Canadian Flax for Fiber: An Introduction

Prepared by
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Crop Fibers Canada / Biolin Research Inc
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Existing Prairie Situation

• In last 10 years, area seeded to flax has been 700,000 to 900,000 ha/year
  – about 70% grown in Saskatchewan
  – about 25% grown in Manitoba
  – about 5% grown in Alberta
Canada is the Largest Exporter of Flax Seed

• Annual Area:
  500,000 - 900,000 ha
  (AVG 700,000)

• Annual Seed Production:
  500,000 - 1,100,000 t
  (AVG 850,000)
### Canada: Flaxseed Area, Yield and Production of Seed

<table>
<thead>
<tr>
<th>Crop Year</th>
<th>Metric Units</th>
<th>English Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Harvested Area (kha)</td>
<td>Seed Yield t/ha</td>
</tr>
<tr>
<td>97/98</td>
<td>737</td>
<td>1.40</td>
</tr>
<tr>
<td>98/99</td>
<td>874</td>
<td>1.24</td>
</tr>
<tr>
<td>99/00</td>
<td>777</td>
<td>1.32</td>
</tr>
<tr>
<td>00/01</td>
<td>591</td>
<td>1.17</td>
</tr>
<tr>
<td>01/02</td>
<td>662</td>
<td>1.08</td>
</tr>
<tr>
<td>02/03</td>
<td>633</td>
<td>1.07</td>
</tr>
<tr>
<td>03/04</td>
<td>728</td>
<td>1.04</td>
</tr>
<tr>
<td>04/05</td>
<td>528</td>
<td>0.98</td>
</tr>
<tr>
<td>05/06</td>
<td>803</td>
<td>1.35</td>
</tr>
<tr>
<td>06/07</td>
<td>829</td>
<td>1.16</td>
</tr>
<tr>
<td><strong>10 AVE</strong></td>
<td><strong>716</strong></td>
<td><strong>1.18</strong></td>
</tr>
</tbody>
</table>

**SOURCE:**
Statistics Canada, Cereals and Oilseeds Review Series, Cat. No. 22-007
### Potential Volume of Canadian Flax Fiber based on Traditional Harvest Methods

<table>
<thead>
<tr>
<th>Type of Flax Field</th>
<th>Approx. Portion of fields</th>
<th>Approx. Area Kha</th>
<th>Salvageable Straw yield t/ha</th>
<th>Salvageable Straw Kt</th>
<th>Potential Fiber Kt</th>
<th>Potential Shive Kt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too weedy, too short, too far, etc</td>
<td>20%</td>
<td>134</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Less than knee height</td>
<td>50%</td>
<td>336</td>
<td>1.00</td>
<td>336</td>
<td>61</td>
<td>262</td>
</tr>
<tr>
<td>More than knee height</td>
<td>30%</td>
<td>202</td>
<td>1.50</td>
<td>303</td>
<td>55</td>
<td>236</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>672</strong></td>
<td><strong>639</strong></td>
<td><strong>116</strong></td>
<td><strong>498</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SOURCE:** Author’s estimates

**Notes:**
1) Traditional Harvest Methods = swath or straight cut; drop straw in windrows, bale windrows
2) Straw and fiber production numbers are based on a 10-year average of 672,000 ha and an estimated fiber content of 18%; shive content estimated at 78% and dust at 4% although actual content will vary considerably depending on the processing method used
Existing Flax Straw Processors

• Pay C$5 - C$10 per tonne to farmers

• Spend additional C$30 - C$40 per tonne to get it inspected, baled, hauled and stored
Existing Prairie Situation

- Flax can be grown across Saskatchewan but in last five years, generally most competitive in dark brown (2) and black (3) soil zones
Existing Prairie Situation

• Handling flax straw is a problem

• Usually dealt with by:
  – chopping and spreading (with difficulty!)
  – burning (may be banned soon?)
  – selling for $5 - $10/tonne to processors
  – selling to local users (e.g., Ducks Unlimited)
  – using on the farm
Existing Prairie Situation

• Farmers
  – usually NO knowledge of how to improve quality and retting of straw
  – need financial incentives to improve quantity, quality and retting of straw
Recent Prairie R&D......

- there are very significant differences in the amount of fiber that can be produced from an acre of land depending on varieties, agronomic practices and weather

- fiber flax varieties grow well in areas suited to oil seed flax varieties

- textile quality fibers can be produced on the Prairies in most years if proper management practices are implemented
Recent Prairie R&D

- **IF oilseed flax** straw is managed and treated in the same way as fiber flax, the **quality of the fiber** is very **similar**, however, fiber production per unit area is generally less because of shorter plants, lower fiber content and lower seeding rate.
Recent Prairie R&D

- flax straw on the Prairies will ret in the fall or early spring if non-traditional straw management techniques are used

- without retting, only 20-80% of actual bast fiber can be extracted and fiber will not be easy to completely clean or to divide into very thin diameter (i.e., fine) fibers and hence will be significantly lower in value
....Variety Selection

Linseed Flax Varieties

(Ranges Depends Upon Variety and Year)

– Fibre Contents
  • Average 15-20%
  • Range 2%-27%

– Salvageable Straw Yields*
  • Average 0.9-1.3 t/ha
  • Range 0.2-2.2 t/ha

– Fiber Production
  • Average 0.13-0.26 t/ha
  • Range 0.00-0.60 t/ha

* if just baling straw dropped behind combine

Note: Could be 2X or 3X with changes in agronomic practices and harvest methods
Table 1: Average Fiber Content at Plot Locations *(Average of 2001 to 2003)*

<table>
<thead>
<tr>
<th>Location</th>
<th>Fiber %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assiniboia</td>
<td>17.2</td>
</tr>
<tr>
<td>Nipawin</td>
<td>16.7</td>
</tr>
<tr>
<td>Battleford</td>
<td>15.9</td>
</tr>
<tr>
<td>Carlyle</td>
<td>14.5</td>
</tr>
<tr>
<td>Wynyard</td>
<td>13.5</td>
</tr>
<tr>
<td>Shellbrook</td>
<td>12.9</td>
</tr>
<tr>
<td>Luseland</td>
<td>11.5</td>
</tr>
<tr>
<td>Rosthern</td>
<td>11.1</td>
</tr>
<tr>
<td>Girvin</td>
<td>10.8</td>
</tr>
<tr>
<td>Kelvington</td>
<td>7.8</td>
</tr>
<tr>
<td>Kernen</td>
<td>3.6</td>
</tr>
<tr>
<td>Variety</td>
<td>Area 1</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------</td>
</tr>
<tr>
<td>CDC Arras</td>
<td>97</td>
</tr>
<tr>
<td>CDC Bethune</td>
<td>93</td>
</tr>
<tr>
<td>AC Carnduff</td>
<td>107</td>
</tr>
<tr>
<td>AC Emerson</td>
<td>105</td>
</tr>
<tr>
<td>Flanders</td>
<td>108</td>
</tr>
<tr>
<td>FP1082</td>
<td>104</td>
</tr>
<tr>
<td>FP1094</td>
<td>101</td>
</tr>
<tr>
<td>FP1096</td>
<td>94</td>
</tr>
<tr>
<td>AC Lightning</td>
<td>95</td>
</tr>
<tr>
<td>CDC Normandy</td>
<td>94</td>
</tr>
<tr>
<td>Taurus</td>
<td>103</td>
</tr>
<tr>
<td>CDC Valour</td>
<td>83</td>
</tr>
<tr>
<td>Vimy</td>
<td>104</td>
</tr>
<tr>
<td>AC Watson</td>
<td>102</td>
</tr>
<tr>
<td>Solin</td>
<td></td>
</tr>
<tr>
<td>Linola™ 989</td>
<td>96</td>
</tr>
<tr>
<td>Linola™ 1084</td>
<td>112</td>
</tr>
<tr>
<td><strong>Site Average (%)</strong></td>
<td><strong>17%</strong></td>
</tr>
</tbody>
</table>
Table 3: Indices of Linseed Seed Yield  
Site Average = 100 \textit{(Average of 2001 to 2003)}

<table>
<thead>
<tr>
<th>Variety</th>
<th>Area 1</th>
<th>Area 2</th>
<th>Area 3</th>
<th>Area 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC Arras</td>
<td>110</td>
<td>94</td>
<td>103</td>
<td>103</td>
</tr>
<tr>
<td>CDC Bethune</td>
<td>114</td>
<td>116</td>
<td>103</td>
<td>98</td>
</tr>
<tr>
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<td>97</td>
<td>98</td>
<td>98</td>
<td>88</td>
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<td>90</td>
<td>98</td>
<td>89</td>
</tr>
<tr>
<td>Flanders</td>
<td>113</td>
<td>109</td>
<td>104</td>
<td>112</td>
</tr>
<tr>
<td>FP1082</td>
<td>81</td>
<td>84</td>
<td>94</td>
<td>59</td>
</tr>
<tr>
<td>FP1094</td>
<td>100</td>
<td>98</td>
<td>96</td>
<td>103</td>
</tr>
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<td>FP1096</td>
<td>97</td>
<td>92</td>
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<td>Taurus</td>
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<td>Linola™ 1084</td>
<td>98</td>
<td>101</td>
<td>91</td>
<td>111</td>
</tr>
<tr>
<td>Site Average (kg/ha)</td>
<td>1,774</td>
<td>1,011</td>
<td>1,759</td>
<td>959</td>
</tr>
</tbody>
</table>
Why aren’t flax straw processors and manufacturers using our flax straw?
Constraints...

• perception that rewards are low

  • existing Prairie processors have concentrated on low end markets because they believed it was not possible to improve the quality of flax straw (but did almost no research)

  • potential new entrants do not know that the production of higher quality flax fiber is possible in the prairies
...Constraints

- past experience with salvaged flax straw has given straw that is often inconsistent, unretted, short, low fiber content, many seed holders, contaminated with plastic, fields far apart
  => only target low end markets

- European processors think “salvaged” prairie oilseed straw it is too risky and has too low a potential return to ensure a profitable venture (“what is” vs. “what could be”)
  => no investment on the Prairies
...Background

• Flax fibre-related production research relatively new to Western Canada

• Biolin Research Inc. has been involved in most of the flax fibre-related research done in Western Canada in the last ten years

• Biolin has developed manual and Near InfraRed (NIR) methods to determine fibre content in intact flax stems
Recent Flax Straw Developments...

- NIR system developed to quickly estimate fiber content in intact, unretted straw

- Analyzed thousands of straw samples for fiber content from different years, different locations, different varieties and different agronomic practices

- Developed an understanding of how different factors influence fiber content
Recent Flax Straw Developments...

• On small scale, have found ways to cost effectively increase fiber yields from oilseed flax by three or four fold

• On small scale, have successfully produced flax fibers suitable for textile and all other applications under Western Canadian growing conditions using oilseed flax
Recent Developments

- Work being done to lower the cost of "cottonizing" flax

- Development of successful field retting systems for the prairies
...Recent Developments

- Improved flax straw processing systems

- Research has shown the prairies can be potential low cost supplier of medium and even high quality fiber
...Recent Developments

• Increased interest by fiber based companies

• Lobbyists trying to stop burning of agricultural residues
Recent Developments

• The Saskatchewan Flax Development Commission has been formed, has funds and wants to develop added value opportunities for straw and fiber
...Recent Developments

• Technology advancement by Biolin Research Inc. in testing of fiber content and sampling techniques to better equip the farmer with the knowledge of what they have growing in the field.
Recent Related Developments

- Conferences, workshops, feasibility studies
- Pilot Plant for processing small lots of fiber
- Fields trials
- Further end use trials and communication with potential end users
- Testing and grading systems being developed
...Recent Related Developments

• Education (farmers, lenders, government people, possible users and processors)

• Flax straw, fiber and shive processing pilot plant, education center and testing facility being expanded in Saskatoon (Crop Fibers Canada)
Crop Fibers Canada Vision

To help create a wide spectrum of profitable businesses based on the production, processing and/or use of flax straw, fiber and shive
Crop Fibers Canada

• is a concept and work-in-progress

• is a pilot plant (Phase 1 almost complete)

• is an education center

• is a testing center

• should be a “catalyst” for the industry
Organaeleptic Testing

• Using the human “organs” of eyes, nose, and skin to see, smell and touch to judge certain properties and give a ranking or comparison of one test specimen with another specimen

• examples: buying fruit at a supermarket or judging at a dog show
REPORT Fibre Thickness

Straw Diameter Testing

powered by www.istag.ch, Vilters Switzerland

Date: May 19 2006
Signature:
Fiber Fineness (Diameter) Distribution

REPORT Fibre Thickness

First image: 060511t901.jpg
lot/file no: 060511T001
Quality: STRAW DIA
Controller: CHRISTINE
Application: Fiber Diameter
Measuring Mask: ALF1800LE
Comment: STRAW DIA.

Set-up Parameters & Limits
Resolution: 1800 [dpi]
Min.thickness: 20.000 [μm]
Max.thickness: 5000.000 [μm]

Major Results from
Counted objects: 926
Fibre Thickness: 26.62, s: 6.45 [μm]
Median Fibre Thickness: 24.85 [μm]
Iwt Fibre Thickness: 25.92 [μm]
Curvature: 0.00418015
Rectangularity: 0.9594, s: 0.0539
Measured objects image fraction [%]: 0.74
Object area fraction [%]: 0.75
All objects image fraction [%]: 88.62

Histogram of Fibre Thickness

powered by www.istag.ch, Vilter Switzerland

Date: June012006
Signature:
Shive Size Distribution
Fiber Content

- A NIR system that quickly estimates bast fiber content in flax straw

  - allows quick testing of fiber content for both research and commercial activities

  - took four years and 1,000s of samples to develop
Fiber Content

Position 1  Sample number CG05DOT01

X = 1450  Y = 0.54655117
NIR region
Absorption by stretching - bending
Degree of Retting
Kink & Crimp of Fiber
Length of Fiber Testing

CIC - PO#500409 - Length Measurements
Sample 4
Some Next Steps

• Select target markets

• Decide on processing equipment and quality and quantity of straw that is needed

• Select target straw collection areas

• Develop and implement plan to get desired quality and quantity of straw
Some Next Steps

• Make contingency plans for producing consistent products with straw that has variable quantity

• Initiate 3\textsuperscript{rd} party testing of potential products

• Initiate test marketing

• ???
Any Questions or Comments?

Contact Alvin Ulrich

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