

Cornell University

Department of Plant Breeding and Genetics

2008 GRASS ENERGY CROPS INFORMATION SHEET #1

Introduction

The purpose of this information sheet is to inform New York State (NYS) residents of a perennial grass research project initiated at Cornell University in 2007, and to provide practical agronomic and plant variety information to individuals, who are considering planting perennial grasses for energy uses, either on their own or rented land. The bioenergy feedstock project is managed by the Forage Breeding Program in the Department of Plant Breeding and Genetics, and is led by Dr. Donald Viands and coordinated by Dr. Hilary Mayton. The project is part of a multi-disciplinary renewable energy research effort supported by the New York Farm Viability Institute (NYFVI), Cornell University, the College Agriculture and Life Sciences, and the Northern New York Agricultural Development Program (NNYADP). The research project was initiated in response to the need for information on planting and managing warm season perennial grass crops for the emerging agricultural energy industry in NYS. An overarching goal of the project is to increase production of perennial grasses for use as bioenergy feedstock to support this alternative energy industry. The close proximity of agricultural land in the Northeast to major population and transportation centers makes this region ideal for development of bioenergy crops and industrial by-products from energy conversion processes.

Production of warm season perennial grass field crops for dedicated use as bioenergy crops has the potential to increase revenue for NYS's agricultural industry and transportation sectors, make use of idle farmland, and expand options to the livestock industry for manure management. The experience and research base with production of these crops in NYS is limited. Developments and breakthroughs in biofuel conversion technology by government, industry, and academic researchers are also happening rapidly; therefore, informative fact sheets will be developed and made available to NYS residents through Cornell Cooperative

Extension offices, field day demonstrations, and the project web-site (<http://nybiofuels.info>) on a continuing basis over the course of this project.

Because the US Department of Energy's Biomass Research Program has selected switchgrass as the model perennial grass bioenergy crop, our initial field trials are primarily focused on this species. In 2007 (Figure 1), the Forage Program at Cornell University established research trials and large scale field trials consisting of both monoculture and mixed species stands of switchgrass, big bluestem varieties, and other warm season species in diverse regions of NY (Table 1). Additional research trials will be planted in 2008 (Figure 1). These grasses were selected because of their ability to produce high yields and for their adaptability to diverse regions of the country. Average yields of these grasses range from 3-7 dry tons/acre in the Northeast. Life cycle analyses of the perennial grasses have demonstrated that they will reduce greenhouse gas emissions when used as an alternative to fossil fuels. In addition they can reduce soil erosion and improve soil health and structure through production of an extensive root system.

Native warm season grasses, such as switchgrass, and big bluestem have specific physiological and morphological characteristics which allows for efficient growth in hot, dry weather. Although they grow efficiently in warm weather, certain varieties of these grasses are tolerant of cold climates and have been grown successfully in northern NYS, and native populations exist in the Northeast. Warm season grasses take longer to establish than cool season grasses during establishment in the cooler climate of New York. These warm season grasses can tolerate soils with low pH and have low fertility requirements. In addition, it has been shown through research trials in other regions of the

Table 1. Common name and scientific name of grasses planted in NYS in 2007

Common name	Species
big bluestem	<i>Andropogon gerardii</i>
coastal panic grass	<i>Panicum amarulum</i>
eastern gamagrass	<i>Tripsacum dactyloides</i>
indiangrass	<i>Sorghastrum nutans</i>
switchgrass	<i>Panicum virgatum</i>

country that yields of 5-10 dry tons per acre can be achieved in a one-cut harvest management system. It is important to follow recommendations closely to increase chances for a successful seeding. With very good weed control, it will take 2-3 years for the stand to reach full potential.

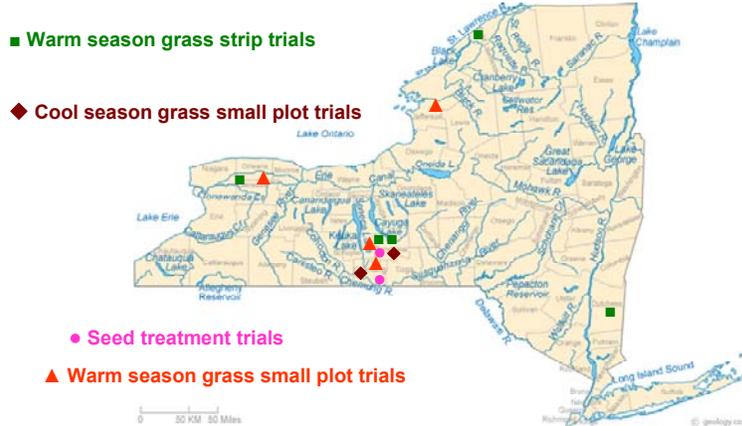
As mentioned earlier, several varieties of warm season grasses are presently under evaluation for performance in various locations around the state (Figure 1). The ‘Cave-in-rock’ variety of switchgrass is presently the highest yielding commercially available switchgrass adapted in New York; ‘Carthage’ is another variety with high biomass potential. If used for forage, ‘Shawnee’, a selection out of Cave-in-Rock, for higher *in vitro* digestibility would be the best choice for this region of the country. ‘Sunburst’ is also a cultivar that is more adapted to colder areas. Big bluestem commercial varieties adapted to this region include ‘Niagara’, ‘Roundtree’, ‘Pawnee’, ‘Bonanza’, ‘Kaw’ and ‘Goldmine’. Kaw and Goldmine are later in maturity. Other warm season grasses currently being evaluated in Cornell’s trials are eastern gamagrass ‘Pete’ and, indiagrass ‘Rumsey’, ‘Holt’ and ‘NE-54, the latter being more adapted to northern locations. New varieties that are in development and seed increases are underway by Universities, USDA and private companies. Big bluestem varieties Goldmine and Niagara did not establish as well as the majority of switchgrass cultivars in our 2007 seedings but may do well in the second year (2008) of our research trials.

Purchasing Seed. Warm season perennial grass seed is available from many commercial seed

companies. Seed for our research trials was purchased from Ernst Conservation Seeds, Inc. Meadville, PA (Ernst Conservation Seeds has a very thorough planting guide for the Northeast USA and Canada - see additional information); Stock Seed Farms, Murdock, NE; and the Gamagrass Seed Company, Fall City, NE. It’s important to ask for the highest quality seed available. A high quality seed lot will have a high % germination, high pure live seed (PLS), and low dormancy. We will be conducting trials on seeding rates in the future. A successful stand of warm season grasses will have approximately 10-20 plants per square yard. As part of our research effort on establishing warm season perennial grasses we are collaborating with a seed scientist at Cornell (Dr. Alan Taylor, Geneva Campus) on seed germination and dormancy issues and will have more information on seed quality as the project continues.

Site preparation and establishment. Warm season grasses in the Northeast climate do not compete well with cool season grasses and weeds. Site selection and preparation are important for successful establishment. If possible, warm season grasses should be seeded in fields with low weed pressure. Roundup (glyphosate) should be applied in the fall prior to plowing and seeding. In the spring we recommend a second application of Roundup if weeds are a concern. The fields should then be plowed and cultipacked before seeding. Warm season grasses should be seeded mid May until mid June.

2007 Cornell University Perennial Grass Field Trials



2008 Cornell University Perennial Grass Field Trials

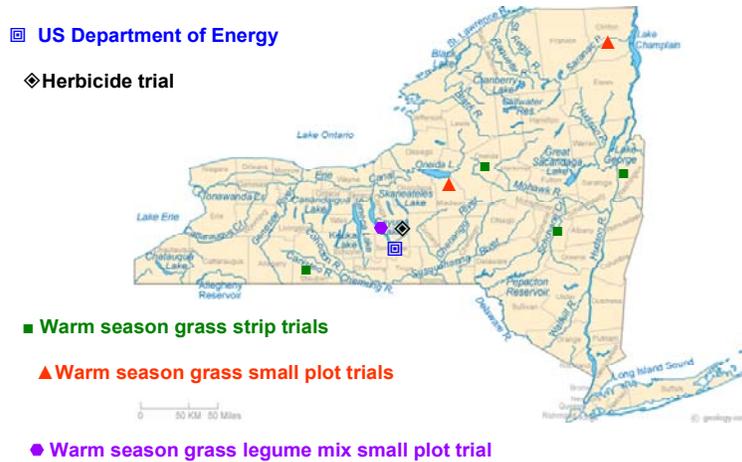


Figure 1. Research trial sites for 2007 and those planned for 2008

Some warm season grasses require special planting equipment due to the seed morphology. The fluffy big bluestem and indiangrass seed cannot flow through a typical seeder. For our large strip research trials, conducted on cooperators' fields, we used a Truax Drill seeder (owned by the USDA/NRCS Plant Materials Center at Big Flats, NY (Figure 2). Recommended rates/acre for warm season perennial grasses are generally lower than those used in our trials; however, our concern was to achieve a stand with which we could evaluate yield and biochemical qualities associated with conversion to combustible and liquid fuels. The seeding rate and depth used for our trials is shown in Table 2.



Figure 2. Truax Drill seeder used for planting warm season grasses
(http://www.truaxcomp.com/about_truax.html)

Table 2. Plant variety, seeding depth and rate used for NYFVI trials

Variety	Seeding depth inches	Seeding rate lbs (PLS)/acre
big bluestem	1/4 - 1/2	10-12
indiangrass	1/4 - 1/2	with switchgrass 2-4
switchgrass	1/8 - 1/4	10-12
eastern gamagrass	1 - 1 1/2	8-10

Markets and utilization. Some of the warm season grasses can be used for livestock bedding, forage and grazing. The agricultural energy market is in the developmental stage but is anticipated to open up over the next few years. As renewable energy technology advances, this project will provide up-to-date information on new developments in the industry. Hopefully this information will enable NYS growers to make informative decisions concerning production of bioenergy crops.

Additional information. Listed below are sources for additional information on warm season perennial grass establishment, production and utilization. For more information on this project contact

Dr. Hilary Mayton (hsm1@cornell.edu)
(607-255-5043 or 607-339-7216)
Web-site:(<http://nybiofuels.info>)

Dr. Paul Salon
USDA/NRCS Plant Materials Center
Big Flats, NY
<http://plant-materials.nrcs.usda.gov/nypmc/>

Ernst Conservation Seeds, LLP
9006 Mercer Pike
Meadville, PA 16335
www.ernstseed.com

Project Leaders and Key Personnel:

Dr. Donald Viands, Plant Breeding and Genetics, Cornell University, Ithaca, NY
Dr. Christopher Watkins, Cornell Cooperative Extension, Cornell University, Ithaca, NY
Dr. Hilary Mayton, Plant Breeding and Genetics, Cornell University, Ithaca, NY
Dr. Julie Hansen, Plant Breeding and Genetics, Cornell University, Ithaca, NY
Dr. Paul Salon, USDA/NRCS, Plant Materials Center, Big Flats, NY
Jamie Crawford, Plant Breeding and Genetics, Cornell University, Ithaca, NY
Robert Deubler, Plant Breeding and Genetics, Cornell University
Dr. Patricia McGlynn, Plant Breeding and Genetics, Cornell University, Ithaca, NY



Figure 3. Small plot trial of several varieties of warm season grasses located at Cornell University