

Wicking bed design - the effects of different reservoir media on plant growth, water use and soil moisture in wicking beds using capillary watering

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Wicking beds are planting containers that have a reservoir of water in the lower portion that provides moisture to plants a growing medium above by capillary action. The scientific literature contains only a small number of studies that have found wicking beds to have a higher yield and greater water use efficiency than top watered containers but no research has been done into the effects of different materials in the reservoir layer. This study investigated the capillary rise and water holding capabilities of various reservoir materials and how they performed in wicking beds.

Capillary rise in various materials in 50mm diameter perspex tubes was measured. Crusher dust had the greatest capillary rise, followed by sand, fine perlite and a cocopeat/compost/sand mix. Gravel and scoria had poor capillary rise. Water holding capacity was greatest in cocopeat, followed by gravel and scoria, then sand and crusher dust.

Wicking beds were constructed with four reservoir treatments - cocopeat mix, sand, 10mm crushed gravel and WaterUps® with medium grade perlite as the wicking medium. A cocopeat/compost/sand mix was used as the growing medium. A commercial potting mix was also used with a sand reservoir. Three replicates of each treatment were performed. Two crops were grown sequentially: spinach then butterhead lettuce.

With the spinach crop, the cocopeat and sand/cocopeat beds grew the greatest plant weight followed by WaterUps®, gravel, and sand/potting mix. Soil moisture at 150mm depth was lowest in gravel, followed by WaterUps®, sand/cocopeat, cocopeat and sand/potting mix.

For growing lettuce, the wicking material in the WaterUps® was changed to sand. There was no significant difference in the weight of lettuce grown in any of the treatments. Soil moisture at 150mm depth remained reasonably constant throughout the growing period in WaterUps® and cocopeat. Gravel and sand/potting mix dried the most. The potting mix remained wettest of all treatments at 200mm depth but was driest at 100 and 50mm depths indicating that it had poor capillary rise capabilities.

A third wicking bed experiment testing the effect of the presence or absence of geotextile between the reservoir and growing layers with reservoirs of sand and cocopeat showed no difference between treatments.

This study showed that the reservoir material does have an effect on the soil moisture and plant growth in wicking beds. Gravel is a poor choice as it results in the driest growing medium. The cocopeat mix and sand maintain better soil moisture and plant growth, but questions about the long term performance of cocopeat were not addressed. WaterUps® with sand as the wicking material maintained a high level of soil moisture.