

Technology Brief

TWO TESTS OF THE COMPATIBILITY OF CRUSHED RECYCLED GLASS WITH PLANT GROWTH

This technology brief describes the results of two studies conducted on the use of crushed recycled glass:

- As a hydroponic rooting medium; and
- As a replacement of sand in topsoil mixes.

Hydroponic Rooting Medium -- Experimental System

To test the hypotheses that glass can serve as a viable rooting medium, 20 basil plants were grown in crushed container glass and 20 were grown in expanded clay aggregate over a period of 72 days. The glass used in the experiment was crushed, mixed-color recycled bottle glass. Glass particles ranged in size between 2.36 mm and 4.74 mm (#8 sieve and #4 sieve). A reflector and 1000 watt halide bulb were shifted over the growing area by an electrically powered chain over 20 minute intervals during daily 14-hour light periods.

System Testing

To monitor the experiment, conductivity, pH, and temperature of the nutrient solution were measured weekly. At harvest, plants were cut from their roots and dried to eliminate transient differences in moisture content. Dry weights were recorded.

Test Results

No significant ($p=0.05$) difference in dry weight was found between plants grown in glass and plants grown in clay aggregate. The clay-grown basil were considerably larger during weeks four through eight.

While there appeared to be no significant difference in the pH between the clay and glass solution tanks, conductivity appeared slightly lower in the glass tank



Key Words

Materials: Crushed bottle glass.

Technologies: Hydroponics.

Applications: Hydroponic rooting medium, topsoil mixes.

Abstract: Results of testing to determine the suitability of crushed bottle glass as a hydroponic rooting medium or as a replacement for sand in topsoil mixes.

during weeks four through eight. This corresponds with differences in growth during those same weeks. As clay-grown basil grew faster during weeks four through eight, it also used more nutrients, reducing the conductivity of its solution.

Conclusions

The difference in final plant growth may have been due to one of three factors.

1. The glass grown basil roots may have been receiving less oxygen due to the smaller size of the particles. (Also the relatively flat surfaces of the glass particles allowed for better packing than the rounded surfaces of the clay).
2. Light may have permeated the glass and reached the roots.
3. The darker color of the clay may have absorbed more heat and may have provided the clay grown roots with additional warmth.

Some challenges exist when using glass in this application: (1) Glass is heavier than the expanded clay aggregate; (2) Glass clings to fingers, creating an inconvenience; and (3) Glass fines can cause skin irritation.

While the experiment indicates that glass can serve as a hydroponic rooting medium, its use as such will not likely create a large market for crushed mixed-color cullet. It may, however find a niche market among environmentally minded hobbyists.

The results of the experiment also suggest that crushed glass will not negatively affect plant growth when used in gardening and landscaping applications.

Crushed Glass Cullet Replacement of Sand in Topsoil Mixes -- Experimental System

This study examined a topsoil that was composed of 50% compost and 50% sand and the effects of replacing portions of the sand with portions of glass cullet (50%, 30%, and 10% crushed glass). The objectives were to determine the growth performance of plants in a soil medium containing glass cullet and to determine whether these mixes would pose risks to humans.

Test Results

Results were measured ten weeks after three plant species were grown in the different soil media. There were small, yet statistically significant differences in height and biomass between plants grown in the 50% sand/50% glass mix, and the 10% glass mix. There were insignificant differences in height or biomass between the 50% sand/30% glass mix, suggesting that a 3/5 replacement ratio of crushed glass for sand was not detrimental to plant growth.

In the tenth week, water leachate samples were collected from two replicates of each species for the 50% sand and

50% glass treatments. Chemical composition of the soil leachates revealed that nutrient levels between treatments within each species were not a significant limiting factor to plant growth. In addition, heavy metal analysis showed that the levels of lead and boron in the different mixes were no higher than in sand/compost samples. It was concluded that, within each species, the differences in plant growth between the treatments were attributed to the relationship between soil and water.

Analysis of the four soil mixes' water holding capacities (WHC) revealed that, while the 50% sand, 30% glass, and 10% glass media had similar water holding capacities, the 50% glass media had a higher WHC. The 50% glass mix also drained more quickly than the others.

A scratch test was also used to test the safety of the soil for horticultural workers. The glass particles in the soil did not scratch a variety of materials. Further, vinyl gloves were worn to prevent skin abrasions while handling the different soils.

Conclusions

Results from this study suggest that it is feasible to use recycled glass to replace portions of sand in a standard topsoil mix. Topsoil composed of 3/5ths glass cullet instead of sand can produce plants of equal or greater growth size compared with plants grown in a standard topsoil. In addition, cost savings and a decreased reliance on virgin materials may be realized when glass is used in some portion of the mix.

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For More Information

For a copy of the report, *Testing The Use of Glass as a Hydroponic Rooting Medium (No. GL-96-2)* or *Crushed Glass Cullet Replacement Of Sand in Topsoil Mixes* use CWC Publication Order Form or call (206) 443-7746. For more information call CWC at (206) 443-7746, email info@cw.org, or visit the CWC Internet Website at www.cw.org.

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