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GREENHOUSE STUDIES ON ROOT GROWTH AND MORPHOLOGY

UtahState
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by Julie Chard

For studies of root growth and morphology, an ideal containerized plant culture system should provide: 1) adequate nutrients, water and oxygen; 2) appropriate mechanical impedance to root elongation; 3) adequate depth to prevent root binding; and 4) easy separation of roots from the root-zone substrate.

Columnar containers are preferable to pots because they can support deep root growth while taking up less bench space. Many columns can be arranged within a small area, such as a gas-exchange chamber, thereby maximizing the number of treatments and replications in a given space.

Standard potting substrates typically contain sphagnum peat mixed with perlite or vermiculite. These well-drained, organic-rich mixtures support an appropriate balance of water and oxygen while also providing exchange surfaces for plant nutrients. Separation of plant roots from the potting substrate, however, is impossible.

We have developed a columnar plant culture system that supports healthy plant growth while also enabling complete separation of the roots from the growth substrate. Our substrate of choice is Turface[®], a porous ceramic produced by baking clay at high temperatures (Figure 1). Turface[®] drains well, resists compaction, and retains nutrients well with a cation exchange capacity (CEC) of 33 meq/100 g.

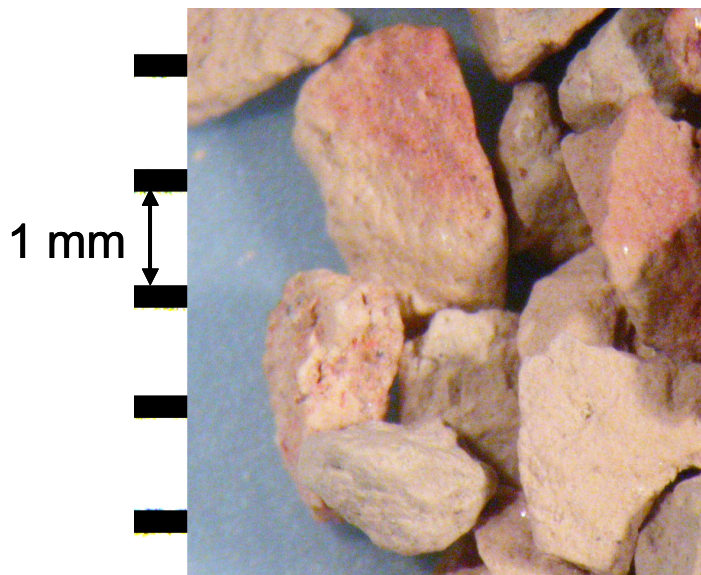


Figure 1. A closer look at Turface[®].

Our columns are constructed of 2" diameter PVC pipe. A bell-shaped reducer fitting secured to the bottom of the pipe stabilizes the column, and also holds in place a mesh screen. The mesh supports the Turface® substrate while also allowing water to drain by gravity. An automated watering system delivers a dilute nutrient solution to each column. The watering system is programmed to add small amounts of nutrient solution at the substrate surface 20 times per day. This high frequency keeps the tops of the columns moist and ensures delivery of nutrients throughout the column.

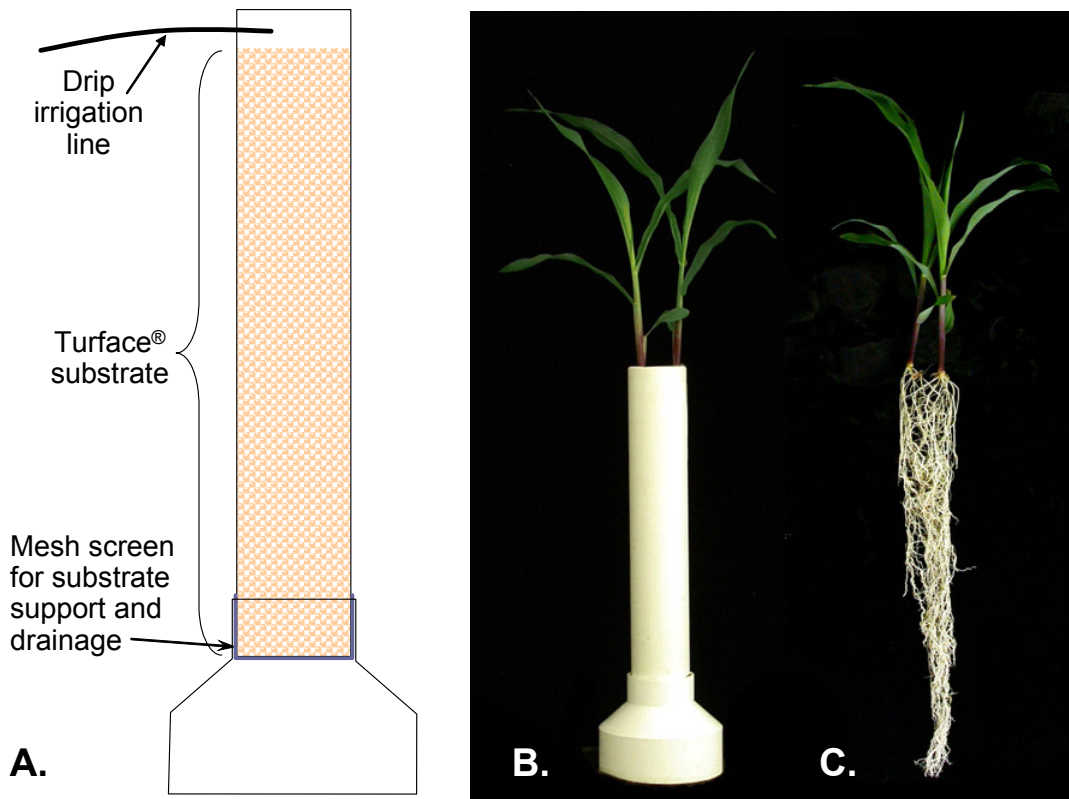


Figure 2. A) Root observation column construction. B) Corn plants growing in a root observation column. C) Roots of corn plants are easily separated from the Turface substrate.