Pilot study uses recycled glass to grow plants for salsa ingredients

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Cilantro, bell pepper and jalapeño plants can grow faster when some of the potting soil is replaced with glass particles. Shown here are cilantro seedlings grown in 100% recycled glass material. Credit: Andrea Quezada

Tortilla chips and fresh salsa are tasty in themselves, but they could be even more appealing if you grow the ingredients in a sustainable way.

Researchers report that cilantro, bell pepper and jalapeño can be cultivated in recycled glass from discarded, pulverized bottles like those from beer or soda. The pilot study found that partially substituting soil in a planter with recycled glass fragments speeds up plant development and reduces unwanted fungal growth.

The researchers will present their results at the fall meeting of the American Chemical Society (ACS). ACS Fall 2024 is being held virtually and in person from Aug. 18–22.

When nanomaterial scientist Julie Vanegas joined the faculty at The University of Texas Rio Grande Valley, she was paired with a faculty mentor, Teresa Patricia Feria Arroyo, an ecologist who works on solving problems related to food security and sustainability.

During their early conversations, Vanegas mentioned that she'd been assessing recycled glass particles for coastal restoration projects, such as growing willow trees. Feria wondered if glass could also be used for growing produce. To answer Feria's question, they developed experiments for growing foods that people are familiar with, mature quickly and can be cultivated in containers and backyard gardens—the ingredients for pico de gallo.

"We're trying to reduce landfill waste at the same time as growing edible vegetables," says Andrea Quezada, a chemistry graduate student in the Nanoworld Vanegas lab who is presenting the team's research at the meeting. "If this is viable, then we might be able to introduce glass-based soils into agricultural practices for people here in the Rio Grande Valley and across the country."

For their experiments, the researchers get recycled glass particles from a company that diverts bottles from landfills, crushes them into particles and tumbles the pieces to round off the edges. The final product is

smooth enough that people can handle the glass bits without getting cut, says Quezada. Similarly, plant roots can easily grow around the glass pieces without being harmed.

In initial tests, the researchers assessed the soil-like qualities, such as compaction and water retention, of three different sized glass fragments. They found that a size similar to coarse sand grains had characteristics, such as allowing oxygen to reach the roots and maintaining sufficient moisture levels, that could be ideal for plant cultivation.

Now, Quezada is evaluating the recyclable glass material as a viable substitute for soil. In a greenhouse on campus, she's growing cilantro, bell pepper and jalapeño plants in a variety of pots containing anywhere from 100% commercial potting soil to 100% recycled glass. Pots with more soil have higher levels of nutrients required for plant growth, including nitrogen, phosphorus and potassium, compared to those with more glass. But there's little variation in pH levels among the pots, which is a promising result because plants thrive in a narrow soil pH range.

Early results suggest that the plants grown in recyclable glass have faster growth rates and retain more water compared to those grown in 100% traditional soil. "A weight ratio of more than 50% of glass particles to soil appears best for plant growth compared to the other mixtures we tested," says Vanegas. Though, the researchers are waiting until harvest time to confirm what soil mixture produces the highest yields—and tastiest produce.

Another noteworthy result is that pots with 100% potting soil developed a fungus that stunted plant growth. Feria hypothesizes the fungus may impact nutrient uptake by the roots. However, the pots that included any amount of recyclable glass didn't have any fungal growth. The researchers are collecting data to determine why this might be.

These results are particularly promising to Quezada because the study was done without fertilizers, pesticides or fungicides. From her experience working in agriculture, she notes that a lot of the chemicals applied to the land impact people like her family members who work or live around farming communities.

"I think it's really important to try to minimize the usage of any chemicals that can negatively affect our health," says Quezada. "If we are able to reduce them, and help the community by collecting recyclables, then we can give people a better quality of life."

Provided by American Chemical Society

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