COLLEGE OF SCIENCE
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

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"That Code-Switching Switchgrass" — A Root Analysis of Two Ecotypes of *P. virgatum* Under Temperature Variations

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Overview

- "Code switching" is changing the language/dialect someone speaks with respect to the environment/situation (e.g., speaking in a professional, rather than colloquial, manner to one's boss).
- Plants "code switch" during root development, but it is not well understood.
- Root functional traits such as branching, root lengths, and root diameters are "dialects" and "jargons" that enable a certain switchgrass (*P. virgatum*) ecotype to better navigate its environment.
- Climatical temperature variations seem to manifest as distinct root functional traits in upland and lowland switchgrass ecotypes (Shawnee and Alamo, respectively).

Methodology

- Shawnee and Alamo switchgrass seeds were obtained from Ernst Seed Company and cold stratified for 2 weeks.
- The seeds were imbibed with distilled water for 24 hours in a petri dish in the UAH Greenhouse.
- The seeds were individually planted in 4-inch square cups at an approximate depth of 3-5 mm below the soil line and then maintained in the UAH Greenhouse for germination.
- Eight weeks after germination, 5 Shawnee and 5 Alamo plants were placed on a heating mat in the Greenhouse and kept at an average temp. range of 31-33˚C at the bottom of the cup, and the control plants were kept at 27-30˚C.
- The plants were maintained for another 4 weeks and then harvested.
- The root systems were extracted from the soil, scanned, and analyzed using the WinRHIZO root imagery analysis software.
- The data collected from this software were analyzed using two 1-factorial ANOVAs.

Results

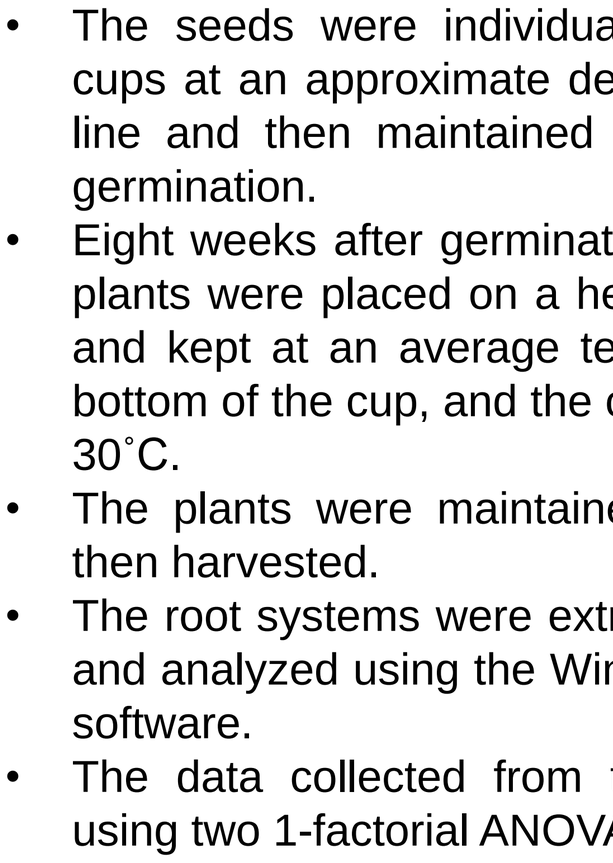

Figure 1. Shawnee Heat Control root system

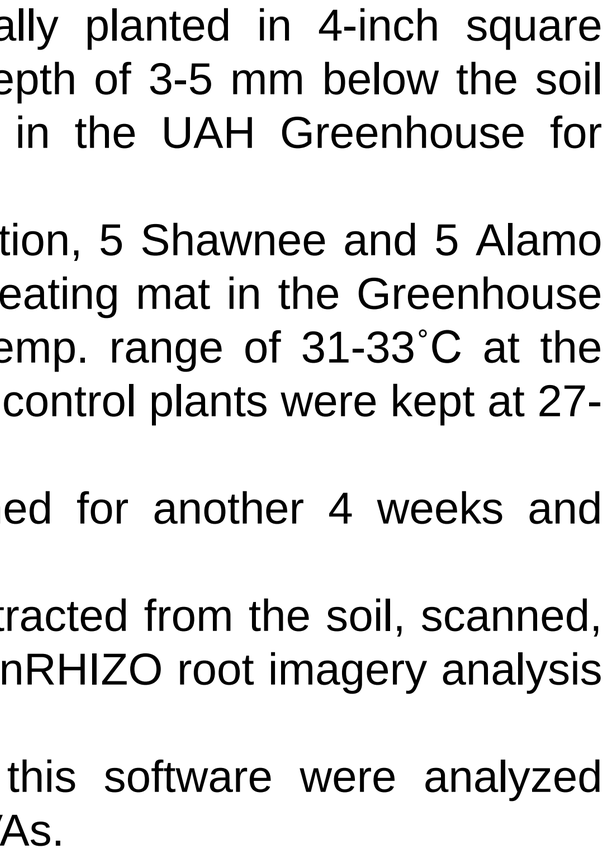

Figure 2. Shawnee Heat Experimental root system

One Factorial ANOVA – Alamo Control (27.14˚C) vs Alamo Heat Experimental (28.62˚C)			
Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Total	30078433.16	9	3342048.129
Groups	55071.686	1	55071.686
Error	30023361.47	9	3335929.052
			F=0.0165
			$F_{0.05\ (1)\ 1,9}$ = 5.12 and therefore accept H_0

Figure 3. The Alamo Heat Experimental plants showed no significant difference from the Alamo Controls (null hypothesis was accepted), p-value 0.00005**.**

One Factorial ANOVA – Shawnee Control (27.14˚C) vs Shawnee Heat Experimental (28.62˚C)			
Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Total	5927.595	9	658.6216667
Groups	16782.295	1	16782.295
Error	31605951.25	9	35.17723611
			F=477.078
			$F_{0.05\ (1)\ 1,9}$ = 5.12 and therefore accept H_A

Figure 4. The Shawnee Heat Experimental plants showed significant difference from the Shawnee Controls (tested hypothesis was accepted), p-value 0.00005.

Impacts

- Shawnee Heat Experimental plants showed overall longer total root lengths/volumes than did the controls.
- In the realm of agriculture/genetic engineering, understanding how roots "code switch" to adapt to different climates could be beneficial as we face issues such as climate change and overdevelopment of viable farmland.
- Approaches like this experiment could pave way for catalogues of visual root traits alongside the gene(s) responsible for those modifications and allow for enhancements of those traits at the genetic level.

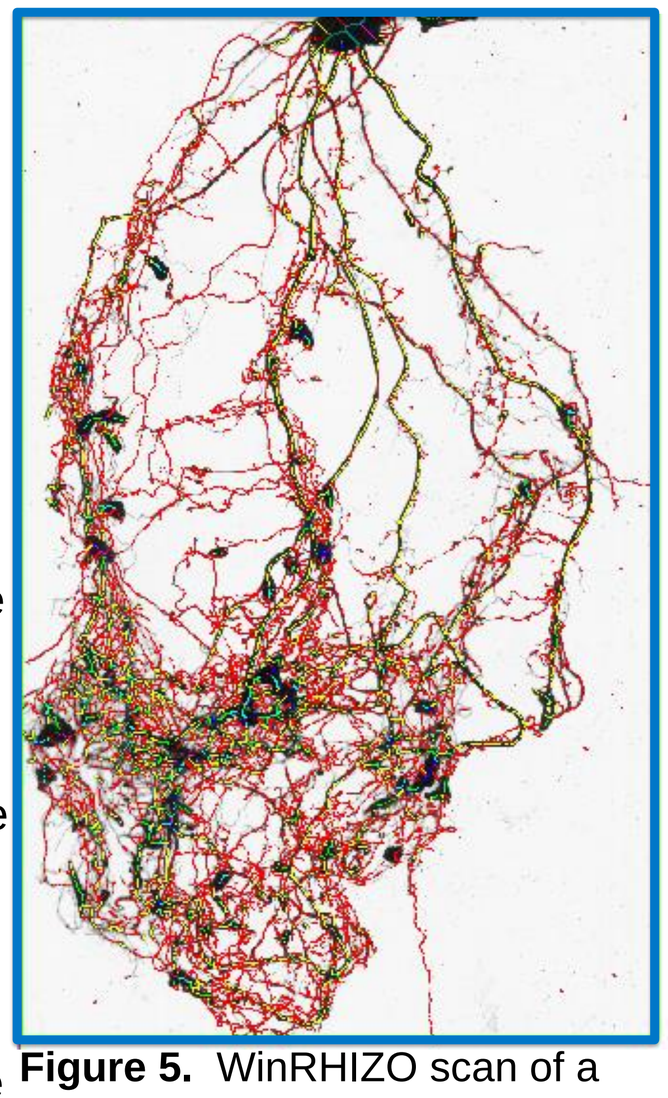

Figure 5. WinRHIZO scan of a Shawnee Heat Experimental root system

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