



## FREQUENTLY ASKED QUESTIONS ABOUT HANDLING FLOODED PRODUCE

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Flood waters are likely to contain contaminants from upstream farms and rural septic systems, urban lawns and roadways, industrial sites and/or overflow from municipal sewage systems. Contaminants may include raw manure or feces, agricultural chemicals, fuel, heavy metals or other chemical contaminants. Microbial pathogens that could be in flood waters include bacteria, viruses, and parasites. It only takes a small amount of some pathogen to make people (particularly the young, old, pregnant, or immune-compromised) very sick.

The Federal Food Drug and Cosmetic Act states that food that is grown, held or packed under unsanitary conditions where it may have become contaminated with filth is considered [adulterated](#) and is not to enter the human or animal food supply.

Under this law, the U.S. Food and Drug Administration (FDA) has stated that any crops where the edible portion was in contact with flood waters must be discarded, destroyed or tilled into the soil. This applies to both above ground crops and root crops. Under this law, if a farmer sells food that is later identified as being the cause of a food borne illness outbreak, that farmer is criminally liable.

[The FDA's guidance](#) to our industry provides recommendations on how to evaluate the safety of flood-affected food crops for human consumption.

This guidance can be challenging to interpret because it does not provide specific guidelines. Rather, it states that: *For crops that were in or near flooded areas but where flood waters did NOT contact the edible portions of the crops, the growers should evaluate the safety of the crops for human consumption on a case-by-case basis for possible adulteration.*

Factors to consider in the evaluation include:

- What is the source of flood waters and the extent of potential upstream contributors of human pathogens and/or chemical contaminants?
- Is the edible portion of the crop developing?
- How far above the ground does the lowest edible portion grow?

Based on this guidance we have divided the information in this FAQ into two sections:

- 1) questions where the FDA's stance is clear and
- 2) questions where the FDA's guidance is broader and more difficult to interpret.

*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 sanitizers 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. What about other perennial crops that were under flood waters but that I won't be harvesting until 2024, 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.

**10. 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. The UVM Agricultural Testing Lab offers an initial screen for heavy metals as well as a more accurate test if the screen shows high levels. While it is not practical to test for all possible contaminants, a heavy metals screen may be useful in determining the level of risk that replanting poses. See this UVM Extension [fact sheet](#) for information on how to interpret soil test results for heavy metals.

UVM Extension is offering soil testing, including heavy metals, at no-charge to Vermont farms for flooded fields until **August 15, 2023**. Make a note on the yellow soil questionnaire submitted with the sample that the soil is from a flooded field. The [UVM Agricultural and Environmental Testing Lab](#) web site provides submission forms and price information for soil tests, or call 802-656-3030

To assess whether fossil fuel contamination is present in flooded soil, growers can contact [Endyne Labs](#) in Williston, Vermont about the "TPH" petroleum screen. The test costs \$90 per sample and requires special containers for samples. Their phone is (802) 879-4333.

**11. My field has large deposits 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 does 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.

**12. Should I test my water?**

If your wellhead was submerged under flood water, your well water should be tested to ensure that it is potable. Only potable water should be used to wash produce after harvest. The Vermont Department of Health is offering free well test kits to homeowners who have been impacted by recent flooding.

Order a "Water Kit A" on this [web page](#) or call 1-800-660-9997 and follow instructions for testing well water for coliform bacteria. If your water tests positive for coliforms, disinfect the well according to [the directions](#) provided by the Health Department.

**13. 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, to avoid potential contact with or breathing contaminants. 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.

**14. My fields sometimes flood in the spring, but in some years 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. Rye for straw could also be an option. It is not a very high value crop, but if it floods, you will lose less in both money and in soil erosion. You can still grow a cash crop after the risk of spring flooding passes.

**15. How does flooding affect the organic certification of my land?**

You 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. 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 tested and you will likely need to provide your organic certifier with a copy of your test results.

**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 local produce, or even the potential lack of consumer confidence from the uncertainty of the safety of potentially flooded produce, would have serious ramifications for growers throughout the state. 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 guidance](#) about evaluating the safety of flood-affected crops.

Although the edible portion of a crop 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:

- a) Are you confident that there are no major sources of contamination upstream (see description below for how to assess sources of contamination)?
- b) Were the flood waters only a few inches up on the plant, and is the plant 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)?
- c) Is there is any evidence that flood water splashed 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 potential risks 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.

You can make an initial assessment of certain contamination sources by consulting the [Agency of Natural Resources Atlas](#):

- Click on “Launch Map Viewer” (above the black title box)
- At the top left of the screen click on “Layers” (under the Vermont Logo)
- At the bottom of the screen, enter your town’s name from the drop-down menu (then it will zoom to your town)

On the left-hand side, check the boxes under Waste Management next to: Underground storage tank, Hazardous waste site generator, Hazardous waste site and Brownfields. Those items will populate the map. The more there are upstream from you, the more likely contaminants were in the floodwaters on your fields. You can also look at the number of permitted storm water discharges as one indication of upstream development densities. The pollution control components of these facilities and treatment systems cannot be engineered to withstand the effects of massive flooding. Therefore, the greater the number of permitted storm water discharges upstream, the more likely it is that floodwaters may contain pathogens or toxins.

In addition, you can consult the ANR's [Watershed Coordinators](#) for the area in question to discuss what is known about land use and surface water impacts in the watershed upstream of your farm. You can also call upstream municipalities to see if sewage treatment facilities were breached during the flood.

**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. Factors to consider when evaluating the crop 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 factors listed above. However, do not sell these crops *if 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.

*All crops harvested as described above should be rinsed in water with a sanitizer that is labeled for use on produce prior to sale, even if you do not normally wash them.* Keep in mind however, that sanitizer in the wash water will not remove the contaminants once they have attached to the produce.

**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 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 leaves, then the crop should not be sold, especially since it is often eaten raw. Cilantro, which has a similar growth form as parsley, has tested positive for pathogenic E.coli in 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 peracetic acid-based sanitizer approved for use on produce such as Sanidate 5.0® or Tsunami 100® at the highest labeled rate. *Rinsing in water with a sanitizer 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 sanitizer in rinse water is to reduce the microbial load in the water to avoid cross-contamination. Sanitizers must be used properly to be effective and must always be used according to their label. Excess organic matter and soil in the wash water, or an improper pH of the wash water will reduce the efficacy of the sanitizer.

<b>Amount of sodium hypochlorite (chlorine) to add to wash water for 150 PPM</b>		
Sodium hypochlorite, 5.25%		
<b>Target PPM</b>	<b>Teaspoon chlorine /5 gallons water</b>	<b>Cup chlorine /50 gallons water</b>
150	11	2.25
Sodium hypochlorite 12.75%		
150	4.5	1

- 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 10 degrees warmer than the temperature of produce to prevent the crop drawing in water, potentially contaminating the flesh.
- Use test strips to monitor the level of the sanitizer often.

**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 sufficient 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 before harvesting a crop, and if your fields were exposed to raw manure or feces in flood waters, then flooding can be considered a similar – or more extreme – situation. If a high level of biological contaminants is suspected, as with extreme flooding conditions that breached many septic and waste water systems, it is prudent to allow a longer waiting period before replanting. This waiting period allows time for microbial pathogens to naturally die-off over time.

A waiting period before replanting after a flood is important to reduce risk. How long you should wait depends on the crop, extent of flooding, soil conditions, and weather. Recommended waiting periods posted on Extension sites nationwide vary quite a bit but are typically 30 to 60 days. We offer this guidance:

- Lower Risk Crops: Wait several weeks to a month to replant with crops that are rarely consumed raw (beets, eggplant, potatoes, winter squash). The FDA has a [list of these crops](#).
- Medium Risk Crops: wait 1-2 months to replant with crops whose edible portion grows above ground and is not in contact with the soil. Staking and/or plastic mulch may help further reduce contact with the soil for these crops.
- High Risk Crops: wait 2 months or more, or until the following growing season, to replant flooded fields with crops whose edible portion grows in or on the soil.

In summary, there is no established timeline for when growers can safely replant after flood waters have receded. The lowest risk strategy is to use field cultivation, compost applications, and cover crops to help accelerate pathogen die off in previously flooded fields and to wait to plant human food crops until the following season. Growers should review FDA guidance and follow these general principles: wait until the soil is fully dry before reworking; implement an appropriate waiting period before replanting to allow pathogens in the soil to die off over time; and clean and sanitize all tools and equipment that contacted flood water before using them to replant or harvest.

#### **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 bins that have been in contact with flood water to store unflooded produce?**

All bins and produce equipment that came into contact with flood water should be thoroughly cleaned, and if possible, sanitized prior to subsequent use. See: [A Guide to Cleaning, Sanitizing, and Disinfecting for Produce Farms](#).

It is not advisable to use wooden bins that have been flooded as they 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 thoroughly scrub and clean bins with a detergent and then allow them to completely dry out (fans can speed up the drying time). Then once dry, line bins with a clean poly liner which are available from companies that sell harvest supplies.

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