Evaluating the Phenolic Profiles of Two Turfgrass Species at Various Growth Stages

CJ Wegner, RE Gaussoin, G Sarath, MA Pedersen, R Zbasnik, VL Schlegel

University of Nebraska-Lincoln

Objective: To monitor shifts in the phenolic profiles of grass matrices during seedling germination in order to obtain the most health benefitting phenolic extracts

The Research Premise

Have amenity grasses been historically overlooked for human health?

- Ammenity or turfgrasses…

- ✓ Most abundant and renewable resource in the plant kingdom
- ✓ Do not impede on the global food supply
- ✓ Nutraceutical potential initially identified in relation to the extensive lignification of grasses (Palmer et al., 2008; Sarath, Baird, Vogel, & Mitchell, 2006).
- ✓ Epidemiolgical evidence of native grasses in traditional medicine.

Background

- Elevated phenolic concentrations and antioxidant activities (AA) identified and characterized for numerous amenity grass species
- Antiproliferation of liver and colon (**Figure 1**) cancers by phenolic extracts of amenity grasses *in Vitro*

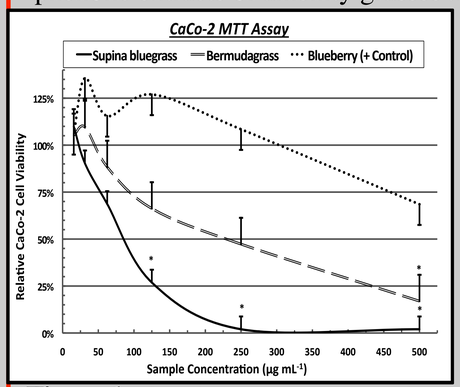


Figure 1. Ongoing UNL *in Vitro study* demonstrating inhibition of colon cancer by phenolic extracts of amenity grasses.

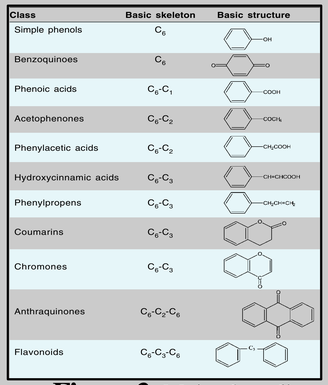


Figure 3. Main phenolic classes in diets adapted from Lee and Koo, (2003)

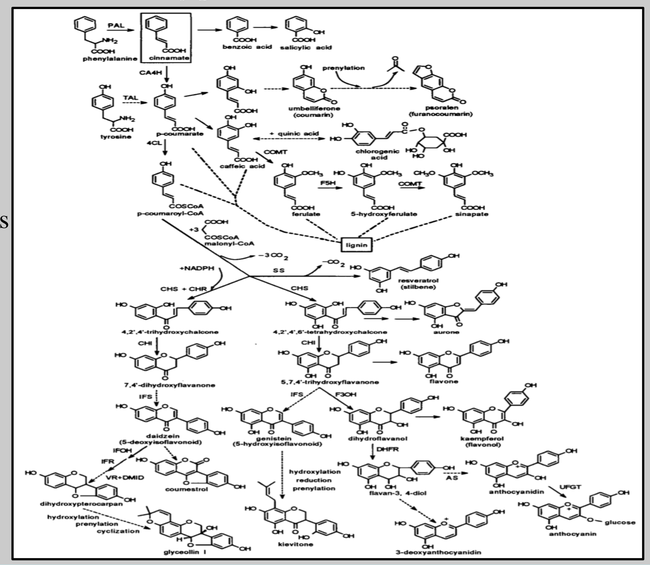


Figure 2. Complexities of phenolic pathways

Introduction

Diets rich in plant-based foods reduce incidences of degenerative disorders, largely due to the abundant phenolic concentrations that confer antioxidant potentials (Kitts, 2006). Phenolic compounds are secondary metabolites involved in plant antioxidant defense systems and thousands of natural phenolics have been identified in edible plants (Scalbert & Williamson, 2000). It is therefore currently difficult, if not impossible, to characterize the precise nature and fate of all ingested phenols (**Figure 2**). Yet, it is feasible to determine the main classes (**Figure 3**) of phenols in rendering foods (Scalbert & Williamson, 2000).

Phenolic synthesis within plant matrices is influenced by factors such as climate, season, abiotic/biotic stress and post-harvest treatments (Harbaum et al. 2008). Additionally, considerable fluxes in phenolic occurrence and production during germination are well-documented (Kulkarni et al., 2006; Cevallos-Casals & Cisneros-Zevallos, 2010), yet appreciable phenolic germination trends among similar plant species/cultivars have yet to be elucidated.

Materials and Methods

Supina bluegrass [*Poa supina Schrad*. 'Supranova'] and bermudagrass [*Cynodon dactylon* (L.) Pers. var. *dactylon* 'Sovereign'] were sampled at 3, 7, 14, and 21 days of post-germination growth and stored immediately at -20° C. Grass species were germinated under optimal greenhouse conditions during July of 2010 at the University of Nebraska-Lincoln's east campus.

Cell Wall Phenolic Extractions

Modified method of Sarath et al., (2006)

Determination of Total Phenolics[a] and Total Flavonoids[b]

Singleton & Rossi (1965)[a], Adom & Lui (2002)[b] **[Figure 4]**

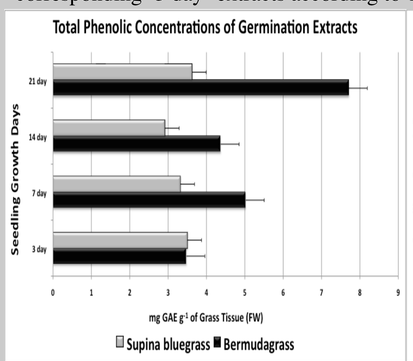
Oxygen Radical Absorbance Capacity (ORAC)

Ou, Hampsch-Woodill, & Prior (2001) **[Figure 5]**

Reverse Phase HPLC

Cosmulescu et al., (2010) **[Figure 6][Table 1]**

Figure 4. Total Phenolics and Flavonoids: Data expressed as mean ± SE (n=3) of gallic acid equivalents (GAE) or catechin equivalents (CE) per gram of fresh weight (FW) grass tissue. (*) denotes means significantly different from corresponding '3 day' extracts according to Tukey's HSD test (α=.05).



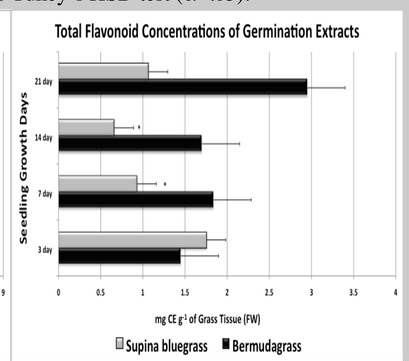


Figure 5. Antioxidant Activity (ORAC)

Data expressed as mean ± SE (n=3) of Trolox equivalents (TE) of extracts per gram of fresh weight (FW) grass tissue. (*) denotes means significantly different from corresponding '3 day' extracts according to Tukey's HSD test (α=.05).

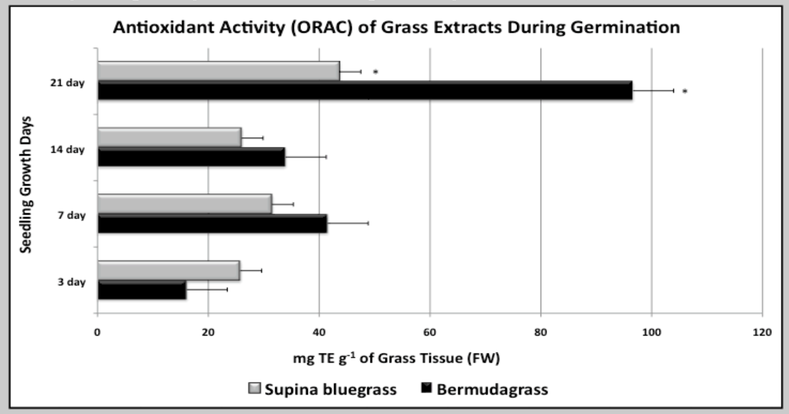
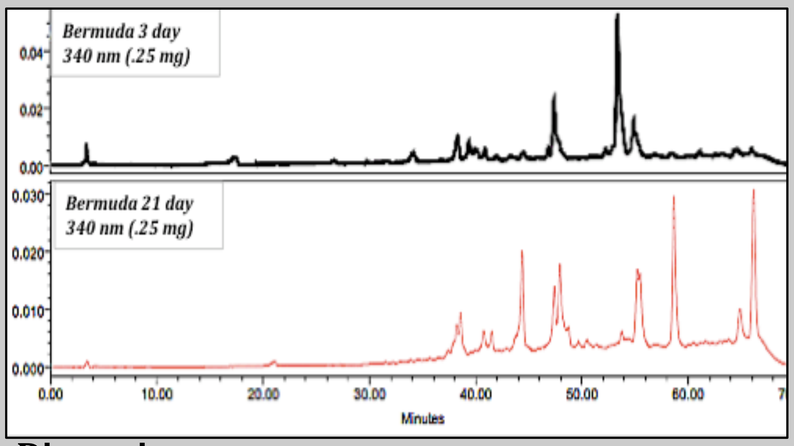


Figure 6. HPLC-RP Analysis

HPLC-RP of bermudagrass '21 day' (red curve) and '3 day' (black curve) detection at 340 nm.



Discussion

The conceptual basis of this research set out to gain insight about the chemotherapeutic/chemopreventative nature of phenolic extracts of amenity grasses when accounting for germination-induced phenolic profile shifts. The HPLC chromatogram (**Figure 6**) definitively shows phenolic compositional shifts in bermudagrass '3 day' and '21 day' sample extracts. These shifts clearly correlate with increased phenolic concentrations and antioxidant activities of the '21 day' extracts. This evidence demonstrates the substantial impacts that sampling time can have on the overall phenolic nature of amenity grass extracts.

Contact and Literature Cited

For a complete list of the cited literature or any general questions, please contact Casey Wegner at: cwegner1@yahoo.com