

Farming Hemp in Vermont

Cultivating for CBD, Fiber, & Grain

A Presentation from NEHC 2019

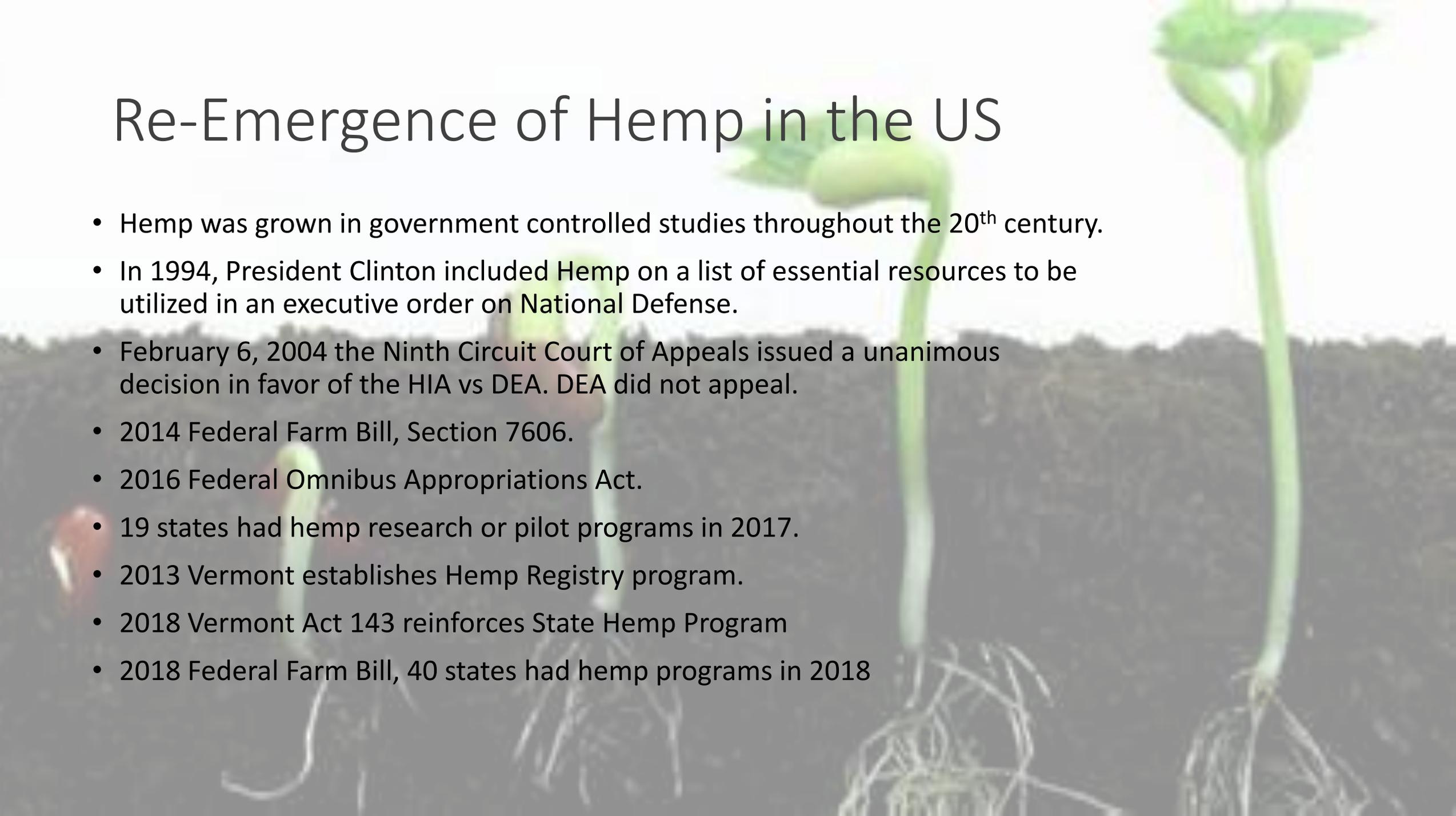


Botanical Background

What is the difference between Cannabis, Hemp, and Marijuana?

- Over centuries of cultivation dispersed across continents, the genetics and definitions of Hemp and Marijuana have diverged into two distinct branches of the *Cannabis Sativa* plant species, which is an annual flowering herb.
- Differences including plant morphology, seed oil content, fiber quality, and cannabinoid profile delineate the thousands of Cannabis cultivars.
- Hemp is all Cannabis with Total THC Content of 0.3% or less by dry weight.
- Hemp and Marijuana can cross pollinate to produce viable offspring.
- This is generally undesirable, as it disrupts stable genetic traits.
- Cannabis is predominantly dioecious, meaning there are separate male and female plants. Males produce pollen, wind-pollinated female flowers bear seed.
- Some Hemp varieties have been bred to be monoecious, with both male and female organs on the same plant, thus increasing the population of seed bearing plants per acre. Hermaphroditic abilities are a survival trait in Cannabis populations.

Re-Emergence of Hemp in the US



- Hemp was grown in government controlled studies throughout the 20th century.
- In 1994, President Clinton included Hemp on a list of essential resources to be utilized in an executive order on National Defense.
- February 6, 2004 the Ninth Circuit Court of Appeals issued a unanimous decision in favor of the HIA vs DEA. DEA did not appeal.
- 2014 Federal Farm Bill, Section 7606.
- 2016 Federal Omnibus Appropriations Act.
- 19 states had hemp research or pilot programs in 2017.
- 2013 Vermont establishes Hemp Registry program.
- 2018 Vermont Act 143 reinforces State Hemp Program
- 2018 Federal Farm Bill, 40 states had hemp programs in 2018

Testing and Compliance



The data contained within this report was collected in accordance with the requirements of ISO/IEC17025:2005. I attest that the information contained within the report has been reviewed for accuracy and checked against the quality control requirements for each method. These results relate only to the test article listed in this report. Reports may not be reproduced except in their entirety.

CN: Cannabinoid Profile & Potency [WI-10-04]

Analyst: jsg

Test Date: 9/17/2018

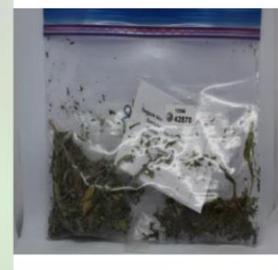
The client sample was analyzed for plant-based cannabinoids by Convergence Chromatography (CC). The collected data was compared to data collected for certified reference standards at known concentrations.

39064-CN

ID	Weight %	Conc.	
D9-THC	0.05 wt %	0.49 mg/g	
THCV	ND	ND	
CBD	0.47 wt %	4.68 mg/g	
CBDV	ND	ND	
CBG	0.10 wt %	0.99 mg/g	
CBC	0.03 wt %	0.29 mg/g	
CBN	ND	ND	
THCA	0.54 wt %	5.35 mg/g	
CBDA	13.23 wt %	132.34 mg/g	
CBGA	0.41 wt %	4.13 mg/g	
Total	14.83 wt%	148.27 mg/g	0% Cannabinoids (wt%) 13.2%
Max THC	0.52 wt%	5.18 mg/g	
Max CBD	12.07 wt%	120.74 mg/g	

Ratio of Total CBD to THC 23.3:1

Max THC (and Max CBD) are calculated values for total cannabinoids after heating, assuming complete decarboxylation of the acid to the neutral form. It is calculated based on the weight loss of the acid group during decarboxylation: Max THC = (0.877 x THCA) + THC. ND = None detected above the limits of detection (LLD)



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CN: Cannabinoid Profile & Potency [WI-10-17]

Analyst: JDP

Test Date: 11/29/2018

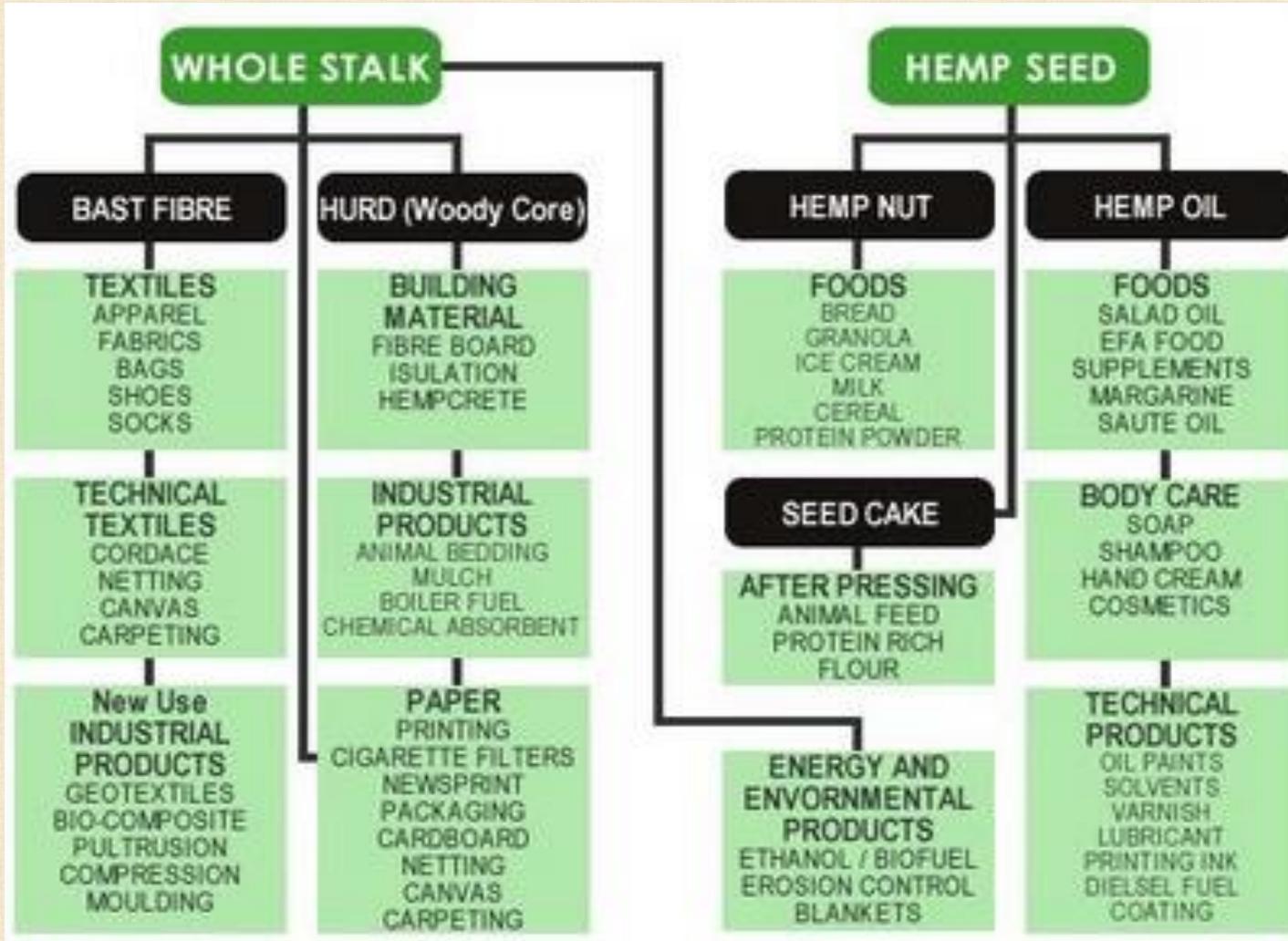
The client sample was analyzed for plant-based cannabinoids by Liquid Chromatography (LC). The collected data was compared to data collected for certified reference standards at known concentrations.

42870-CN

ID	Weight %	Conc.	
D9-THC	0.06 wt %	0.57 mg/g	
THCV	ND	ND	
CBD	0.58 wt %	5.82 mg/g	
CBDV	ND	ND	
CBG	0.13 wt %	1.32 mg/g	
CBC	0.44 wt %	4.44 mg/g	
CBN	ND	ND	
THCA	0.05 wt %	0.49 mg/g	
CBDA	14.74 wt %	147.38 mg/g	
CBGA	0.66 wt %	6.65 mg/g	
Total	16.66 wt%	166.65 mg/g	0% Cannabinoids (wt%) 14.7%
Max THC	0.10 wt%	1.00 mg/g	
Max CBD	13.51 wt%	135.07 mg/g	

Max THC (and Max CBD) are calculated values for total cannabinoids after heating, assuming complete decarboxylation of the acid to the neutral form. It is calculated based on the weight loss of the acid group during decarboxylation: Max THC = (0.877 x THCA) + THC. ND = None detected above the limits of detection (LLD)

Over 50,000 uses and growing...



Hemp

KNOW more USE more

Past Use of HEMP

- 2008** The Lohmeyer company released the "Eco-Bio"™, a new line of hemp seed-based nutritional bars, or hemp "eco bars", to eat in the body of the car.
- 1941** Henry Ford made a car lubricated and fueled by hemp.
- 1937** 4 million pounds of hemp seed are sold used as a long food food in the U.S.A.
- 1935** 118 million pounds of hemp seed were used commercially in America to manufacture paper and matches.
- 1842** Salicylic acid derivatives of the hemp plant are the second and third most prescribed medicines in the U.S.A.
- 1800** Australia arrives, two prolonged voyages by sailing, initially making but hemp used for protein and hemp leaves for fiber.
- 1776** The organization, "Sowing Seed" turns hemp fiber into military uniforms for General Washington's Continental Army.
- 1750** Benjamin Franklin visits one of America's first hemp-growing paper-mills.
- 1600** Barbed-wire patents use hemp yarns.
- 1450** Columbus Bible printed on hemp paper.
- 500 A.D.** The French constructed a bridge using a mixture of hemp bark and lime, a material known as the "celtic mortar" used in stone.
- 400** Romans used hemp to make water transport.
- 2,700** Chinese use hemp fabric, cordage, medicine, and food. Hemp has been grown in the vicinity of all cultures of the Middle East, Asia Minor, India, China, Japan, and Africa.
- 6,000** Carved hemp seeds used for food in China.
- 8,000 B.C.** The earliest known human fabric was made with hemp fibers, which began to be worked in the eighth millennium.

Seeds

- Highly nutritious as a protein source, better tasting and more digestible than soybeans.
- Contains the recommended 3:1 ratio of essential omega-6 and omega-3 fatty acids.
- Reduces the risk of cardiovascular disease, stroke, osteoporosis and diabetes.

Long Fibers

- Longer, stronger, stiffer and superior to cotton.
- Natural anti-mold and anti-microbial properties, particularly useful for sails, ropes, clothing and carpets.
- Biodegradable and serves as an environmentally sound substitute for fiberglass.

Leaves

- Very absorbent and good for animal bedding.
- Green canopy of leaves prevents soil evaporation.
- Reduces carbon dioxide in the atmosphere.

Short Fibers

- A substitute for cotton, stronger on a weight-for-weight basis for packaging and bookbinding.
- Known as a "green" fiber, suitable replacement for wool in construction materials.
- A biodegradably environmentally responsible material for use in manufacturing pulp.

Roots

- Deep root system, strong-good material for erosion control.
- Microscopic diameter and suitable for use in construction.

Useful Parts of HEMP

- TEXTILE**: Apparel, Cordage, Netting, Canvas, Carpeting
- BUILD**: Plastics, Fiberboard, Insulation, Paper, Building
- FOOD**: Flour, Protein, Oil, Seed Cake
- HEALTH**: Hemp Seed Oil, Hemp Protein, Hemp Fiber
- PAPER**: Newsprint, Packaging, Cardboard, Netting, Canvas, Carpeting
- Products made from HEMP**: Paper, Textiles, Food, Health, Building, Environmental

Print

Pictures

Non-Print/Online

Help Sites

More Info: "Cultivating Hemp"

More Info: "Sowing Seed"

Additional Query: Hemp

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www.hempmagazine.com

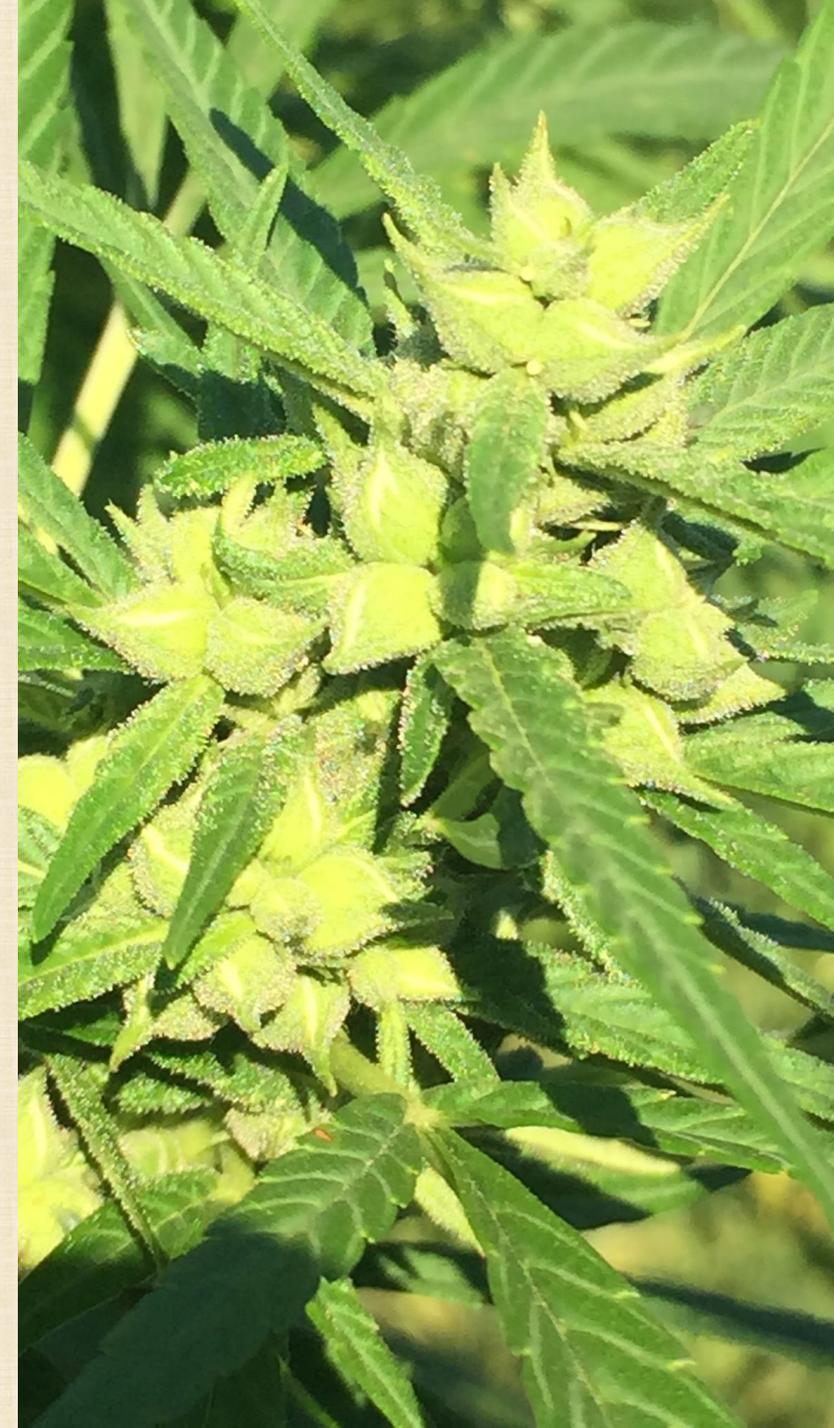
There are many ways to farm Hemp



Cultivating Hemp in the Northeast

CBD Flower Crops, Growing for Resin Production

- Well drained, loamy soil is best. Not compacted.
- pH 6.0 to 6.8. Slightly higher during Vegetative, lower during flowering.
- For CBD Production, Female Only fields are often transplanted, 3-6 ft. spacing. 800-1600 per acre.
- CBD Hemp is seeded in trays in Early May, depth ¼", Transplanted Early June.
- Diseases include Botrytis, Head Blight, Sclerotinia, Spot Fungus & Stem Rot.
- Pests include Aphids, Corn Borers, Voles and sometimes deer.
- CBD Crops need a broad range of micronutrients, soil depending.
- Generally Feed N for vegetative, P for Flowering, K for Finishing.
- Beneficial microbes can be applied to assist with nutrient uptake and to keep many detrimental fungi and diseases at bay.
- CBD Harvest dependent on cultivar, ranges from Late August through October.
- Hemp Flower must be dried below 12% for safe storage.
- Life cycle is dependent on variety, season and harvest objective.



Cultivating Hemp in the Northeast

Growing Grain and Fiber Crops

- Well drained, loamy soil is best. Not compacted; pH 6.0 to 6.8.
- Soil temp. Min 50 F. Planting depth $\frac{3}{4}$ ".
- Best Germination at 70-80 F. Avoid standing water after seeding.
- Seeding Rate for grain 18-25 lbs. per acre, for Fiber 45-50 lbs. per acre.
- Rows 7 – 14" on center allow Hemp crop to suppress weeds.
- Diseases include Botrytis, Head Blight, Sclerotinia, Spot Fungus & Stem Rot.
- Pests include Aphids, Corn Borers, Voles and sometimes deer.
- Grain Crop Fertilizer needs, similar to winter wheat or corn, soil dependent.
- Apply all amendments in the fall or spring before planting.
- If Fiber only, harvest after 60-70 days. Fiber needs retting 2-3 weeks.
- If Grain, harvest when seed moisture is below 20-25%. Usually 110-120 days.
- Grain must be dried to 8-10%.
- Life cycle is dependent on variety, season and harvest objective.





Field Setup and Transplanting











← Female Flower

Male Flower →

← Hermaphroditic Flower







Dual Fiber & Grain Crop





Thank You!

