CULTIVATION OF INDUSTRIAL HEMP ON THE PRAIRIES FOR FIBRE BIOPRODUCTS

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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
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

Bast fibre

Hurd
Industrial applications of biofibres

Hemcrete

Textiles

Erosion control

Autoparts

Made with Natural Fibre

Kestrel
Canada’s first biocomposite electric car
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