

NOTE - Before cleaning up or destroying crops in flooded fields, check with your crop insurance and/or their local Farm Services Agency (FSA) representatives regarding exact documentation to certify losses, procedures for initiating claims, possible financial assistance.

DEALING WITH FLOODED VEGETABLE FIELDS

Steve Reiners

Associate Professor in Horticultural Sciences

Cornell University

Record-breaking rains in eastern New York State have left many vegetable growers in dire straits. What had been shaping up to be a decent season has quickly turned into a nightmare with crops under water in many locations. Growers have been asking many questions as to what they can do in the short and long term. The following are recommendations pulled from many sources including Michigan State University, Ohio State University, Texas A and M, Florida State University, as well as Cornell.

FLOODS AND FOOD SAFETY

There are two types of flooding. The first is more typical and occurs after a heavy downpour when fields become saturated and water pools on the soil surface. This type of flooding can reduce yields and even kill plants but usually will not result in contamination of produce with human pathogens. The second type of flooding is more severe and unfortunately occurred with the recent storm. This occurs due to runoff from stream/river overflows will more likely be contaminated with human pathogens, as well as chemicals. Unless you are absolutely sure that flooding is not from streams and surface water, **do not** use fruits and vegetables that were at or near harvest at the time of flooding.

In fields flooded due to poor drainage and not from surface waters, leafy vegetables (such as lettuce, cabbage, mustard, kale, collards, spinach, and Swiss chard) at or near harvest will be quick to rot. Silt and other contaminants may be imbedded in the leaves, petioles, stems, or other natural openings of fleshy structures and can be difficult to remove. Do not use if mature when flooded.

Root, bulb, and tuber crops such as beets, carrots, radishes, turnips, onions, and potatoes may be slower to rot than leafy greens. Produce with a protected fruit or impervious outer skin such as melons, eggplant, sweet corn, or winter squash may be contaminated on the surface. For melons this is a major concern as pathogens on the surface are moved to the edible part as the product is sliced and eaten raw.

It is extremely important that produce be properly washed to reduce postharvest losses. It is recommended that produce be washed in chlorinated water before storage or shipping (see table below). The wash temperature should be about 10°F warmer than the produce temperature to ensure that decay organisms are not sucked into the tissue. Since chlorine is most effective at a slightly acidic pH, it is important that wash water is buffered to adjust the pH to between 6 and 7.

Chlorine in the wash water is often inactivated when the wash water becomes dirty. Use filtering devices to remove soil and organic material, and check the chlorine concentration often. Produce should be subjected to the chlorinated wash from one to ten minutes. After it is removed, allow it to drain for several minutes before packing. **NOTE: Vegetables at or near harvest that were flooded with stream/river overflows should not be harvested or consumed. Chlorinated wash water will not eliminate likely human pathogens on their surface.**

Amount of sodium hypochlorite to add to wash water for 50-150 PPM dilution.

Target PPM	ml/L	tsp/5 gal	cup/50 gallons
Sodium Hypochlorite, 5.25%			
50	1.0	3.66	0.75
75	1.4	5.5	1
100	1.9	7.25	1.5
125	2.4	9	2
150	2.9	11	2.25
Sodium Hypochlorite, 12.75%			
50	0.4	1.5	0.33
75	0.6	2.25	0.5
100	0.8	3	0.66
125	1.0	3.75	0.8
150	1.2	4.5	1

PLANT SURVIVAL UNDER WATER

Many growers have asked how long a crop can live once it is flooded and what may be the effect on yield. Depending on the stage of growth and the type of vegetable, flooding of a short duration, less than 48 hours should have a minor impact on yield. That is especially true for young plants. At the stage with mature vegetables already being harvested, the problem is quality. Tomatoes, peppers and eggplants are likely cracked and starting to rot. Vine crop plants like pumpkins and squash will likely die. Mature or near mature fruit should be harvested as soon as possible. Results have been mixed when treating pumpkins with a chlorine wash but cutting fruit off dying vines is important as is moving fruit to dry, warm areas. For crops that are still relatively young, the two most important things growers can do to aid recovery is 1) as soon as the soil can be worked, till the soil to break up sealed surfaces and allow air to enter the soil, and 2) sidedress with nitrogen, up to 50 pounds of N per acre, perhaps during the tillage operation or, if conditions do not allow for soil applications, apply a foliar application (see below). **Please note**, many plant diseases will be much worse following flooding rains. It is important that growers closely monitor their crops and manage these diseases.

FLOODING AND SOIL FERTILITY

That "gaspings" sound heard in some vegetable fields is the plant roots trying to get some oxygen. Many of the vegetable plants in fields across parts of New York have an off-green or yellowish color. These plants are suffering from a complex of nutrient deficiencies, nitrogen, phosphorus, potassium and perhaps others, even though the soil contains adequate amounts. But the main deficient element is oxygen. Plant roots need oxygen to take up nutrients and water to utilize the photosynthate from the tops and to grow. With the heavy rains we have had, soils are saturated; that is, nearly all of the pore space is filled with water, leaving little room for air. Ideally, for good root growth 50 percent of the pore space should be filled with air. As soils drain, air is drawn into the soil, but when it rains, the water forces the air out of the pores. As is obvious to all, what is needed now is several rain-free days so the soils can drain and draw in air to stimulate root growth. Unfortunately, the flooded fields often develop a hard surface layer that prevents air from entering. Any tillage that can be done to break that seal will be beneficial. Once the plant roots get adequate oxygen they will begin to grow and take up the nutrients present in the soil.

Plants can absorb nutrients through their leaves. Spraying the plants with nitrogen, phosphorus and potassium can help plants through stress periods. Use a low salt liquid fertilizer to supply 4 to 5 lb nitrogen, 1 lb phosphate (P_2O_5) and 1 lb potash (K_2O) per acre. Since nitrogen is the key nutrient to supply, spraying with urea-ammonium nitrate (28 % N solution) alone can be helpful. These can be sprayed by aerial or ground application. Use 5 to 20 gallons of water per acre. The higher gallons per acre generally provide better coverage. However, before investing money in trying to salvage root crops check to be sure that the main root that develops into the marketable product is still healthy. Flooded fields often kill the large taproot resulting in a fibrous root and an unmarketable product. This is especially true for fresh market carrots.

Tests were conducted in Florida to determine the effectiveness of different foliar fertilizers in recovering flood-damaged vegetable crops and found that potassium nitrate performed the best, urea the second best, and calcium nitrate the third. See table below for details.

Nitrogen fertilizer application information.

Fertilizer	Formula	N%	Application* (lb/100 gal)	Rate (gal/ac)
Potassium nitrate	KNO_3	13	15	50-100
Urea	$CO(NH_2)_2$	46	9	50-100
Calcium nitrate	$Ca(NO_3)_2$	12	35	50-100

*Pounds of product, not pounds of N

WHAT TO PLANT NOW?

Even assuming fields could be worked and planted today, it is too late to replant most vegetables. At best, we are looking at about 30 days before a likely frost as the first frost in the Albany area arrives around October 1. Only crops that can withstand frost with a short growing season can be planted. These include leafy greens such as spinach, Swiss chard, leaf lettuce, mesclun mix, beet greens, kale, rocket salad, and Asian greens like mizuna and tatsoi, along with radishes.

Before planting, growers need to take a step back and think this through. Just because a crop can be planted does not mean it should be. Do you have the proper equipment to grow the crop? Any experience with the crop? Are you aware of the crop's potential pests and what to look for in terms of damage? Do you have the chemicals needed to control these pests? Was a herbicide used in a field this spring that could cause injury in a newly planted crop? Perhaps most importantly, how will you market the crop? Don't spend two or three thousand dollars to grow a crop only to have no market at the end. Work the numbers. Will you be better off with a partial payment from crop insurance and possibly disaster relief from the federal government rather than losing more money with an unfamiliar crop?

There are some cover crop options that growers may want to consider for their flooded fields. Rather than let productive fields go to weeds for a season, use the opportunity to plant a cover crop or green manure. Go to Cornell's cover crop decision tool (www.hort.cornell.edu/bjorkman/lab/covercrops/decision-tool.php) to see your options.