

SIZE MATTERS

A TESTING LAB PROVIDES INSIGHTS ON GROWING MEDIA

BY SAM FERRO

Testing labs have a somewhat unique view of the green roof industry. Experience from testing of the many diverse products that come to our lab provides insight into how different components can affect the performance of growing media.

Most green roof growing media mixes are comprised of a combination of lightweight aggregate, soil (usually sand), and organic matter (usually compost). Whether a two-part, three-part, or multi-component mix, it is the type of base materials used and the ratio at which the base materials are blended that gives the mix its unique properties.

The size of the actual components used for green roof growing media and drainage

aggregate has a profound affect on the performance. While it may seem obvious that particle size affects performance, the extent to which size affects performance may not be so apparent. Changes in component size can have just as big of an affect on the growing media as changes to mix ratios.

Lightweight aggregates, such as expanded shale, clay and slate are the most widely used aggregates in green roof growing media. Other lightweight aggregates, such as pumice, lava rock and calcined clay are also used. Lightweight aggregates are used because they provide cation exchange capacity, and have pore space for air, water, nutrients and microbes.

The size of the particles affects the drainage rate (permeability) and to a lesser extent, water retention and release to plant roots. Larger particles provide for faster drainage and less water retention. The size of the pores in the aggregate also affects the amount of water retention, absorption and water release. The larger the pores the more space for water and air, the smaller the pores the greater the absorption. If weight is a factor, material that absorbs the most water will also increase the weight of the media by the weight of the water. Most lightweight aggregates range in size from one millimeter (mm) to 12.5 mm. Particles larger than 16 mm are usually not recommended for growing media.

Small changes in the amount of lightweight aggregate can cause big changes in growing media properties. In some cases, a change in the ratio of lightweight aggregate is the single biggest factor in the overall performance of the mix. Since lightweight aggregates are the largest component in most mixes, small changes in their content have a major affect on the structure of the mix. Coarser mixes have lower water retention,

higher permeabilities and higher air-filled porosities than finer mixes.

Organic matter is added to green roof mixes to aid with moisture and nutrient retention. Organic matter can also provide beneficial organisms to the growing media.

Coarse organics can create large voids in the growing media which provide much needed space for large roots. Large voids can also create channels where water and nutrients flow through unabated, increasing permeabilities and reducing water and nutrient retention.

The origin and age of the organic matter may also influence its suitability for use in growing media. Fresh compost is usually not desirable. Immature composts can cause a depletion of oxygen in the soil and may produce ammonia gas which can burn plant roots. Cured and aged compost are usually preferred for use in growing media.

Sands made up of fine to coarse particles (0.05 – 2 mm in size) tend to provide the most desirable growing media. These widely graded sands offer a good balance of air and water for plant roots while providing excellent drainage.

Soils comprised mostly of fine particles may not be desirable due to their lack of permeability. Fine soils containing significant amounts of silt and clay (particles less than 0.05 mm) are generally not recommended. These fine soils can clog drain mats and filter fabric, and may present a barrier to effective drainage.

Soils that are comprised mostly of coarse sand and gravel particles (0.5 mm and greater) may have excessive irrigation needs. While coarse soils drain well, they may not offer enough water retention to support plant life.

Components and mixes with similar names or appearance can have vastly different characteristics. Independent testing of green roof media is the only way to assess whether a product will meet project goals and specifications. Testing can provide information that is critical to both the engineering and agronomic aspects of roof top gardens. It is recommended that suppliers should have quality control testing performed on media at the least, annually. We also recommend that specifiers and buyers of growing media should require compliance testing of the actual media that is going on the roof.

Proper analyses and assessments can help to promote success and limit failures related

to water retention, drainage, and plant growth issues. Significant tests related to performance of green roof growing media (dry and saturated media densities, moisture content, porosities and water permeability) are carried out according to ASTM Standard E2399. Particle size, organic matter content, and other tests are also performed to help define the growing media. The test procedures performed and equipment used are specified in the testing methods.

A sample size of 3 to 5 gallons (12 to 20 liters) of media is required for testing. It is important that the sample being tested is truly a representative sample. Although there are differences in procedures, there is one nearly universal truth. In order to get a truly representative sample, a composite sampling technique is most desirable. This sample is comprised of material obtained from multiple locations that are combined to create a single sample.

Media testing at Turf Diagnostics typically takes 3 to 5 working days, with results reported electronically as soon as testing is completed. Turnaround times depend on which testing methods are performed. Turnaround can also be affected by the condition in which the sample arrives at the lab. Samples that are too wet (> 25% moisture) may need to be air-dried prior to testing, which can delay the start of testing.

There is no such thing as a single perfect green roof growing media. A mix that is perfect for an extensive roof may not be suitable for an intensive roof. Climatic conditions and plant choices also play a major part in determining desirable growing media composition. When a drier growing media is needed, a coarser mix may be desirable. A finer graded, higher organic mix may be more desirable when higher water holding is needed.

Knowledge of mix component properties, such as how particle size and organic type affect performance, allows suppliers to adjust mixes to meet the needs of a given project. This same type of knowledge gives designers and contractors a solid basis for writing specifications or requesting changes to the materials proposed for a green roof.

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