Upper Canada’s feral hemp genetics provide unique traits to develop the biofibres / biomass sector in Ontario.

John Baker  M.Sc., P.Ag.
Founder / President
Stonehedge Bio-Resources Inc.

&
Past Chairman - ELORIN
(Eastern Lake Ontario Regional Innovation Network)
1801 – 1823 Upper Canada Hemp Program
(Archives of UC Legislature)

• First subsidized crop in Canada
• It was a rural economic development project of the day.
• Naval and commercial demand for hemp rope and hemp sail cloth was high
• District Sheriff’s distributed hemp seed and paid Bounty (subsidy) to growers
• Imported best hemp genetics of Russian origin (Land Races – multiple)
• Imported best processing equipment (new innovative Heckle machines)
• Failed payments by government program discouraged farmers.

But
The distributed seed took hold in various isolated locations.
The genetics adapted to the harsh environment.
Isolated adapted landraces have persisted for 200 years.
Stonehedge has discovered, researched and developed the UC material.
# Bio Prospecting for Biodiversity

THC must be Less than 0.30 %

<table>
<thead>
<tr>
<th>Location</th>
<th>Count</th>
<th>THC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peterborough County</td>
<td>1</td>
<td>0.05</td>
</tr>
<tr>
<td>Northumberland</td>
<td>2</td>
<td>0.12, 0.12</td>
</tr>
<tr>
<td>Prince Edward</td>
<td>1</td>
<td>0.08</td>
</tr>
<tr>
<td>Hastings</td>
<td>4</td>
<td>0.11, 0.12, 0.04</td>
</tr>
<tr>
<td>Lennox &amp; Addington</td>
<td>4</td>
<td>0.12, 0.05</td>
</tr>
<tr>
<td>Frontenac</td>
<td>1</td>
<td>0.08</td>
</tr>
</tbody>
</table>
Upper Canada (Ontario) Hemp Traits

200 years of Canadian Adaptation.

- Seed Dormancy Mechanisms that allow fall planting and frost seeding.
- Cold Germination / survival traits.
- Extension of the Vegetative growth period.
- Seed Dormancy mechanism that prevents seed head sprouting.
- Inbred populations of land race dioecious material (potential to improve).
# Identifying Best Breeder Traits for Incorporation into New Hemp Varieties

<table>
<thead>
<tr>
<th>Trait</th>
<th>EU Traits</th>
<th>UC Traits</th>
<th>Breeding Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Biomass Yield</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Fall Seeding</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Dormant Over-wintering</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Cold Germination</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>No Seed Head Sprouting</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>THC LT 0.2% @ 100 Day</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Large Leaves</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Spring Seeding</td>
<td>+</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td>Photo Period</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Rapid Vegetative Growth</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Large Seed</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Large Seed Yield</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>% Fibre GT 25%</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

| Total Positives | 8 Positives | 8 Positives | 12 Positives |

*Stonehedge Bio-Resources Inc.*
UC-RGM - Orchard Field  13 t/ha
Self Seeded (Fall Planted) field that is running ~ 3.7 m high
## Fall Planting Discovery
### UC – RGM 2004 Field Data

<table>
<thead>
<tr>
<th>Field</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reps</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Planting</td>
<td>Volunteer</td>
<td>June 3</td>
<td>June 3</td>
<td>May 31</td>
</tr>
<tr>
<td>Ht (cm)</td>
<td>263</td>
<td>162</td>
<td>180</td>
<td>130</td>
</tr>
<tr>
<td>Pts/sq m</td>
<td>124</td>
<td>87</td>
<td>76</td>
<td>314</td>
</tr>
<tr>
<td>% Male</td>
<td>43</td>
<td>39</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>kg/ha</td>
<td>13,310</td>
<td>4120</td>
<td>3856</td>
<td>5001</td>
</tr>
<tr>
<td>THC</td>
<td>0.10</td>
<td>0.08</td>
<td>0.07</td>
<td>0.10</td>
</tr>
<tr>
<td>% Female Fibre</td>
<td>26.2</td>
<td>27.25</td>
<td>23.14</td>
<td>30.25</td>
</tr>
<tr>
<td>% Male Fibre</td>
<td>26.2</td>
<td>28.63</td>
<td>23.77</td>
<td>31.10</td>
</tr>
</tbody>
</table>
2007 Industrial Hemp Site: Morgan Road
Yield Data: Fall vs Spring & Row Spacing

NOTE:
Upper Canada varieties successfully fall plant.
EU varieties (Anka & Carmen) failed to fall plant.

Dec. 21, 2006 Planting
May 5, 2007 Planting
May 23, 2007 Planting (7 inch row)
May 23, 2007 Planting (15 inch row)
Trait incorporation for fall seeding

GEORGINA April 5th 2010 photo
Emerged March 25th/2010
Extension of the Vegetative Growing Period

We need to capture a longer vegetative growth period = increased biomass.

Normal Spring Planting
Day length shortens

Vegetative Growth
Reproductive Growth

Early Spring Planting.

Fall Planting!
2009 Breeder Plot - GEORGINA

FEATURES

• Large Biomass crop
• 7.5 t / ha (3.0 t/a) in less than 120 days (Ontario)
• 3 - 4 m high canopy
• Maturity – 5 days later than Victoria
• Seed recovery challenging
• Seed yields 350 lb / a
• Fibre recovery 25% +
• Fall Planting feature
• Registration in process

May Planted - Sept. 15th photo
Research Plot Combine

Stonehedge Bio-Resources Inc.
Certificate of Eligibility for Certification

This is to certify that under the authority of the Canada Seeds Act the variety designated as

GEORGINA HEMP (dioecious-type)

has been recognized as eligible for certification by the Canadian Seed Growers’ Association

Number: 1199-2009

Date: December 3, 2009

Signature: [Signature]

Executive Director
2009 Breeder Plot - VICTORIA

FEATURES

• Large Biomass crop
• 12.5 t / ha (5 t/a) in less than 120 days (Ontario)
• 3 - 4 m high canopy
• Maturity – (medium)
• Seed recovery challenging
• Seed yields 300 lb / a
• Fibre recovery 25% +
• Fall Planting feature
• Registration in process

May Planted - Sept. 15th photo
Certificate of Eligibility for Certification

This is to certify that under the authority of the Canada Seeds Act
the variety designated as

VICTORIA HEMP (DIOECIOUS-TYPE)

has been recognized as eligible for certification
by the
Canadian Seed Growers’ Association

Number: 1198-2009

Date: December 3, 2009

[Signature]
Executive Director
# 2007 Strip Plot Hemp Straw Yields from Frankford Rd.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Mean Yield g/m² (n=5)</th>
<th>Std Dev.</th>
<th>Mean Yield kg/ha (n=5)</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carmen *</td>
<td>1004.52</td>
<td>106.465</td>
<td>10,045.</td>
<td>1,065.</td>
</tr>
<tr>
<td>Petera *</td>
<td>1073.58</td>
<td>51.999</td>
<td>10,073.</td>
<td>520.</td>
</tr>
<tr>
<td>VICTORIA</td>
<td>1292.88</td>
<td>73.83</td>
<td>12,929.</td>
<td>738.</td>
</tr>
<tr>
<td>06P x B (F-1)</td>
<td>941.74</td>
<td>88.841</td>
<td>9,417.</td>
<td>888.</td>
</tr>
<tr>
<td>06P x D (F-1)</td>
<td>889.02</td>
<td>193.389</td>
<td>8,890.</td>
<td>1,934.</td>
</tr>
<tr>
<td>06P x RGM (F-1)</td>
<td>827.58</td>
<td>102.342</td>
<td>8,275.</td>
<td>1,023.</td>
</tr>
<tr>
<td>06RGM x B (F-1)</td>
<td>760.3</td>
<td>116.989</td>
<td>7,603.</td>
<td>1,170.</td>
</tr>
<tr>
<td>Alyssa *</td>
<td>862.52</td>
<td>70.390</td>
<td>8,625.</td>
<td>703.</td>
</tr>
<tr>
<td>Anka *</td>
<td>701.68</td>
<td>124.027</td>
<td>7,016.</td>
<td>1,240.</td>
</tr>
<tr>
<td>USO-14 *</td>
<td>579.44</td>
<td>63.392</td>
<td>5,794.</td>
<td>634.</td>
</tr>
<tr>
<td>USO-31 *</td>
<td>653.08</td>
<td>64.739</td>
<td>6,530.</td>
<td>647.</td>
</tr>
<tr>
<td>UC-P</td>
<td>928.6</td>
<td>81.836</td>
<td>9,286.</td>
<td>818.</td>
</tr>
<tr>
<td>UC-D</td>
<td>827.94</td>
<td>74.001</td>
<td>8,279.</td>
<td>740.</td>
</tr>
<tr>
<td>UC-RGM</td>
<td>687.56</td>
<td>122.808</td>
<td>6,875.</td>
<td>1,228.</td>
</tr>
</tbody>
</table>

* Variety is of recent EU Origin
## 2008 Strip Plot Yields from Reid Plot

<table>
<thead>
<tr>
<th>Variety</th>
<th>Mean Yield g/m² (n=5)</th>
<th>Std Dev.</th>
<th>Mean Yield Kg/ha (n=5)</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC-RGM</td>
<td>531.3</td>
<td>69.101</td>
<td>5,313.</td>
<td>691.</td>
</tr>
<tr>
<td>UC-P</td>
<td>720.52</td>
<td>69.603</td>
<td>7,205.</td>
<td>696.</td>
</tr>
<tr>
<td>UC-D</td>
<td>839.24</td>
<td>92.896</td>
<td>8,392.</td>
<td>928.</td>
</tr>
<tr>
<td>USO-14</td>
<td>611.66</td>
<td>126.65</td>
<td>6,116.</td>
<td>1,266.</td>
</tr>
<tr>
<td>Alyssa *</td>
<td>852.44</td>
<td>140.18</td>
<td>8,524.</td>
<td>1,401.</td>
</tr>
<tr>
<td>Anka *</td>
<td>540.12</td>
<td>49.658</td>
<td>5,401.</td>
<td>496.</td>
</tr>
<tr>
<td>Petera *</td>
<td>825.22</td>
<td>106.851</td>
<td>8,252.</td>
<td>1,068.</td>
</tr>
<tr>
<td>06PxG</td>
<td>858.28</td>
<td>142.063</td>
<td>8,582.</td>
<td>1,420.</td>
</tr>
<tr>
<td>06PxRGM</td>
<td>513.54</td>
<td>103.379</td>
<td>5,135.</td>
<td>1,033.</td>
</tr>
<tr>
<td>VICTORIA</td>
<td>1057.68</td>
<td>190.100</td>
<td>10,576.</td>
<td>1,901.</td>
</tr>
<tr>
<td>GEORINA</td>
<td>720.64</td>
<td>110.895</td>
<td>7,206.</td>
<td>1,108.</td>
</tr>
<tr>
<td>06PxD</td>
<td>637.06</td>
<td>58.409</td>
<td>6,370.</td>
<td>584.</td>
</tr>
</tbody>
</table>

* Variety is of recent EU Origin
Multi Site Yield Data 2008/2007

Dry Weight g/m²

Varieties

Reid 2008
Greydanus 2008
Burnham 2008
Phillips 2007

n=5

g/m² x 10 = kg/ha

UC-P
USO-14
Alyssa
06PXD
06 PXren
VICTORIA
Plant Density (p/m²)

Varieties

Plants per m²

UC-P  USO-14  Alyssa  06PxCarmen  06PxD

Reid  Greydanus  Burnham

n=5

Stonehedge Bio-Resources Inc.
Hemp Baling in Ontario
Grower Focus group results for Hemp as a Biomass crop

a) Annual crop that fits present Agri-infrastructure.
b) Will generate a profit from year one.
c) A crop that is not limited to one market.
d) Potential to be a good rotational (Break) crop.
e) Multi Year Contract for stability.
f) No specialize equipment Investment by growers (Harvesters).
g) Processor takes responsibility for harvest (Equipment and cost).
h) Crop Insurance availability.
i) Advanced Payment system to maintain cash flow.
Hemp Products

Sustainable

Environmentally Friendly

Green

Bio-Products
Hemp Composite
- In 2006 Chrysler door panel
- UC hybrid hemp in background
HEMP INSULATION
HORSE BEDDING

- Highly Absorbent
- Low Odour
- Dust Extracted
- Labour Saving
- Ease Of Disposal
- Convenient To Use
- Economical In Use
Spraying Hemcrete®
The Lime Technology office
<table>
<thead>
<tr>
<th>Hemp Pellet Fuel</th>
<th>MJ / Kg</th>
<th>BTU / lb</th>
<th>% Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irish Hemp Pellets</td>
<td>18.5</td>
<td>7959</td>
<td>4.0</td>
</tr>
<tr>
<td>UC Hemp Pellets</td>
<td>18.3</td>
<td>7884</td>
<td>4.6</td>
</tr>
<tr>
<td>UC Hemp Straw</td>
<td>18.3</td>
<td>8333</td>
<td>2.9</td>
</tr>
<tr>
<td>Algoma Flax Straw</td>
<td>20.3</td>
<td>8773</td>
<td>4.3</td>
</tr>
<tr>
<td>Wood</td>
<td>20.3</td>
<td>8733</td>
<td>0.6</td>
</tr>
</tbody>
</table>
Markets

• Hurds
  – Animal Bedding
  – Construction (hemcrete)
  – Garden Mulch

• Technical Fibre
  – Automotive
  – Insulation
  – Plastics Reinforcement

• Short fibre
  – Paper Industry

• Dust
  – Fuel
Upper Canada Hemp Germplasm

A 21st Century multi-purpose Biomass Crop Platform