

# RUTGERS

New Jersey Agricultural  
Experiment Station

## What the Hemp is Going on in New Jersey

Bill Bamka & Steve Komar

Industrial Hemp Agronomy Team

Rutgers NJAES

Cooperative Extension

# Is Hemp a miracle crop?

- NO
- NOT immune to the basics of crop management !!
- Sales up
  - estimates the global market will reach \$5.7 billion USD across all markets, representing a three-year compound annual growth rate (CAGR) of 17.5%. (New Frontier Data – Feb. 2019)
  - Farmer's see \$\$ ..... reality??

## Hemp fiber manufacturer Sunstrand files for bankruptcy

Published 13 hours ago



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Kentucky hemp fiber manufacturer Sunstrand has [filed for bankruptcy](#) protection in federal court.

The privately held company filed for Chapter 7 bankruptcy, a type of bankruptcy sometimes called straight or liquidation bankruptcy.

**Hemp**  
INDUSTRY DAILY  
CONFERENCE

JUNE 3-4, 2020  
New Orleans, LA

NOW ACCEPTING  
**Speaker Applications**

Based in Louisville, Sunstrand said it has between \$100,001 and \$500,000 in assets but owes more than \$10 million.

Its listed creditors include Hemp Traders, a California hemp-fiber importer and wholesaler, and Nature's Root, a Colorado company that makes CBD-infused skin-care products.

Sunstrand's filing comes as fiber manufacturers struggle to



# The Paducah Sun

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EDITOR'S PICK

## Involuntary bankruptcy filed against hemp company GenCanna

By ERIC WALKER Mayfield Messenger Jan 29, 2020 0

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MAYFIELD -- GenCanna has been put in a position of possibly facing bankruptcy court in order for creditors to recoup payments related to an uncompleted hemp processing plant north of Mayfield.



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# It's Everywhere



# What is the difference between I-hemp and marijuana

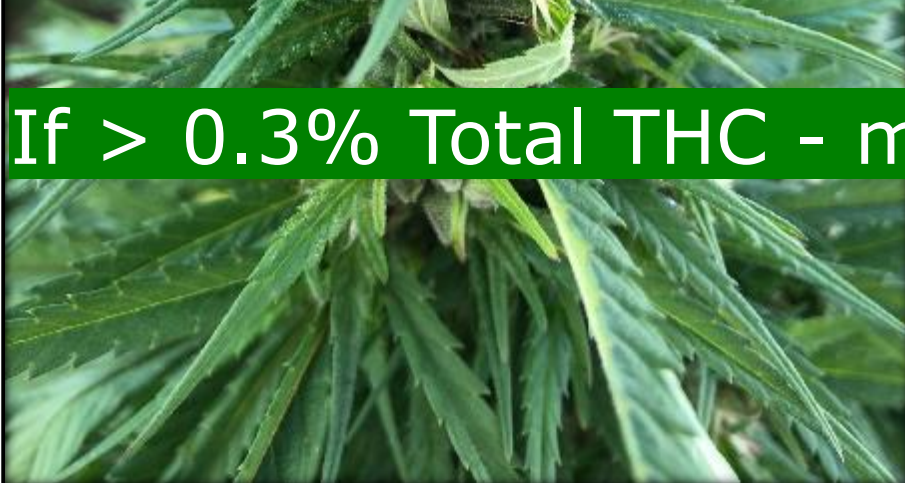
- It's basically the same thing, right?
  - Well, yes and No
- What is the difference between feed corn and sweet corn?
  - They are both corn, right?
- Corn has been bred for different purposes, just like hemp has.





Both hemp and marijuana are *Cannabis sativa* L.

If  $> 0.3\%$  Total THC - marijuana





**Hemp**

**Marijuana**

Hemp contains a very low concentration of THC (0.3% or less)

Marijuana is abundant in THC with concentrations between 15% to 30%



# Three End Markets for I-Hemp

- Seed/Grain for food products
- Fiber
- Flower Extracts “CBD”

End market determines which type of industrial hemp you grow and how you grow it.

Limited to no market today



Limited market today

# Floral CBD

- Trichomes  
CBD / THC
- Others
- Terpinenes





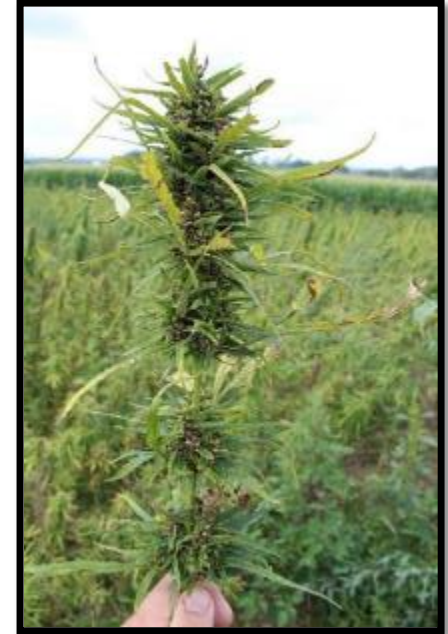
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# Hemp Terminology

- Low THC types= **Industrial Hemp**
- High THC types= **Marijuana**
- Hemp cultivated for pharmaceuticals=  
**Medical Marijuana**
- THC=D9-tetrahydrocannabinol
- CBDs= a group of up to 104 cannabinoids other than THC in the hemp plant



## Constituents of *Cannabis sativa*

No.	Groups	Number of Known Compounds
1	CBG type	17
2	CBC type	8
3	CBD type	8
4	$\Delta^9$ -THC type	18
5	$\Delta^8$ -THC type	2
6	CBL type	3
7	CBE type	5
8	CBN type	10
9	CBND type	2
10	CBT type	9
11	Miscellaneous	22
12	Total cannabinoids	104
13	Total noncannabinoids	441 
	Total	545

- Seed
  - Pressed oil
  - Hemp Hearts
  - Hempseed meal





- Fiber
  - “Bast” or Bark
  - Inner core or “Hurd”



- Pharmaceutical/Supplement
  - CBDs (Low THC)
  - Medical marijuana (CBD+THC)
  - Recreational marijuana (High THC)



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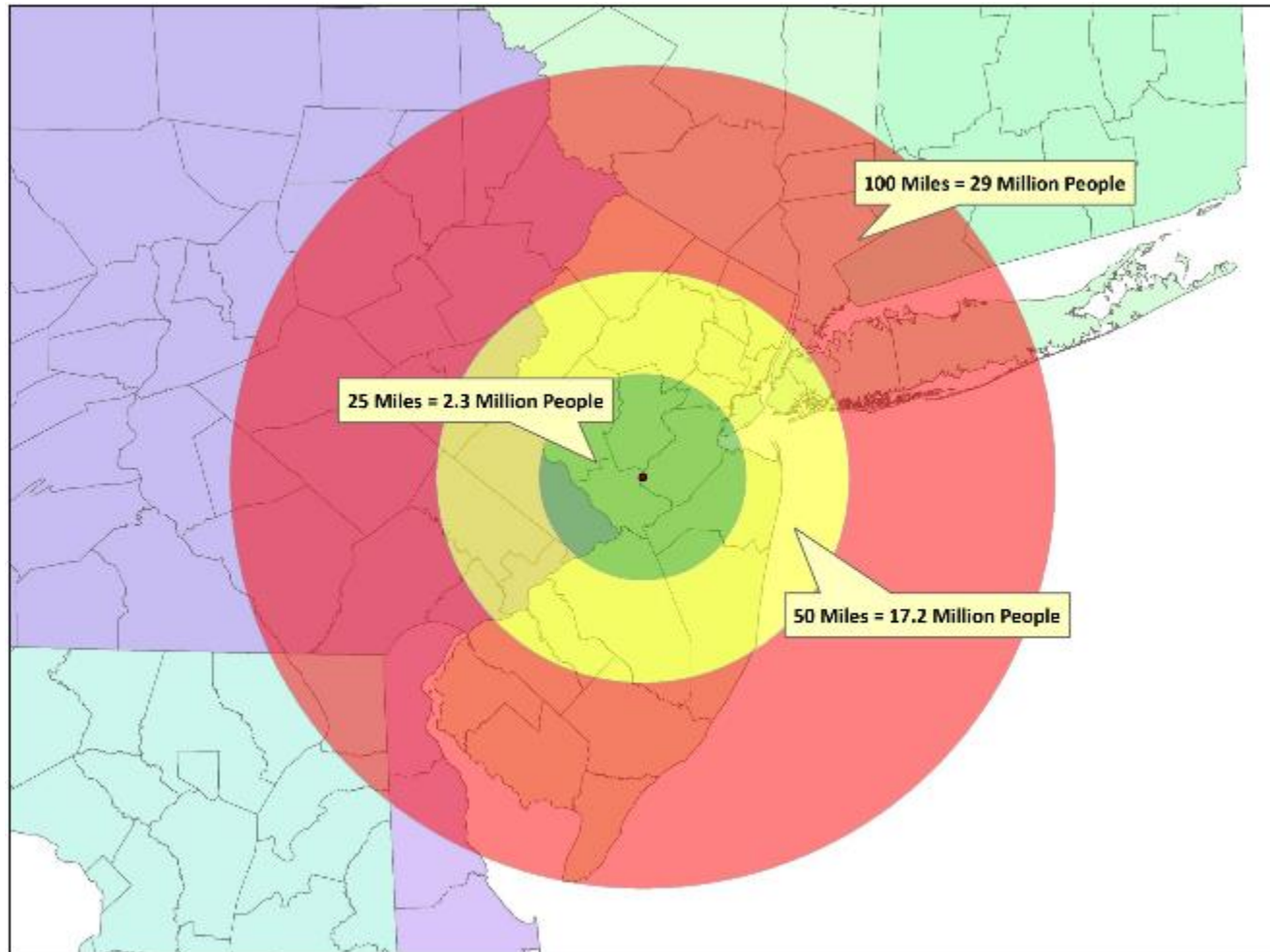
*This is Cannabis*



# Is CBD oil and hemp oil the same?

- Cannabidiol (CBD) is sometimes called “hemp oil”
- CBD oil should not be confused with hemp oil from the seed
- CBD is made from the Flower extracts of the plant
- Seed oil is made from pressing the seed the same way as sunflower or canola oil

# Market Potential



# We are Not Alone







**2019 Preliminary  
estimated crop harvest:  
138,000**

State	2017 Acres	2018 Acres
Colorado	9,700	21,578
Hawaii	1	2
Illinois	0	1
Indiana	5	5
Kentucky	3,271	6,700
Maine	30	550
Massachusetts	N/A	21
Minnesota	1,205	710
Montana	542	22,000
Nebraska	1	0.5
Nevada	417	1,881
New York	2,000	2,240
North Carolina	965	3,184
North Dakota	3,020	2,778
Oklahoma	N/A	445
Oregon	3,469	7,808
Pennsylvania	36	580
South Carolina	N/A	256
Tennessee	200	3,338
Vermont	575	1,820
Virginia	87	135
Washington	175	142
West Virginia	14	155
Wisconsin	N/A	1,850
<b>Total</b>	<b>25,713</b>	<b>78,176*</b>

\*includes 10,090,188 square feet of greenhouse or indoor cultivation

## 2018 FARM BILL EFFECT

Under the 2018 Farm Bill, hemp has been removed from the Controlled Substances Act (CSA) and is now considered an agricultural product.



HEMP-DERIVED  
CBD IS LEGAL



HEMP FARMERS  
CAN APPLY FOR  
CROP INSURANCE



BANKS WILL BE  
WILLING TO WORK WITH  
HEMP COMPANIES



**\$1.3**  
BILLION  
BY 2022

HEMP-DERIVED  
CBD PRODUCT SALES



HEMP INDUSTRY  
GROWTH



# Removed hemp from Schedule 1

**The FDA affirmed its position in a statement released  
November 25, 2019:**

“Based on the lack of scientific information supporting the safety of CBD in food, the FDA ... cannot conclude that CBD is generally recognized as safe (GRAS) among qualified experts for its use in human or animal food.”

A close-up, top-down view of a dense field of cannabis plants. The leaves are bright green, serrated, and have a distinct palmate shape. The plants are growing closely together, filling the entire frame. The lighting is natural, highlighting the texture and veins of the leaves.

Questions?



# End use is key to Agronomic Management

- Summer annual that is very photoperiod sensitive
- Flowers according to day length/photoperiod
- Mostly dioecious – male and female flowers occur on separate plants
- Monoecious commercial varieties are available – male and female flower parts on the same plant
- Male plants and/or pollen might be wanted or completely unnecessary depending on components harvested
- Hemp varieties will be regionally specific and designated as Fiber, grain or dual use

Industrial hemp is composed of three types:

- Oilseed
- Fiber
- Hybrid (dual purpose)
  - which produces both fiber and seed, but not to the yield or quality of single purpose cultivars.





# ***Challenge #1***

Your CBD cannabis  
Exceeds 0.3% (+/-)

USDA says you are  
growing marijuana  
Schedule 1 drug

Must be destroyed



- Varieties
- Planting Date
- Planting Rate
- Row Spacing
- Fertility
- Pest Management Trials
- Harvest and Storage
- Rotational and Production Systems
- Residue Management










**Table 1.** General agronomic recommendations for the main harvestable components of industrial hemp

	<b>Fiber</b>	<b>Grain/Dual Purpose</b>	<b>Cannabinoids*</b>
Seeding rate (PLS)	40-60#/A	30-40#/A	30-40#/A
Row spacing	8 inches	8-16 inches	8-16 inches
Soil pH	6.2-6.5	6.2-6.5	6.2-6.5
Applied nitrogen	50 lb/A	100 lb/A	50-100 lb/A
Available phosphorus	60 lb/A	60 lb/A	60 lb/A
Available potassium	300 lb/A	300 lb/A	300 lb/A
Harvest timing	<=20% male flowering	~70% grain maturity	~75% trichome maturity

			
Type of Hemp	Grain	Floral Material	Fiber
Purpose	For human food (hemp hearts, oil, and protein powder), or seeds for planting hemp.	For extraction of plant resin (which includes CBD and other cannabinoids) for health and wellness products.	For construction, textiles, from stalks, bast (bark-long outer fibers), hurd (core-inner woody material).
2017 Avg. Yield*	518 pounds per acre	1,024 pounds per acre	2,556 pounds per acre
2017 Avg. Price*	\$1.70 per pound**	\$7.20 per pound	\$0.34 per pound
Grower Fees	\$100 – Application Fee \$400 – Grower Participation Fee PER Address \$750 – Site Modification Surcharge PER field or greenhouse	Same As Previous	Same As Previous
Processor Fees***	\$500.00	\$3,000.00	\$500.00

\* Based on 2017 Grower Production Reports.

\*\* Includes both grain for food and certified seeds for planting. Average price for grain only is about \$0.80.

\*\*\* There is a \$500 fee for handlers of raw materials. Handlers must be licensed by KDA.

# Soil Fertility





- Seed and grain varieties are sold much like any other commodity
- You may be able to contract with a company to grow industrial hemp
  - Company could specify variety and production methods
- Market is developing



# Hemp for Grain.....

- Different varieties than those bred for fiber
- Shorter, easier to harvest with conventional equipment
- Variety selection is very important relative to latitude and climate
- Planting date will define the size of the plant when reproductive growth begins, in addition to variety selection
- More fertilizer; similar to corn
- Harvest at maturity, like all grain crops

- Plant mid May early June (50 F Soil Temp)
- Drill, 1/2 to 3/4 in deep
- 30 lbs/acre (\$2.50/lb)
- Deep well drained soils best
- 150-30-20 fertility
- Manage to reduce weeds w/o herbicides

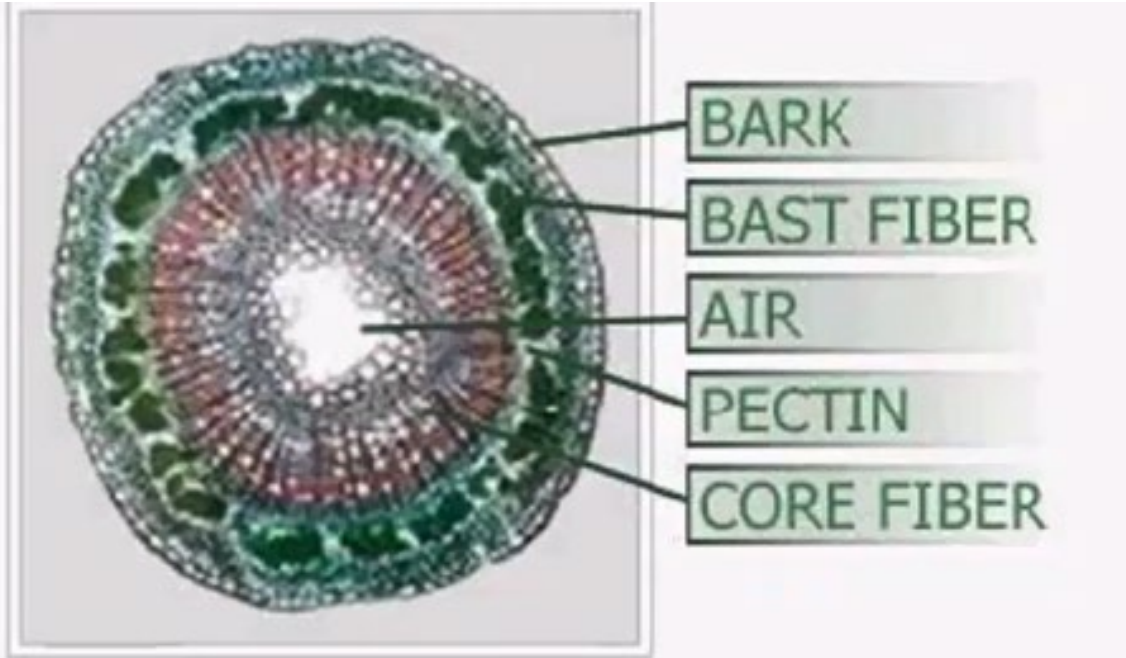


# Production for Hemp seed

- Ready to harvest early September
- Don't wait for complete desiccation
- Most seeds should be ripe, shattering starting
- Grain will likely need to be dried
- Monitor fiber wrapping on combine
- Some combines do better than others
- Yields 1000-2000 lb/acre
- Historical price 0.50 to 0.70/lb



- Goal is strong vegetative growth
- Variety selection is important relative to latitude and climate
- Less fertilizer
- Harvest at the start of reproductive growth
- Retting is key to success



## **Retting**

Retting is a process involving the use of moisture and microbes to break down the chemical bonds (pectin) holding the hemp stem together, enabling easier separation of the bast from the woody core (the hurd or shiv).





# Hemp for Fiber

- Plant mid May early June (50 F soil T)
- Drill, ½ in deep
- 55-65 lbs/acre (\$2.50/lb)
- Deep well drained soils best
- 150-20-20 fertility
- Weed control easier with tall fiber varieties



# Hemp for Fiber

- Harvest between early bloom and seed set
- Windrowed and raked one to two times
- Retted in field to break down bonds between bast and hurds
- Length 14-21 days.. depends on several factors- precip., desired color etc.
- Baled in round or large bales (<15% moisture)
- Yields 4 to 5 tons/acre possible







- CBD are present throughout the plant but most concentrated in tissue of female flowers
- CBD not in significant concentrations in hemp seed, seed oil or pollen
- Reports of higher CBD in unpollinated female flowers
- Questions about field scale harvesting of entire plant for CBD

# Hemp Production for CBDs



# Hemp for CBDs

- Harvest by machine or hand
- Dry and process material
- Sell material to processor
- Yields vary 1000 lb/acre is good
- Price dependent on CBD content:
  - 10%-\$20-30/pound
  - 2%- \$6/pound
- Some farms process on site and develop their own hemp/CBD products
- Legal and quality risks exist for on farm production
- Cost of production???
  - ~\$4-6000/acre

## Maine: mostly high labor harvesting







Need drying  
and  
storage

- ~~Crop Insurance~~
- ~~No labeled pesticides~~
- Variety Selection is important
- Markets?
- Processing?
- Just beginning to understand THC Spikes
  - Ex. Roughly 10% of NC growers had to destroy crop











Darby et al., 2018  
Alburgh VT

Evaluated  
Planting date  
Spacing effects  
On yield / quality

# Plant Spacing Effect on Plant Growth

<b>Spacing</b>	<b>Weight</b>	<b>Height</b>
Foot x Foot	Lbs/plant	cm
1x1	0.6a	76
3x3	4.7b	81
5x5	9.1c	79
LSD 0.1	0.7	NS

**Table 5. The impact of variety on plot characteristics and harvest yield of industrial grain hemp, Alburgh, VT, 2018.**

Variety	Height @ harvest	Population	Moisture @ harvest	Test weight	Yield @ 10% moisture	Seed oil
	cm	plants m <sup>2</sup>	%	lbs bu <sup>-1</sup>	lbs ac <sup>-1</sup>	%
<b>Anka</b>	<b>162</b>	388,035	14.7	35.6	854*	21.9
<b>Canda</b>	117	488,172	12.8	36.6	983*	20.2
<b>CFX-1</b>	100	356,741	14.0	37.3	<b>1035</b>	22.4
<b>CFX-2</b>	93.3	275,379	13.1	38.7	941*	22.1
<b>CRS-1</b>	118	388,035	14.5	<b>42.0</b>	923*	22.8
<b>Ferimon</b>	146*	400,552	19.3	34.1	776	23.1
<b>Joey</b>	117	425,586	14.1	38.5	846*	22.4
<b>Katani</b>	86.0	331,707	13.6	37.2	836*	19.2
<b>USO-31</b>	128	337,966	16.1	34.8	756	21.7
<b>LSD (0.10)</b>	16.1	NS	NS	3.11	225	NS
<b>Trial mean</b>	119	376,908	14.7	37.2	883	21.8

\*Treatments marked with an asterisk performed statistically similar to the top performing treatment (p=0.10) shown in **bold**.  
NS – There was no statistical difference between treatments in a particular column (p=0.10).



**Table 5. The impact of variety on plant characteristics and harvest yield of industrial hemp fiber, Alburgh, VT, 2018.**

Variety	Height @ harvest	Stem diameter	Harvest population	Dry matter yield	Dry matter @ harvest	Bast fiber
	cm	mm	plants ac <sup>-1</sup>	lbs ac <sup>-1</sup>	%	%
Anka	135	4.95*	325,448	7,127	32.3*	37.4*
Canda	108	4.06	682,190	7,109	33.3*	34.7
Carmagnola	129*	4.34	638,379	8,155*	29.1	34.7
Carmagnola selezionata	117	4.56*	744,776	<b>10,286</b>	29.4	35.0
CFX-1	86.8	3.43	657,155	5,225	33.6*	23.1
CFX-2	70.1	2.73	844,914*	4,829	33.6*	19.6
CRS-1	107	4.27	738,517	5,851	<b>33.8</b>	30.1
Eletta campana	128*	<b>5.34</b>	719,741	9,665*	27.4	33.5
Ferimon	118	4.58*	444,362	5,275	32.9*	<b>38.8</b>
Fibranova	135*	4.58*	757,293	8,147*	28.4	34.6
Joey	105	4.03	<b>976,345</b>	6,489	32.8*	28.6
USO-31	110	4.92*	381,776	5,094	31.8*	37.0*
LSD (0.10)	15.1	0.893	185,475	2597	2.47	3.55
Trial mean	112	4.31	659,241	6,938	31.5	32.3

\*Treatments marked with an asterisk did not perform statistically worse than the top performing treatment shown in **bold** (p=0.10).

[https://www.uvm.edu/sites/default/files/media/2018\\_Fiber\\_hemp\\_variety\\_trial.pdf](https://www.uvm.edu/sites/default/files/media/2018_Fiber_hemp_variety_trial.pdf)

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# Rutgers Hemp Program

On December 27, 2019, New Jersey was among the first three states to have its Industrial Hemp Program approved by the USDA. Rutgers Cooperative Extension and the New Jersey Agricultural Experiment Station has established a Hemp Working Group consisting of faculty with topic area expertise.

## Rutgers Hemp Working Group

### HEMP CONTROLLED ENVIRONMENT PRODUCTION

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A close-up, top-down view of a dense field of cannabis plants. The leaves are bright green, serrated, and have a distinct palmate shape. The plants are growing closely together, creating a lush, textured appearance. The lighting is natural, highlighting the veins on the leaves.

Questions?