Northern NY Agricultural Development Program
2012 Project Report

Grass Biomass Potential in NNY

Project Leader(s):

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Cooperating Producers:
- 28 NNY farmers

Background:
New York and New England represent 80% of the nation's heating oil demand. In addition to global warming, northern NY has strong economic reasons for developing local bioenergy resources. A local closed-loop sustainable bioenergy source would greatly reduce imported liquid fossil fuels. New York State has an estimated 9 million tons/year of grass available for biomass, which is 75% of the total available grass biomass in the entire Northeast. Much of this potential grass biomass is in northern NY, with a significant underutilized land base capable of producing grass biomass.

Grass combustion bioenergy (bioheat) is several times more energy efficient than other bioenergy options, including grass conversion to ethanol. Grass combustion in the Northeast would reduce greenhouse gas emissions, help with nutrient management and energy costs on farms, generate rural jobs and economic diversification, improve soil health, maintain open spaces, and encourage species diversity and wildlife nesting.

From an environmental standpoint, global warming is caused by increased concentrations of greenhouse gases in the atmosphere, resulting from activities such as burning of fossil fuels. The Biomass Energy Resource Center in Vermont estimates that converting a residential gas or oil fossil fuel heating system to biomass would reduce net CO_2 emissions by 75-90%. REAP-Canada estimates that two acres of grass can meet the space and water heating needs of an average residence, and save from $700-$1000/year in heating costs over liquid fossil fuels.

Grass composition varies greatly due to fertility and harvest management, and biomass composition significantly affects combustion. There are currently only a select number of stoves and boilers capable of burning grass. Emissions are a function of the efficiency of the combustion device and the composition of the combustion fuel. Emissions from any type of combustion are coming under increased scrutiny from US-EPA and NY-DEC.

NYSERDA is currently funding emissions testing, both at Cornell and at SUNY-Canton, on a range of stoves and boilers burning grass pellets. Emissions are a significant issue for biomass, whether it is burned on a small scale for residential heat, or on a larger light-industrial scale, such as heating schools or greenhouses. A number of minerals influence combustion and/or combustion emissions. The most important elements from an emissions standpoint are nitrogen, potassium, chlorine and sulfur. The gross energy content (BTU) and the total ash content also affect combustion efficiency.

Shrub willow biomass may become established in northern NY, due to a huge federal subsidy program for willow production. Without any subsidies or some sort of monetary recognition of the value of grass biomass, it will be very difficult to establish this industry in northern NY at the present time. Currently mulch hay for mushroom production is selling for as high as $125/ton delivered. The value of the energy in a ton of grass biomass is likely less than $50/ton at current energy prices (wet wood chips are $30-40/ton). Without any carbon crediting or other subsidy that recognizes the environmental benefits of grass biomass, it is currently uneconomical.

Methods:

Hay produced by 28 farmers in the six county region was sampled between September and December, 2012. In general, hay lots were mulch-type hay, unsuitable for ruminant animal forage, although some of this hay may have been fed to beef cattle. Hay of reasonable forage quality is too valuable as a forage source, to be considered for grass biomass potential.

10 bales from each lot of hay were sampled, most were large square bales, although round bales were also sampled. From 4 to 8 cores were taken from each bale. 58 lots of hay were sampled, generating 580 individual samples. Samples from each lot of hay were composited for compositional analysis. 2012 samples are currently being analyzed for CP, NDF, ADF, Lignin, Ash, Ca, P, Mg, K, S, B, Mn, Zn, Cu, Fe, Al, Na, Cl, Mo, and Ti by Dairyland Labs. Samples have been analyzed for BTU content at Cornell University.

Results:

Supplies of potential biomass hay were significantly lower in 2012 compared to 2011. There were two major reasons for this. High grain prices resulted in a considerable acreage of old hay land being converted to grain crop production, economically viable but not environmentally sound. A significant shortage of hay for cattle resulted in a considerable amount of mulch-type hay being diverted to cattle feed. Also, much of the mulch hay was loaded and shipped shortly after baling in 2012, due to anticipated shortages. Typically much of this hay is stored on fields for several months. All of these factors limited the amount of mulch hay available for sampling in 2012.

As in 2011, bale lots were clearly variable in appearance, and will likely be variable in composition. Energy content of hay lots was relatively consistent in 2012, with a range of 7722 to 8408 BTU/lb (Fig. 1), and much of this range is likely due to soil contamination. Keep in mind that each of these lots is actually a composite sample of 10 bale cores, soil contamination in one or two bales would not greatly affect the average values. This compares to a range of 6674 to 8394 BTU/lb in 2011 samples. In 2011, hay lots with low BTU values had high levels of soil contamination. There appears to be much less soil contamination in 2012 hay samples, chemical analysis will confirm this. Although there was no visible soil found on the surface of bales when sampling, as in 2011, clearly there is some soil present in the hay. Soil contamination is typically variable, and is a function of the soil type, soil moisture, harvesting equipment, and the length of time between mowing and baling. Hay lots were analyzed for energy content in Cherney's lab. Duplicate hay samples were submitted to Dairyland labs in December 2012 for complete chemical analysis, results have not yet been received.

Conclusions/Outcomes/Impacts:

Currently there are no incentives to produced mixed grass hay for any type of biomass energy use. There may be incentives available to produce switchgrass for ethanol, but mixed hay will likely never be an appropriate feedstock for ethanol conversion technologies. So in the near term, it will be difficult to have economical biomass combustion on-farm. The one exception might be combined heat and power. If energy costs are high, and a producer has grass available and has a need for both heat and power, then a CHP unit could be economical. A producer who needs to dry significant quantities of grains, along with a cattle operation, would be possible example.

Based on 2011 compositional analyses, significant range was found in composition of parameters important for biomass combustion, this is likely to be true in 2012. Based on 2012 BTU results, there appears to be less soil contamination, compared to 2011. Ash content is very highly related to energy (BTU) content of the bale. The highest rate of soil contamination lowered energy content of the bale by almost 50%. From a practical standpoint, it appears that ash content can probably be used to estimate energy content of hays. BTU analysis is over 100-fold more expensive than ash analysis. Once 2012 data is summarized, we will be able to determine whether mulch-type hay is appropriate for all scales of biomass combustion, or whether some or all of it would be most appropriate for light industrial and industrial combustion.

Outreach/Next Steps:

Once the 2012 compositional data is received from Dairyland labs, a factsheet will be generated on this topic.

For more information:

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<u>Photos</u>: J. Cherney

Mulch hay in Jefferson County

Wasted mulch hay

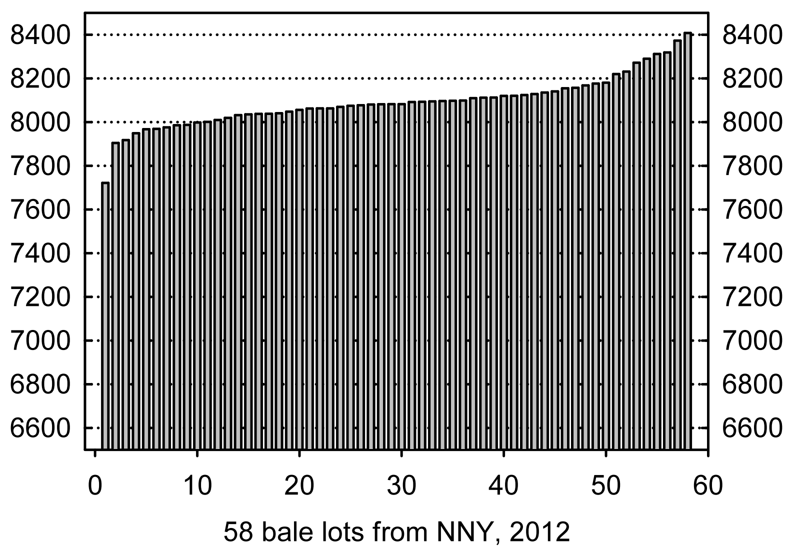

Fig. 1. Range in BTU content of bale lots from NNY in 2012.

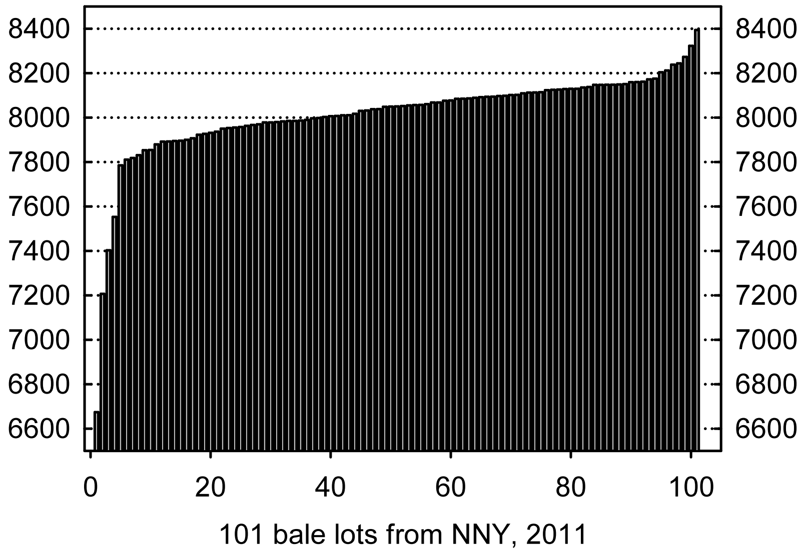

Fig. 2. Range in BTU content of bale lots from NNY in 2011.