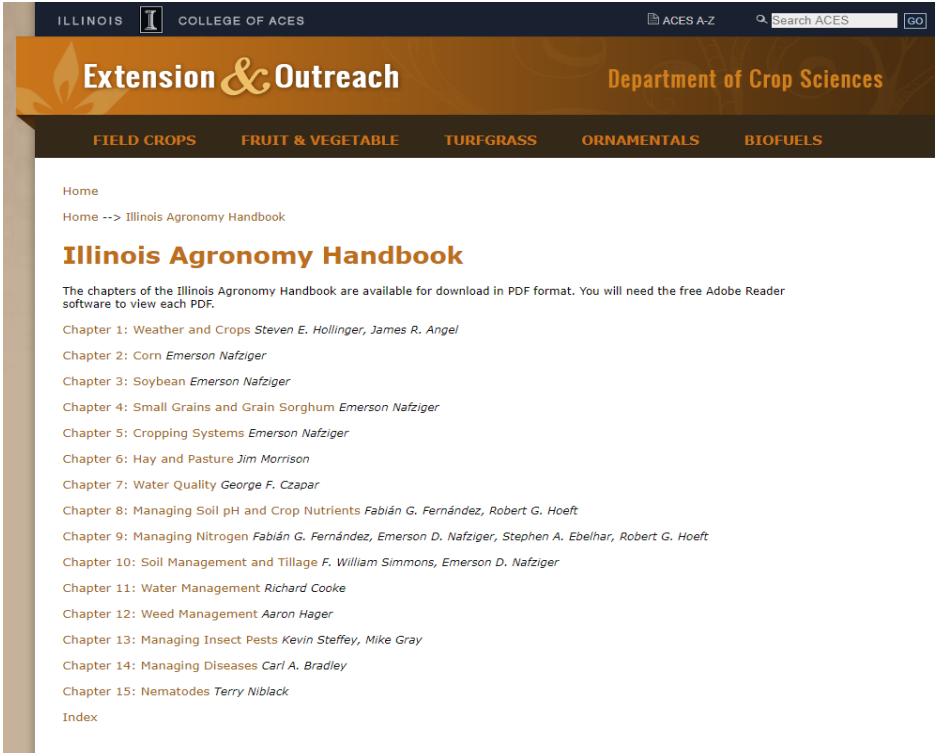
A Introduction to Hemp Production

Industrial Hemp Production Workshop
August 6, 2019
Moline, IL

Phillip Alberti, Extension Educator
Commercial Agriculture
NW IL

Illinois Agronomy Handbook



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Illinois Agronomy Handbook

The chapters of the Illinois Agronomy Handbook are available for download in PDF format. You will need the free Adobe Reader software to view each PDF.

Chapter 1: Weather and Crops *Steven E. Hollinger, James R. Angel*

Chapter 2: Corn *Emerson Nafziger*

Chapter 3: Soybean *Emerson Nafziger*

Chapter 4: Small Grains and Grain Sorghum *Emerson Nafziger*

Chapter 5: Cropping Systems *Emerson Nafziger*

Chapter 6: Hay and Pasture *Jim Morrison*

Chapter 7: Water Quality *George F. Czapar*

Chapter 8: Managing Soil pH and Crop Nutrients *Fabián G. Fernández, Robert G. Hoeft*

Chapter 9: Managing Nitrogen *Fabián G. Fernández, Emerson D. Nafziger, Stephen A. Ebelhar, Robert G. Hoeft*

Chapter 10: Soil Management and Tillage *F. William Simmons, Emerson D. Nafziger*

Chapter 11: Water Management *Richard Cooke*

Chapter 12: Weed Management *Aaron Hager*

Chapter 13: Managing Insect Pests *Kevin Steffey, Mike Gray*

Chapter 14: Managing Diseases *Carl A. Bradley*

Chapter 15: Nematodes *Terry Niblack*

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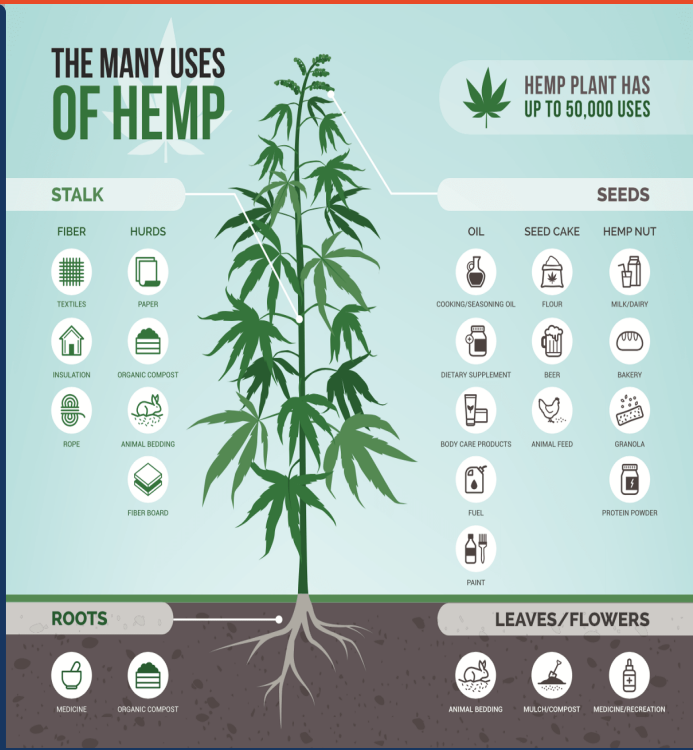
Talking Points

- Taxonomy and Morphology
- Types of Hemp
- Hemp Production
- Hemp Processing (briefly)
- Legislation/Registration

History of Hemp in Illinois

Industrial Hemp

- *Cannabis sativa*
  - *Hemp vs Marijuana*
- Dicotyledonous Plant
- Primarily Dioecious
- Hemp is Photoperiod Dependent
  - Short-Day
  - 10-12 hours darkness



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Phillip Alberti- palberti@Illinois.edu or
815-599-3644 or @NorthernILCrops

Industrial Hemp

Hemp is harvested for three things:

Stalk

Seed

Flower

Phillip Alberti- palberti@Illinois.edu or
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Considerations

- **Soil Type**: Well-drained
- **pH Range**: 6.0-7.5
- **Soil Temperatures**: >50°F
- Planting Depth ¼- ¾ in.
- **Optimum Air Temperature**: 66-77°F
- **Moisture Requirement**: >10-15 inches
- Plant AFTER a rain, NOT BEFORE

- **Field Selection:**
  - Highly Productive
  - Low weed pressure
  - Well-drained
- **Planting Rate**: Depends
- **Planting Method**: Depends

Considerations- Organic

- Rotations that provide naturally low weed pressure
  - Rotation after legume sod crops (Alfalfa, Clover)
    - Best weed control
    - Residual nitrogen
  - Rotation after Corn/Soybeans
    - High weed potential
    - Increased disease potential
- Possible use of Rotary Hoe, Tined-Weeder, Harrow, cultivator (rows)
- Increase planting rates

Considerations

- Nutrient demand increases with plant age
- **Nitrogen**:
  - 100-125 lbs./acre (Grain)
  - 50 lbs/acre (Fiber)
- **Phosphorus**: 40-70 lbs./acre
- **Potassium**:
  - 60-100 lbs./acre (Grain)
  - 200+ lbs./acre (Fiber)
- **Sulfur**: 15-25 lbs./acre

Growth Stages

- **Germination**: 24-48 hours
- **Emergence**: 4-10 days
- **Slow Growth**: Day 1-30
  - ¼ - ½ inch per day
- **Rapid Growth**: Day 30-60
  - 1-3 inches per day

http://www.hemptrade.ca/eguide/background/the-hemp-plant

Pests: Weeds

- One of the most significant pests of hemp
- Field Selection is critical
- Find situations that reduces weed pressure
  - Use of soil amendments
- Weed control during first 30-Days is critical
- Possible mechanical control

Pests: Disease and Insects

- Insects
  - European Corn Borer
  - Japanese Beetles
  - Grasshoppers
  - *Spider Mites*
  - *Aphids*
  - *Whiteflies*

- Disease
  - White Mold
  - Gray Mold

Hemp Pests

Growth Stages

Reproductive Phase

- **Reproduction**: Day 60-90
- **Maturity**: Day 100-110
- **Harvest**: Day 110-130
  - September/October

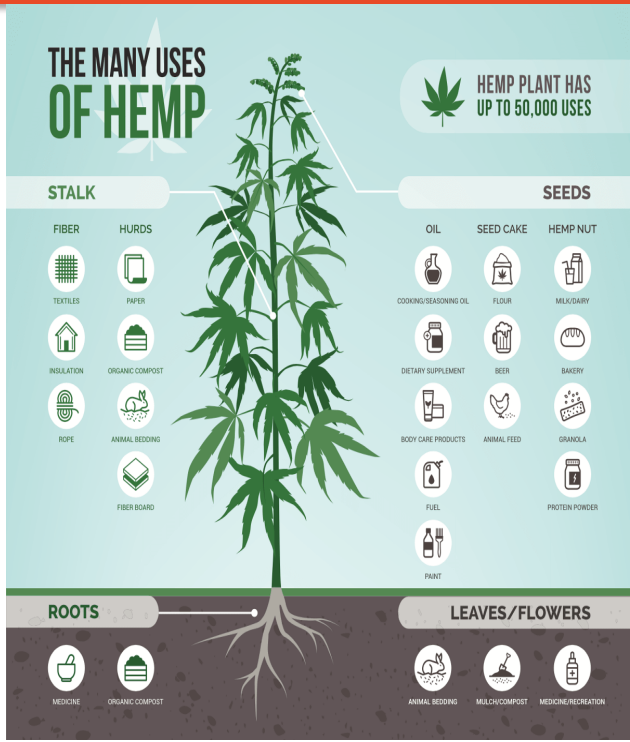
Grain Field Nearing Flowering

Male Plant

Female Plant

Types of Hemp

- Grain
  - Small Grains (Wheat)
- Fiber
  - Forages (Hay)
- CBD
  - Specialty Crops (Tomatoes)



Grain Hemp (Small Grains)

- **Planting Stock**: Seeds
- **Planting Method**: Grain Drill, Broadcast, Corn Planter
- **Planting Rate**: 25-35 lbs./acre
- **Harvest Method**: Combine
- **Post-Harvest**: Dry grain in aeration bins immediately

Male Plant

Female Plant

Grain Hemp (Small Grains)

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Maturing Grain Hemp Field

Combining Seed Heads

Grain Harvest

- 70-80% of seeds mature
- Maturation begins at the bottom of the head and continues upward
- Seed calyx/bracts will turn brown and shrink exposing seeds
- **Grain Harvest Moisture**: 12-18%
  - Handle Grain with Care
  - Quick Cleaning is recommended
  - Grain should be dried in aeration bins immediately
- **Storage moisture**: 9%

"Mature" Seed Head and Seeds

Photo Credit: Bryan Parr

Grain Harvest

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Grading/Specification

Microbial Specification Standards	
Standard Plate Count	<100,000 cfu/g[1]
Total Coliforms	<1000 cfu/g
E. coli	Negative
Salmonella	Negative
Yeast & Mold (combined)	<1000 cfu/g
THC	<10 ppm[2]
Free Fatty Acid	<2%
Peroxide	<2meq/kg[3]
Gluten	<20 ppm

Reminder: Quality is the most important aspect of this crop.

1 - cfu/g - colony forming unit per gram or the measure of viable bacterial or fungal cells.
2 - ppm - parts per million
3 - meq/kg - milliequivalents per kilogram

Grain Hemp

- Hemp seeds are high in complete proteins and healthy saturated fats
- Hemp seed oil (NOT CBD) can be extracted
- Has potential to be used in both animal and human feed
- Storage of both seeds and oil to prevent spoilage is critical

Fiber Hemp (Hay/Forages)

- **Planting Stock**: Seeds
- **Planting Method**: Grain Drill, Broadcast
- **Planting Rate**: 50-70 lbs./acre
- **Harvest Method**: Mower, Baler
- **Post-Harvest**: Bales are stored at 15% moisture

Hemp Fiber Ready to Be Mowed Down

Hemp Fiber After Being Mowed

Photo Credit: Canadian Hemp Trade Alliance

Fiber Hemp (Hay/Forages)

- Fiber (Bast) is the most valuable product from decorticated stalks
  - Textiles,
- Hurd can be used in building materials, agricultural products, paper
- Pellets are absorbent and can be burned as biofuel

Fiber Hemp (Hay/Forages)

- **Harvest time:**
  - **Mowing: 1-3 days after combining**
  - **Bale: 7-21 days after combining Mow and bale in Spring**
- **Equipment**
  - **Mower**: disk mower, sickle mower, swather
  - **Baler**: large square baler, round baler

Hemp Fiber Ready to Be Mowed Down

Hemp Fiber After Being Mowed

Photo Credit: Canadian Hemp Trade Alliance

Fiber Hemp (Hay/Forages)

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Hemp Fiber After Being Mowed

Bailed Hemp Fiber

CBD Hemp

- **Planting Stock**: Transplants
- **Planting Method**: Transplanter
- **Planting Rate**: 1000-2000 plants/acre
- **Harvest Method**: Hand
- **Post Harvest:** Plants are hung to dry in drying sheds or warehouse

Cannabidiol (CBD)

- CBD is found within the oil/resin glands (trichomes) **NOT** in the seeds
  - Flowers and leaf material
  - **Males MUST be culled**
- CBD is not psychoactive
- CBD is extracted from the plant material
  - Supercritical CO_2
  - Butane/Propane
  - Alcohol/Ethanol

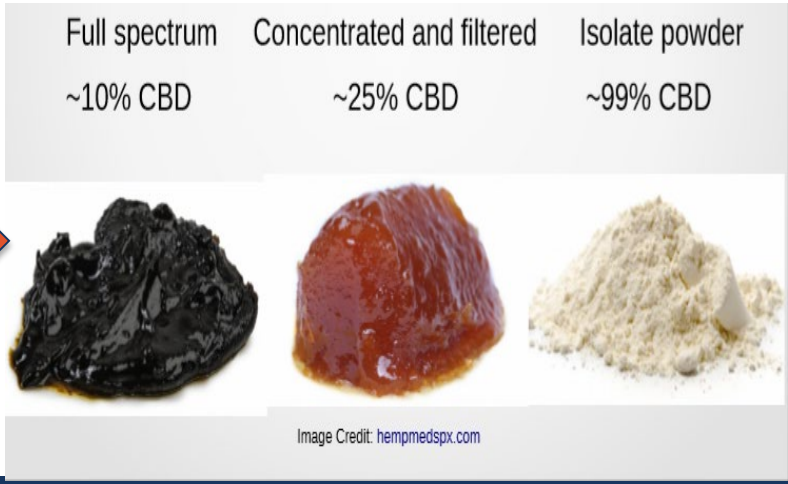
Closeup of female cannabis flower

CBD Hemp

- **Planting Stock**: Transplants
- **Planting Method**: Transplanter
- **Planting Rate**: 1000-2000 plants/acre
- No research based information on fertility; production analogous to marijuana
- **Harvest Method**: Hand
- **Post Harvest:** Plants are hung to dry in drying sheds or warehouse

CBD (Specialty Crops)

- Most lucrative area of hemp production
- Hemp-derived CBD is available in many forms, concentrations due to processing strategies



Economics of CBD

- Currently no hemp grain or fiber processors in IL
- Hemp flower sale (CBD) is on a contract basis; producers are encouraged to have an buyer before cultivation
- Economics Example (University of Kentucky Hemp Budgets)
  - **DISCLAIMER: These Budgets Do NOT Represent IL Market**
  - Price per %CBD: $3-6
  - CBD: (1-20%) 5%
  - Dry Matter: 1000-2000 (1200 lbs)
  - Estimated Revenue: $18,000-36,000/acre

Sensitivy Analysis

Price per % CBD	Total Revenue	Returns Above Variable Costs
$6	$36,000	$25,594
$5	$30,000	$19,594
$4	$24,000	$13,594
$3	$18,000	$7,594
$2	$12,000	$1,594
$1	$6,000	-$4,406

Economics of Grain and Fiber

- Grain Yield: 1200 lbs

Sensitivy Analysis		
Price per # Hemp Grain	Total Revenue	Returns Above Variable Costs
$1.00	$1,200	$405
$0.90	$1,080	$285
$0.80	$960	$165
$0.70	$840	$45
$0.60	$720	-$75
$0.50	$600	-$195

- Fiber Yield: 5 Tons

Sensitivy Analysis		
Price per # Hemp Fiber	Total Revenue	Returns Above Variable Costs
$0.10	$1,000	$113
$0.09	$900	$13
$0.08	$800	-$87
$0.07	$700	-$187
$0.06	$600	-$287
$0.05	$500	-$387

Summary

- Field selection is important
  - Well drained soils
  - Highly productive, low weed pressure fields
  - Organic – Best to follow sod-forming legume
- Think of ways that promote rapid emergence and seedling growth
  - Good fertility
  - Good seedbed preparation
- Harvest grain heads only to reduce fiber wrapping
- Consider cleaning grain after combining
- Move grain to aeration bins immediately after harvest
- CBD Production is LABOR intensive

General Provisions

- No person shall cultivate hemp in the state without an License
- No person shall process processor/handler registration
- All licensed persons in the state must provide “research” information
- Licensed cultivators are responsible for procuring seeds, clones, transplants or propagules for planting
- All seeds, clones, etc., shall be certified under the Association of Official Seed Certifying Agencies (AOSCA) standards and guidelines for industrial hemp OR contain a Certificate of Analysis (COA) which shows it tests below 0.3% THC threshold
- Licenses and registrations cannot be transferred or assigned, in whole or in part, to another business, individual or other entity

General Provisions – cont'd

- No land area may contain cannabis plants or parts of cannabis plants
- Minimum land area for cultivation shall be a contiguous land area of ¼ of an acre for outdoor cultivation and 500 square feet for indoor.
- Each noncontiguous land area shall require a separate application fee
- Licensee info may be shared with law enforcement without notice
- Any violations by a licensee or registrant may be subject to administrative action

Draft Rules

- Apply!!
- Background Check – forms supplied by the IDOA
  - No person convicted of any felony, drug-related misdemeanor, or crime of dishonesty in the 10 years prior to the date of application shall be eligible for license/registration
- Within 30 Days, IDOA will either approve or deny application
  - If approved, submit license fee for each noncontiguous land area and each indoor cultivation operation
  - List varieties and acreage to be planted, along with COA
  - Any changes to the licensee's cultivation plan must be approved by the Dept.
  - All processor and Handlers must also register with the Department

Draft application process -Cultivation

- Applicant must provide the following:
  - Name and address of the applicant;
  - Type of business or organization;
  - Business name and address (if different than information provided)
  - Legal description of land area, including GPS coordinates
  - A map of the land area on which you plan to grow hemp, showing boundaries and dimensions of growing area
  - The application fee of $100
  - Registration fee
    - 1 year→ $375
    - 2 year→ $700
    - 3 year→ $1000

Draft process –processor/handler

- Name and address of the registrant;
- Type of business;
- Business name and address (if different than information provided in (1));
- Nature of the processing or handling by the registrant;
- The applicable fee of $100
- If approved, the registrant must pay $1,000 registration fee for each registered address operated by a processor
- Registration fee
  - 1 year→ $375
  - 2 year→ $700
  - 3 year→ $1000

Research information

- Pre-Harvest Report – at least 30 days prior to harvest
  - Expected harvest dates and locations of each variety of industrial hemp
  - Notify Department if the harvest dates change in an excess of 5 days
- Final Report – no later than February 1 of each year
  - Total acres or square fee of industrial hemp planted
  - A description of each variety planted and harvested
  - Total acres or square feet harvested; and
  - Total yield in the appropriate measurement, such as tonnage, seeds/acres, etc. OR any other measurement approved by the IDOA

Inspection and sampling

- All licensees are subject to inspection at the discretion of the IDOA
  - An “agent” must be present
- Dept. shall provide 5 business days’ notice to inspection
- A representative of sample MAY be taken by IDOA or approved laboratory personnel.
  - Producer is responsible for payment
- All plants are subject to sampling and testing to verify that delta-9 THC concentration does not exceed 0.3% on dry weight basis
    - Exceeding 0.3% and is not retested at the request of the licensee will be destroyed
    - Plant will be destroyed if retested and still “hot”
      - Methods for destroying crops have yet to be determined
- Must wait for results before processing and/or transportation of industrial hemp