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Testing Health of *Baptisia alba* Growing in a Reconstructed Tallgrass Prairie to Investigate How Lawn Watering Affects Plants

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ABSTRACT

The lawn at College of DuPage, Illinois, is maintained by watering, often twice a day. This study investigates if over-watering the lawn is harmful to plants growing in the Russell R. Kirt Tallgrass Prairie. The prairie legume, *Baptisia alba,* was used as an indicator species for the prairie vegetation. Measurements included soil moisture at 10 cm depth, height, basal diameter, and chlorophyll light absorbency of *B. alba* indicating chlorophyll degradation where moisture levels were high. Soil moisture was negatively correlated to light absorbency at 460 nm in this test. Over watering appears to affect the health of *B. alba.*

INTRODUCTION

There have been many studies about water efficiency in plants, but usually with the goal of helping plants conserve water in times of drought. Over-watering is usually associated as a waste of water and money (Brennan 2008, Whittenbury and Davidson 2009). However, studies have shown that over-watering can decrease reproductive yield, lead to nutrient leaching from soil, and contaminate groundwater by introducing hazardous materials (DeTar 2008). Over-watering can lead to salinization by drawing salts to the surface as the water evaporates (Ahmed et al. 2007, Hill and Woodland 2003). Salts can also draw nutrients away from plant's roots. Leaves deficient in nutrients tend to lose chlorophyll and turn yellow (Roy 2005). These yellow leaves do not absorb sunlight as well as green leaves. Also, excess watering will not make up for a period of drought (Jibrin et al. 2010). Plants require a specific optimal amount of water. Companies, farmers, or suburban yard keepers who are likely to over-water are also likely to use pesticides. This combination is not only damaging to the plant, but the excess runoff pollutes other water reserves (Farenga and Ness 2007). The runoff can lead to soil erosion in some cases. Sprinklers or watering system should be set in accordance to multiple factors, like time of day, plant zones, changing seasons, light exposure, and slope of surface to avoid over-watering (Halm 2004).

This study used the Russell R. Kirt tallgrass prairie, Illinois, which was a reconstructed prairie. The prairie legume, *Baptisia alba,* served as an indicator species. The objective of this study was to learn how over-watering affects the plants of the Russell R. Kirt prairie at College of DuPage, Illinois. Reconstructed natural areas function to preserve native floral diversity, but are often relatively small in area and exposed to maintenance practices of the surrounding area. The tallgrass prairie has always been a central part of Illinois, which is known as the Prairie State, and *Baptisa alba* is native to tallgrass prairies. The plant blooms and reaches its full height in early summer (Ladd 1995).

METHODS

Reconstruction of the 7.1 Russell R. Kirt Tallgrass Prairie began in 1984. The dominant grasses of the prairie include the big bluestem (*Andropogon gerardii* Vitman), Indian grass (*Sorghastrum nutans* (L.) Nash), and prairie dropseed (*Sporobulus heterolepsis* Gray). *B. alba* is one of roughly 100 herbs growing in the prairie.

On August 24, 2011 twelve *B. alba* plants were tested for the surrounding soil moisture at 10 cm depth, basal diameter which provided an estimate of above-ground plant biomass, and height of the central raceme. Ten leaves were also sampled from each plant for use in pigment analysis. Soil moisture was measured at 10 cm depth with an Aquaterr Temp-200 meter (Aquaterr Instruments, Costa Mesa, CA). Height and basal diameter provided measure of plant size and seasonal growth.

Chlorophyll was estimated by taking 2g of leaves per plant and extracting pigments in acetone for 20 minutes. The acetone extracts were then tested for light absorbency at 460 nm and 640 nm by a Milton Roy Spectronic 20D spectrophotometer (Milton Roy Company, Ivyland, PA). The percent of light absorbency was used as a measure of chlorophyll. Linear correlation was used to test for relationships between soil moisture at 10 cm depth and growth measurements of *B. alba.*

RESULTS

Table 1summarizes data taken from the twelve *B. alba* plants. Soil moisture was negatively correlated to the absorption of *B. alba* leaf extracts at 460 nm (Table 2).

DISCUSSION

This experiment showed a link between greater soil moisture and less plant health. Light absorption by chlorophyll should be especially high at 460 nm (Campbell et al 2011). Hence, earlier senescence of *B. alba* tissue is indicated in the more water-saturated areas. Pre-mature senescence could indicate lower carbohydrate reserves to last the plant through winter or to support greater root growth. It could also mean death of the plant. Many of the *B. alba* plants in the Russell R. Kirt Prairie had mold spots on the leaves, which are often symptoms of over-watering (Boughey 2009). Since *B. alba* blooms in early summer, it reached its peak height and basal diameter early too, when the temperature was warm enough to evaporate extra water. This is why over-watering in fall, when the temperature is not warm enough to evaporate extra water, did not affect height or basal diameter for this study. This might be when mold is highest and over-watering is most damaging. There must be further studies to determine definitively that over-watering is harmful for plants. These studies should include more plants to test and use controlled water treatment.

LITERATURE CITED

Ahmed, A., H. Iftikhar, and G. M. Chaudhry. 2007. Water resources and conservation strategy of Pakistan. Pakistan Development Review 46:997-1011.

Brennan, D. 2008. Factors affecting the economic benefits of sprinkler uniformity and their implications for irrigation water use. Irrigation Science 26: 109-120.

Boughey, A. S. 2009. The ecology of fungi which cause economic plant diseases. Transactions of the British Mycological Society 32:179-189. (http://www.sciencedirect.com/science/article/pii/S0007153649800064)

DeTar, B. 2008. Yield and growth characteristics for cotton under various irrigation regimes on sandy soil. Agricultural Water Management 95:69-76.

Farenga, S. J., and D. Ness. 2007. Making a community information guide about nonpoint source pollution. Science Scope 30:12-14.

Halm, K. 2004. Turf battle: finely tuned watering practices keep gardens while saving precious resources and capital. Journal of Property Management 69:48-52.

Hill, J. and W. Woodland. 2003. Contrasting water management techniques in Tunisia: towards sustainable agricultural use. The Geographical Journal 169:342-358.

Jibrin. Musa Dibal, A. A. Ramalan and M. A. Oyebode. 2010. Varietal response of Irish potatoes to irrigation scheduling in the north guinea savannah zone of Nigeria. Continental Journal of Engineering Sciences 5:18-27.

Ladd, D. 1995. Tallgrass Prairie Wildflowers. The Nature Conservancy, Falcon Press, Helena, MO.

Roy, K. 2005. Plant the seeds of knowledge. Science Scope 29:14-19.

Whittenbury, K. and P. Davidson. 2009. Beyond adoption: the need for a broad understanding of factors that influence irrigators' decision-making. Rural Society 19:4-17.

Table 1. Summary (mean ± standard deviation; all n=12) of data taken from 12 different *B. alba* plants.

Variable	Mean ± standard deviation
Soil moisture at 10 cm depth	6.85 ± 13.2%
Basal diameter	14.8 ± 2.89 mm
Plant height	99.3 ± 21.7 cm
Absorption at 460 nm	19.7 ± 9.3%
Absorption at 640 nm	0.5 ± 8.3%

Table 2. Results (correlation coefficients) of linear correlation analyses between soil moisture at 10 cm depth and various plant variables. All n=12. *denotes $P \leq 0.05$.

Plant Variables: Basal diameter	Height	Absorption of *B. alba* leaf extracts at 460 nm	Absorption of *B. alba* leaf extracts at 640 nm
-0.13	0.10	*-0.64	-0.20