

Bioenergy Research Activities at the Northern Great Plains Research Laboratory

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Hanson, John Berdahl (retired), Al Frank (retired)**

**NP213 Bioenergy Workshop
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Beltsville, MD**

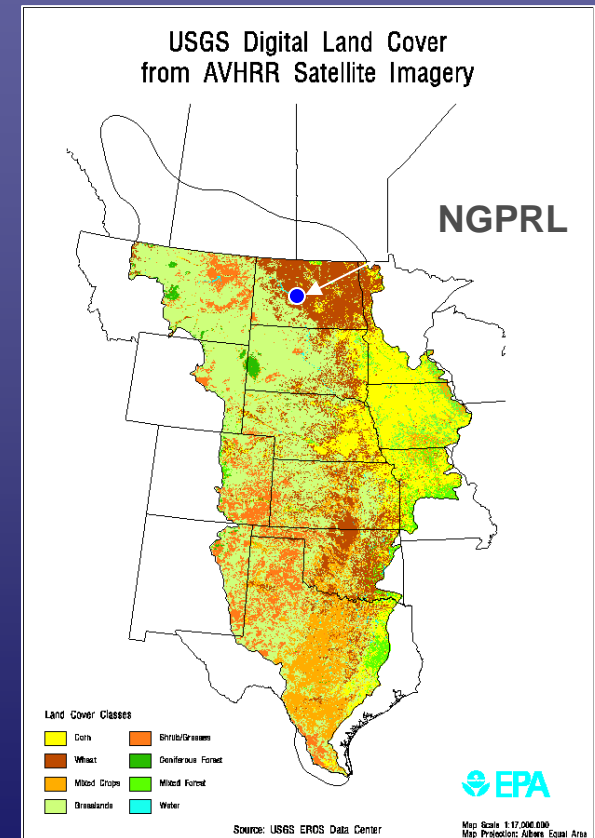
Northern Great Plains Research Laboratory

Geography: West-central North
Dakota

Climate: Semiarid / Subhumid
(MAP, 404 mm; MAT, 5°C)

Biota: Mixed-grass prairie

Soils: Mollisols (Wisconsin age
glacial till with loess cap)



Northern Great Plains Research Laboratory

Research: Integrated agricultural systems.

Staff: 11 SYs, 26 support personnel.

Facilities: Laboratories, greenhouses, growth chambers, rain-out shelter.

Equipment: Large- and plot-scale.

Land: 2000+ acres.



Recent Accomplishments: Switchgrass Cultivar Evaluations

- Evaluated yield, phenology, and survival of eight cultivars in western ND.
- **Key findings:**
 - Sunburst and Trailblazer top yielding entries.
 - Greater biomass yield with September harvest than August.
 - Yield closely associated with water availability.



Berdahl, J.D., A.B. Frank, J.M. Krupinsky, P.M. Carr, J.D. Hanson, and H.A. Johnson. 2005. Biomass yield, phenology, and survival of diverse switchgrass cultivars and experimental strains in western North Dakota. *Agron. J.* 97:549-555.

Recent Accomplishments: Disease Identification

- Evaluated disease susceptibility of switchgrass.
- Key Findings:
 - Leaf spot disease on switchgrass caused by *Bipolaris oryzae*.
 - Potential to diminish yields under intensive plantings for high biomass production.



Krupinsky, J. M., J.D. Berdahl, C.L. Schoch, and A.Y. Rossman. 2004. Leaf spot on switchgrass (*Panicum virgatum*), symptoms of a new disease caused by *Bipolaris oryzae*. *Can. J. Plant Path.* 26:371-378.

Recent Accomplishments: Carbon Dynamics of Switchgrass

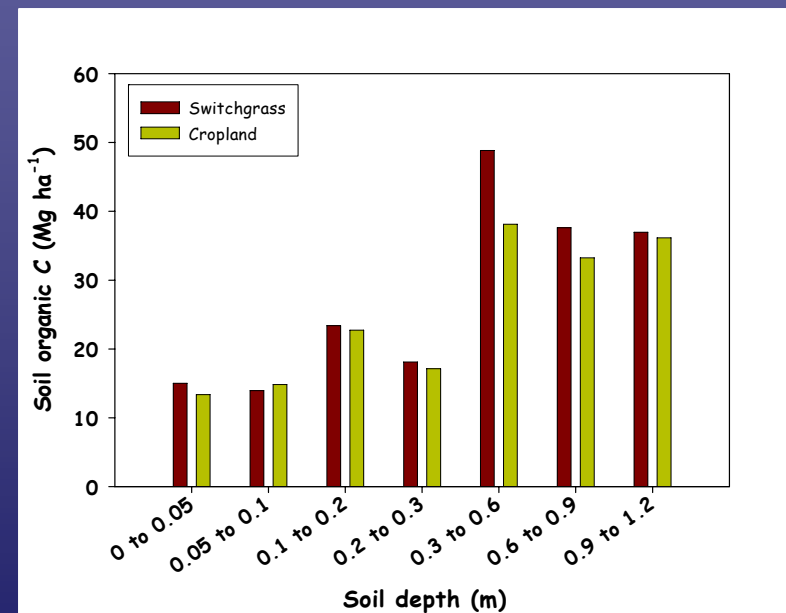
- Determined biomass and C partitioning in above- and belowground plant components.
- Key findings:
 - Root biomass accounted for >80% of total biomass.
 - Increase in soil organic C was $1.01 \text{ kg C m}^{-2} \text{ yr}^{-1}$.



Frank, A.B., J.D. Berdahl, J.D. Hanson, M.A. Liebig, and H.A. Johnson. 2004. Biomass and carbon partitioning in switchgrass. *Crop Sci.* 44(4): 1391-1396.

Recent Accomplishments: Soil Carbon Storage under Switchgrass

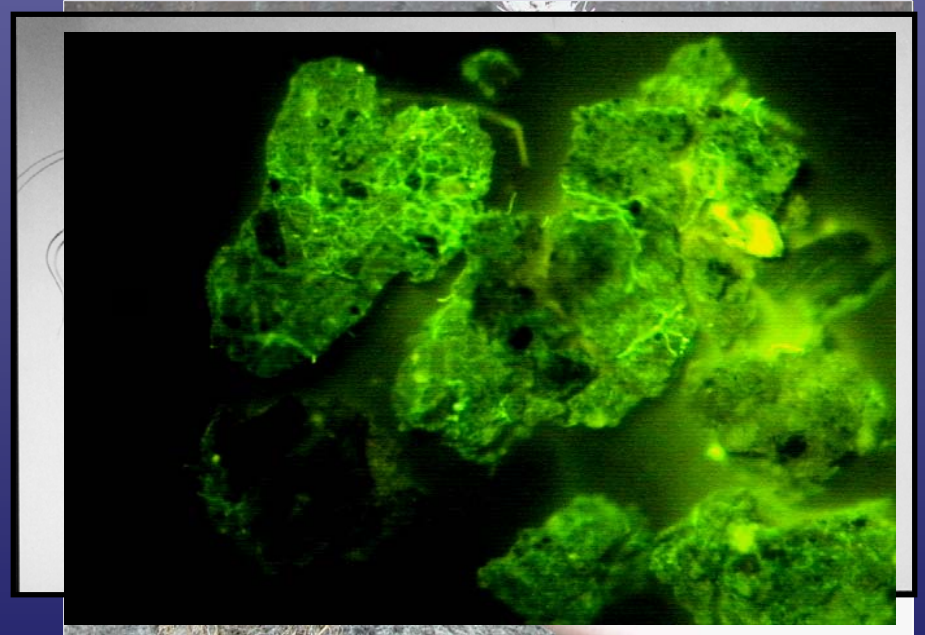
- Evaluated soil C stocks in switchgrass stands and cropland in SD, ND, and MN.
- Key finding:
 - Switchgrass is effective at storing soil organic C below 30 cm.



Liebig, M.A., H.A. Johnson, J.D. Hanson, and A.B. Frank. 2005. Soil carbon under switchgrass stands and cultivated cropland. *Biom. Bioe.* 28(4):347-354.

Current Projects: Mycorrhizal Fungi Evaluations

- Potential bioenergy feedstocks are mycorrhizal.
- Research activities include:
 - Creation of inoculum
 - Quantification of glomalin production and soil aggregation



Current Projects:

Long-term Herbaceous Biomass Study (North Dakota Natural Resources Trust)

- Multi-location, 10 yr project with NDSU extension stations.
- 20 feedstock/harvest treatments.
- Objectives:
 - Evaluate productivity, stand persistence, etc.
 - Measure impact of treatments on soil quality/carbon storage.



Planned Activities

- Evaluate approaches to successfully transition perennial biofeedstocks with annual crops in semiarid cropping systems.
- Determine greenhouse gas intensity for production of biofeedstocks relevant to northern Great Plains.
- Assess effects of pyrolysis byproducts on mycorrhizal hyphae, soil physical attributes, and carbon storage.

