EVALUATION OF SEED WATERING GUIDE™ FOR USE AS A TURFGRASS ESTABLISHMENT AID

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INTRODUCTION

Irrigation is nearly always required to ensure complete germination and establishment of turfgrass. Of the total turfgrass area in the US, home lawns make up the greatest percentage of area – typically greater than 65%. Therefore, home lawns are likely the largest user of water for turfgrass irrigation purposes. The most efficient way to determine irrigation requirement is to use a daily estimate of evapotranspiration (ET). However, very few homeowners have access to this information, and ET-based is rarely, if ever, practiced by homeowners. Encap, LLC. Has developed a crosslinked polyacrylamide (Seed Watering Guide™) that claims to help get seeds the water they need. The product is intended for grass, flowers and vegetable, and is included in ENCAP's combination turf establishment products and seed cover products. The label indicates that the product swells when exposed to water and when the product is no longer visible it is time to re-apply water. If the product works as advertised, it could improve the establishment of turfgrass by indicating when watering is required, and it might also save water by preventing over-application of irrigation.

The overall objective of this research was to evaluate the effectiveness of Seed Water Guide™ (SWG) as an irrigation scheduling tool. We conducted several lab and greenhouse evaluations to determine how quickly SWG absorbs water, how easily SWG releases water in high and ambient temperatures, and how effective SWG was for scheduling irrigation on newly germinating turfgrass in sandy and silty soils growing in a greenhouse.

MATERIALS & METHODS

We evaluated how quickly SWG absorbed water by placing a single SWG particle in a shallow dish of distilled water and measured the weight of SWG after 30 seconds, 1, 2, 4, 8, 16, 32, and 64 minutes. The trial was replicated four times. Desorption of water was conducted at high temperature in a gravity-convection laboratory oven set to 120 °C, and at ambient temperature (23 °C) in the laboratory. A fully hydrated-SWG particle was weighed in an aluminum dish and droplets of water approximately the same weight and surface area as the hydrated SWG were then placed in aluminum dishes. The hydrated-SWG and free water droplets were weighed at approximately 4 minute time intervals in the oven, and 30 minute time intervals at ambient temperature. The desorption experiments were replicated six times.

We also evaluated the use of SWG as an irrigation scheduling tool on two soil types. The first was a sand soil containing 20% peat humus by volume (approximately 4% by weight). The second soil was a Plano Silt Loam. Both soils were placed in germination tubes that measured six inches in depth and one inch in diameter. Ten seeds of perennial ryegrass were carefully placed on the surface of each soil and covered with soil until the seeds were no longer visible. The newly seeded tubes were fertilized at a rate of 1 lb N/M, 1.5 lb P_2O_5/M, and 1.9 lbs K_2O/M using a liquid fertilizer solution. Following fertilization, each tube was watered to its water holding capacity. The treatments were different watering schedules, and included: 1) twice a day, 2) once a day, 3) once every two days, 4) once every four days, and 5) whenever need was indicated by SWG. At each irrigation event ¼" of water was applied with a pipette. Each treatment was replicated three times and the germination tubes were arranged randomly in a rack designed to hold the tubes.

RESULTS

Product Description

In a dry state, the SWG particles are firm, appear white, and have over 80% of the particles have a diameter of 1 – 2 mm (Figure 1). When water is added the particles absorb the water and continue to swell until they reach a diameter of between 6 and 10 mm. The hydrated SWG has a gel-like consistency and reflects light in a way that makes the particles stand out clearly when applied to a dark surface such as soil.

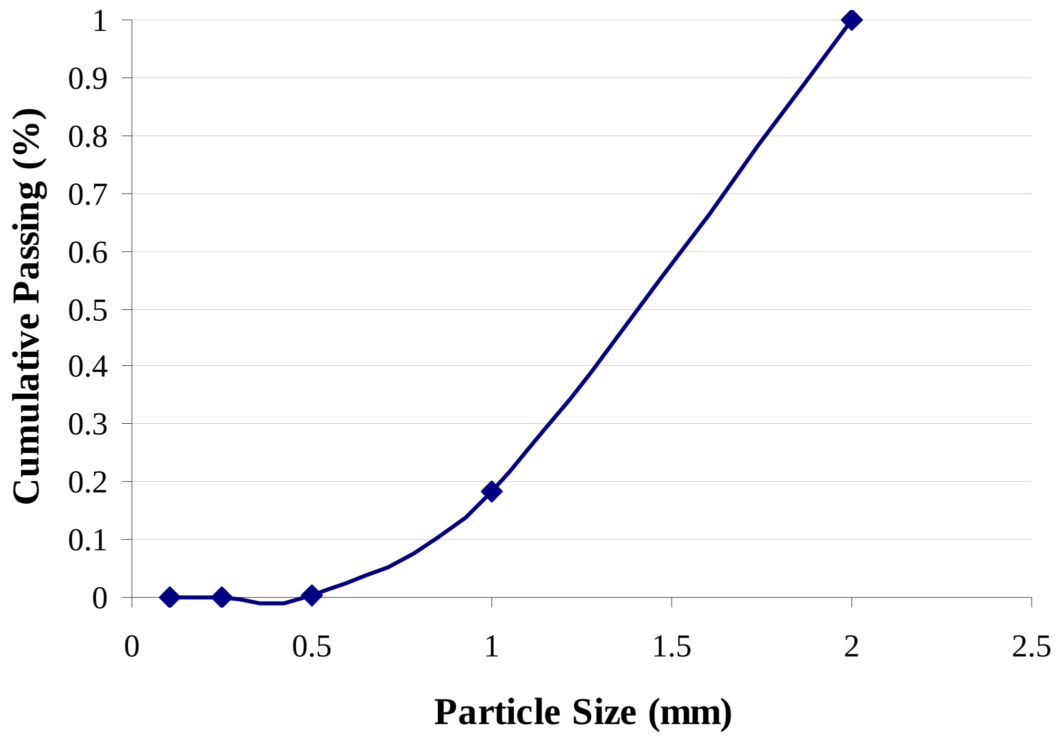

Figure 1. Particle size distribution of dehydrated SWG. 100% of particles were smaller than 2 mm, 81.5% were retained on top of the sieve with 1 mm openings, 18.0% of particles were retained on a sieve with a 0.5 mm openings, and 0.3% of particles were retained on the sieve with 0.25 mm openings.

Water Absorption of SWG

Dehydrated SWG particles absorbed water in a linear fashion up to 15 minutes, at which point absorption began to slow. By 64 minutes, absorption was nearing completion. Figure 2 shows the average weight gain due to water absorption of SWG. The average SWG particle weighs 0.57 mg, and therefore the increase in weight was 20% after 30 seconds, 71% after 2 minutes, 218% after 8 minutes, 577% after 32 minutes, and 789% after 64 minutes.

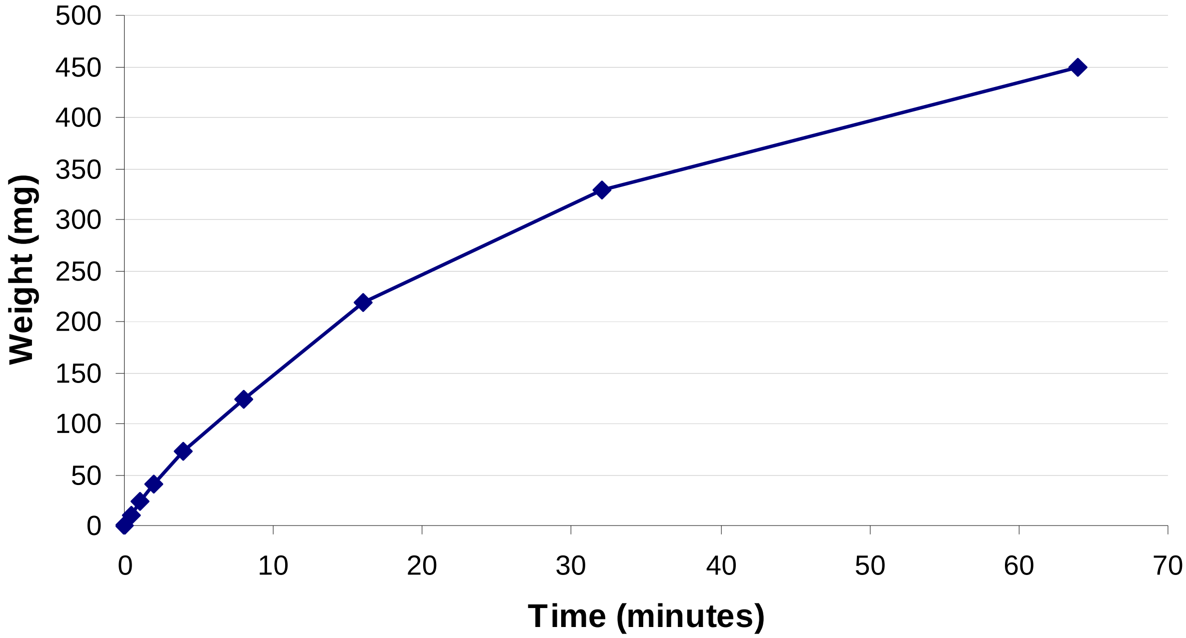

Figure 2. Gain in weight due to water absorption of a single particle of Seed Watering Guide, a crosslinked polyacrylamide.

Water Release of SWG

Seed watering guide was found to release water faster than a drop of water (Figure 3) at high temperatures. However, at ambient temperatures the rate and magnitude of water loss was remarkably similar for SWG and the water drop (Figure 4). At high temperature, we found that although SWG released water more slowly than the water droplet, SWG didn't bind water irreversibly. We found SWG to release water in an approximately linear fashion beginning at 5 minutes. The water drop was completely evaporated between 12 and 17 minutes, while SWG was completely evaporated between 21 and 28 minutes. It is unknown why the differences in water release rate where found between the two temperatures.

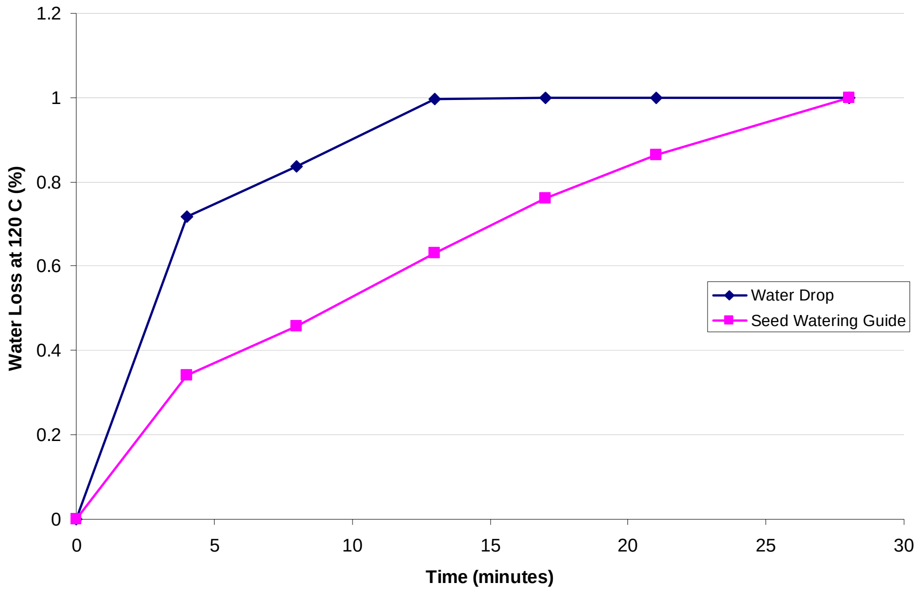

Figure 3. Water desorption curves for a water drop and Seed Watering Guide, a crosslinked polyacrylamide, at 120 °C. Initially, the water drop and SWG were approximately the same size (~0.35 g) and surface area (by visual inspection).

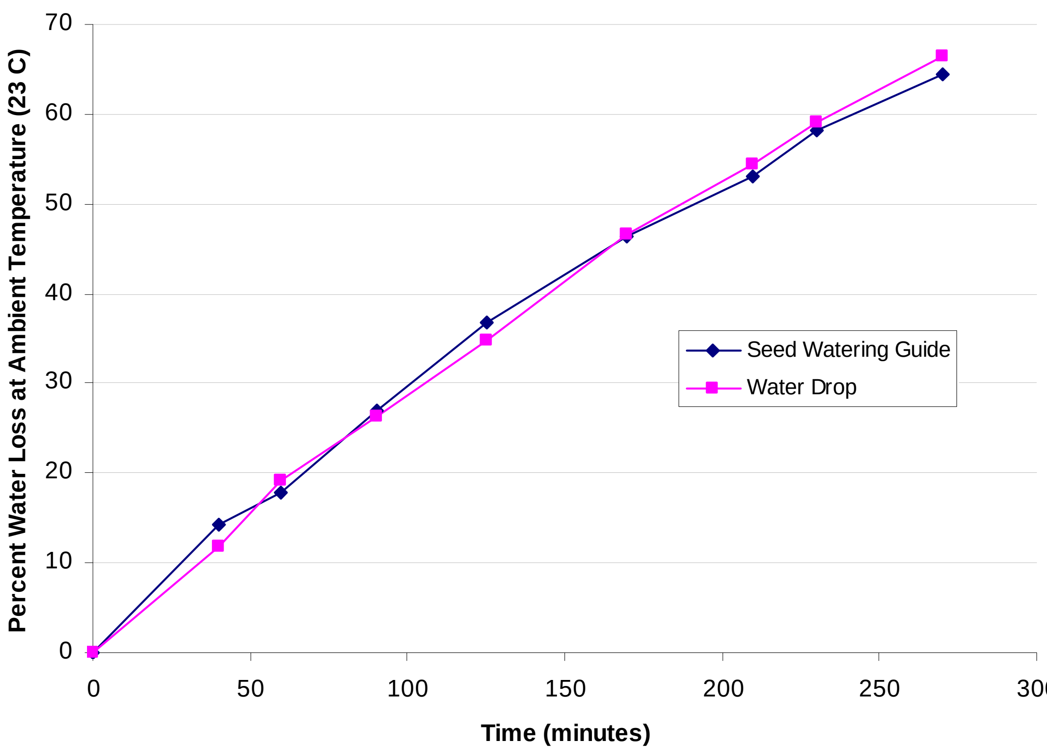

Figure 4. Water desorption curves for a water drop and Seed Watering Guide, a crosslinked polyacrylamide, at ambient temperature (23 °C). Initially, the water drop and SWG were approximately the same size (~0.30 g) and surface area (by visual inspection).

Stability of SWG

We have determined SWG to be stable material for at least 60 days as we did not observe failure of the product during a 60-day period of constant wet/dry cycles. It would be unusual for turfgrass establishment to extend beyond a 60-day time frame, and therefore the stability of SWG is not anticipated to be a relevant issue.

Effectiveness of SWG for Irrigation Scheduling

Seed Watering Guide proved to be a very effective means for determining when irrigation was required. Of the various treatments, seed watering guide had the second highest percent germination of the perennial ryegrass seeds (second to once per day) on the sand soil (Figure 5), and SWG had the greatest percent germination on the silt loam soil (Figure 6), which is a typical soil type of home lawns in Wisconsin and elsewhere.

One potential concern about SWG is that it, when hydrated, the loss of water would only be related to atmospheric variables and not be responsive to soil moisture. If true, then the SWG would dry out similarly in a sand soil and a mineral soil if placed side-by-side in the same environment. However, during the 16 day germination period, we found differences between the two soil types in the number of times that need for irrigation was indicated by SWG. The silt loam required an average of 12.3 irrigation events over the germination period, while the SWG on the sandy soil indicated that 14.7 irrigation events were required. This finding is very interesting because it indicates that SWG behaves differently on different soil types. The sand required more frequent irrigation than the silt loam soil to maximize germination. We found SWG to respond appropriately based on the soil type.

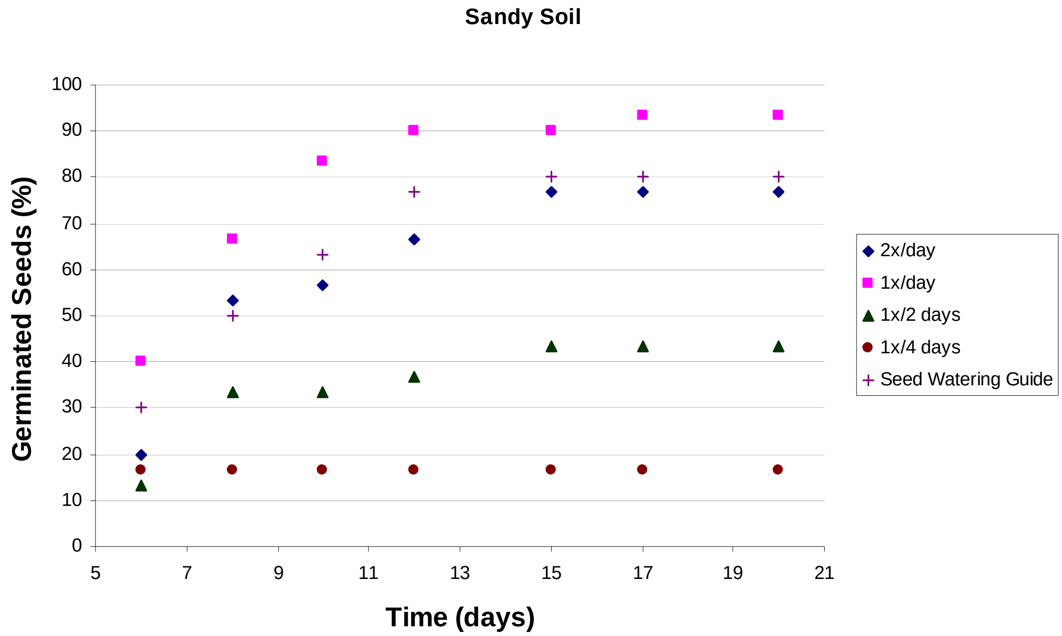

Figure 5. Germination of perennial ryegrass seeds in a sand soil containing 20% peat humus by volume in a greenhouse under various irrigation regimes, including use of a crosslinked polyacrylamide (Seed Watering Guide). For this treatment, pots were irrigated when the product became dehydrated. Numbers are averages of three replicates.

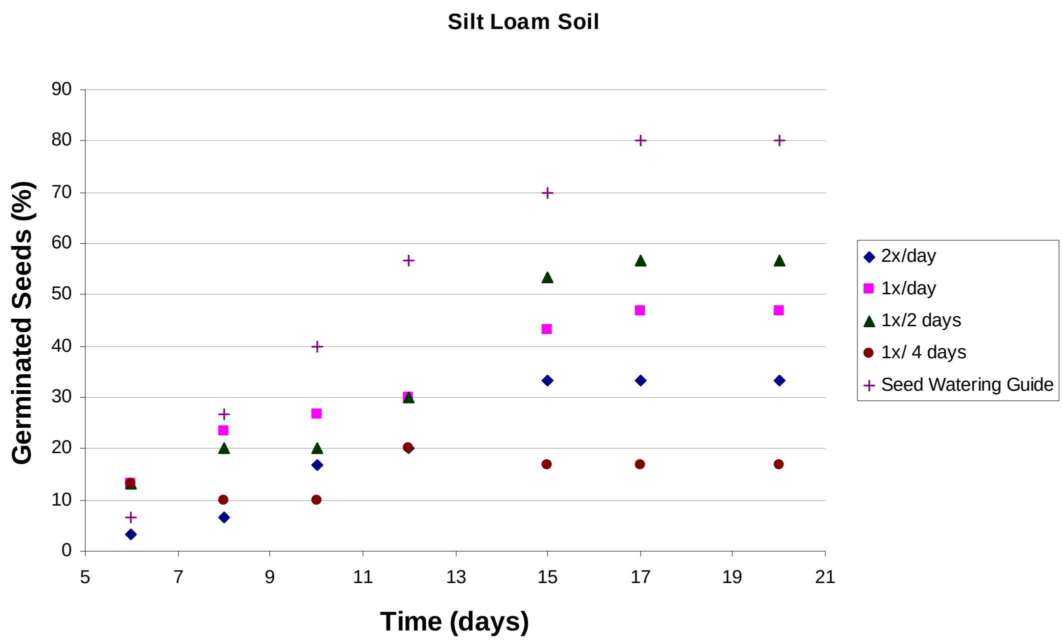

Figure 6. Germination of perennial ryegrass seeds in a silt loam soil in a greenhouse under various irrigation regimes, including use of a crosslinked polyacrylamide (Seed Watering Guide). For this treatment, pots were irrigated when the product became dehydrated. Numbers are averages of three replicates.

CONCLUSIONS

1. SWG can absorb up to 700 – 800% of its initial weight in water. The majority of the absorption is complete in about one hour.
2. SWG releases water similarly faster than free water droplets dry at high temperature (120 °C), but releases water identically to a similarly sized water droplet at ambient temperature.
3. SWG is stable for at least 60 days of wet/dry cycles, long enough to be an effective guide for establishment of turfgrass.
4. The SWG is an effective gauge for knowing when to start and stop watering newly planted seeds to ensure optimal moisture is present to maximize seed germination and plant establishment.
5. This research found SWG accurately indicated the presence of adequate surface moisture for optimum seed germination and establishment, and accurately indicated when additional moisture was required.
6. The dehydration rate of SWG is related to the soil moisture of the soil.
7. SWG is a practical and effective tool for scheduling irrigation for the germination and establishment of turfgrass.