

# Alleopathic effects of exogenous deuterated phenylalanine

## Objective:

- Determine if deuterium isotopic label can be targeted to lignin through absorption of deuterated phenylalanine by roots of growing whole plants

## Approach:

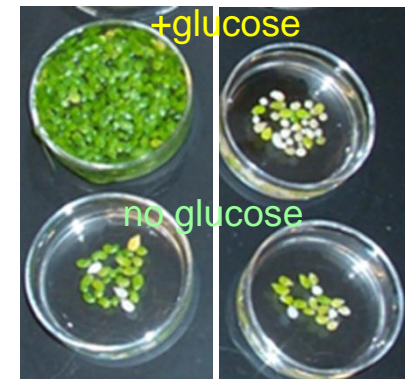
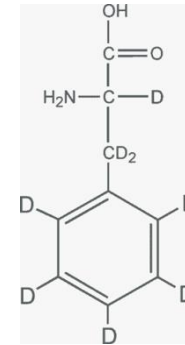
- Grow four monocot species in solutions containing 2 mM deuterated phenylalanine- $d_8$  or protiated phenylalanine and analyze lignocellulosic biomass for D-incorporation
- These three grasses and *Lemna* duckweed were previously shown to incorporate D when grown in 50%  $D_2O$ .

## Results:

- Deuterium incorporation was determined by FTIR and  $^1H^2H$ -NMR
- There was significant stunting of annual ryegrass by protiated but not deuterated phenylalanine- $d_8$  indicative of a kinetic isotope effect
- Winter grain rye showed stimulation of root growth by deuterated phenylalanine but D-incorporation was very low at 0.5%.
- Switchgrass grew normally, but incorporated only 3% D in lignin.
- Both phenylalanine and deuterated phenylalanine- $d_8$  inhibited growth of *Lemna* duckweed.

## Significance:

- Root uptake of phenylalanine is not a viable strategy for sufficiently labeling grass lignin at the 30-40% D desirable for neutron scattering studies but may be sufficient for investigation of phenyl propanoid pathways and their differences among plant species by NMR, mass spectroscopy and imaging techniques.



*Lemna minor*  
control 2mM Phe- $d_8$

## BER Biofuels SFA at ORNL

### (Dynamic Visualization of Lignocellulose Degradation ...)

Evans BR, Bali G, Ragauskas A, Shah R, O'Neill H, Howard C, Lavenhouse F, Ramirez D, Weston K, Ramey K, Cangemi V, Kinney B, Partee C, Ware T, and Davison B. *Planta* (June 2017) in press.