Washington State University

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SPOTLIGHT ON… IRRIGATING YOUR GARDEN WITH RAIN BARREL WATER

Using Rain Barrel Water on Garden Vegetables

Is it safe to use rain barrel water collected from your roof to irrigate homegrown lettuces, strawberries, and tomatoes?

The question is so straightforward, and yet the answer has been so murky. In the past, many sources cautioned against this use of stormwater runoff, while some, including Seattle Public Utilities, suggest it's OK with water collected from some roof types but not others.

As rain barrels proliferate and climate change squeezes summer water supplies, there's certain to be increasing interest in using roof runoff to grow vegetables and fruits. The problem is that there has been little direct research using runoff to water edibles and checking them for contamination.

Photo by Barb Howe

Now data from Australia, where scientists used stormwater runoff to irrigate vegetables, as well as recently released results from the Washington Department of Ecology, which analyzed the pollutants washing off roofing materials, are helping resolve the rain barrel dilemma.

Based on these experiments and others, it appears that rain barrel water is safe to use on edibles, particularly if you adhere to some easy-to-follow advice to reduce exposure to bacteria and other contaminants. Unfortunately, some roofing materials—namely treated wood-shake roofing—release much higher levels of pollution than other roof types and are still too suspect to allow use of the runoff on food. But tests on the stormwater dripping from asphalt shingle roofs find that it's remarkably clean.

So what exactly do the new data say? Let's take a look.

Veggies Irrigated in Stormwater

Scientists from Australia's University of Melbourne and the University of Monash, also in Melbourne, did experiments in which they watered a variety of vegetables with "synthetic" stormwater that was mixed to specifications that represent highly polluted runoff.

Beets by UGA College of Ag & Environmental Sciences

They used soils with a range of contamination to simulate the accumulation of metals that can occur in the ground over time. They grew kale, beets, and French beans, irrigating them with sprinklers over the course of 11 weeks. Then they harvested the crops and tested the beans, kale, beet roots, and greens for levels of chromium, copper, zinc, cadmium, and lead. They published their results in the peer-reviewed journal PLOS ONE in November 2014.

The scientists found that some of the samples of the French beans and the beet leaves, but not the beet root, had lead levels that exceeded Australia's health guidelines. The kale in particular had lower levels of all of the metals, illustrating the wide variability in metal uptake among crops, and even into different parts of the same plant. They also reported that the more contaminated soils resulted in higher pollution levels in the plants.

The researchers concluded:

Our study makes it clear: irrigation with stormwater is indeed feasible, as long as appropriate crops are selected and [soils] are frequently turned over.

But perhaps the most important message to take away from the study was how safe the veggies were considering the rather massive doses of pollution that they received. The synthetic stormwater used for irrigation was brewed to worst-case-scenario levels of pollution—levels much higher than what's likely to be washed off a Northwest roof.

A Closer Look at Roof Runoff

To better understand how much pollution is being flushed from Puget Sound area roofs into nearby waters, Washington Department of Ecology researchers did an experiment to capture the runoff coming from 14 different roof types.

At the Ecology headquarters in Lacey, Washington, researchers set up panels measuring 4-by-8 feet made of different common roofing materials, plus two glass control panels. Because roughly 71 percent of the total roof area in the Puget Sound basin is composite roofing, four of the 18 panels were covered with asphalt shingles, and one of the four composite panels also contained algae-resistant copper-containing granules.

Photo of the roof runoff experiment at the Washington Department state of Ecology. Photo of the roof runoff experiment at the Washington Department state of Ecology.

Then the researchers collected the rainwater running off the panels during 10 rain events from February to April of 2013 and from 10 more events from October ‘13 to January 2014.

They tested the stormwater for arsenic, cadmium, copper, lead, and zinc; poly-aromatic hydrocarbons (PAHs) associated with combustion and petroleum products; chemical flame retardants; and phthalates, an ingredient in plastics.

The runoff was surprisingly clean. A study published in September 2014 reported that the asphalt roofs and most of the others had metal levels lower than 1 part per billion (ppb), with lead levels from the asphalt roofs measuring around 0.06 ppb. By comparison, the stormwater

used in the Australian experiments had lead levels averaging 330 ppb—that's more than 5,000 times higher than the Ecology measurements.

The treated wood-shake roof, by contrast, produced high levels of arsenic (1,385 ppb), plus elevated cadmium and copper. As expected, runoff from the copper roofs also had high levels of copper.

The levels of PAHs and other organic pollutants were very low as well. Concentrations of PAHs were "generally not distinguishable from concentrations from the glass control panels, even in those roofs which have asphalt components," Ecology reported. PAHs are produced from wood-burning stoves and auto exhaust and these air pollutants could have washed onto the roofs with the rain.

The results from Ecology support the findings from a study published in 2013 by scientists with Rutgers Cooperative Extension. In these experiments, researchers placed 12 rain barrels at homes with asphalt shingle roofs in urban and suburban settings in New Jersey. Over the course of four months, they collected and tested the runoff. The scientists found lead and zinc levels 10 times higher or more than the Washington study, but the concentrations were still well below the level of concern and were still suitable to use for irrigating crops. In New Jersey, the amount of PAHs in the runoff was undetectable.

While both the Ecology and Rutgers experiments suggest that runoff from most roof types is low in metals and common organic pollutants, there are limitations to the Ecology study in particular. The roof on a typical house would be longer than eight feet, so the water would likely pick up more pollution running down a longer surface. Also, the test panels did not include gutters, downspouts, and flashing materials that are typically found on actual roofs and that can also leach pollutants. And the pollution levels are likely to change over time. In the two rounds of rain events, some of the pollutants decreased over time, while the PAHs appeared to increase slightly.

But even given the caveats from the Ecology study, it's a long way to go from 0.06 ppb lead in the roof runoff in Washington to the 330 ppb in the Australian experiment, which still produced some edible veggies.

Bird Droppings and Bacteria

Roofs, of course, are out in the environment and depending on where you live, some mix of crows, starlings, gulls, house sparrows, and other birds are going to be flying overhead, perching on your roof, and leaving droppings behind. Birds are known to transmit disease-causing agents including *E. coli* and *Salmonella*. Add to that the waste from the occasional squirrel or rodent and there's a good chance some bacteria or other pathogens will be added into the runoff mix. Unfortunately, there's little research on the question of whether roof runoff is likely to contain troublesome pathogens that pose a risk as irrigation water. While the Australian's faux stormwater runoff included bacteria, the scientists didn't report results regarding it. And there is research on using roof runoff for drinking water and applying sewage sludge on edibles, but it's

Photo: Rusty Clark

challenging to use that information to draw conclusions for rain barrel water and food.

Luckily, the New Jersey study did take a limited look at bacteria. The researchers started their project by tabulating total coliform, but when high bacteria levels kept coming back, they added *E. coli* measurements to the study partway through their data collection. When the final results were tallied, the *E. coli* levels exceeded New Jersey drinking water standards in 66 percent of the 47 samples collected. But when compared to the U.S. Food and Drug Administration's standards for water used in agricultural irrigation, the rain barrel water missed the mark only 9 percent of the time.

Hedging Your Rain Barrel Bets

The fact is, the data are still less than perfect for answering all of the questions around roof-runoff and food safety. But there is good information available, and it points toward the conclusion that rain barrel water is fine for irrigation in nearly all cases. Plus, there are some straightforward strategies for further reducing your risk:

Consider your roofing materials

Seattle Public Utilities has a rain barrel homeowners guide that gives a thumbs down to watering edibles with runoff from treated wood-shake roofs; other roofs treated with toxic agents, including chemicals to kill moss, algae, or rot; roofs with zinc strips; or roofs made of copper or with copper gutters.

Don't collect the first "flush"

The runoff from the first couple of heavy rains after a dry spell can wash away some of the pollution and bird waste that has accumulated over times. So don't collect this water; instead divert it straight into the ground or a storm drain.

Bleach the bacteria

Rutgers researchers suggest treating rain barrel water with bleach to kill the bacteria before using the water for irrigation. To do this, add approximately one ounce of household unscented chlorine bleach to 55 gallons of water and wait 24 hours to allow the chlorine to dissipate before applying to your garden.

Water the soil, not the food

As stormwater percolates through soil, the dirt and microorganisms living in it will help clean it. Northwest researchers demonstrated this dramatically with an experiment using salmon. They put one group of fish into stormwater runoff collected directly from a roadway and a second group in runoff after it trickled through a simulated rain garden with compost, sand, and gravel. The untreated runoff quickly killed the salmon, while the fish in the rain garden-treated water survived.

So watering the soil instead of pouring it directly on the veggies provides an opportunity for the soil to work some of its purifying magic before the water is taken up by the plants.

Wash your veggies

You were probably going to do this anyhow, but it's a good idea to wash those raspberries, snap peas, and cherry tomatoes however tempting they are right off the vine.

Clean your rain barrel

Over time, it's a good idea to clean your rain barrel by rinsing out any sediment that has collected. The University of Nebraska-Lincoln Extension also recommends using a solution of one-eighth cup of chlorine bleach mixed into five gallons of water, or a solution made from one-quarter cup each of castile soap and vinegar or lemon juice mixed into five gallons of water. Then rinse with clean water.

For additional rain barrel resources, check out The American Rainwater Catchment Systems Association or HarvestH2O, a forum for rainwater collecting enthusiasts. The magazine Organic Gardening also has some good tips.

This "Spotlight On" publication was originally written by Lisa Stiffler, in an article originally published by Sightline Institute. The original article and website for the Sightline Institute can be seen at: http://daily.sightline.org/2015/01/07/a-green-light-for-using-rain-barrel-water-on-garden-edibles/ This was published in a Shore Stewards Newsletter in February 2015. See Guideline 2 for a Spotlight on building rain barrels.