Poster Number

C-14 Optimizing Green Roof Technologies in the Midwest

Southern Illinois University Edwardsville

Dave Richey, Lane Richter, Abby Wackerly

Background and Problem Definition – *People, Prosperity and the Planet*

Green roofs, which establish a vegetative cover on a building rooftop that replaces the ecological footprint lost when the building was constructed (Monterusso et al. 2005), provide numerous environmental and subsequent economic benefits, such as: reducing storm water runoff (Moran et al. 2005, VanWoert et al. 2005); insulating the building thus saving on energy consumption (Niachou et al. 2001); increasing the lifespan of a roof by reducing the impact of ultraviolet rays, extreme temperatures, and rapid temperature fluctuations (Giesel 2001); filtering harmful air pollutants (Liesecke and Borgwardt 1997); increasing the diversity of urban habitat (Brenneisen 2003); and reducing the urban heat island effect (Wong et al. 2003). Because green roofs offer the potential to address storm water runoff and reduce energy use and subsequently reduce emissions from electricity generation, they have the potential to be an important tool for local areas and individuals to reduce or prevent pollution and reduce long-term operating and maintenance costs of buildings.

Storm Water Runoff

Heat Islands

November 2003 *August 2003*

Phase I – Purpose, Objectives, and Scope

1) to determine the growing medium and plant species combination in ongoing green roof experiments that has the best water loss to the atmosphere following saturation (and, therefore, increases the storm water retention capacity of the green roof system)

2) to determine the concentration of nitrate being released from two green roof systems (built-in-place models and Green Roof Blocks™) compared to a conventional roof

3) to determine the temperature of the roof surface (membrane) under three available green roof systems (built-in-place green roofs, Green Roof Blocks™, and Green Paks™) in order to evaluate the thermal benefits of green roofs.

Technology Transfer

Atmospheric Storm Water Loss

Figure 1. Individual Green Roof Blocks™ and Green Paks™ with Arkalyte, Hadite, Lava, and Midwest Mix™ for the water loss experiment on the SIUE Engineering Building.

Figure 2. Individual Green Roof Blocks™ and Green Paks™ with Arkalyte, Hadite, Lava, and Midwest Mix. One-half of the models with plants – each model was weighed at saturation and during drying periods.

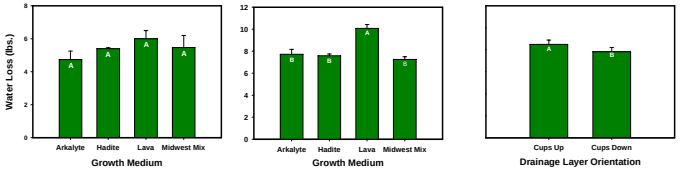

Figure 3. Storm water loss (by weight) of planted Green Roof BlocksTM and Green PaksTM. Values represent one sampling/analysis between Sept. 18-21, 2006. Bars with different letters are significantly different (α<0.05). Error bars represent +1se. (n=3)

CONCLUSIONS – Atmospheric Water Loss

1) Weighing modular green roof systems can accurately determine water loss via evaporation and transpiration.
2) Differences in water loss exist between two modular systems, between growing mediums in one modular system, and between drainage layer orientation.

Recommendation: Over time, the storm water retention capacity of green roof systems can be optimized by continuing the water loss monitoring efforts.

Storm Water Nitrate Analysis

Figure 4. Built-in-place green roof models with 5, 10, 15, and 20 cm growth medium depths at the SIUE Environmental Sciences Field Site.

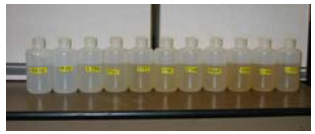

Figure 5. Runoff samples from various growing medium depths and planted and non-planted models. Samples are aligned with control roof on the far left and increasing depth towards the right including 5, 10, 15 and 20 cm depths.

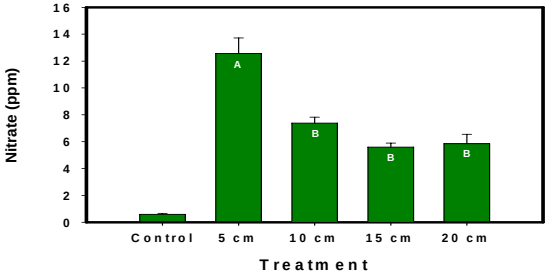

Figure 6. Storm water nitrate concentrations from a control roof and planted built-in-place green roof systems containing 5, 10, 15, and 20 cm of growing medium (80% Arkalyte and 20% composted pine bark). Values represent one sampling/analysis on November 17, 2006. Bars with different letters are significantly different (α<0.05). All green roof storm water nitrate values are greater than the nitrate value from the control (EPDM membrane) roof system. Error bars represent +1se. (n=4)

CONCLUSIONS – Nitrate Analysis

1) Nitrate concentrations leaching from green roof systems with different growing medium depths and types were quantifiable.
2) Nitrate concentrations in runoff from green roof systems were greater than from control roof systems.

Recommendation: Nitrate concentrations can be reduced by utilizing different fertilizer types, different plants, and different growing medium types.

Our goal is to evaluate the performance of green roof technology and to make the information available to users for development/establishment of green roofs.

SIUe