Using Fytofoam in Constructing Water Conserving Landscapes

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Research Report

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INTRODUCTION

Most homeowners tend to use too much water to irrigate their lawns. Residential water usage for outdoor purposes is approximately 1.45 million acre feet per year. Residential water usage can potentially be reduced by 25 – 40% (Gleick et. al., 2003). The low residential outdoor water usage rate is approximately 983,000 acre feet per year, while the high would be 1.9 million acre feet per year, which results in the aforementioned average of 1.45 million acre feet per year. There are several ways that potential water savings can occur that include turf maintenance, irrigation maintenance, and irrigation scheduling (20%), irrigation and soil maintenance (65 – 75%), auto rain shutoff (10%), soil moisture sensors or probes (10 – 30%), gray water (up to 100%), rain barrel catchment (up to 100%), landscape design (19 – 35%), turf reduction (19 – 35%), and choice of plants (30 – 80%) (Gleick et al., 2003). These percentages of potential water savings can be very helpful in reducing the amount of water used by homeowners.

This excessive water usage is due to inefficient irrigation systems, lack of knowledge that the controller needs to be adjusted for different seasons and time of the year, and lack of proper management practices. Soil compaction is a common problem in home lawns which leads to reduced infiltration and increase in runoff, which can carry contaminants that include pesticides and fertilizers. This runoff water can make its way to surface water, groundwater, and even the ocean in some cases, which has the potential to cause eutrophication or other adverse effects in the aquatic environment. Homeowners also have a tendency sometimes to apply an excess of supplemental nutrients that can lead to elevated concentrations at residential sites of total suspended solids, total lead (Pb), total nitrogen (N), total nitrate N (NO_3^-), and soluble phosphorous (P) when compared to other urban land uses. The sources of these pollutants are thought to be from atmospheric deposition, automobile exhaust, detergents, lawn fertilizers, and soil erosion (US EPA, 1983).

OBJECTIVES

The objective of the project was to evaluate the potential of water conservation in landscapes using Fytofoam. The effect of incorporating Fytofoam in a heavy and light textured soil was studied. The effect of Fytofoam on the growth and development of a cool season and warm season turf species was also evaluated.

MATERIALS and METHODS

The experiments were conducted at the Center for Turf Irrigation and Landscape Technology (C-TILT), California State Polytechnic University, Pomona. The experiment was set up to observe the effects of incorporating Fytofoam in a heavy and light textured soil. The plots also included a cool-season turf and a warm season turf. The Fytofoam was rototilled into the soil and the soil was leveled with rakes. A medium weight roller was used to roll the soil after rototilling to level the soil. The warm season turf species, bermudagrass was allowed to fill into the area. The cool season turf, rhizomatous tall fescue was seeded and allowed to establish.

RESULTS and DISCUSSION

The health, growth and development of the turf was monitored with a Greenseeker (N Tech Instruments, Ukiah, CA). The Greenseeker sends light from a source and records the reflectance from the turf canopy. Monitoring the reflectance in the near infrared (NIR) and red (R) wavelengths allows the determination of turfgrass quality, detection of early water stress, and reduction of irrigation needs to maintaining turfgrass quality (Park et al., 2005). The characteristics of healthy, live, green vegetation are that it has a low reflectance of light from the visual spectrum R as a result of the leaf pigments and has a high reflectance of NIR from the scattering of light in the leaf mesophyll cells (Park et. al., 2005). On the other hand, dead, brown vegetation and the soil have the reflectance that increases monotonically from the visible spectrum to the NIR (Park et. al.,2005). The normalized difference vegetative index (NDVI) is strongly correlated with plant biomass, leaf area index, canopy photosynthetic capacity and chlorophyll production (Park et al. al., 2005). Hence healthy dense turf stand has a higher NDVI value and the ratio of R/NIR is lower than the values observed in thin unhealthy stand of turf.

Cool-season Turf

The normalized difference vegetative index (NDVI) values for the cool season turf indicated that the Fytofoam incorporated plots had significantly higher values compared to the plots that did not have the Fytofoam in the soil profile. Higher NDVI can be correlated to darker green live turf. The Red/NIR ratios of the Fytofoam incorporated plots were lower than the plots which did not have the Fytofoam in the soil profile. Hence the turf in the Fytofoam plots did not experience stress and were healthier compared to the untreated plots. Overall the addition of the Fytofoam resulted in improved turf color, quality and the turf did not experience stress as indicated by the high NDVI and low Red/NIR ratios.

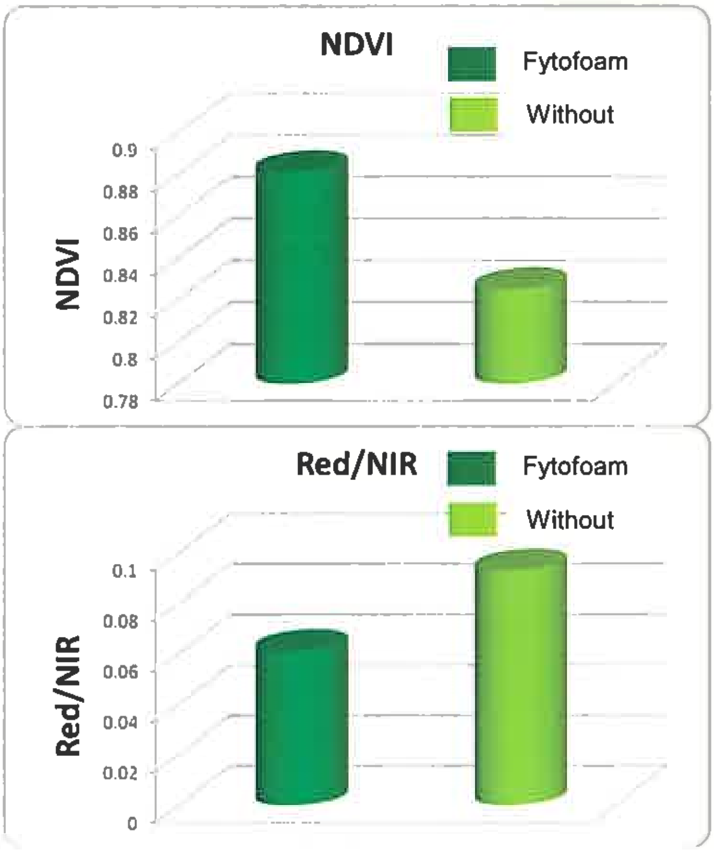

Figure 1. The normalized difference vegetative index (NDVI) and the Red/NIR ratio of the cool season turf in the Fytofoam incorporated and untreated plots.

Warm-season Turf

The NDVI and Red/NIR values for the warm season turf plots had a similar trend as the cool season turf plots. The NDVI values for the warm season turf indicated that the turf in the Fytofoam plots was darker and denser compared to the untreated plots. The Red/NIR ratio was lower in the Fytofoam plots compared to the untreated plots. Hence the incorporation of the Fytofoam in the soil resulted in improved turf quality and provided a good environment for turf growth and devlopment.

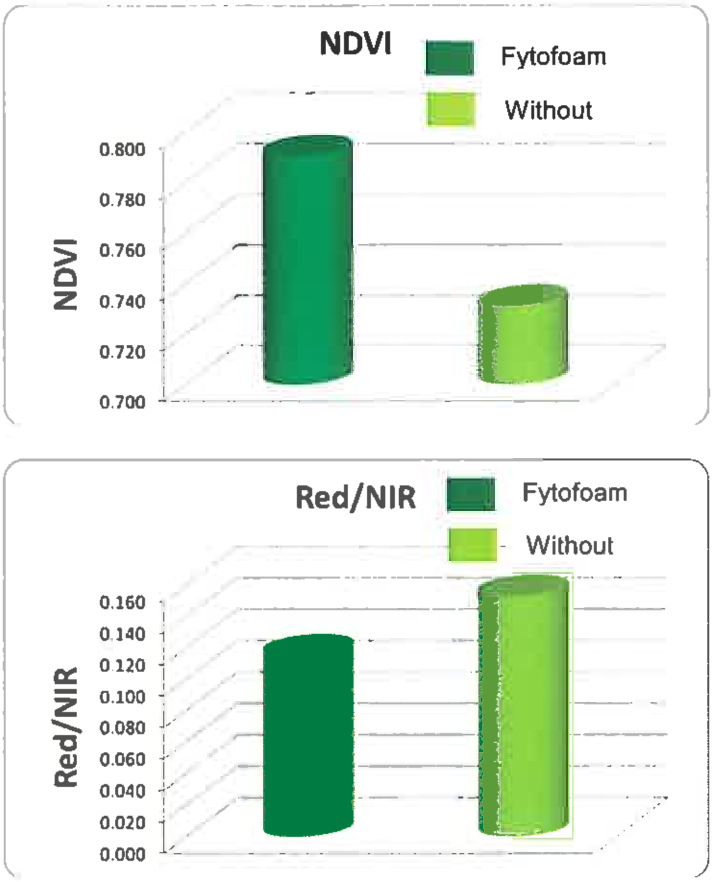

Figure 2. The normalized difference vegetative index (NDVI) and the Red/NIR ratio of the cool season turf in the Fytofoam incorporated and untreated plots.

Heavy Textured Soil

The volumetric soil moisture content (VMC) was measured with the Delta T devices Theta probe (Delta-T Devices Ltd, Cambridge, U.K.). Six replicates were taken from each pot and the means were reported in Figures 3 and 4. The VMC in the Fytofoam treated heavy textured clay loam soil was significantly higher than the untreated plot. The mean VMC was 31% in the Fytofoam incorporated soil while the plots without the Fytofoam had a mean value of 25% (Figure 3).

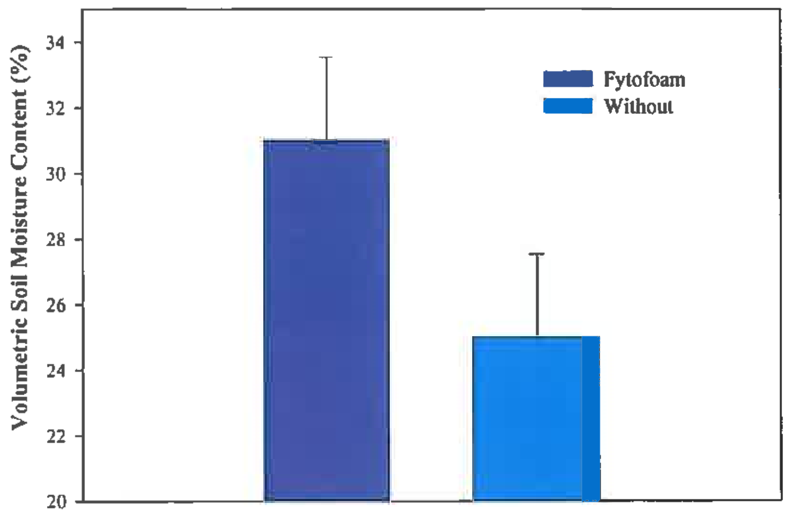

Figure 3. The volumetric moisture content (VMC) in the clay loam soil for the Fytofoam treated and untreated soil.

Light Textured Soil

The mean VMC in the Fytofoam incorporated sandy loam soil was 28% compared to only 21% in the untreated soil. The incorporation of the Fytofoam increased the moisture holding capacity of the soil.

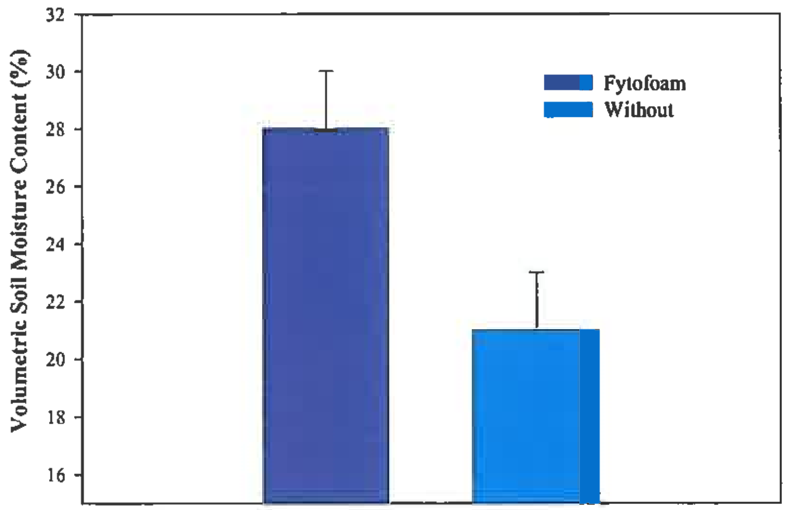

Figure 4. The volumetric moisture content (VMC) in the sandy loam soil for the Fytofoam treated and untreated soil.

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