INDUSTRIAL HEMP: RULES, REGULATIONS AND AGRONOMICS

BY

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HEMP FARMING ACT 2018

• “HEMP.—THE TERM ‘HEMP’ MEANS THE PLANT CANNABIS SATIVA L. AND ANY PART OF THAT PLANT, INCLUDING THE SEEDS THEREOF AND ALL DERIVATIVES, EXTRACTS, CANNABINOIDs, ISOMERS, ACIDS, SALTS, AND SALTS OF ISOMERS, WHETHER GROWING OR NOT, WITH A DELTA-9 TETRAHYDROCANNABINOL CONCENTRATION OF NOT MORE THAN 0.3 PERCENT ON A DRY WEIGHT BASIS.”
HEMP FARMING ACT 2018

- Hemp is removed from the Controlled Substances Act
- USDA maintains authority over federal regulations and guidelines
- FDA maintains authority over hemp products
- Allows for federal funding for hemp research
- Allows for Federal Crop Insurance
- Allows interstate commerce (of products <0.3% THC)
HEMP PROGRAM – GETTING STARTED

- Need to acquire a license
  - Grower License
  - Processor License
- Need to pass a criminal background check and finger printing
- Provide maps and GPS coordinates of the Growing/Processing location(s)
- Pay Fees
  - License Fee
  - Application Fee
  - Testing Fee
MORPHOLOGY

- **Dicotyledonous Plant**
- **Primarily Dioecious**
  - Separate Male/Female Plants
- **Sometime Monocious**
  - Male/Female flowers on Same plant
- **Gender can be determined 4-6 weeks after planting**
- **Reproduction occurs through pollination**
  - Pollen shed typically lasts 2-4 weeks
  - Male plants will die after pollination
CLIMATE AND SOIL REQUIREMENTS

- **Soil Type**: Well-drained soils are best (Sandy to Loamy)
  - Heavy clay soils can remain saturated and cooler
- **Soil Temperatures**: >45-50°F
- **Optimum Air Temperature**: 65-75°F
- **Moisture Requirement**: Minimum of 10-15 inches
  - Doesn’t like wet conditions but tends to be thirsty
- **Soil Fertility**: Avoid marginal soils with low fertility
- **Photoperiod**: Requires >10 hours darkness to initiate flowering
FIELD SELECTION

**GENERAL**
- Fields that are most productive
- Fields with lowest weed pressure
- Fields that are well-drained
- Avoid fields with compaction
- Avoid fields prone to disease
- Rotation after Soybeans
  - Potential for White Mold
- Rotation after Corn
  - Increased nitrogen demand

**ORGANIC**
- Rotations that provide naturally low weed pressure
  - Rotation after legume sod crops (Alfalfa, Clover)
    - Best weed control
    - Residual nitrogen
  - Rotation after winter rye
    - Terminate 10-14 days prior to planting to reduce potential allelopathic effect
- Rotation after Corn/Soybeans
  - Higher weed potential
- Increase planting rates
FERTILITY

- **Nutrient demand increases with plant age – greatest demand is at flowering**
- **pH Range:** 6.0-7.5
- **Nitrogen** *(actual):* 125-150 pounds/acre *(Grain)*; 50-150 pounds/acre *(Fiber)*
  - Majority is stored in the stalk
  - Excess nitrogen can cause lodging and/or delay maturity
  - Need to determine the effect on fiber quality
- **Phosphorus** *(actual):* 40-70 pounds/acre *(Grain and Fiber)*
  - Majority is stored in the seed
- **Potassium** *(actual):* 60-100 pounds/acre *(Grain)*; 200-300 pounds/acre *(Fiber)*
  - Majority stored in the stalk
- **Sulfur** *(actual):* 15-25 pounds/acre
NITROGEN

40 lbs/ac - Nitrogen
Yield: ~500 lbs/ac

125 lbs/ac - Nitrogen
Yield: ~1500 lbs/ac
PLANTING

• **Firm, shallow seedbed**
  - Rolling/Packing for good seed-to-soil contact

• **Planting Depth:** $\frac{1}{4} - \frac{3}{4}$ inches
  - **Target:** $\frac{1}{2}$ inch

• **Planting Rate:**
  - CBD: 1500-2000 plants/acre (1 plant per 4-6 ft)
  - Fiber: 40-60 pounds/acre (23-34 seeds/ft^2)
  - Grain: 25-35 pounds/acre (14-20 seeds/ft^2)

• **Planting Method:** Grain Drill/Air Drill, Brillion Seeder, Broadcast, Corn Planter (CBD, Grain), Transplanter (CBD)

• **Planting Date:**
  - Fiber: April to May ($>45^\circ$F soil temp) – same time as **small grains**
  - Grain/CBD: May to June ($>50^\circ$F soil temp) – same time as **corn**
  - Plant AFTER a rain, NOT BEFORE (except in arid regions)

Planting Depth is IMPORTANT!
PESTS (WEEDS)

• One of the most significant pests of hemp
• Field selection is critical
• Avoid wet weather after planting
• Weed control during first 30-days is critical
• Find situations that reduces weed pressure
  • Plant after legume sod crops (Alfalfa, Clover)
  • Good soil fertility
  • Plant after a rain, not before
    • Plant during a dry period
  • Well-drained soils
  • Use of soil amendments (Gypsum, Lime, Compost)
• Possible mechanical control (Rotary Hoe, Tined-Weeder, Harrow, Cultivator)
PESTS (DISEASE)

- Two Significant Diseases:
  - White Mold (*Sclerotinia sclerotiorum*)
  - Gray Mold (*Botrytis cinerea*)

- Conditions for mold
  - Cool – Moderate temperatures (<85°F)
  - High Humidity
  - Drizzle/foggy conditions (maritime-like)

- Reduce Disease Pressure
  - Know the disease history of your fields
    - Avoid fields prone to White Mold or Gray Mold
  - Consider rotating after corn/wheat rather than soybeans
  - Reduce plant populations and widen row spacing (increases airflow)
PESTS (INSECTS)

- Generally, insect pests are not economically significant in grain or fiber hemp.
- Common insect pests:
  - Japanese Beetles
  - Corn Earworm
  - European Corn Borer
  - Eurasian Hemp Borer
  - Aphids
  - Seedcorn Maggot
  - Spider Mites
  - Stinkbugs
  - Grasshoppers
TYPES OF HEMP

- **Cannabidiol (CBD)**
- **Fiber**
- **Grain**
TYPES OF HEMP

CBD HEMP

• **Similar to growing Produce or Tobacco**

• **Planting Stock**: Seeds or Transplants (Clones)
  • Female plants ONLY

• **Planting Method**: Typically by Hand or Transplanter. Can be grown in Greenhouse

• **Planting Rate**: 1500-2000 plants/acre (<1 lb seed)

• **Harvest Method**: Typically by Hand

• **Post-Harvest**: Plants are hung to dry in drying sheds or warehouses; flowers are stripped from branches
COMPARISON OF CBD AND THC OVER TIME

CBD:
Ratios Vary: 20:1 to 30:1

THC:
Ratios Vary: 20:1 to 30:1
POST HARVEST (CBD)

STORAGE

• **This is one of the most overlooked and underestimated portions of growing CBD hemp.**

• **Plant size will determine how much space is needed to hang and store the crop.**
  
  • **Estimates range from 5 – 50 cubic feet/plant.**
    
    • Depends on size of plants: 6 ft (height) x 3 ft (width) x 3 ft (depth) = 54 cubic feet per plant

• **Some will harvest and hang entire plants while others will de-branch at harvest.**
POST HARVEST (CBD)

Drying

• **Hanging plants to dry is the most popular and cost effective way to dry**
  • Absolutely essential to have adequate airflow

• **Climate controlled buildings are preferred**
  • Dry Time: 7-21 days to dry
  • Temperature: 65 – 70°F
  • Humidity: 50 – 55%
    • Dehumidifiers are preferred

• **Drying sheds can work but cannot control humidity**
  • Dry Time: 30-90 days to dry – depends on outside humidity
  • Relatively high risk of mold without controlling humidity

• **Drying containers/structures (10-30 days to dry)**
  • Allows for batch drying and can be mobile
  • Low heat with good airflow is essential
COMMERCIAL CBD PRODUCTION
(HIGH CBD GRAIN CULTIVARS)

The GrassHopper – FormationAg
Chaff Collection

CleanCut Harvester – FormationAg

CleanStrip Harvester – FormationAg

http://business.hemptrade.ca/list/member/power-zone-agricultural-center-4944

https://www.pinterest.com/pin/57959137387972750/

https://formation-ag.com/products/harvesting/clestrip
MARKETING/SALES (CBD)

- Contact several processors to determine their demand and specifications
  - Very few processors buying biomass
  - Most processors are doing Oil Splits or Toll Processing
    - Processor turns farmer’s biomass into oil and take HALF of the oil as payment
  - Many processors have a minimum %CBD requirement (Most are >8%-10% CBD)
- Contracting prior to planting is critical
  - Analysts estimate 90% of CBD crop has NOT been processed or sold
- Oversupply
  - * 2019: ~511,000 acres licensed; ~230,000 acres planted; ~115,000 harvested
  - * 2018: ~78,000 acres grown
  - * 2017: ~25,000 acres grown

* Vote Hemp License Report
INDUSTRIAL HEMP
- FIBER -
TYPES OF FIBER HEMP

**Fiber Hemp**

- **Two Types:** True Fiber Type vs. Dual Purpose
- **Planting Stock:** Seeds
- **Planting Method:** Grain/Air Drill, Broadcast
- **Planting Rate:** 40-60 lbs/ac vs 25-35 lbs/ac
- **Harvest Method:** Mowing, Raking (1-3x), Baling (Round or Square)
- **Harvest Timing:** At pollination (July/Aug) vs after combining (October/Spring)

[True Fiber Type](http://www.hemptrade.ca/eguide/fibre-production/fibre-harvesting-equipment)

[Dual Purpose](http://www.hemptrade.ca/eguide/fibre-production/fibre-harvesting-equipment)
HARVEST (FIBER)

- **Harvest Timing:**
  - **Mowing:**
    - **First 1-2 weeks of pollination (July/August)**
    - **Leave 4-6 inches of stubble to reduce ash content**
  - **Raking:**
    - **Rake when stalks turn from green to pale yellow**
    - **1-3 turns may be required**
  - **Retting Period:** 2-6 weeks (depends on environment)

- **Baling**
  - **Bale moisture:** <15%
  - **Large Square Bales are preferred**

http://www.hemptrade.ca/eguide/fibre-production/salvaging-hemp-fibre
http://www.hemptrade.ca/eguide/fibre-production/storing-baled-hemp-fibre
FIBER YIELDS

• True fiber-type: 4 - 6 tons/acre
• Dual purpose: 0.5 – 2.0 tons/acre
• Height of plants and plant density greatly influence yield
INDUSTRIAL HEMP
- GRAIN -
TYPES OF HEMP

**Grain Hemp**

- **Similar to growing small grains (wheat)**
- **Planting Stock:** Seeds
- **Planting Method:** Grain/Air Drill, Broadcast, Corn Planter
- **Planting Rate:** 25-35 pounds/acre
- **Harvest Method:** Combine
- **Post-Harvest:** Grain should be cleaned, then dried in aeration bins immediately after harvest
ASSESSING MATURITY

- Maturation begins at the bottom of the head and continues upward
- Seed bracts will turn brown and shrink exposing seeds

**Harvest Time:**
- 70-80% of seeds mature (100-120 days)
  - September/October
- Within 2-4 days of a killing frost
- Some seeds will be immature at harvest

**Harvest Moisture:** 12-18%

**Storage Moisture:** 9%
HARVEST

- **Straight cut combining is recommended**
  - Rotary works best (single)
    - Conventional works fine
  - Draper headers are preferred
- **Cut grain heads only**
  - Reduces fiber intake in the combine
  - Consider leaving 5-15% of the lower heads in uneven stands
- **Reduce ground speed (2-3 mph)**
- **Swathing is NOT recommended**
  - Allows large volumes of fiber through the combine

http://www.hemptrade.ca/eguide/fibre-production/fibre-harvesting-equipment
POST HARVEST

- **Handle grain with care**
  - Conveyors are preferred
  - Run augers full and slow
- **Quick cleaning is recommended prior to storage**
  - Final cleaning can be performed after grain is dry
- **Grain should be dried in aeration bins immediately after harvest**
  - Spoilage can begin within **4-6 hours** after combining
    - **Do NOT** leave grain sit overnight without air
  - Grain may need to be rotated in bins to reduce “hot spots”
  - Monitor grain regularly
- **Dry moisture:** 9%
GRAIN YIELD

- **Yield**
  - **Range**: 600-2000 POUNDS/ACRE
  - **Average**:
    - **Conventional**: 1200-1400 POUNDS/ACRE
    - **Organic**: 600-800 POUNDS/ACRE

- **Know which food-grade cultivars buyers want**
FIBER HARVEST (DUAL PURPOSE)

- **Average Yield:** 0.5-2.0 tons/acre
- **Harvest Time:**
  - Mowing: 1-3 days after combining
  - Bale: 14-30 days after mowing (when dry)
  - **Mow and bale in spring (preferred)**
- **Moisture:** <15%
- **Equipment**
  - **Mower:** Disk mower (watch for wrapping), sickle mower (preferred), swather
  - **Baler:** Large square baler (preferred), round baler

SUMMARY

- Know which type of hemp you want to grow (CBD, Fiber, Grain)
- Best to find a buyer before growing a hemp crop
- Know what quality specifications the buyer/processor requires
  - CBD: Minimum CBD concentration, heavy metals
  - Fiber: True Fiber Type vs. Dual Purpose
  - Grain: Food-Grade Cultivars, Microbial concentration
- Field selection is important for weed control
- Apply adequate nitrogen
- Understand harvest and drying requirements to avoid spoilage
RESOURCES

- **Canadian Hemp Trade Alliance (online)**
- **Wisconsin Hemp – UW Extension (online)**
- **Alberta Agriculture and Forestry – Industrial Hemp (online)**
- **Growing Industrial Hemp in Ontario (online)**
- **Industrial Hemp Production and Management – Manitoba (online)**
- **Hemp Production in Saskatchewan (online)**
- **Hemp Diseases and Pests: Management and Biological Control (book)**
- **The Cultivation of Hemp: Botany, Varieties, Cultivations and Harvesting (book)**
- **Marijuana Botany: The Propagation and Breeding of Distinctive Cannabis (book)**
QUESTIONS?

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