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# Industrial Hemp: A new crop for Michigan

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## Outline

- Brief History of Hemp in North America
- Relevant Laws and Regulations
- Varieties
- Uses and Markets
- Agronomy
- Economics




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## What is Industrial Hemp?

- *Cannabis sativa* L.
- Legally defined as cannabis 0.3% THC
- Annual broadleaf plant
  - Tall and competitive, 6-13 ft.
  - Tap-rooted
  - Photoperiod sensitive
  - Wind pollinated
  - Plants are indeterminate
    - flowering and seed set continue over a period of time




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## A Brief History of Hemp in North America

- **1300's** – Cannabis commonly used by Europeans for medicine, clothing, ship's rigging & sails
- **Late 1500s** – Spaniards introduce hemp to the Americas via South America
- **1700's** – Prominent agriculturalists like George Washington and Thomas Jefferson investigate hemp as a crop & raw material for the U.S.
- **1840-1890** – U.S. hemp acreage peaks, with production concentrated in Kentucky, Missouri, and Illinois



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### A Brief History of Hemp in North America

- **1937** – Sales of cannabis effectively outlawed nationally by aggressive taxation through Marihuana Tax Act
- **1942-1945** – Federal government authorizes planting 400,000 acres of hemp as part of “Hemp for Victory” campaign during World War II
- **1970** – The federal Controlled Substances Act officially prohibits cannabis for any use
- **1998** – Canada legalizes industrial hemp

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### A Brief History of Hemp in North America

- **2012-present** – 10 states pass laws legalizing recreational marijuana, some including hemp
- **2014** – U.S. Farm Bill and MI laws remove “industrial hemp” from legal definition of marihuana, authorize regulated research by states and universities
- **2014-2018** – 40 States legalize industrial hemp
- **2018** – Federal legalization of industrial hemp production in U.S. Farm Bill opens door for redevelopment of domestic hemp industry

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### Relevant Regulations for Michigan

- [2014 Farm Bill, S. 7606](#) Authorizing hemp research
- [MI HB 5439](#) (2014) Authorizing hemp research
- [MI HB 5440](#) (2014) Defining industrial hemp as cannabis with less than 0.3% THC
- [MI Prop 1](#) (2018) Legalizing recreational marijuana and industrial hemp cultivation
- [MI HBs 6330, 6331](#) & 6380 (2018) Clarifying regulation of industrial hemp research
- [2018 Farm Bill, S.10111](#) Legalizing commercial hemp

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## State Regulatory Responsibility

- Submit a regulatory plan to USDA describing:
  - Procedures for recording where hemp is produced
  - Procedures to ensure hemp produced meets the legal definition of not more than 0.3% THC
  - Procedures for disposal of materials with a THC concentration exceeding 0.3%
  - Procedures for handling violations of the 2018 Farm Bill and the proposed state plan
    - Corrective action plan with deadlines and monitoring
  - Question about zones and cannabis pollen spread


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## Pollen Contamination

- Isolation requirements between different types/varieties listed by AOSCA (seed certifiers)
- Pollen of *C. sativa* has been shown to travel by wind and/or pollinators as far as 90+ miles with most sources stating 10 miles is safe starting point



Inspected Crop	Other Crops	Isolation Distance Required (feet)
Dioecious Type Registered and Foundation	-Different varieties of Industrial Hemp	16,150
	-Non-certified crop of same kind	
	-Lower certified class seed crop of same variety	6,460
Dioecious Type Certified	-Same class of certified seed of same variety	3
	-Different varieties of Industrial Hemp	3,230
	-Non-certified seed of same variety	
	-Lower certified class of seed crop of same variety	646
	-Same class of certified seed of same variety	3

<https://mtseedgrowers.org>

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## Pollen Contamination

- Question of whether marijuana and industrial hemp license holder information can be made publicly available



[www.colorado.gov/pacific/agplants/industrial-hemp](http://www.colorado.gov/pacific/agplants/industrial-hemp)

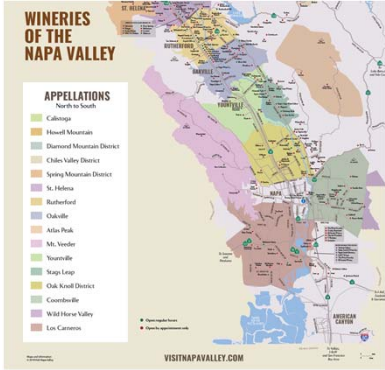
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## Pollen Contamination

- One suggestion is to set up appellations similar to wine production
  - “A geographical name (as of a region, village, or vineyard) under which a winegrower is authorized to identify and market wine” ([www.merriam-webster.com](http://www.merriam-webster.com))



<https://www.visitnapavalley.com>

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## MDARD registration process

- Required under 2014 Farm Bill language for research ag-pilot program
- No online process available for 2019
- Likely a 2-step process through the mail



[https://www.michigan.gov/mdard/0,4610,7-125-1569\\_74018---,00.html](https://www.michigan.gov/mdard/0,4610,7-125-1569_74018---,00.html)

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## MDARD registration process

### Industrial Hemp Ag-Pilot Program for 2019

- Step 1: Download, print and complete the appropriate application(s)
  - Hemp Grower – growing only (\$100 application fee)
  - Hemp Processor-Handler – if you want to sell (\$1,350 fee)
    - Required for those who want to process, handle, broker or market
- Step 2: Complete online background check from the Michigan State Police, Internet Criminal history access tool (ICHAT)
- Step 3: Download, print and complete the 2019 Hemp Ag-Pilot Program application

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## MDARD registration process

- Step 4: Review the terms of the Sample Research Agreement – official copy will be mailed
- Step 5: Create map(s) of all locations where you will grow, handle, store, process, broker or market hemp including GPS
- Step 6: Mail in license and Ag-Pilot applications
- Michigan stats as of June 7
  - 331 Grower and 223 Processor-Handler licenses
  - 615 “growing locations” totaling over 25,000 acres

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### Hemp Varieties

- Hemp varieties selected based on desired end product
  - Fiber
  - Seed/Grain
  - Non-seed oils and extracts (cannabinoids)




www.hempgazette.com ColoradoHempProject.com www.leafly.com 17

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### Hemp Varieties

- Most industrial hemp varieties originate from Europe
- Three types: dioecious, monoecious, and female predominant dioecious
- Seed size, oil content and composition, fiber quality and yield unique to each variety
- Dual-purpose cultivars suitable for both fiber and seed
- Current industry trend in other countries toward breeding varieties for specific use




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### Hemp Varieties

- Most hemp cultivars are photoperiod sensitive
  - Flowering triggered by shorter days, generally 4–5 weeks after summer solstice depending on latitude
- Finding cultivars suited to local conditions and purpose is key
- In Canada, only varieties of industrial hemp that are named in the List of Approved Cultivars, published by Health Canada, are approved for planting
- Currently no U.S. federal standards exist for hemp seed certification, but some states have seed policy



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### Hemp Varieties

- Seed breeders vs. “seed producers”
- Genetic stability is crucial for a viable crop, good yield, and quality end-product
  - Feminization, germination rate, THC <0.3%
  - 20:1 CBD to THC ideal for CBD strains
- Fiber strains: Bialobrzeskie, Fermion
- Seed strains: Fedora 17, Futura 75, Grandi, Katani, Picolo, Tygra, USO 31
- CBD strains: Berry Blossom, Elektra, Charlotte’s Web, Cherry Wine, Lifter, ACDC, etc.




Photo: Debbie Roos North Carolina State Extension 20

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## Hemp Seed Sources

- Similar to buying from unknown online sellers, risky
- Certified seed, if available
- Recognized or listed varieties
- Can show breeding program & results of THC testing
- Sales made to other growers in state, with referrals
- Number of years in business
- Guarantee of germination and feminization, if applicable
- Phytosanitary certificate from the exporting country's national plant protection organization

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## Uses for Industrial Hemp

- "Over 25,000 uses" for the crop
- Main categories include:

Agriculture	Automotive
Construction materials	Cosmetics
Food/nutrition/beverages	Furniture
Paper	Pharmaceuticals/supplements
Textiles/clothing	Other industrial

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Industrial Hemp Association of Tasmania in Johnson, R. 2018. Hemp as an Agricultural Commodity, Congressional Research Service.

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### Uses for Hemp Fiber

- Stems processed into two types of fibers:
  - Basts – longer, higher quality for making fabric, rope
  - Hurds, or shivs – shorter, woody, lower quality for animal bedding, compost, other lower value products

www.gov.mb.ca/agriculture/crops/production/hemp-production

www.hemptek.org

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### Uses for Hemp Fiber

www.hempbizjournal.com

May 9, 2019 www.businessinsider.com

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### Uses for Hemp Seed

- Seed can be sold to several markets
  - Resold for crop planting
    - Quality likely low outside of qualified breeding program
  - Hulled for food
  - Crushed for oil and cake byproducts

www.petco.com

www.amazon.com

Target.com

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### Uses for Hemp CBD

- Cannabidiol (CBD) is concentrated in the glandular trichomes (specialized hairs) of flowers and leaves
- Products including tinctures, skin cream and oils with numerous claims of relief from anxiety, pain, sleeplessness, and other ailments

Jonathan Page, Anandia Labs

www.everydayoptimalcbd.com

www.azurestandatd.com


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## Uses for Hemp CBD

- Epidiolex was FDA approved in June 2018 for treatment of two specific types of epilepsy (Dravet syndrome and Lennox-Gasaut syndrome)
- In September 2018, Epidiolex was reclassified from schedule I to schedule V
- Derived from marijuana plants, but is made from CBD-isolate
- Stated price of \$32,500/yr



<https://www.cbdschool.com>

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**Hemp fibres 2013, total: 25,000 tonnes**

Use	Percentage
Biocomposites	57%
Insulation	14%
Technical textiles	0.1%
Pulp and paper	26%
Clothing	3%

**Hemp shivs 2013, total: 43,000 tonnes**

Use	Percentage
Construction	45%
Animal bedding (other than horses)	2%
Animal bedding (horses)	19%
Garden mulch	16%
Others (fungi cultivation, incineration)	18%

## Hemp Uses in Europe: 2013

**Hemp seeds 2013, total: 11,500 tonnes**

Use	Percentage
Oil (food)	13%
Oil (flour, cosmetics and others)	0.1%
Oil	43%
Feed	44%
Others	0.3%

Carus, M. 2017. The European Hemp Industry: Cultivation, processing and applications for fibres, shivs, seeds and flowers. European Industrial Hemp Association.

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## Hemp Agronomy: Climate

- Prefers daytime temperatures around 80 °F
- Tolerates cool temperatures down to 31 °F after third set of leaves emerge
- Prefers at least 10–13" of rainfall in season
  - Moisture important during flowering and seed set



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### Hemp Agronomy: Soils

- Well Drained
- Fertile loam or sandy loam
- Neutral pH (6.0 – 7.5)




Pro Stock Professional 33

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### Hemp Agronomy: Site Preparation

- Plant in April or May after soil temps warm to greater than 46 °F
  - Do not plant after early June due to day length sensitivity
- Tillage generally recommended, but no-till can work with even moisture and good seed to soil contact
- CBD systems often utilize plastic mulch, irrigation and cuttings or transplants




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### Hemp Agronomy: Planting

- Fiber and grain crops are planted from seed with grain drills or broadcast with cultipacking, ¼ – ¾ inch deep
- Fiber: 1 million seeds per acre
  - About 50 lbs per acre
  - Plant thick to discourage branching
  - 8" or less row spacing
- Grain: 500,000 seeds per acre
  - About 35 lbs per acre
  - Lower density encourages flowering and branching to increase seed set
  - 8-16" row spacing



YouTube, Whitmore Hemp Drilling Part 1



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### Hemp Agronomy: Planting

- Cannabinoid production different than fiber or grain
  - 2,500 plants per acre
  - Female plants only, often grown from cuttings, transplants or feminized seed
  - Isolation from other cannabis to avoid pollination, 3–10 miles
  - Rogue out male plants
  - Very wide spacing to encourage branching and flowering





Photo: GenCanna




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### Hemp Agronomy: Planting

- Planting in Illinois, 2018
  - 5'x5' spacing
  - Planted in May
  - 5-6' tall by August
  - 3-4" thick stems



<https://farmweeknow.com>

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### Hemp Agronomy: Planting

- CBD hemp demo plots planted June 23
  - Plants vs direct seed, 2' vs 3' spacing, plastic vs fabric, other?



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### Hemp Agronomy: Soil Fertility

- Fiber and grain hemp benefit from fertility levels similar to other high yielding crops in Michigan, such as corn
  - ~110 lbs N/ac for seed, 50 lb N/ac for fiber
  - P and K according to soil tests for winter wheat
    - Additional P and K for seed vs. fiber
  - Sulfur and other micro-nutrients as needed
- CBD production may have more specific nutrient requirements

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### Pest Management: Weeds

- No current herbicides approved in U.S. for in-season weed management
- Fiber and grain crops should be planted into weed free fields
- Hemp grows very quickly and reaches one foot tall within 2-4 weeks during warm weather
- Dense planting helps to close canopy and shade weeds quickly
- Consider potential for herbicide carry-over from previous crop applications when planting hemp


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### Pest Management: Insects

- Due to lack of previous cultivation, significant insect pests are not expected immediately
- However, many insects can and will feed on hemp, and we expect pest buildup over time as the crop becomes more abundant
  - Defoliators (grasshoppers, corn earworm)
  - Borers (corn borer, hemp borer)
  - Sucking pests (aphids, mites)
- Bud and flower protection most important
- No insecticides currently labelled for hemp



Canadian Hemp Trade Alliance


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### Pest Management: Diseases

- Diseases are not expected to be a big problem initially due to lack of previous cultivation
- Hemp is known to be susceptible to white mold (*Sclerotinia sclerotiorum*), which should be considered in rotations containing soybean
- No fungicides currently registered for use on hemp



Canadian Hemp Trade Alliance

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### Hemp Harvest: Fiber

- Fiber hemp is windrowed between early bloom and seed set and left in the field for a ~5 week “retting” process
  - Outer husk of stem rots and separates from inner fibers
  - Multiple raking events help separate leaves from fibers
  - When fibers are ≤ 15% moisture, it is round or square baled
    - Drying to 15% may be difficult for Michigan farmers due to climate




Photo: Matt Barton, University of Kentucky


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### Hemp Harvest: Grain

- Grain hemp is harvested when shattering begins
  - Seed heads mature from bottom up
  - Only 70-75% of seeds are ripe at this point
  - Grain is between 22–30% moisture
  - Plants are still green at time of harvesting
  - Conventional combine can be used, but some machines can harvest grain and fiber simultaneously



Harvesting www.valleybio.com


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## Hemp Harvest: CBD

- CBD hemp is harvested at peak flowering
  - CBD testing can be used to target harvest
  - Weather is critical to yield and quality
  - Hand harvesting of whole plants is standard
  - Immediate drying at moderate temps with good ventilation is critical



catawba.ces.ncsu.edu

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## Hemp Economics: Fiber and Seed

Net Hemp Returns/Acre (does not include land cost) \$75/ton Fiber and \$.70/lb Seed				
Production System	Low Productivity	Medium-Low Productivity	Medium-High Productivity	High Productivity
Fiber Only	-\$167	-\$149	-\$130	-\$112
Dual System (fiber plus seed)	\$42	\$125	\$208	\$290
Seed Only	\$119	\$217	\$315	\$412

*Notes: Costs include labor and depreciation/overhead but not land costs. \$3.50/gal fuel; N, P, and K at \$.50/unit; 50 miles one-way trucking to market.*

University of Kentucky, 2013. Economic Considerations for Growing Industrial Hemp: Implications for Kentucky's Farmers and Agricultural Economy

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## Hemp Economics: Fiber and Seed

2017	Grain	Fiber	Floral
Growers	20	14	112
Acres Planted	1,227	159	1,883
Acres Harvested	826	120	1,371
Avg. Yield lb/acre**	518	2,556	1,024
Avg. Price per lb	\$1.70	\$0.34	\$7.20


\*Preliminary; analysis of 2017 production results  
 \*\*Average Yield was calculated only from plots with yields above zero. (Does not include dual plots)

- 1 lb biomass/plant
- 10% CBD
- \$3.00/percent CBD
- \$30/plant
- \$60,000/ac (2000 plants/ac)

Slide courtesy of Dr. David Williams, University of Kentucky, as presented at UW Extension "Industrial Hemp Educational Meeting", Feb. 25, 2019

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*Thank You!*

*Questions?*

