilantro and other herbs grow low to the ground and have a lot of leaf surface area to which soil can cling. If you have any doubt about soil getting onto the parsley leaves, then the crop should not be sold, especially since it is often eaten raw. Cilantro, which has a similar growth form to parsley, has tested positive in the past for pathogenic E. coli on tests conducted by the UDSA-AMS Microbiological Data Program.

21. **I had flood water come into the wheel tracks of my field but the raised beds of crops/hills of potatoes were above the flood level, can I sell my produce?** It depends. Above ground crops that did not contact the water can be sold. Water permeates the soil in a fan shape and could move from the wheel tracks into some parts of the raised beds, potentially contacting the potatoes. If any edible portion of root crops or crops that lie on the surface (e.g. melons) came in contact with contaminated flood water or soil that could be contaminated, that would prohibit their sale.

22. **How should I treat the crops that did not come in contact with flood water?** If a crop is anywhere near flooded soils, take extra precautions to avoid cross contamination from soil contact, blowing dust, and equipment such as dirty bins. After harvest, thoroughly rinse off any soil on the produce with potable water, and then triple rinse (i.e. put through three separate baths) in a solution of 150 ppm chlorine (sodium hypochlorite), or Sanidate® at the highest labeled rate (0.5 fl. oz/10 gal. water). Rinsing in water with disinfectant will not disinfect produce if the pathogens have already been internalized in the produce or have attached to the surface of the fruit or vegetable. The purpose of disinfectant in rinse water is to reduce the microbial load in the water to avoid cross-contamination. Disinfectants must be used properly to be effective. Excess organic matter and soil in the wash water, or an improper pH of the wash water will reduce the efficacy of the disinfectant.



- If you are using chlorine, check the wash water pH with pH test strips and adjust the pH to between 6 and 7.
- If washing tomatoes, peppers or eggplants, etc. the temperature of the water should be no more than 10 degrees cooler than the produce to prevent the crop drawing in water, potentially contaminating the flesh.
- Use test strips to monitor the level of the disinfectant often. Test strips for pH and Chlorine levels (one option)

**23. When can I replant my flooded field to edible crops?**

It is up to the farmer to decide when the risk is low enough to replant. The following can help reduce risk when replanting: allow the soil to dry out, till thoroughly, and allow some time for the population of microbial pathogens to decline before planting the next human food crop. The longer you can wait, the better, and it is not advisable to plant without a waiting period. Keep in mind that the USDA GAPs food safety practices as well as the organic standards require waiting several months after the application of raw manure, and if your fields were exposed to raw manure or feces in flood waters then that can be considered a similar situation. A minimum of several weeks waiting before planting is a good idea given that some research studies have found that pathogens in soil may decline significantly during this time. But again, if a high level of biological or chemical contaminants is suspected, as with extreme flooding conditions that breached many septic systems, it is prudent to wait longer to allow time for the carbon-based contaminants to be decomposed. Current industry guidance recommends 60 days, with shorter times possible based on the growers assessment of their field and flood conditions. Mixing in well-made compost will help stimulate biological activity and decomposition. Where you can, it will further reduce risk to sow a cover crop such as oats or winter rye and wait to plant human food crops until the following season.

**24. What kinds of edible crops can I replant on soils that have been recently flooded?**

Avoid planting any leafy greens, carrots, and other crops that might be eaten raw, directly into flooded soils. These crops pose a relatively high risk, as described above. If you have greenhouses or high tunnels that you normally use for growing such crops, an alternative would be to build raised beds at least 6 inches high and fill them with soil and

compost that has not been flooded. With garlic and root crops for next year's harvest it is still a good idea to wait as long as possible to plant these crops, allowing microbial pathogen populations to decline, since there is some evidence that crops can internalize pathogens from the soil. While microbial pathogens will decline over time, keep in mind that chemical contaminants may persist.

**25. Can I use wooden bins that have been in contact with flood water to store unflooded produce?**

It is not advisable, as wooden bins have porous surfaces that can retain soil and harbor microbes; this creates concern about cross-contamination from contact between clean produce and contaminants that may be on the surface of the bins. However, to greatly reduce risk, you can insert a clean poly bin liner after power washing the wooden surfaces and sanitizing with a 150 ppm chlorine solution. Bin liners are available from several companies that sell harvest supplies.

*This information was compiled in 2011 by: Ginger Nickerson, Vern Grubinger, Londa Nwadike and Lynn Blevins. Frequently Asked Questions about Handling Flooded Produce, Univeristy of Vermont.*

*Updated by: Londa Nwadike, Ph.D. Frequently Asked Questions about Handling Flooded Produce, Kansas State University.*

# Plant Bugs Damaging Elderberry Plants

by Michele Warmund

In April, damaged elderberry plants were observed in field plantings at several Missouri locations. Symptoms were dead or damaged terminal growing points of young succulent shoots or recurved leaflets with necrotic margins on new tissue (Figure 1). Where growing points were killed, lateral buds eventually grew, however, the cyme that would have developed from the damaged tissue will not be produced. In cases where the leaflet margins were damaged, this tissue fails to enlarge, but subsequent “normal” growth occurring from the growing point resumes. Upon close inspection, a 2 mm-long insect was found feeding on the plant tissue, which has been tentatively identified as a nymph of *Neurocolpus jessiae* (Figure 2). Early nymphal stages (instars) of this insect have green bodies covered with dorsal brown setae (hairs) and a dark spot at about two-thirds of the length of its body. It also has long antennae with three alternating brown and green segments covered with setae. Legs of nymphs are similarly long with alternating brown and green patches with relatively long, erect setae.

The winged adults are about 6 mm-long and 2-mm-wide, with yellowish bodies blotched with brown and covered with setae (Figure 3). The long pubescent antennae and legs have an alternating pale yellow and brown pattern.

*Neurocolpus jessiae* is classified as a true plant bug in the Family Miridae. This species was collected by Jessie Knight at Hollister, Missouri on July 3, 1921. Later descriptions state that there are two generations, with the first occurring in early summer in June and the second one in August. Other researchers report that *Neurocolpus jessiae* adults feed on elderberry flowers and berries, reducing berry production. Additionally, adults have been found on nearby flowering plants, including hollyhocks (*Alcea rosea*) and *Viburnum* species. Since this plant bug was first identified, it has been collected across the eastern United States where elderberry is found, including Iowa, Illinois, Mississippi, Texas, Massachusetts, Wisconsin, and Ontario, Canada. While *Neurocolpus jessiae* apparently feeds on vegetative tissues, flowers, and berries of elderberry, the damage to plant growth and crop yield has not yet been documented. For products approved to control plant bugs in Missouri, use the Missouri Department of Agriculture’s Pesticide Database Searches. Enter “plant bug” in the search box, click “Search for Pest Name”, and view a variety of plant bug species, growth stages and what you can use to control them.

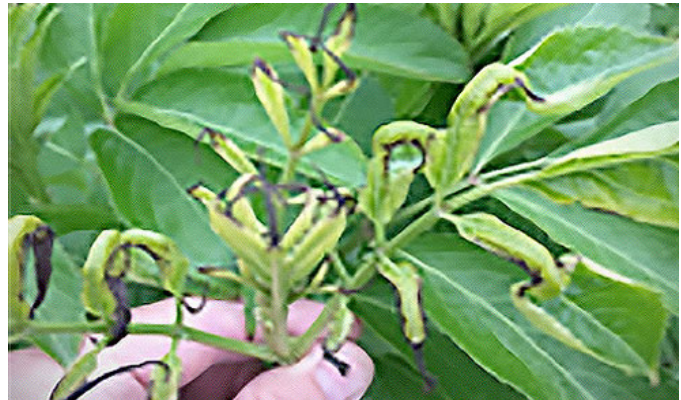


Figure 1 Necrotic growing point and leaflet margins damaged from plant bug feeding.



Figure 2 Early stage plant bug nymph (with legs folded and obscured by the abdomen) found feeding on succulent new growth of elderberry plants.



Figure 3 Adult plant bug (tentatively identified as *Neurocolpus jessiae*) observed on greenhouse-grown ‘Bob Gordon’ American elderberry plants.

# JUNE GARDENING CALENDAR

Category	Week				Activity	
	1	2	3	4		
Ornamentals	x				Deadhead bulbs and spring flowering perennials as blossoms fade.	
	x				Watch for bagworms feeding on many garden plants, but especially juniper and arborvitae.	
	x				Thin seedlings to proper spacings before plants crowd each other.	
		x	x	x	Plant tropical water lilies when water temperatures rise above 70 degrees.	
		x	x		When night temperatures stay above 50 degrees, bring houseplants outdoors for the summer.	
		x	x		Apply a balanced rose fertilizer after the first show of blooms is past.	
		x	x		Rhizomatous begonias are not just for shade. Many varieties, especially those with bronze foliage, do well in full sun if given plenty of water and a well-drained site.	
		x	x		Most houseplants brought outside prefer a bright spot shaded from afternoon sun. Check soil moisture daily during hot weather.	
		x	x		Apply organic mulches as the soil warms. These will conserve moisture, discourage weeds, and enrich the soil as they decay.	
		x	x		Apply a second spray for borer control on hardwood trees.	
				x	x	Softwood cuttings can be taken from trees and shrubs as the spring flush of growth is beginning to mature.
				x	x	Continue spraying roses with a fungicide to prevent black spot disease.
				x	x	Tired of the same old foundation plantings? Find fresh ideas among the evergreens planted in the Dwarf Conifer collection.
				x	x	Trees and shrubs may still be fertilized before July 4th.
	Lawns			x	x	Pruning of spring flowering trees and shrubs should be completed before the month's end.
x		x	x	x	Water turf as needed to prevent drought stress.	
x		x	x	x	Mow lawns frequently enough to remove no more than one-third the total height per mowing. There is no need to remove clippings unless excessive.	
x		x	x	x	Gradually increase the mowing height of zoysia lawns throughout the summer. By September, the mowing height should be 2 to 2.5 inches.	
x		x	x	x	Mow bluegrass at 2 to 3.5 inch height. Turfgrasses growing in shaded conditions should be mowed at the higher recommendations.	
Vegetables	x	x			Zoysia can be fertilized now while actively growing. Do not exceed 2-3 pounds of actual nitrogen fertilizer per 1000 sq. ft. per year.	
	x	x			Repeat plantings of corn and beans to extend the harvest season.	
	x	x			Plant pumpkins now to have Jack-o-lanterns for Halloween.	
			x	x	As soon as cucumber and squash vines start to 'run,' begin spray treatments to control cucumber beetles and squash vine borers.	
			x	x	Set out transplants of Brussels sprouts started last month. These will mature for a fall harvest.	
			x	x	Soaker hoses and drip irrigation systems make the most efficient use of water during dry times.	
			x	x	To minimize diseases, water with overhead irrigation early enough in the day to allow the foliage to dry before nightfall.	
			x	x	Start seedlings of broccoli, cabbage and cauliflower. These will provide transplants for the fall garden.	
		x		Stop harvesting asparagus when the spears become thin.		

*continued on pg. 10*

# JUNE GARDENING CALENDAR

Category	Week				Activity
	1	2	3	4	
Fruits			x	x	Control corn earworms. Apply several drops of mineral oil every 3 to 7 days once silks appear. Sprays of Bt are also effective.
			x		To maximize top growth on asparagus, apply 2 pounds of 12-12-12 fertilizer per 100 sq. ft., water well and renew mulches to conserve moisture.
		x			Oriental fruit moths emerge. They are most serious on peaches where the first generation attacks growing tips. Wilted shoots should be pruned out.
		x			Thinning overloaded fruit trees will result in larger and healthier fruits at harvest time. Thinned fruits should be a hands-width apart.
		x			Enjoy the strawberry harvest.
			x	x	Renovate strawberries after harvest. Mow the rows; thin out excess plants; remove weeds; fertilize and apply a mulch for weed control.
			x	x	Summer fruiting raspberries are ripening now.
Miscellaneous		x	x		Begin control for apple maggot flies. Red painted balls that have been coated with tanglefoot may be hung in apple trees to trap egg-laying females.
		x	x		Spray trunks of peach trees and other stone fruits for peach tree borers.
			x	x	Prune and train young fruit trees to eliminate poorly positioned branches and to establish proper crotch angles.
			x	x	When using any gas powered equipment, be sure to allow the engine a few minutes to cool before refilling empty fuel tanks.
			x	x	A mailbox mounted on a nearby post makes a handy place to store and keep dry any small tools, seeds, labels, etc. frequently used in the garden.