Growing Biomass on Marginal Soils

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Background

SOIL

“Marginal soils,” loosely defined, are soils or terrains with limitations for high-end agricultural use. Some limitations include water scarcity, low soil fertility, drainage issues, steep slope, or degraded conditions.

One type of marginal soil is reclaimed mineland sites. To the right is a picture of switchgrass growth two months after planting on a mineland site. At this stage it is difficult to see the switchgrass amongst the weeds, but it is there.

Perennial Bioenergy Crops for the NE

SHRUB WILLOW (Salix spp.) – a perennial crop harvested every 3-4 years for energy purposes. Stem cuttings from 6-18 inches are planted in early spring but as late as early August. The picture on the left shows one month of growth.

SWITCHGRASS (Panicum virgatum) – a perennial grass native of North America harvested every year for energy. The picture on the left shows a few months of growth from seed planting.

MISCANTHUS (X Giganteas) – a perennial grass of Eurasian origin harvested every year for energy. The picture on the left shows second year regrowth from rhizomes.

Challenges

Planting: Equipment and terrain limitations cause plant establishment failures leading to costly replanting in year 2. Examples:
- 25 to 75% of plants missing (“skips”) in double-row willow at Rockview; potential drought-herbicide damage compounded the problem
- 50% survival of switchgrass in mineland site at Philipsburg
- Until second year, when rhizomes enable expansion, miscanthus stands are very open

Pests: saw fly larvae can compromise a plantation of willow in first year if unattended. Example:
- we saw plants with 100% of leaves wiped out
- No observed pests for switchgrass or miscanthus however

Weeds: control can be challenging and costly as marginal lands may have a plentiful seed bank

Nutrient requirements:
Willow, switchgrass and miscanthus may grow with limited nutrients, but is some fertilizer application necessary? Examples:
- Observed nutrient stress symptoms in willow leaves, and visual response of miscanthus to nitrogen

Challenge summary: Establishing even stands is critical from the economic perspective, but also for the perceptions of the public and producers.

The figure to the right shows second year growth in June of a miscanthus stand in Central, PA. Growth appears patchy in the front of the photo, but overall the crop looks very healthy and well established.

Benefits

Once established perennial bioenergy crops may offer substantial benefits
- minimize land competition since marginal soils aren’t used for food production
- after first couple years, low maintenance and cost of project
- high nutrient capture and recycling which is maximized with winter harvest; can help restore soil and water quality
- Potential habitat for birds and other species

Future Work

- Establish minimum nutrient requirements for shrub willow, switchgrass and miscanthus
- Classify marginal soils in terms of soil nutrient content, inorganic material, and slope and water availability
- Develop system to assess weed management for variety of land types

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