

were greater in the bermudagrass/fescue treatment than in the fescue/ryegrass treatment that were greater than the control (Figs. 1, 2, and 3). Plant root parameters indicated that a high potential exists for a positive rhizosphere effect to enhance crude oil biodegradation. Shoot biomass was similar for bermudagrass and fescue vegetation and indicated substantial plant growth had occurred (Fig. 4).

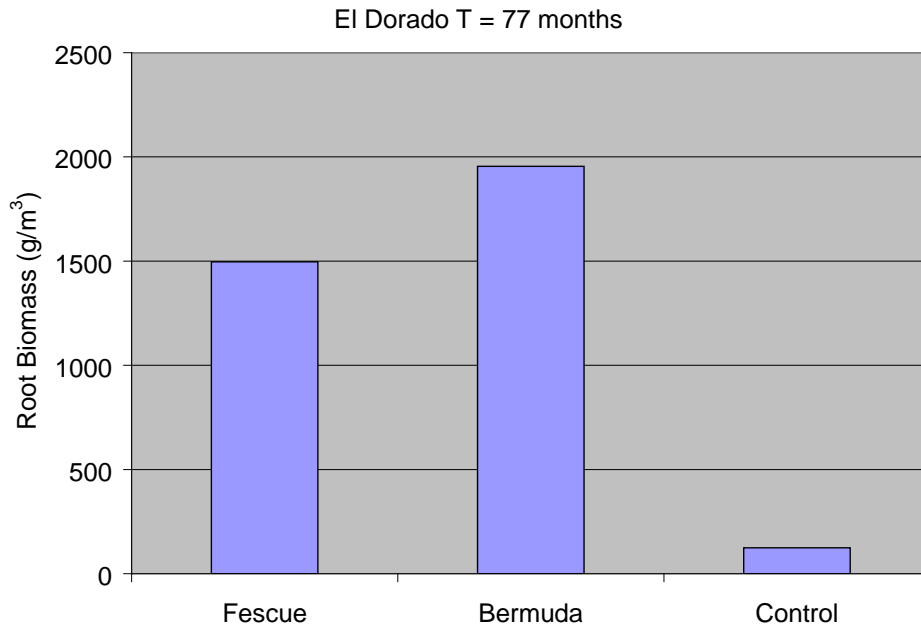


Figure 1. Root biomass for the three treatments at the El Dorado field site for samples collected 77 months after plot establishment. The brine impacted plots were excluded in the averages presented.

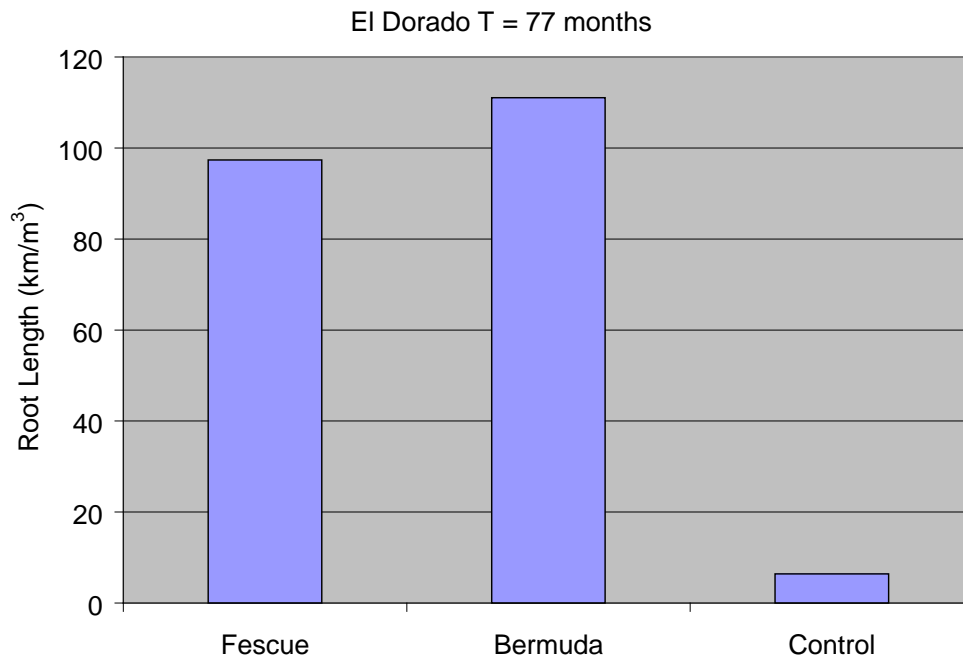


Figure 2. Root length for the three treatments at the El Dorado field site for samples collected 77 months after plot establishment. The brine impacted plots were excluded in the averages presented.

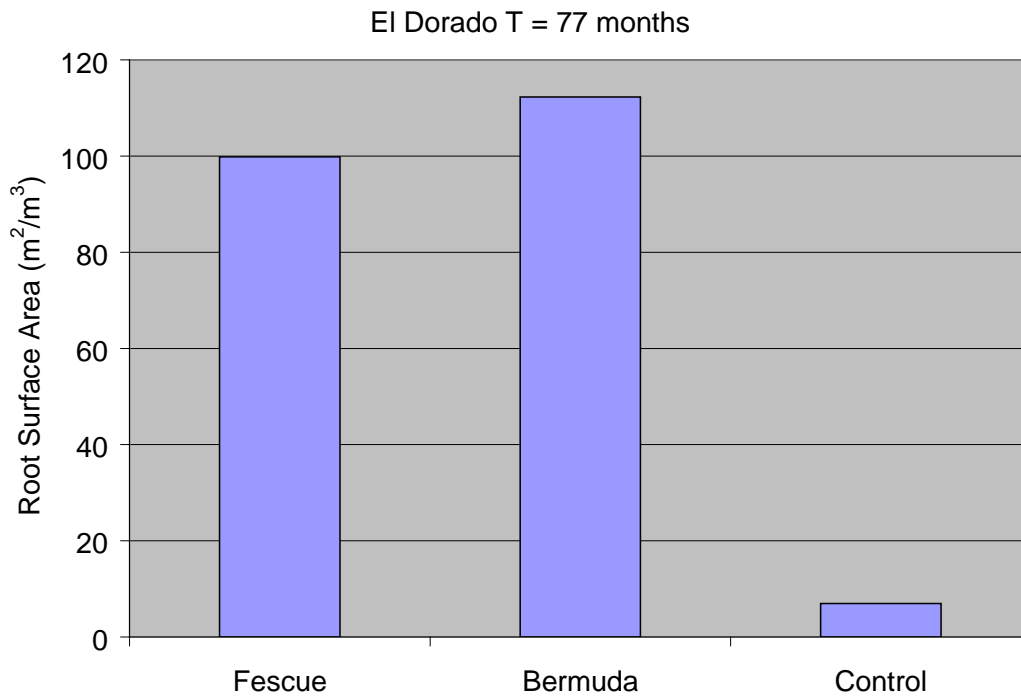


Figure 3. Root surface area for the three treatments at the El Dorado field site for samples collected 77 months after plot establishment. The brine impacted plots were excluded in the averages presented.

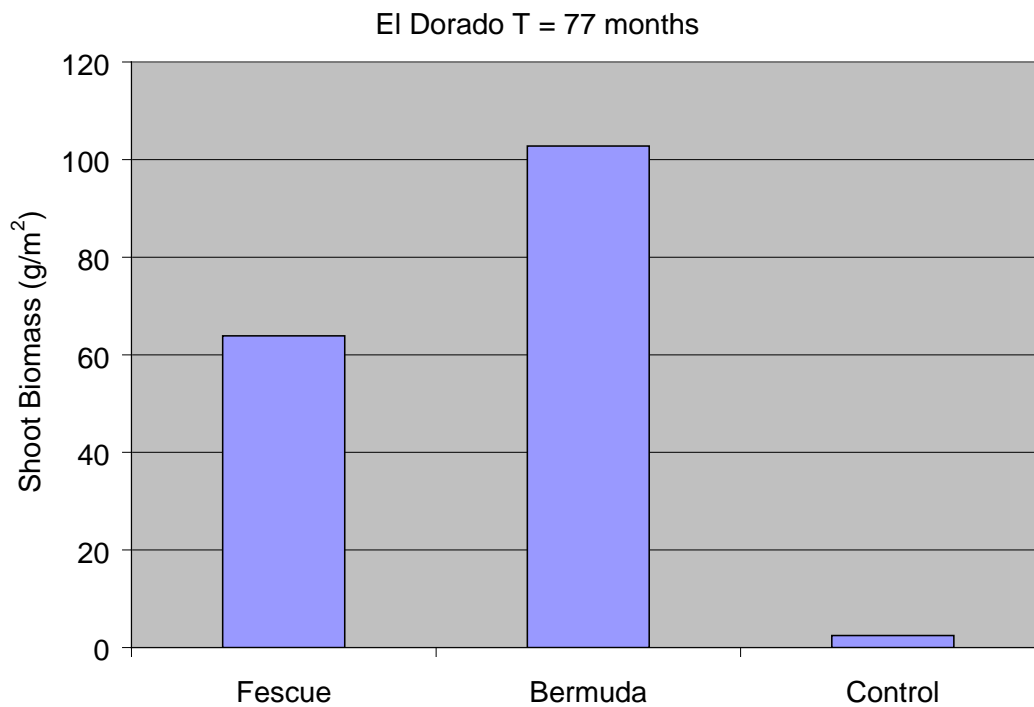
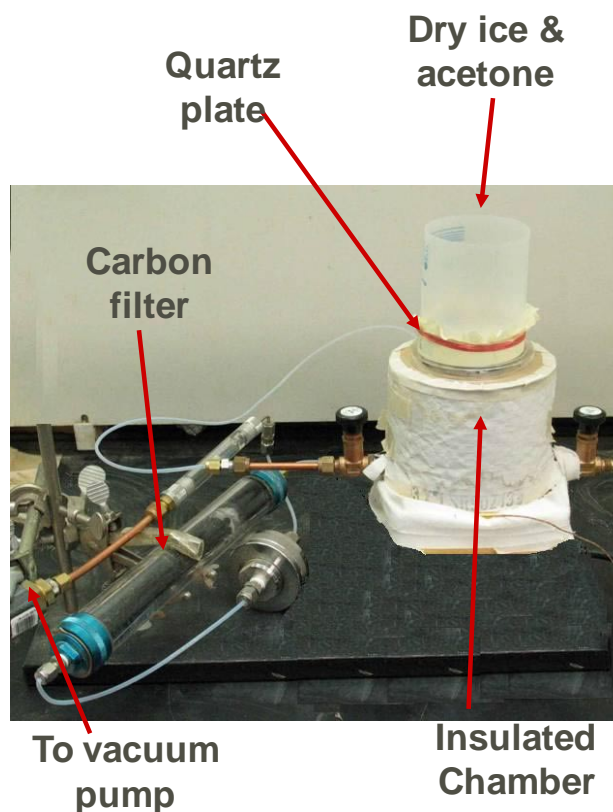


Figure 4. Shoot biomass production for the three treatments at the El Dorado field site for samples collected 77 months after plot establishment. The brine impacted plots were excluded in the averages presented.

Rhizotron Image Analysis

The new heating element installed only requires 3min to reach 130C and provides heat uniformly. Leaking in deposition chamber was discovered and fixed. Also, pressure setting for film deposition was changed from 1.9 torr to 5 torr due to non-uniformity of pyrene film.

Figure 5. Pyrene deposition apparatus with pencil heaters and feedback control for stabilizing deposition temperature.



An experiment to assess the effect of nitrogen addition to the rhizosphere on the in-situ degradation rate is underway. Rye grass and soybeans are being grown in a growth chamber held at 23C. The treatments include +/- 100 mg/kg nitrogen added as ammonium nitrate. Digital images are collected approximately every 4 days.

¹³C Stable Isotope Probing

Analysis of the ¹³C Hexadecane remains ongoing

Publications/Presentations:

Abstracts and titles that have been submitted for presentation as posters or presentations in the future include:

- Duncan, K., S. AbuBakr, K.L. Sublette, E.M. Jennings, N. Alahari, G. Thoma, D. Wolf, and J. Davis. 2006. Efficacy of Various Treatments on the Restoration of Nitrogen Cycling in Tallgrass Prairie Impacted by Oil and Brine Spills. p. 35. In 13th Annual International Petroleum Environmental Conference. 17-20 October 2006. San Antonio, TX. Integrated Petroleum Environmental Consortium, Tulsa, OK.
- Karim, K. G.J. Thoma, P. T. Hsu, T. Ho, and D.C. Wolf, Effect of Nitrogen Addition on Rhizo Degradation Rates of Pyrene. p. 74. In 13th Annual International Petroleum Environmental

Conference. 17-20 October 2006. San Antonio, TX. Integrated Petroleum Environmental Consortium, Tulsa, OK.

Sublette, K., N. Alahari, E. Jennings, K. Duncan, G. Thoma, D. Wolf, J. Brokaw, M. A. Callahan, and T. Todd. 2006. Of Earthworms and Nematodes in Restoration of E&P Sites. p. 75. In 13th Annual International Petroleum Environmental Conference. 17-20 October 2006. San Antonio, TX. Integrated Petroleum Environmental Consortium, Tulsa, OK.

Manuscripts submitted:

Kirkpatrick, W.D., P.M. White, Jr., D.C. Wolf, G.J. Thoma, and C.M. Reynolds. 2006. Selecting plants and nitrogen rates to vegetate crude-oil-contaminated soil. *Int. J. Phytorem.* 8:285-297.

Future Activities:

Our initial findings suggest that phytoremediation does reduce contaminant levels through the action of microbial communities associated with the rhizosphere. It is therefore important to develop successful agronomic management strategies that exploit this understanding. However, our detailed knowledge of the microbial ecology of the rhizosphere is lacking. We plan to use phospholipid fatty acid (PLFA) analysis to identify specifically which group of microbes are responsible for the degradation. We will continue to investigate the modes of action of a phytoremediation system; while keeping in mind that the ultimate goal remains site cleanup.

Supplemental Keywords:

Rhizosphere; rhizodegradation; species selection; Arkansas; South Central United States

Relevant Web Sites:

Remediation Technologies Development Forum: www.rtdf.org; IPEC: ipec.utulsa.edu