Title- Landscape Coefficients in Mixed Species Landscape

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Abstract- Combinations of landscape plants were used to measure crop coefficients (K_L). This was measured as the amount of water used by the crops actual evapotranspiration (ET_A) and compared to that of reference evapotranspiration (ET_o). Irrigation was based on 100% replacement of ET_o. The K_L values were determined using the following landscape crops: St. Augustinegrass, Burford Holly, Yaupon Holly, Ligustrum and Loropetalum. The plants were planted in lysimeters with the dimensions of 2.1 m long x 1.2 m wide x 0.6 m deep. Each lysimeter has six soil moisture probes that took measurements at depths of 0 to 20, 20 to 40, and 40 to 60 cm. The lysimeters contained a PVC leachate pipe system to vacuum leachate out of the lysimeters. The lysimeters were irrigated every 4 to 7 days with a sprinkler system in the event of no precipitation. The K_L for spring 2012 ranged from .67 to 1.06. The average leachate depth for the same time period ranged from 21.3 to 25.6 mm. Landscape coefficients can be used when making irrigation decisions for all landscape purposes.

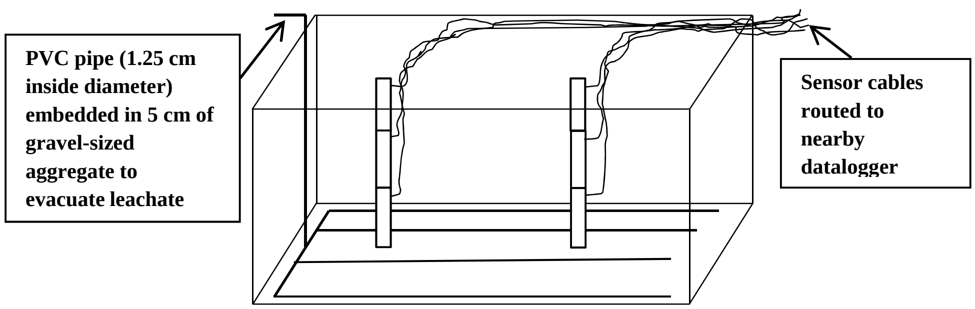
Problem and Research Objectives- Water used for landscape irrigation purposes has become a major issue with conservationists. The objective of this experiment is to use the seasonal water uptake of landscape crop within the lysimeters to calculate actual evapotranspiration (ET_A) and compare to the reference evapotranspiration (ET_o) data that will be collected from the weather station at Sam Houston State University.

Materials/Methodology- The experiment was conducted at the Sam Houston State University Horticulture Center. Irrigation water was supplied from Huntsville Municipal Water Supply. A water analysis was performed in June of 2011, and a soil analysis was performed in June of 2011.

Lysimeter construction. The lysimeter dimensions are 2.1 m L x 1.2 m W x 0.6 m D. An EPDM landfill liner was placed along the bottom and sides of the lysimeters leaving a 5.1 cm border around the top to collect the rainfall within the lysimeters. A 5.1 cm layer of 0.95 cm gravel was placed on the bottom of each lysimeter. A PVC leachate pipe system was constructed and placed in this gravel to allow removal by vacuum. The leachate pipe system consisted of four long pieces manifolded together to a riser at one end. Each lateral piece had holes drilled into it every six inches on the bottom side to allow water to enter the pipes. Each lateral pipe was capped.

The soil was sifted through a screen before being added in lifts of six inches and hand tamped down to four inches. This was repeated until the lysimeters were 2 inches above the surrounding ground level. There were six soil moisture probes placed on the east and west side of each lysimeter. The probes were Decagon 10HS (Decagon Devices, Pullman, WA). The sensors measured soil moisture at 0 to 20, 20 to 40, and 40 to 60 cm depths. The cables from the sensors were routed along the side of the lysimeters, through a trench and connected into a multiplexer which was wired into a data logger (Fig. 1).

Fig. 1



Lysimeters were irrigated manually with an in-ground sprinkler system and a water meter was installed to measure the amount of water applied. A weather station at the Horticulture Center that is located approximately 50 m from the lysimeters. ET was calculated from this weather station and the irrigation schedule would be determined weekly. The irrigation was to replace 100% of the ET_o minus rainfall.

Plant Installation- Lysimeters were arranged in a randomized complete block design with three replications. The plants included: St. Augustinegrass, Loropetalum, Ligustrum, Burford Holly and Yaupon Holly. Plant installation occurred in May 2011. Treatments are a combination of turfgrass and woody plants at the following ratio of plant cover: 20% turf/ 80% woody, 50% turf/ 50% woody, and 80% turf/ 20%woody. The St. Augustinegrass was mowed at a height of 2-3 inches depending on the season. The lysimeters were evacuated once a week with a ½ horsepower electric pump. The pump was fitted with a tube that connected to the glass carboy with a rubber stopper in the opening. An additional tube came out of the rubber stopper and connected to the riser in the lysimeter. The amount of water that was evacuated from each lysimeter was measured and a sample was taken and frozen for later observation.

Principal Findings- During the summer of 2011, Texas experienced a state wide drought. Unusually high temperatures that season slowed the establishment period for the landscape crops. Some plants needed to be replaced, thus extending the establishment period.

During the Spring of 2012, the K_L was greater for the higher woody plant and low turf percentage. K_Ls are as follows: 20% turf/ 80% woody plant was 1.06, 50% turf/ 50% woody plant was .80 and 80% turf/ 20% woody plant was .67. For the same time period, the leachate volume for the treatment with the lowest woody percentage had the highest leachate collection average. The leachate depth averages are as follows: 20% turf/ 80% woody plants was 4.7 mm, 50% turf/ 50% woody plants was 7.3 mm, and 80% turf/ 20% woody plants was 8.3 mm.

Significance- Results indicate that treatments with higher percentage of woody plants have a higher K_L and use more water. The results also indicate that treatments with a higher turf percentage will leach water more quickly and have a lower K_L. This is a strong indication of landscapes that are mostly turf having the ability to leach more water into the ground water and help recharge aquifers. Water districts and water purveyors can use this information within their districts to create and maintain a water usage program. This information can also help environmentally conscious land owners make informed decisions on landscaping and water use. Also because of these results, communities and neighborhoods with homeowner’s associations can create a law or act that requires or denies specific plants for the surrounding landscape.