



**Dedicated Biomass Cropping Solutions**

**Miscanthus Opportunity**

# Sustainable Feed Stock



## Miscanthus

- Low inputs achieving high sustainable yields-not subject to volatile input cost. Little to no pest or disease issues.
- Strong positive energy balance (energy in to energy out).
- Increased biodiversity over the annual life cycle of the crop.
- Reduction or elimination of soil erosion.
- Sequestration of Carbon (yield dependant-miscanthus- 1-1.8 tonnes/acre/yr)
- Highest returns achieved on marginal land compared to other cropping options.
- No specialized harvesting equipment.
- Long term data showing sustainable yields over two decades.
- Biomass quality is constant from one year to the next.
- Harvested dry (9-18%).
- High water use efficiency.
- Examples of the full value chain from farm to end user.

# Where does it grow?

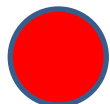
- Genetics available that can grow in any region of Ontario that arable crops are grown. Various different cultivars are generally the same but have different agronomic strategies, biomass quality and yield potentials.
- Can be grown on marginal lands but the better the soil and climate the better the yield potential.
- Heavier soils create strong long-term sustainable yields.

# Expectation of Yield (sustainable)

(No Inputs)

	Poor soils	Poor soils	Good soils	Good soils
precip	500-600	700-900	500- 600	700 -900
Uk	8-10	12-13	14-16	16-19
Ger	12-14	<b>12-18</b>	15-18	18-20
Poland	-	-	<b>15-22</b>	20-22
N.Italy	-	-	-	<b>18-26</b>
Leamington		9.5(2 <sup>nd</sup> yr)	-	21-25 (3 <sup>rd</sup> yr)

Note: giganteus selections- Nagara yields have been consistently 12-18% higher and will allow miscanthus to be grown in most regions of Ontario.



Grey, Bruce, Prince Edward ,Peterborough



Wellington, Dufferin, Simcoe



Essex, Kent, Lambton, Elgin, Middlesex, Oxford

# Common Vegetative Material used in propagation and planting.



# Miscanthus Feedstock Example



# Plug Production



# Development of Foundation Propagation



# Lifting and replanting



# Establishment Costs Excluding Land Prep



## Input Area

Establishment Acres/Yr	100	The number of acres requiring establishment per year
Rhizomes Density/Acre	6,500	Plant density per acre of establishment
1st Year Replication Factor of Rhizomes	15	Estimated plant multiplication for each plant
Propagation Plant Density	16,000	Initial propagation density for purposes of expansion
Price/Plant NEF Price List	\$0.36	NEF price/plant to establish propagation

	/Unit	Year					
		2011	2012	2013	2014	2015	2016
Acres Established			100	100	100	100	100
Accumulative Acres Established			100	200	300	400	500
Rhizomes Required/Yr			650,000	650,000	650,000	650,000	650,000
Propagation Acreage Requirement	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Rhizomes to Establish Initial Propagation	43,333.3						
Rhizomes to Re-Establish Propagation		43,333.3	43,333.3	43,333.3	43,333.3	43,333.3	43,333.3

## Costs of Production

Purchase Initial Plants	\$0.36	15,600					
Crop Lifting/Acre	\$1,000.00		2,708	2,708	2,708	2,708	2,708
Planting Cane Crop	\$75.00		7,500	7,500	7,500	7,500	7,500
Replanting Propagation/Acre	\$150.00	406	406	406	406	406	406


## Machinery

Lifting Machine/acre	\$35.00		3,500	3,500	3,500	3,500	3,500
Planting Machine/acre	\$70.00		7,000	7,000	7,000	7,000	7,000

## NEF Fees

Establishment and Genetic Royalty (one time charge)	\$100.00		10,000	10,000	10,000	10,000	10,000
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<b>Total</b>		15,600	31,115	31,115	31,115	31,115	31,115
<b>Accumulated Expenses</b>		15,600	46,715	77,829	108,944	140,058	171,173
<b>Cost/Acre to Establish Crops</b>			<b>\$467</b>	<b>\$389</b>	<b>\$363</b>	<b>\$350</b>	<b>\$342</b>



**Propagation field planted using a automated planter.  
27 acres planted with one person in 3hrs.**





# 2<sup>nd</sup> Year crop – Summer Early August



**Harvest time 3<sup>rd</sup> year crop.**

**Leamington Ontario- 21.5 tonnes dm/ ha**



# Crop harvest – Late Winter/Spring



Following winter senescence, a two stage process is used to cut the crop into a swath using existing harvesting equipment, followed by compaction using existing farm balers (bulk density circa 150 Kg per m<sup>3</sup>) – Moisture content 15-20%

As well dependent on the location the crop can be chipped directly from field with current forage equipment (bulk density of 60 kg per m<sup>3</sup>).

# On Farm Product Ready For Processing or Delivery



# Storage

- Harvested at the correct time (late winter to spring) the moisture content can be below 15% and N levels being very low- decay is not evident.
- Much of the storage in a bale form is on farm at the production site. Ontario examples of this is the mushroom industry.
- Top bale on stack can be covered with one sheet of poly to repel snow and rain penetration.
- If harvested in a shredded format then the material can be put in in covered bunkers.
- All depends on the end use requirements.

# Analysis

## Proximate Analysis

	As Received (wt%)	Dry (wt%)	Dry & Ash Free (wt%)
Moisture	8.56	0.00	0.00
Ash	1.40	1.52	0.00
Volatile	84.08	92.64	91.12
Fixed Carbons	5.96	5.84	8.88
Total	100.00	100.00	100.00

## Ultimate Analysis

	As Received (wt%)	Dry (wt%)	Dry & Ash Free (wt%)
Carbon	44.91	48.75	49.50
Hydrogen	5.44	5.90	5.99
Nitrogen	0.65	0.70	0.71
Sulphur	0.08	0.09	0.09
Ash	1.40	1.52	0.00
Oxygen (calculated)	38.97	43.04	43.70
Total (includes M.C)	100.00	100.00	100.00

## Calorific Value

	As Received (wt%)	Dry (wt%)	Dry & Ash Free (wt%)
Calorific Value (BTU/lb)	7791.00	8009.00	N/A
Lb. Alkali/mm-BTU	0.74	0.78	N/A

## Ash Analysis

Element	(wt%)
SiO <sub>2</sub>	25.32
Al <sub>2</sub> O <sub>3</sub>	< 0.05
TiO <sub>2</sub>	< 0.05
Fe <sub>2</sub> O <sub>3</sub>	1.90
CaO	7.59
MgO	5.06
Na <sub>2</sub> O	1.90
K <sub>2</sub> O	39.24
P <sub>2</sub> O <sub>5</sub>	1.27
SO <sub>3</sub>	<0.05
Other	17.72
Total	100.00

## Ash Fusion Temp

	Reducing (deg F)
Initial	1460
Softening	1609
Hemispherical	1701
Fluid	1857

## Chlorine Content

	As Received	Dry	Dry & Ash Free
Chlorine Content	0.045	0.049	0.050

# Processing into fuel

*Base energy value circa 16.9  
MBTU / t Dry matter (17.9 GJ/t)*



On or offsite processing



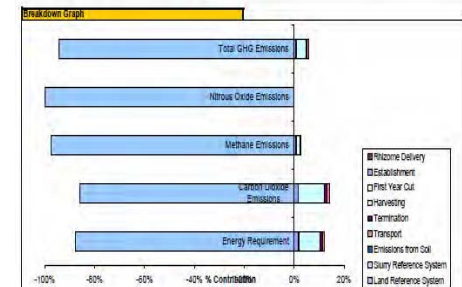
Increasing density / improved logistics / higher processing price





Summary of Resource Inputs and Emissions					
Stage	Energy Requirement MJ/CO <sub>2</sub> T	Carbon Dioxide Emissions kg CO <sub>2</sub> /CO <sub>2</sub> T	Methane Emissions kg CH <sub>4</sub> /CO <sub>2</sub> T	Nitrous Oxide Emissions kg N <sub>2</sub> O/CO <sub>2</sub> T	Total GHG Emissions kg CO <sub>2</sub> eq./CO <sub>2</sub> T
Rizzone Delivery	0.11	0.01	0.00	0.00	0.01
Establishment	36.20	1.85	0.00	0.00	1.90
First Year Cut	5.50	0.17	0.00	0.00	0.18
Harvesting	172.46	11.93	0.00	0.00	12.64
Termination	17.70	1.20	0.00	0.00	1.63
Transport	19.02	1.33	0.00	0.00	1.34
Emissions from Soil	0.00	0.00	0.00	0.00	0.00
Clumpy Reference System	0.00	0.00	0.00	0.00	0.00
Land Reference System	-1024.09	-69.56	-2.24	-0.56	-276.67
<b>Total</b>	<b>-1552.72</b>	<b>42.39</b>	<b>-2.23</b>	<b>-0.56</b>	<b>-286.17</b>

Fossil Fuel Reference			
Fossil Fuel Displaced Per Tonne Miscanthus Bales	118.00 tonnes	Fossil Fuel Displaced per Hectare	118.00 tonnes
% Greenhouse Gas Savings	100.00 %	% Greenhouse Gas Savings	100.00 %
Fossil Fuel Displaced per GJ Miscanthus Bales	118.00 GJ		
% Greenhouse Gas Savings	100.00 %		



# Genetics

**-Pedigree** of the genetics is important.

Ex. European sourced material in most cases has contamination of various miscanthus species some of them highly invasive, and many European sourced material has various virus complexes. Also proprietary rights to much of this “public” material is not necessarily “public”.

-Having a strong pedigree is important not only to the owner or purchaser of the material but the end user who purchases the biomass.

-Many groups making many claims without any data, be careful.

# Current Ontario Foundation sites with New Energy Farms Genetics- Capacity for 80K acres planted in 2012-13



-  **NEF Canadian Foundation site**
-  **NEF Producer Supplier**
-  **NEF Producer**

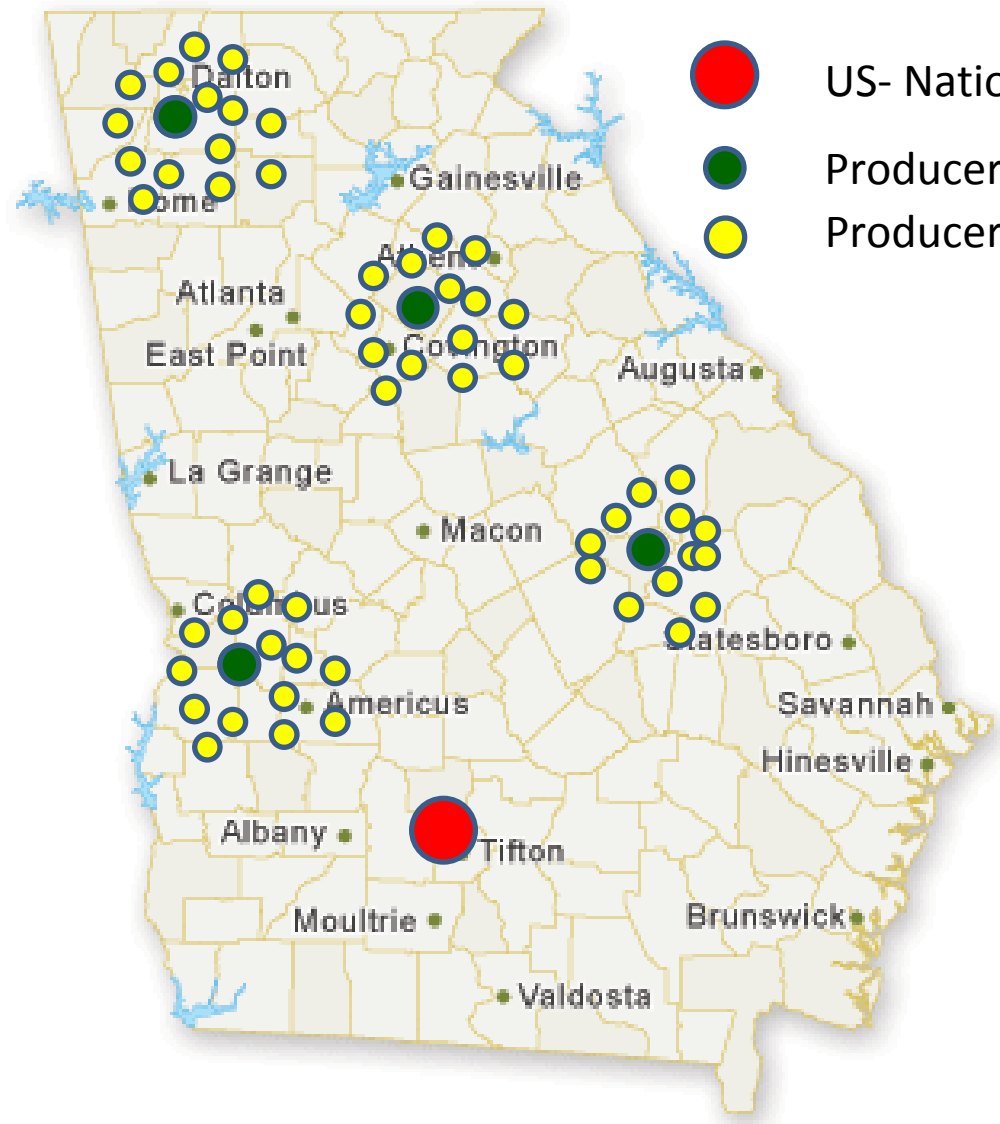
# Affiliate for Georgia and US Propagation partner, Lewis Taylor Farms




Dean Tiessen (NEF)

Bill Brim (LT)

Peter Germishuizen (LT)





-  US- National Foundation Site
-  Producer affiliate (near and around end-user)
-  Producer

**Customer Affiliate -Georgia- 65 million rhizomes  
for 2012 plantings.**



# Hurdles/Barriers

## Market

**Producers are interested**

**Infrastructure of the production value chain is in place**

**What is the price???**

**Who is going to buy it???**

**Etc.**



**Thank You**



[www.newenergyfarms.com](http://www.newenergyfarms.com)