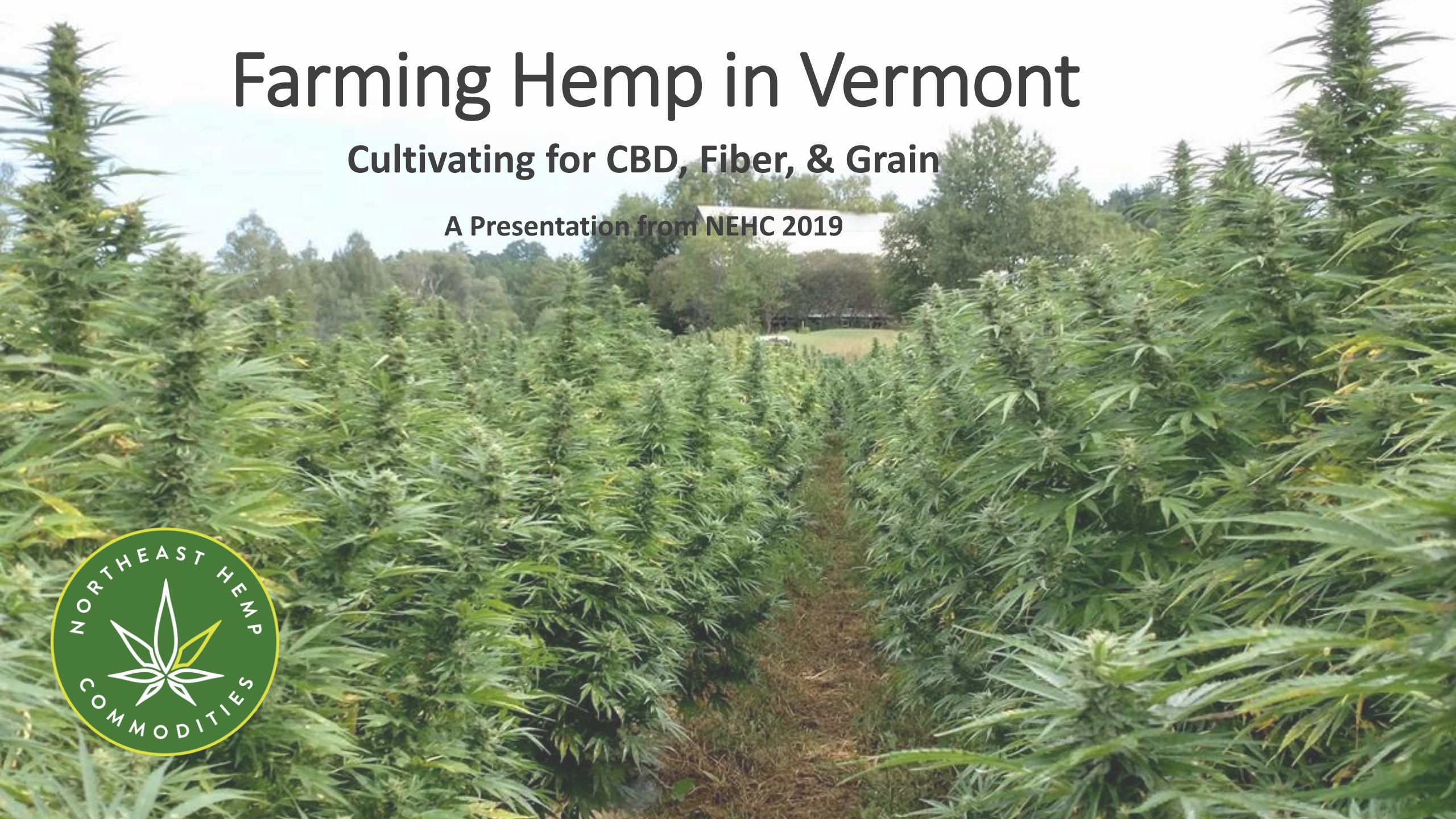
Farming Hemp in Vermont

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

PJLA Testing
Accreditation
80585

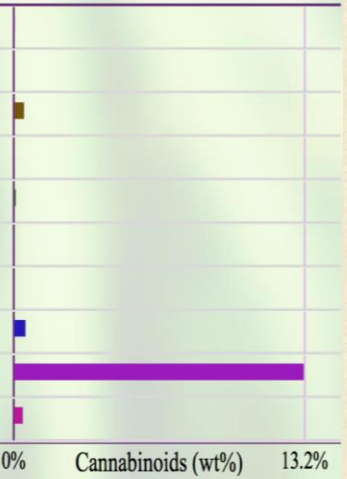
The data contained within this report was collected in accordance with the requirements of ISO/IEC17025:2005. I attest that the information contained within the report has been reviewed for accuracy and checked against the quality control requirements for each method. These results relate only to the 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
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)

PJLA Testing
Accreditation
80585

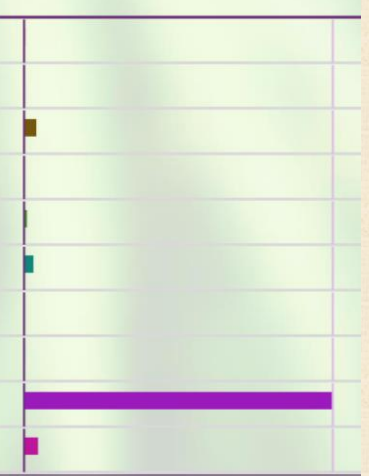
The data contained within this report was collected in accordance with the requirements of ISO/IEC17025:2005. I attest that the information contained within the report has been reviewed for accuracy and checked against the quality control requirements for each method. These results relate only to the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

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

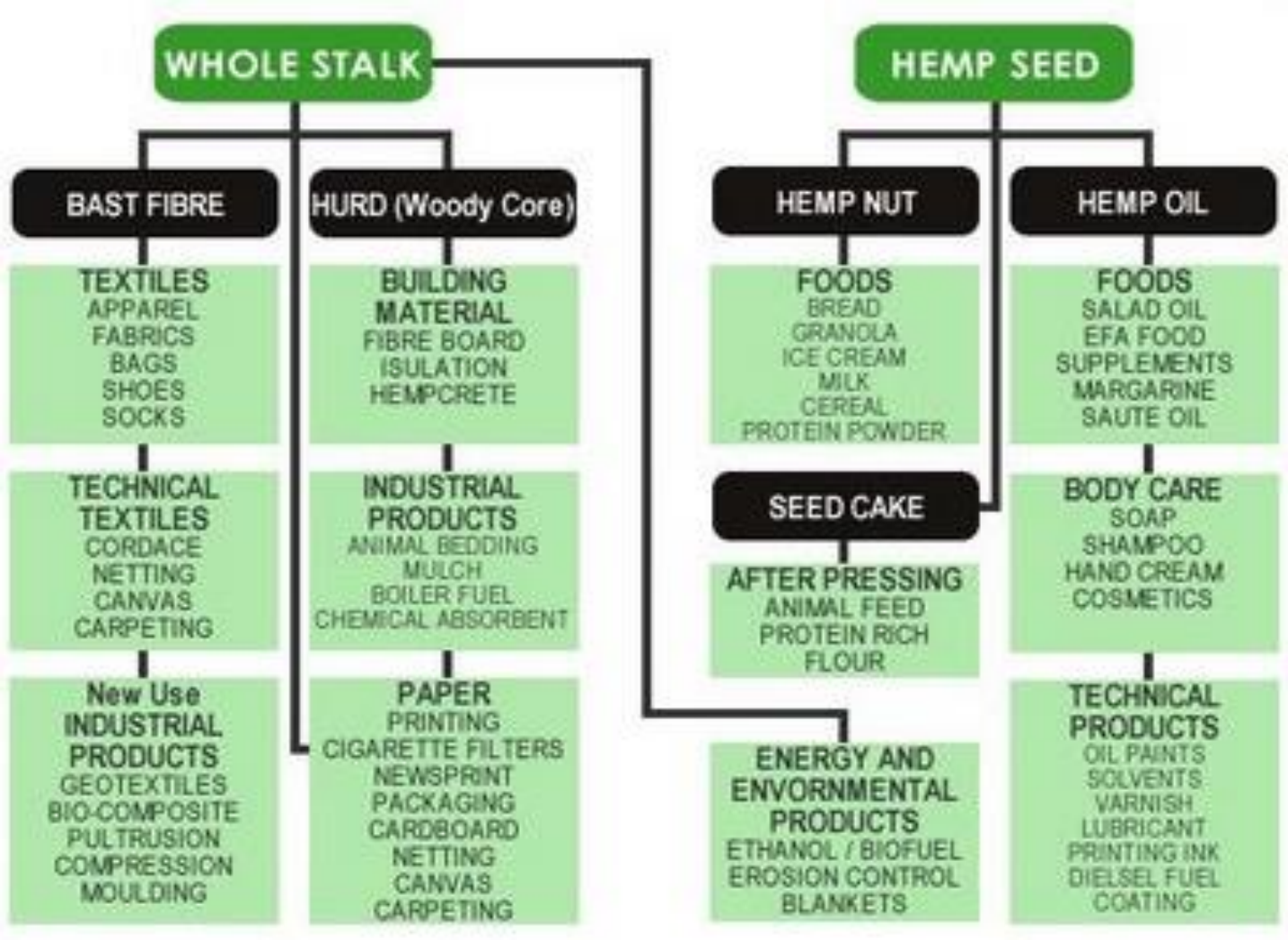
42870-CN

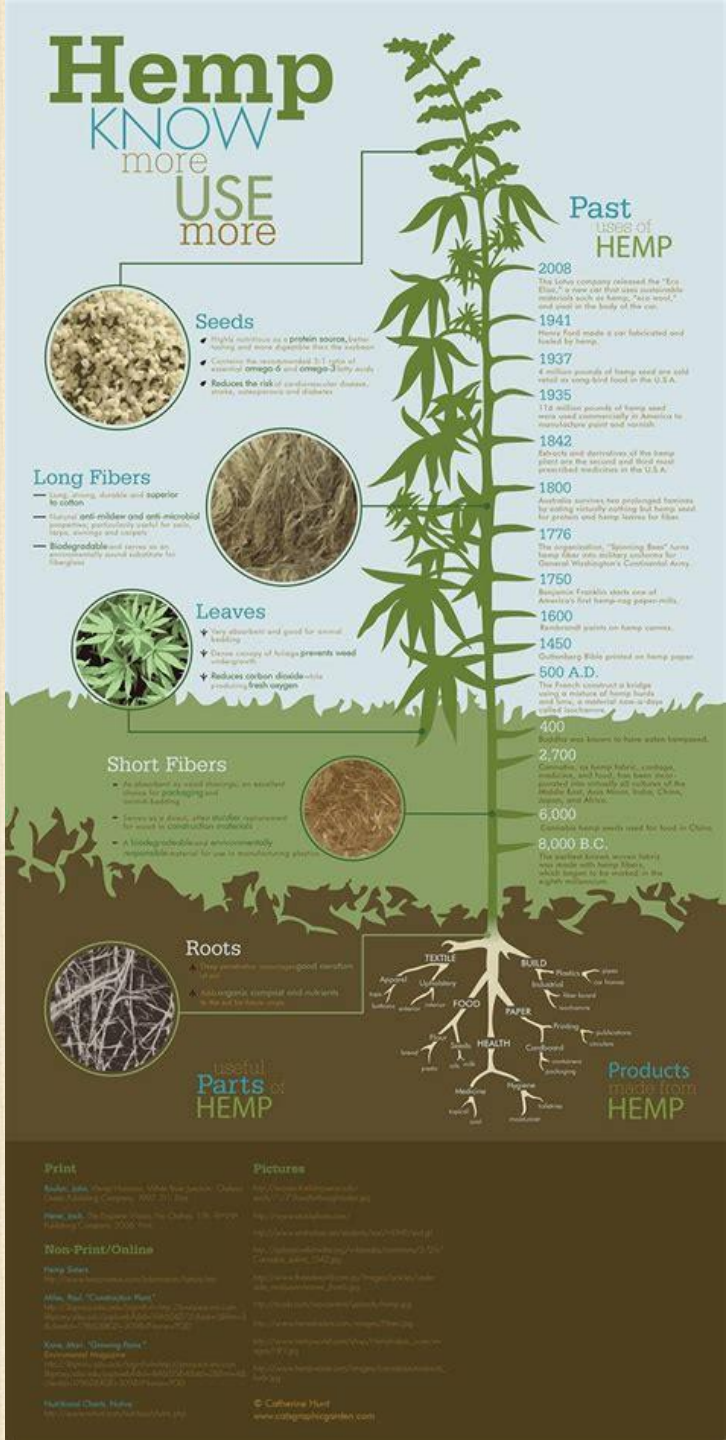
ID	Weight %	Conc.
D9-THC	0.06 wt %	0.57 mg/g
THCV	ND	ND
CBD	0.58 wt %	5.82 mg/g
CBDV	ND	ND
CBG	0.13 wt %	1.32 mg/g
CBC	0.44 wt %	4.44 mg/g
CBN	ND	ND
THCA	0.05 wt %	0.49 mg/g
CBDA	14.74 wt %	147.38 mg/g
CBGA	0.66 wt %	6.65 mg/g
Total	16.66 wt%	166.65 mg/g
Max THC	0.10 wt%	1.00 mg/g
Max CBD	13.51 wt%	135.07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





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 ¾”.
- 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!