Alberta Innovates Technology Futures

Biofibre Innovation and Opportunities

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ABDC

CULTIVATION OF INDUSTRIAL HEMP ON THE PRAIRIES FOR FIBRE BIOPRODUCTS

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Alberta

Freedom To Create. Spirit To Achieve.

What is hemp?

- Hemp is one of the oldest non-food, fibre crops
- Originates from Central Asia where it was cultivated 6,500 years ago

- Hemp (*Cannabis sativa L.*) has two subspecies: C. *sativa* and C. *indica* that differ in content of delta-9-tetrahydrocannabinol (THC)

Industrial hemp < 0.3%
Marijuana up to 40%

Hemp is one of the faster growing plants

Growth rate ~ 15 cm per day !

Root system

Well developed root system:

- water uptake,
- soil organic matter,
- improves soil texture

Hemp is a multipurpose crop

Stalks – source of fibre

Seeds – source of oil, protein

Two types of fibre

Long (bast) fibre -50 mm

Cellulose - 50-70%

Lignin – 5-7%

Short (hurd) fibre -0.5 mm

Cellulose - 35%

Lignin – 20-30%

History of hemp in Canada

- **Arrived in Canada in 1606, became popular 1801**

  Seeds distributed for free **-** used for clothes, ropes, paper, oil

- **Collapse of a long lasting career**

  - **19th century** – new plants (cotton, jute), wood processed into paper pulp

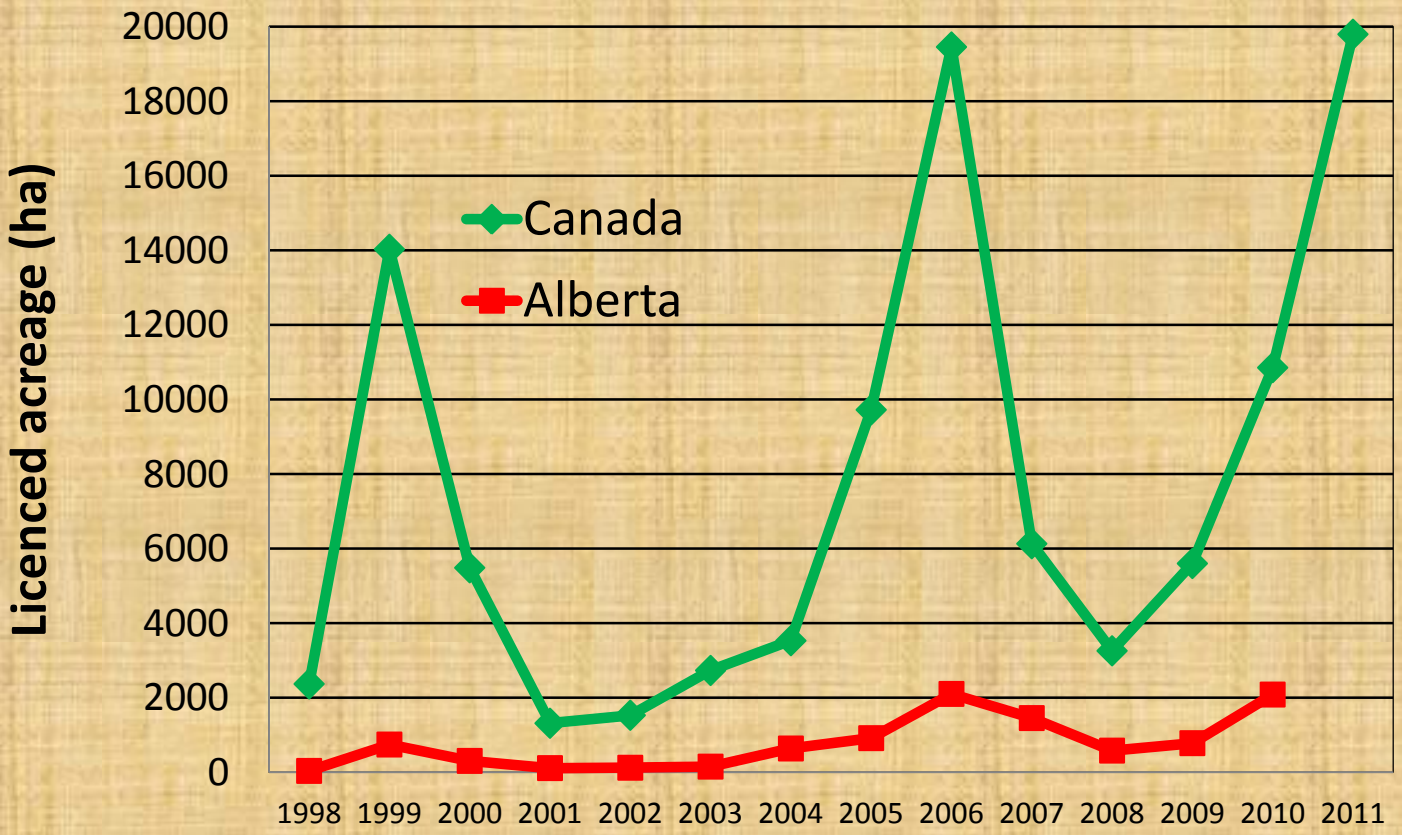
  - **1938 – 80's** – synthetic fibres, psychoactive compounds

- **Revival**

In 1998 it became legal to grow **industrial hemp (less than 0.3% THC)** in Canada as a sixty year ban was lifted.

- **Information gap**
  - old, labor intensive cultivation and processing technologies
  - minuscule breeding and research programs
  - new opportunities

Hemp acreage in Canada



- **Average hemp field – 35-40 ha**
- **Number of licenced growers – 590 (2006)**

Establishing hemp as a mainstream crop for industrial applications

- Hemp fibre has a great potential to be a valuable feedstock for several well established industries.

To realize potential residing within this crop AITF's assembled a program offering solutions from "**Seed to final product**"

- Feedstock development
- Fibre processing
- Biocomposite research
- Market development

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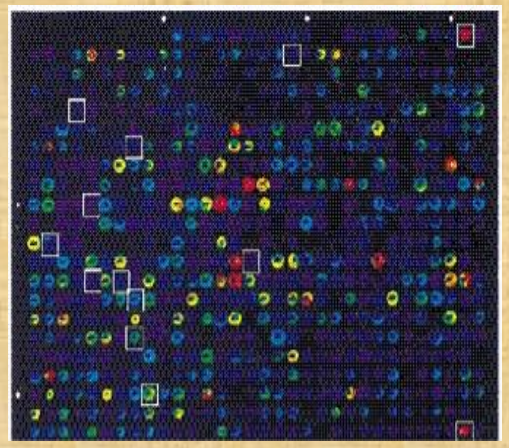
Feedstock development research goals

To **secure supply** of fibre of uniform quality and quantity and to **reduce costs** of fibre production

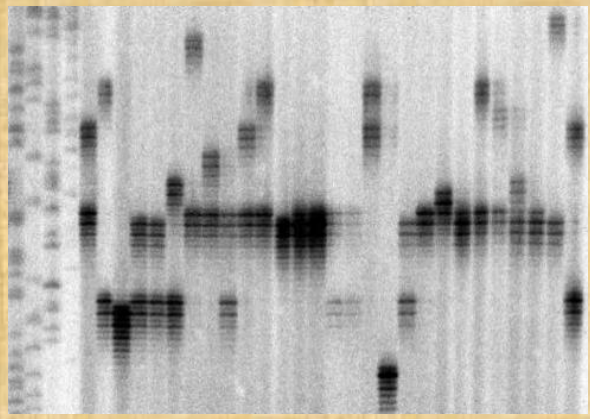
Three pillars of fibre feedstock development

- Gene discovery
- Breeding cultivars adapted to the prairies
- Agronomic studies



Gene discovery

- **Identification and characterization of genes** involved in fibre production using molecular biology non-GMO techniques:
  - Increase biomass
  - Increased bast fibre
  - Decreased lignin
  - Low THC

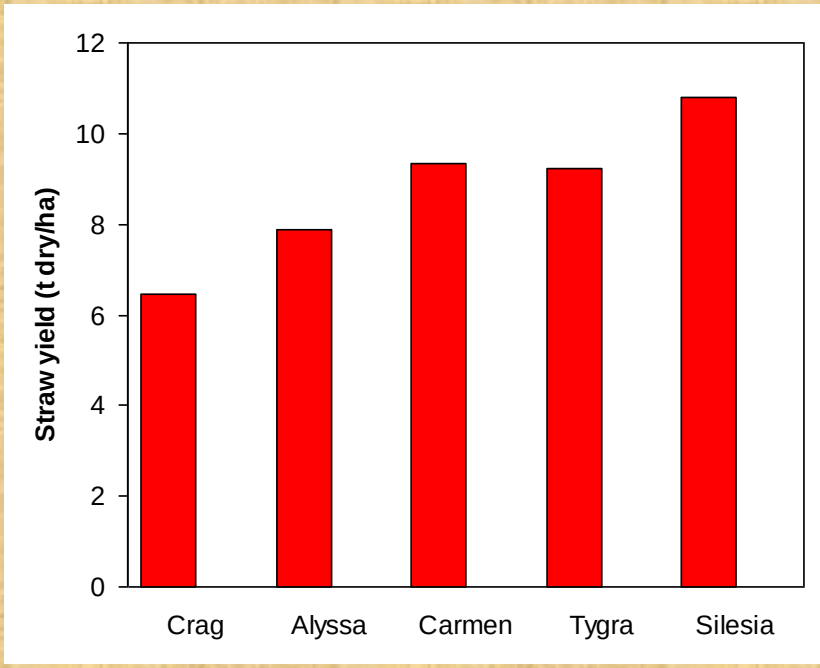


- **Development of mutant populations** with altered fibre traits.

  Generating variability is critical for successful classical breeding program.

Hemp selection and breeding

- Germplasm evaluation
- Selection of top performers under AB conditions
- Maintenance breeding of cv. Silesia
- Initiation of new cultivars breeding for Alberta



AITF's Agronomy Trials

Objective:

Optimization of cultivation practices for Alberta (at the Vegreville site)

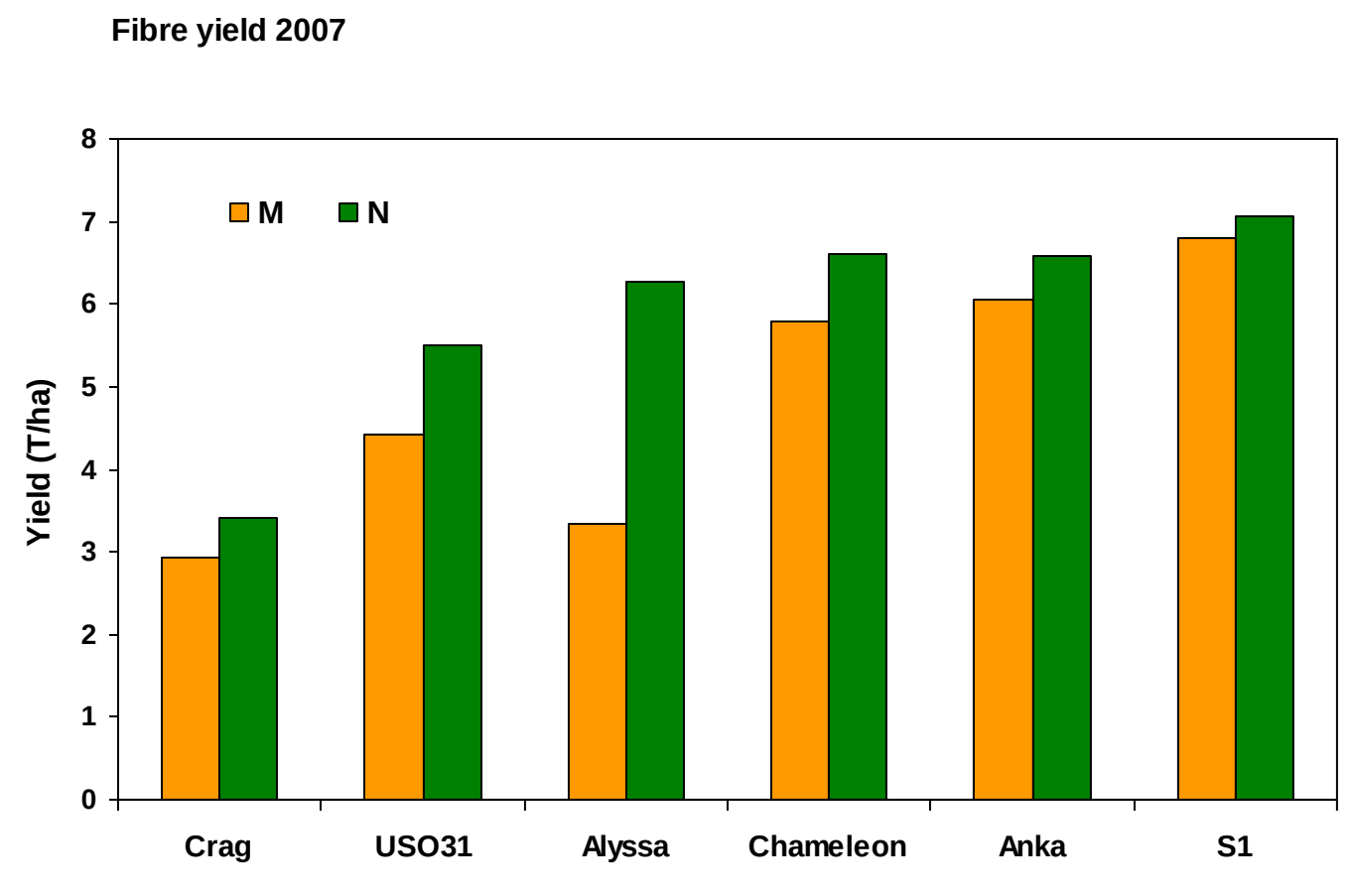
- **4 seeding dates (mid May- mid June)**
- **2 seeding densities (100 and 250/300 seed/m2)**
- **2 fertilizers (cattle manure, mineral)**
- **N rates and forms (ammonia, urea)**
- **3 harvest dates (for juvenile fibre)**
- **Herbicide resistance**

Leading Canadian and European cultivars (USO 14, USO 31, Finola, Anka, Crag, Carmen, Alyssa, Chameleon, Zolo 11, Silesia, Tygra).

General recommendations

- **Seed as early as possible** – (seed bed preparation, moisture, day length)
- **Seeding density** – affects yields of fiber (long/short) and grain
- **Herbicides** – hemp is an effective weed suppressor, but means of chemical control are needed in a tool box

Hemp nutrition



- Mineral – NPK – 100:50:60 kg/ha; PK for seed production
- Manure is good source of nutrients, improves soil physical properties

Harvesting

- For high quality fiber – soon after pollen is shed (70-90 DAS)
- For dual purpose (seed and fibre) – at seed maturity

Retting

A process of beginning to separate the bast fibres from the hurds

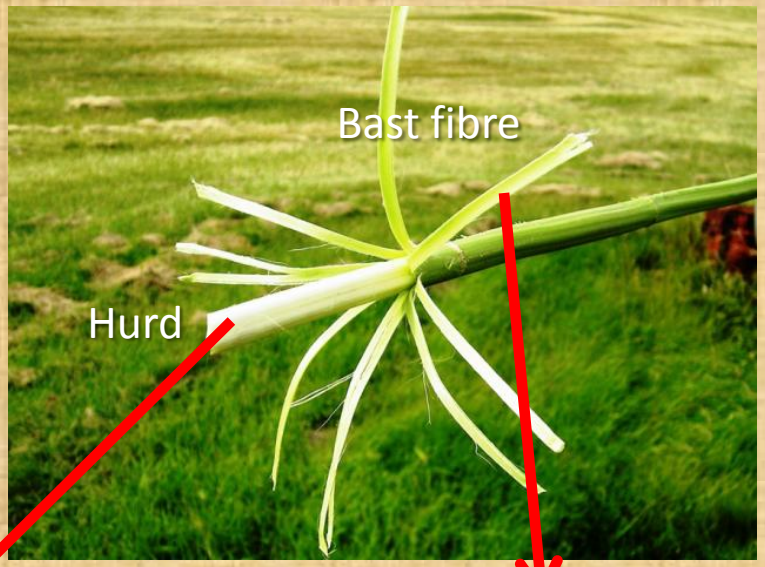
- Types: field – dew retting, tank retting, enzymatic/chemical
- Length of field retting - 14-28 days to complete
- Critical for optimum fibre yield and quality

Baling

Fibre processing

- Decortication – separation of hemp stem

Myriads of hemp applications



- Building materials
- Industrial absorbents
- Insulation
- Animal bedding
- Garden mulch
- Low-grade paper
- Fibreboard
- Biofuels
- Chemicals

- Biocomposites
- Textiles
- Geotextiles
- Rope and twine
- Carpeting, upholstery
- Paper products
- Fibreboard

- Food products (oil, milk, nuts)
- Cosmetics
- Paints, varnish
- Lubricants
- Biodiesel
- Bioplastics

Industrial applications of biofibres


Hemcrete

Textiles


Erosion control

Autoparts

Conclusions – Future is bright!

- Hemp fibre is attractive feedstock for several major industries (automotive, textile, construction)
- Hemp grown for fiber has potential to be a mainstream crop – opportunity of AB farmers
- Fiber processing facilities (enablers of the industry) became a reality on the Prairies
- To keep momentum going we need:
    - Master crop production practices (cultivation, plant protection, equipment, etc)
    - Secure certified seed unrestricted availability
    - Continue development of cultivars for the Prairies
    - Disseminate information about crop advantages (extension, business development work)


Thank you for attention