

Our Goal is to “Facilitate the commercialization of woody biomass crops as a locally grown feedstock for bioenergy and bioproducts by optimizing production systems, developing producer interest and participation, expanding markets and creating renewable energy jobs.”

Environmental & Rural Development Benefits

- Net Energy ratio of 1:55 @ farm gate
- CO₂ neutral fuel – reduce fossil carbon
- Reduced NO_x and SO_x emissions
- Reduce use of petroleum for chemicals, products and fuels
- Soil microarthropod species density & richness similar to old fields
- Bird diversity in willow crops similar to old fields and eastern deciduous forests
- Carbon cycle/storage benefits
- Soil erosion minimized with cover crops
- 75 jobs for every 4,000 hectares of willow crops

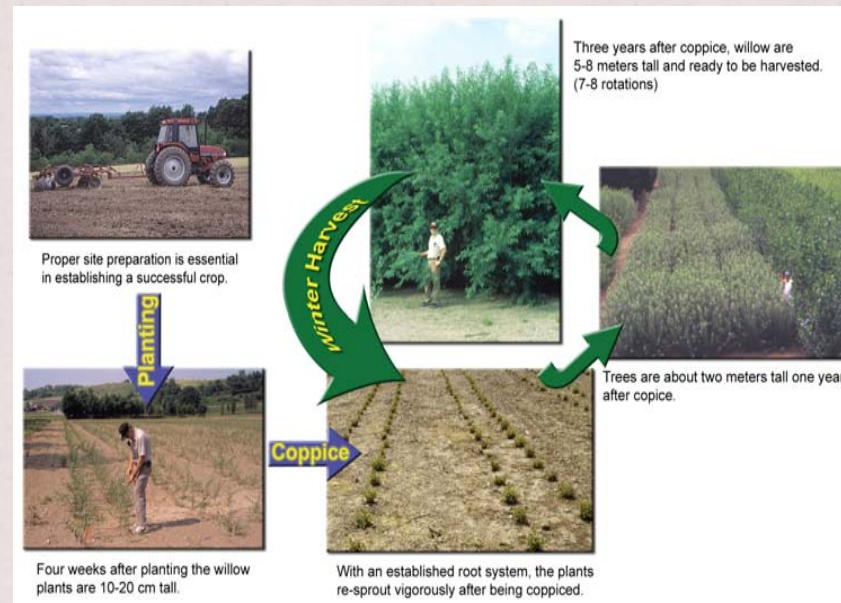


A new two-year old willow clone/variety from SUNY-ESF's willow breeding program.

- High biomass production
- Easily established with unrooted cuttings
- Resprouts vigorously after harvest
- Large potential for genetic improvement

Why Willow?

Closed-Loop Willow Biomass Crops



Additional Applications / Benefits of Willow Crops

- Riparian buffer zone plantings
- Animal waste management systems
- Waste water management systems
- Phytoremediation: heavy metals and hydrocarbons
- Alternative landfill cover
- Living willow snow fences
- Carbon source for manure composting



Rural development through commercialization of willow biomass crops.

Advances in Genetic Improvement

- Developed clones/varieties with improved yield, form, chemistry and pest resistance
- Over 200 controlled crosses completed
- Multiple genetic and site selection trials in Northeastern and Midwestern US
- Potential yield increases of >100%
- Potential increases in cellulose concentration for ethanol production



Controlled pollination.



1000s of willow progeny.

Forest Residues

Wood Manufacturing Residues

Willow Biomass

- Over 200 hectares of willow biomass crops in western and central NY
- Potential to develop 5,000 hectares in both New York & Minnesota in the next three years.

“Woody” or “Lignocellulosic” Biomass Feedstock

SUNY-ESF Integrated Wood Biorefinery

Bioenergy Options

- **Cogeneration @** 100% wood for heat and power
- **Co-firing** in existing coal boilers
 - Minor modification costs
 - Co-fire wood up to 20% by energy input



NRG Dunkirk coal power plant on Lake Erie co-fire tests with 10% wood feedstock completed in fall 2002.

Ethanol Production

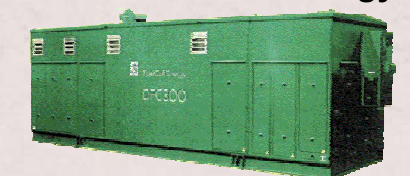
- Increased yield and cellulose concentrations will dramatically improve economics

Gasification - 30% more efficient



Johansson Biomass Gasifier System

Fuel Cell Technology



SUNY-ESF's molten carbonate fuel cell – initially fueled by natural gas to be replaced by syngas from willow biomass.

Portfolio of New Bioproducts and Energy Resources from Wood:

- Bio-based chemicals
- Biofuels & biodiesel
- Biodegradable thermoplastic polyesters
- Composite materials
- Thermoset polymers
- Adhesives
- Sulfur-free lignin

CO₂ Neutral and 1 : 11–16 Net Energy Ratio

