

KBS LTER Cellulosic Biofuel Plots Experimental Design

The purpose of this experiment is to provide a context for asking long-term questions related to the productivity, sustainability, and ecosystem services associated with different strategies for producing cellulosic feedstocks. Note that this experiment is complementary to the KBS LTER GLBRC experiment.

A plot size of ca. 10 by 30 m (30' by 90') allows commercial planting and harvesting by commercial-scale equipment.

Treatments:

- C1 Continuous corn harvested for maximum biomass, fertilized
- C2 Corn–soybean rotation harvested for maximum biomass, fertilized
- C3 Soybean–corn rotation harvested for maximum biomass, fertilized
- C4 *Panicum virgatum* (Cave-in-Rock – non-native variety), fertilized
- C5 *Panicum virgatum* (Cave-in-Rock), not fertilized
- C6 *Panicum virgatum* (Southlow - MI genotypes) fertilized
- C7 *Panicum virgatum* (Southlow) not fertilized
- C8 C3–C4–legume mix (*P. virgatum*, *E. canadensis*, *Trifolium pratense* [red clover, inter-seeded after establishment year])
- C9 MI native prairie grasses (6-species; see Table). Species of common prairie grasses that could occur in a southern Michigan prairie
- C10 MI native prairie with low forb diversity (10 species; see Table 1). Same species as C9 + 4 forbs.
- C11 MI native prairie mixture with medium forb diversity (18 species; see Table 1). Same species as C10 but 8 additional forb species. This is the same species mix as in the GLBRC G10 treatment.
- C12 MI native prairie with high forb diversity (30 species; see Table 1). Same plants as C11 but adds 3 additional forb species to each functional group.

Table 1. Species composition for treatments C6-C10 of the Cellulosic Biofuels Experiment. All species are native and common to diverse southern Michigan prairies (Chapman 1984; Dibold 2005) unless noted.

Group	Species	Native Treatments				
		C8	C9	C10	C11	C12
Graminoids	<i>Panicum virgatum</i> (switchgrass; C4)	•	•	•	•	•
	<i>Elymus canadensis</i> (Canada wildrye; C3)	•	•	•	•	•
	<i>Andropogon gerardii</i> (big bluestem; C4)		•	•	•	•
	<i>Schizachyrium scoparium</i> (little bluestem; C4)		•	•	•	•
	<i>Sorghastrum nutans</i> (Indiangrass; C4)		•	•	•	•
	<i>Koeleria cristata</i> (prairie Junegrass; C3)		•	•	•	•
Legumes ¹	<i>Trifolium pratense</i> (red clover; non-native)	•		•	•	•
	<i>Desmodium canadense</i> (showy ticktrefoil)			•	•	•
	<i>Lespedeza capitata</i> Michx (roundhead lespedeza)				•	•
	<i>Baptisia leucantha</i> (white false indigo)				•	•
Shrub	<i>Amorpha canescens</i> (leadplant)					•
	<i>Desmodium illinoense</i> (Illinois ticktrefoil)					•
	<i>Dalea (Petalostemum) purpureum</i> (purple prairie clover)					•
Early forbs	<i>Rudbeckia hirta</i> (blackeyed Susan)			•	•	•
	<i>Anemone Canadensis</i> (Canadian anemone)				•	•
	<i>Asclepias tuberosa</i> (butterfly milkweed)				•	•
	<i>Euphorbia corollata</i> (flowering spurge)					•
	<i>Tradescantia ohioensis</i> (Ohio spiderwort)					•
	<i>Zizia aurea</i> (golden zizia)					•
Mid forbs	<i>Monarda fistulosa</i> (wild bergamot)			•	•	•
	<i>Silphium perfoliatum</i> (cup plant)				•	•
	<i>Ratibida pinnata</i> (pinnate prairie coneflower)				•	•
	<i>Coreopsis tripteris</i> (tall tickseed)					•
	<i>Asclepias syriaca</i> (common milkweed)					•
	<i>Oenothera biennis</i> (common evening primrose)					•
Late forbs	<i>Solidago rigida</i> (rigid goldenrod)			•	•	•
	<i>Solidago speciosa</i> (showy goldenrod)				•	•
	<i>Aster novae-angliae</i> (New England aster)				•	•
	<i>Aster pilosus</i> (hairy aster)					•
	<i>Solidago nemoralis</i> (gray goldenrod)					•
	<i>Aster laevis</i> (smooth aster)					•

¹ treated with appropriate inoculum.

Table 2. Characteristics of seed mixes.

	C8	C9	C10	C11	C12
Total species richness	3	6	10	18	30
Forb seeds/ft ²	0	0	10	15	20
Grass seeds/ft ²	30	30	25	20	15
Total seeds/ft ²	30	30	35	35	35
Total seed weight (lbs)	7	6.8	6.5	6.6	6.2

References:

- Chapman, K. A. 1984. An Ecological Investigation of Native Grassland in Southern Lower Michigan. Unpublished Masters Thesis, Western Michigan University, Kalamazoo, Michigan.
- Dibold, N. 2005. Designing seed mixes. pp. 135-149 *In* S. Packard and C.F. Mutell eds. *The Tallgrass Restoration Handbook*. Island Press, Washington DC.

Date: June 1, 2008