

Welcome!





Welcome

Opening Session

Opening Comments

Shannon Schlecht

- Executive Director, AURI

Tamara Nelsen

- Executive Director, AgriGrowth

Thom Peterson

- Commissioner, Minnesota Department of Agriculture

Master of Ceremonies

Dan Skogen

- Planning and Government Relations
Director, AURI



The State of Industrial Hemp

Presentation

Harold Stanislawski

- Project Development Director, AURI

Riley Gordon

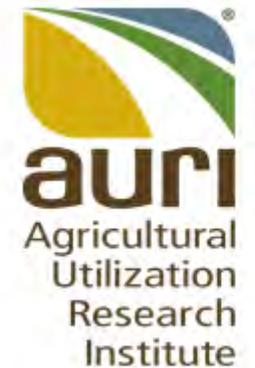
- Engineer, AURI



Building an Industrial Hemp Industry in Minnesota

AURI Initiative “Value Chain Analysis For Industrial Hemp in Minnesota”

*Harold Stanislawski, AURI Project Development Director, Deputy Biobased Systems
Riley Gordon, AURI Engineer*



Hemp Initiative

- ▶ Objectives:
- ▶ Focus on developing a hemp value-chain for Minnesota and the Midwest.
 1. Work closely with producers and processors identifying industry needs.
 2. Analysis of CBD oil, hemp seed meal, hemp flower and hemp fiber for quality control and identification of new uses (fuel, feed, fiber).
 3. Identification of hemp based markets.
 4. Identify state-of-the industry for processing and coproduct approval for feed.
 5. Release public report with findings of opportunities and hurdles for the hemp industry in MN.





AURI Focus Areas

Food

Grain: oils, powders, hemp hearts

Biobased Products

Stalks: various fiber
and hurd applications

Coproducts

Several byproducts resulting from
processing hemp

Renewable Energy

Hemp Biofuels

Milestones of Minnesota Journey in Hemp

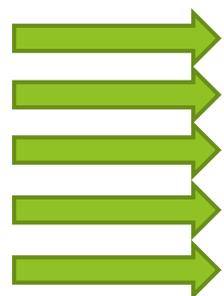
2014 - Farm Bill (section 7606) allows research pilot industrial hemp by state approval

2015 MN Industrial Development Act became law

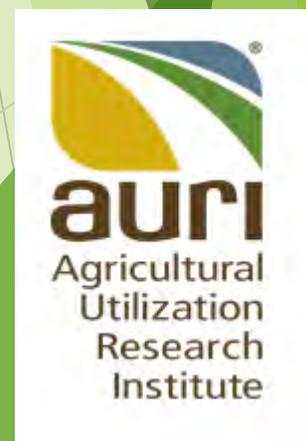
2016 grows first industrial hemp crop

2018 Farm Bill passes allowing industrial hemp production nationwide

2019 - MN hemp infrastructure continues to emerge at rapid rate



CBD oil extraction processing/Value Chain
Food grade industrial hemp oil and protein plant
Fiber Shed development research and studies
Feed characterization (future animal feed approval pending)
Seed production and processing interest





2019 U.S. Hemp License Report



46
States legalized
hemp farming



2019 U.S. Hemp License Report



511,442

Acres of hemp licensed nationally



34

States licensed hemp cultivation



16,877

State growers licenses issued

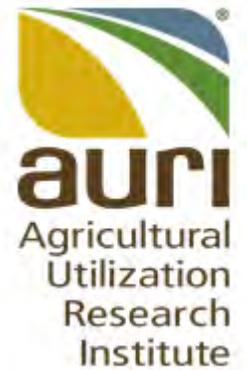
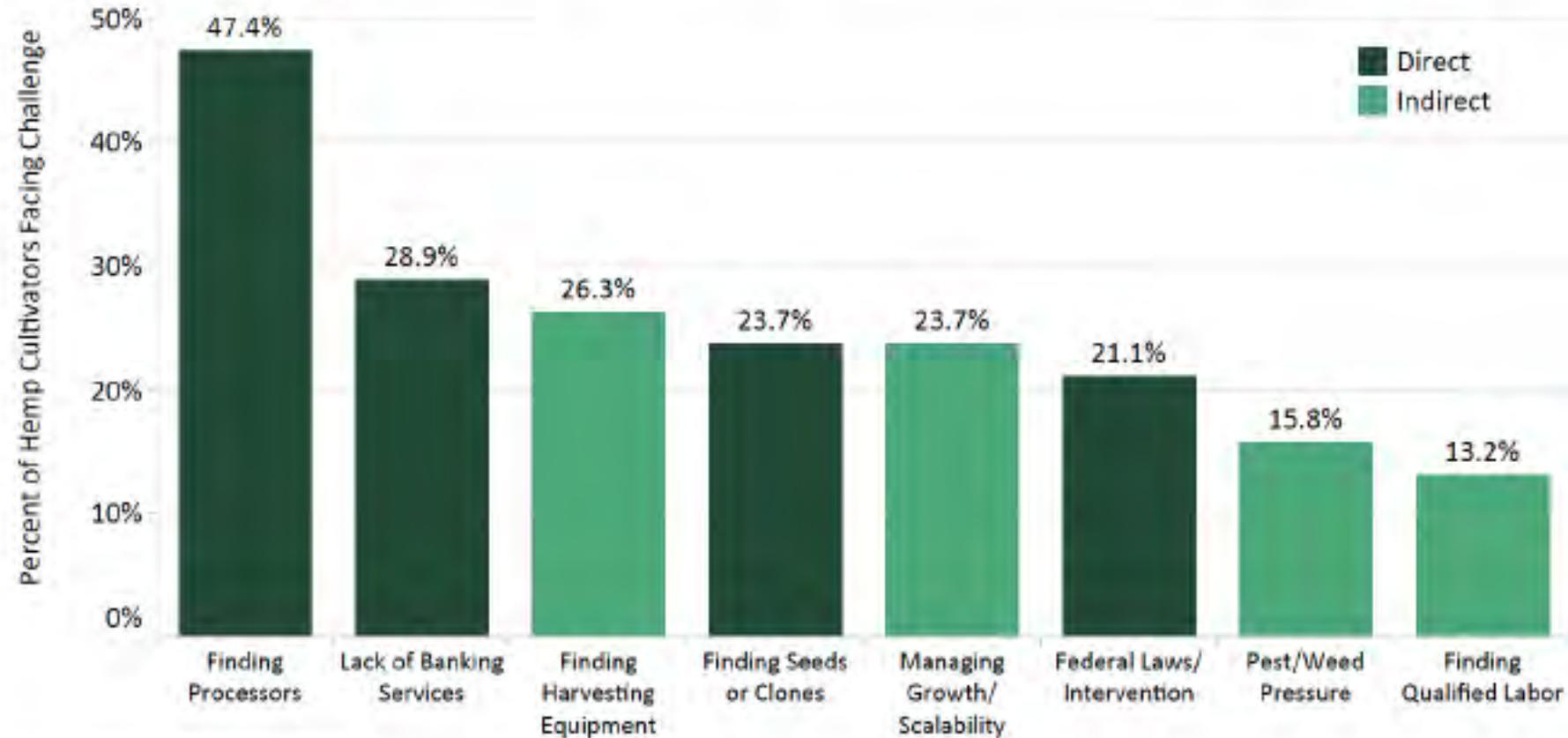


Chart 3: Direct and Indirect Impacts of 2018 Farm Bill on Hemp Cultivators' Top Challenges

Direct & Indirect Impacts of 2018 Farm Bill on Hemp Cultivators' Top Challenges



Source: Hemp Industry Factbook

HEMP HURDS AS PAPER-MAKING MATERIAL

By

LYSTER H. DEWEY, Botanist in Charge of Fiber-Plant Investigations, and JASON L. MERRILL, Paper-Plant Chemist
Paper-Plant Investigations

This bulletin is printed on paper manufactured from hemp hurds, run No. 143, which is recorded on page 20

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3	Proportion of Hurds to Fiber and Yield per Acre	
3	Hurds Available from Machine-Broken Hemp	
4	Present Uses of Hemp Hurds	
5	Present Supplies of Hurds Available	
5	Baling for Shipment	
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WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

FIBER PRODUCTION IN THE WESTERN HEMISPHERE

By

LYSTER H. DEWEY



UNITED STATES DEPARTMENT OF AGRICULTURE
MISCELLANEOUS PUBLICATION No. 518
1943

9C
57

U. S. DEPT. OF AGRICULTURE
RECEIVED
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DIVISION

Issued May 23, 1910.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY—Circular No. 57.
B. T. GALLOWAY, Chief of Bureau.

THE CULTIVATION OF HEMP IN THE UNITED STATES.

BY
LYSTER H. DEWEY,
BOTANIST IN CHARGE OF FIBER INVESTIGATIONS.

HEMP & THE MARIJUANA CONSPIRACY:

COMPLETELY REVISED, UPDATED AND MORE FULLY DOCUMENTED 1990 EDITION \$12.95

THE EMPEROR WEARS NO CLOTHES

The Authoritative Historical Record of the Cannabis Plant, Hemp Prohibition, and How Marijuana Can Still Save the World.

By **Jack Herer**

Designed & Edited by **Chris Conrad**

NO PRESCRIPTION NEEDED
NO RESTRICTIONS
NO LIMITS



HEMP AS A FOOD PRODUCT

Hemp-derived ingredients such as seeds, hearts (the shelled seeds of the industrial hemp plant) and oils are appearing with more frequency in global food markets, including Europe and North America. In conjunction with the signing of the U.S. Farm Bill, former Food and Drug Administration (FDA) Commissioner Scott Gottlieb stated that these three ingredients have been classified as "Generally Recognized as Safe" (GRAS) for use in / as food products, thus additional approvals are not required if marketers do not make claims that they treat disease. A fourth hemp derived ingredient, cannabidiol (CBD), is gaining popularity as a wellness product and / or food ingredient, though the FDA has clearly communicated that CBD is not a legal food product as of mid-2019.

Opportunities

Hemp derived ingredients like seeds, hemp hearts, and oil are the most common forms of hemp found in food. The United States imports the majority of hemp products from Canada. As such, U.S. companies are beginning to work with hemp as a processed food ingredient given the public interest in hemp.

Because of hemp's relatively high protein content (~25%), it is a viable alternative to other high protein, emerging plant-based sources. Hemp protein concentrates and isolates are available and can be used to fortify products such as bars or cereal. Hemp based protein beverages are another possibility, though the solubility of the protein may limit the amount that can be incorporated.

Dietary fiber supplementation in snack products is another opportunity for hemp. Hemp seed contains both soluble and insoluble fiber making it a good option for fiber fortification.

Finally, hemp oil presents another opportunity to take advantage of the nutritional benefits of the plant. The fatty acid profile of Hemp oil is 80 percent polyunsaturated, including the

Hurdles

Hurdles to the use of hemp based ingredients include functionality shortfalls, market competition from a multitude of other plant protein options, lack of food grade processing capabilities, and lack of local sourcing for the raw ingredients. Regarding functionality, limited research has resulted in unfavorable comparisons to other, more established plant-based proteins such as soy. However, additional research into processing methods combined with breeding and genetic efforts, such as those at the University of Minnesota Plant Protein Innovation Center, should improve our understanding of hemp's perceived shortcomings and result in higher usage in food products.

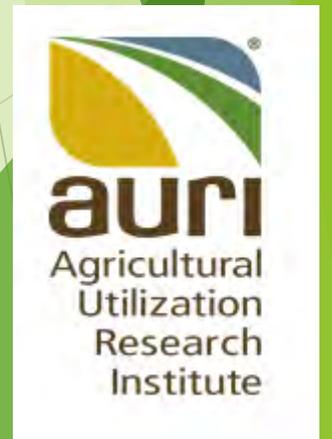
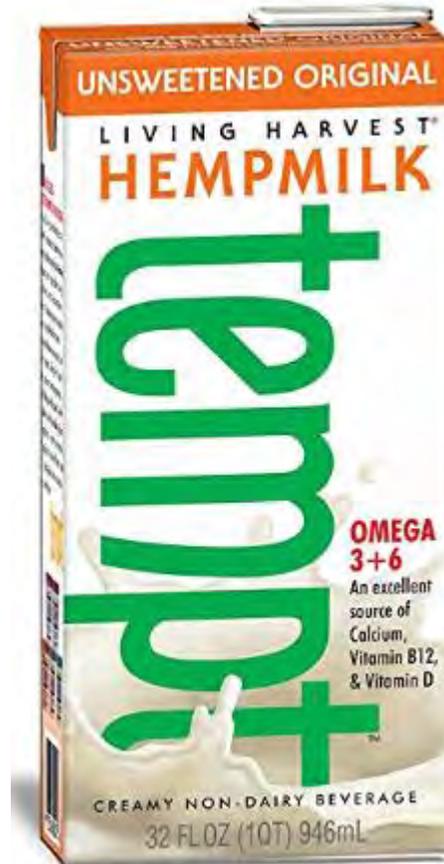
With the introduction of the Minnesota Department of Agriculture's Hemp Pilot Program starting in 2016, Minnesota has seen a steady increase in the total acreage of industrial hemp. While the total acreage has increased over the past three years, the processing capabilities required to transform



III. Hemp as an Ingredient. Industrial Hemp is typically used in these forms as an ingredient in retail food products

			
Hulled Hemp Seed / Hemp Hearts	Toasted Whole Hemp Seed	Hemp Protein Powder	Hemp Oil
Serving Size: 30 g Fat: 13 g 2.5 g omega-3, 8 g omega-6 Fiber: 3 g Protein: 10 g	Serving Size: 30 g Fat: 10 g 2 g omega-3, 6 g omega-6 Fiber: 8.5 g Protein: 8.5 g	Available in fractions of 20, 23, 33, 43 and 50 % protein Non-allergenic	Serving Size: 1 T (15 mL) 5 g of omega-3 and omega-6 0 g trans fat 0 mg cholesterol
MN Hemp Farms (www.mnhempfarms.com); Hastings, MN			
Hemp Production Services (www.hempproductionservices.com); Saskatoon, Saskatchewan, Canada			
Hemp Oil Canada (www.hempoilcan.com); Ste. Agathe, Manitoba, Canada			

HEALTH BENEFIT OF HEMP



Hemp Food Landscape

I. Hemp Market Overview

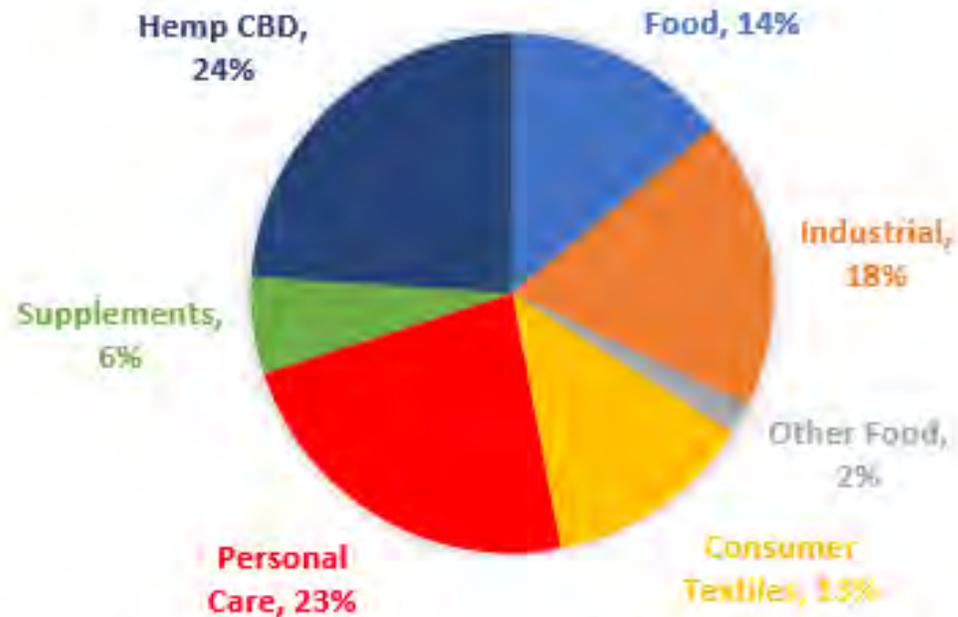


Figure 1. US Hemp-based Product Sales in 2017 (\$795 mil)

Source: Hemp Business Journal

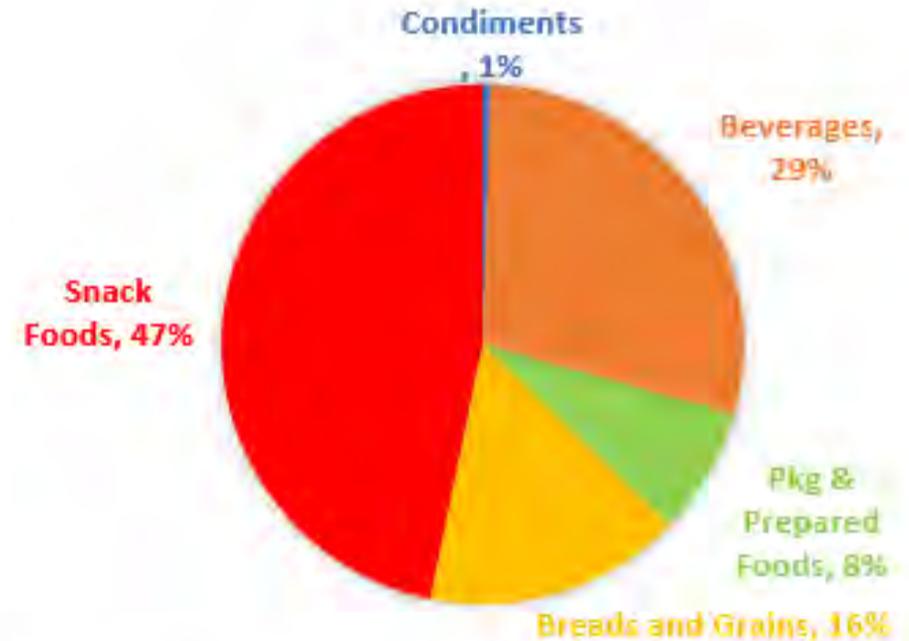


Figure 2. US Hemp-based Food Sales in 2017 (\$112 mil)

Source: Hemp Business Journal

Current Grain Economics

Yields around 1000lb/acre

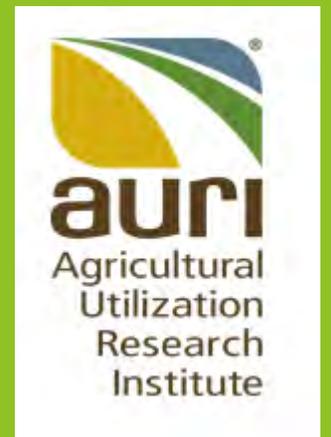
Can grow large acreage and retrofit existing farming equipment for planting/harvesting

Conventional - \$0.40/lb

Organic - \$1.00/lb

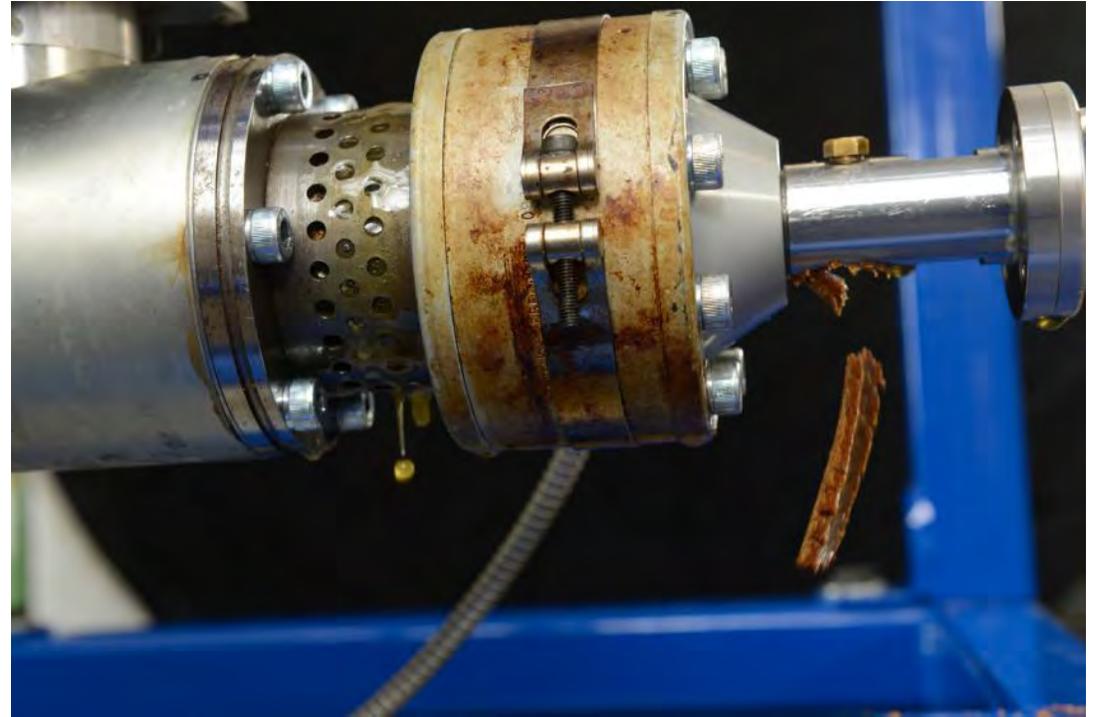
Drying and Cleaning are two biggest concerns

Dry to 9%; clean to 99.95% purity



Food Raw Products/Processing

- ▶ Cleaning equipment: Indent Graders, Air Screeners, Gravity Tables, Color Sorter
- ▶ Cold Pressed Oils - Cleaned hemp seeds
- ▶ Protein powders - Press meal
- ▶ Hemp hearts - dehulling hemp seeds
- ▶ Hemp Milk - using hemp hearts
- ▶ Hemp Beer - Hemp flower and/or seeds



AT A GLANCE



Hemp Feed Value and Supply Chain

Forecasted Projections for Minnesota

OPPORTUNITY FOR HEMP IN FEED AND PET FOOD

The livestock and poultry industries continue to be a growing market domestically and internationally. With this growth comes the opportunity and challenge to provide highly nutritious and energy dense feedstuffs to these animals. Protein and energy are the main requirements for these diets. Identifying new feedstuffs that can supply these required nutrients at an economical cost continue to provide an on-going opportunity. Hemp coproducts such as hemp cake, hemp hulls, and the high protein hemp flower and stem can provide an excellent source of protein and energy to help support the growing livestock industry.

Product	TDN	Crude Protein
Hemp Cake	81%	33%
Hemp Flower	68%	25%
Hemp Seed Hulls	52%	14%
Corn	90%	10%
SBM	84%	44%
Alfalfa Hay	58%	17%

Table 1. Energy and crude protein comparison to main livestock feedstuffs.

Hemp coproducts Total Digestibly Nutrients (TDN) and crude protein were compared to Corn, Soybean Meal (SBM), and Alfalfa Hay to determine a market price for the hemp products at various market inflections.

** All values represented on a dry matter basis. AURI sent Dairyland samples of locally sourced hemp cake and flower for TDN and Crude protein. Hemp hull values taken from Evolve Hemp Hulls product. (<https://elitethree.com/products/e5-evolve-hemp-hulls>)

The table below provides an estimated market value for the various hemp coproducts samples at two different corn, soybean meal and alfalfa hay prices. These two sets of values provide a wide window to show potential value based on variability of commodity prices. Potential feed value may vary based on the livestock species it would be intended for.

When evaluating the feed value of each feedstuff, samples were compared to #2 shell corn, which is the primary source of energy; 44% protein soybean meal, which is the main source of protein in most North American livestock diets; and lastly 17% alfalfa hay a key protein and energy source for ruminant livestock. Estimated values do not consider variability and nutrient requirements for individual ration or rations balanced for amino acid levels. Least cost livestock ration formulation software may apply slightly different feed values based on protein and energy sources available within specific livestock rations.

Product	Corn - \$3.50 / bushel 44% SBM - \$300 / ton 17% Alfalfa Hay - \$140/ton	Corn - \$4.50 / bushel 44% SBM - \$400 / ton 17% Alfalfa Hay - \$170/ton
Hemp Cake	\$222.40/ton	\$294.33/ton
Hemp Flower and Stem	\$153.80/ton	\$203.00/ton

* Table includes value for chemically extracted soybean meal. Cold pressed soybean meal is not produced commercially for livestock feed applications and not realistic to determine feed value estimates.



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Hemp Seed Hulls	52%	14%
Corn	90%	10%
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Alfalfa Hay	58%	17%

Feed value at a glance

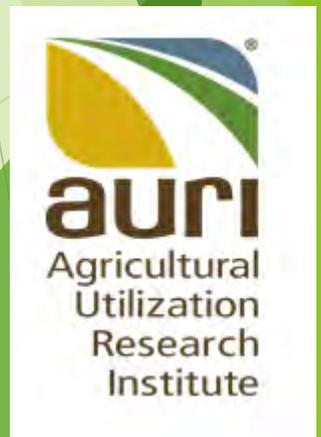
Table 2. Hemp coproducts feed value fluctuations as compared with common US feed commodities

Product	Corn - \$3.50 / bushel 44% SBM - \$300 / ton 17% Alfalfa Hay - \$140/ton	Corn - \$4.50 / bushel 44% SBM - \$400 / ton 17% Alfalfa Hay - \$170/ton
Hemp Cake	\$222.40/ton	\$294.33/ton
Hemp Flower and Stem	\$153.80/ton	\$203.00/ton
Hemp Seed Hulls	\$127.33/ton	\$168.85/ton

Ex. Assuming 1000lb/acre yield of grain, with 30% oil content and 90% extraction efficiency = 730lb of hempseed cake/acre (\$81/acre @ \$3.50/bu corn, etc..)



The Association of American Feed Control Officials (AAFCO) is a voluntary membership association of local, state and federal agencies charged by law to regulate the sale and distribution of animal feeds and animal drug remedies.



Recent Hemp Feed Studies



Effect of feeding hemp seed and hemp seed oil on laying hen performance and egg yolk fatty acid content: Evidence of their safety and efficacy for laying hen diets

N. Gakhar,* E. Goldberg,† M. Jing,* R. Gibson,‡ and J. D. House*†¹

**Department of Animal Science and †Department of Human Nutritional Sciences, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada; and ‡Department of Nutrition and Functional Food Science, University of Adelaide, 5064 Australia*



EFFECT OF FEEDING HEMP SEED MEAL TO LAYING HENS

F.G. Silversides^{1,2}, K.L. Budgell², and M.R. Lefrançois³
Agriculture and Agri-Food Canada¹, Nova Scotia Agricultural College², and Université Laval³



Hempseed cake as a protein feed for growing cattle

Hampfrökaka som proteinfodermedel till växande ungnöt



Industrial Hemp for Silage Trial

Site Information:

Location: Dauphin, Manitoba
Cooperator: Robert Baker

Seeded: May 28, 2001
Harvested: Throughout Season



JOURNAL OF
**AGRICULTURAL AND
FOOD CHEMISTRY**
ARTICLE

J. Agric. Food Chem. 2010, 58, 11801–11807 11801
DOI:10.1021/jf102636b

Evaluating the Quality of Protein from Hemp Seed (*Cannabis sativa L.*) Products Through the use of the Protein Digestibility-Corrected Amino Acid Score Method

JAMES D. HOUSE,^{*,†,‡} JASON NEUFELD,[‡] AND GERO LESON[§]

[†]Department of Human Nutritional Sciences, and [‡]Department of Animal Science, University of
Manitoba, Winnipeg, MB, R3T 2N2, Canada, and [§]Leson & Associates, 440 Michigan Avenue, Berkeley,
California 94707, United States



The nutritive value of hemp meal for ruminants

A. F. Mustafa, J. J. McKinnon, and D. A. Christensen

*Department of Animal and Poultry Science, University of Saskatchewan
72 Campus Drive, Saskatoon, Canada S7N 5B5. Received 24 March 1998, accepted 23 December 1998.*



COLORADO
Department of Public
Health & Environment

Colorado Department of Agriculture Reveals its Hemp in Animal Feed Study



WE ARE CURRENTLY WORKING ON THE FIRST SUBMISSION OF A HEMP INGREDIENT DEFINITION APPLICATION TO THE ASSOCIATION OF AMERICAN FEED CONTROL OFFICIALS FOR 2019!

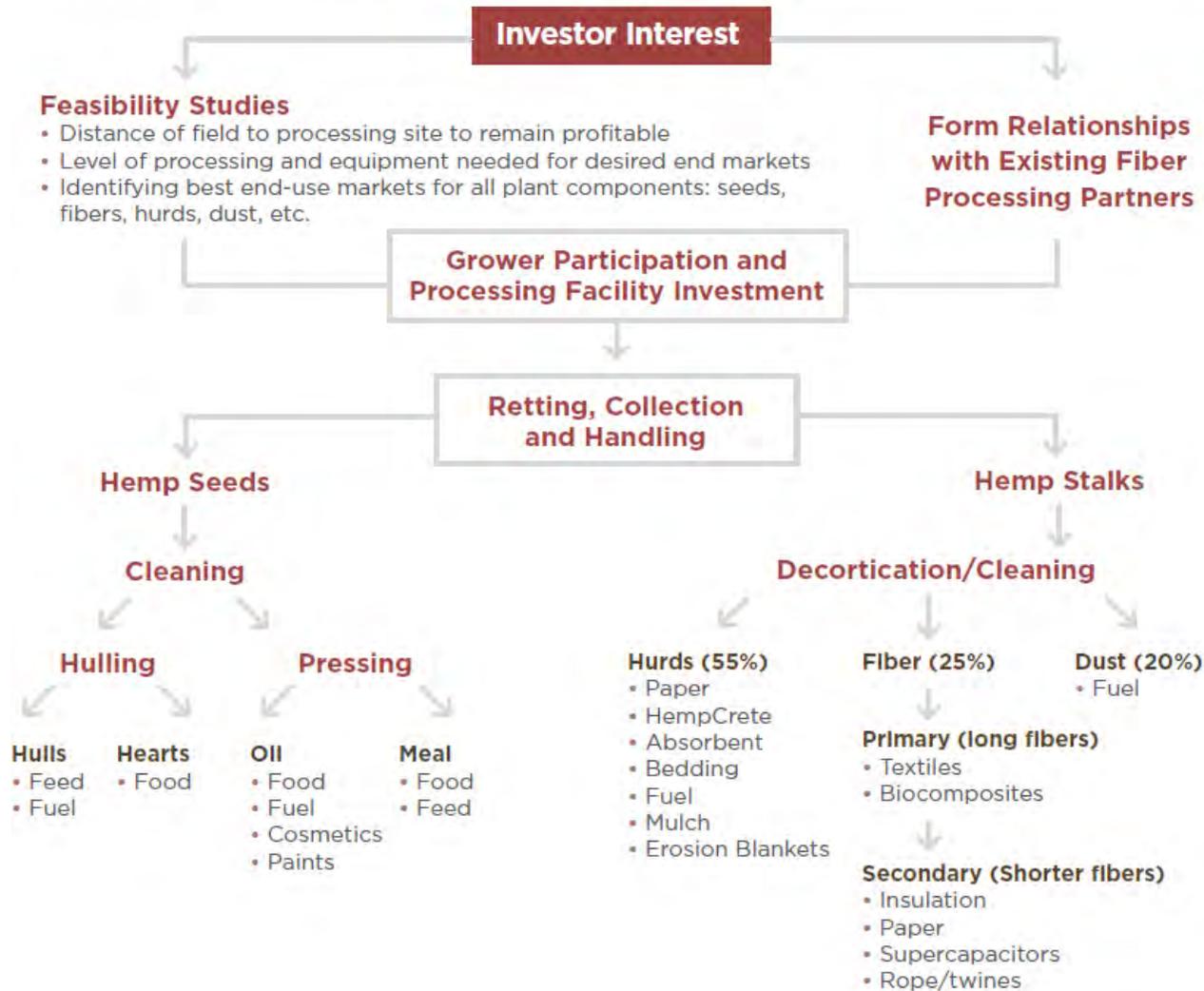


NCSU Researchers Wrap-Up Initial Hemp in Animal Feed Trial



goo.gl/nPLqSe

Hemp Fiber



Fibonacci cuts ribbon on \$5.8M HempWood manufacturing plant in Calloway County



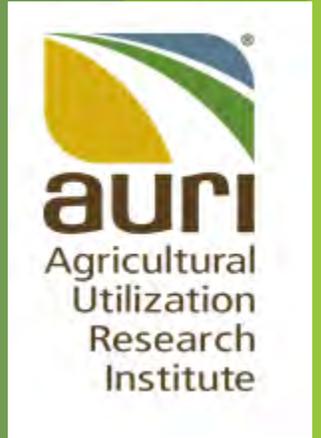
Hemp hardwoods, bioplastics expand crop use beyond CBD

By **United Press International** - October 3, 2019



Wood Is Green

HempWood is the most eco-friendly lumber product on the planet.



Oak is out, hemp is in - Hemp Wood factory opens in Kentucky



Sunstrand - Kentucky



Natural Coreboard Applications

- Cabinetry
- Wall partitions
- Lightweight moldings
- Decorative panels
- Furniture
- Doors
- Millwork
- Displays and more



Hemp Inc. Industrial Hemp Manufacturing - North Carolina



Bastcore Decorticator - Nebraska



D-8 Hemp Decorticator - New Zealand



Powerzone Ag Decorticator- Colorado



Low cost Chinese decorticator



America's first 'HempTrain' is coming to central Pa.: Here's what it is and why it matters





AURI Decorticator set for Waseca Lab

Hemp - Automobile Composites

High-end car manufacturers use hemp-based composites and plastics for interior door paneling, dashboards, body molding and interior textiles. Aircraft manufacturers are looking to the advantages of hemp materials.



Hemp Products Made in Fargo, ND!



c2renew inc

golf tee



hemp guitar picks



Textiles

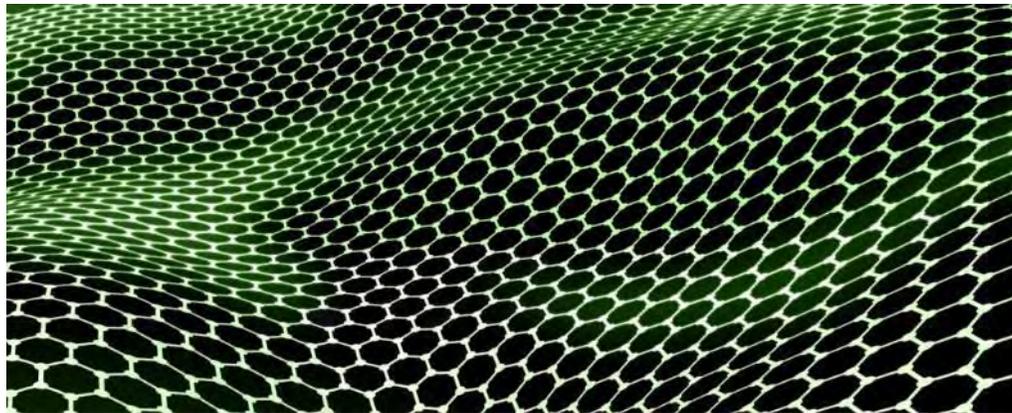


Hemp - Nanomaterials

Industrial hemp derived graphene

exhibit excellent electrochemical performance at a significantly lower cost than industry standard materials.

Data show supercapacitors offer an affordable next generation hemp-based material for rechargeable batteries.



Canadian research shows supercapacitors with electrodes made from hemp-based carbon nanosheets outperform standard supercapacitors by nearly 200%.

“These characteristics favorably place the best power-energy characteristics ever reported for an electrochemical capacitor.”

-Prof. David Mitlin, U of Alberta



Just Bio Fiber - Hempcrete Blocks

- Reinforced Structural building block made from hemp hurd, lime, natural minerals and water
- Strong vertical load bearing strength
- Highly fire resistant - 2 hr rating
- High R-value
- Sequesters carbon throughout life cycle
- Contributes to LEED and/or WELL credits
- Naturally regulates internal temperature and humidity (very breathable) while retaining heat due to high thermal mass.
- Performed a variety of product tests to meet building codes



Declare.

Super Structural R-Value Modular Construction Block (SSR Block) Just BioFiber Structural Solutions

Final Assembly: Calgary, AB, Canada
Life Expectancy: 100 Years
End of Life Options: Take Back Program, Salvageable/ Reusable in its Entirety, Recyclable (100%)

Ingredients:

Hemp Hurd, Calcium Hydroxide, Calcium Carbonate, Calcium Magnesium Tetrahydroxide, Kaolin, Fibrous Glass, Styrene, Crystalline Silica

Living Building Challenge Criteria:

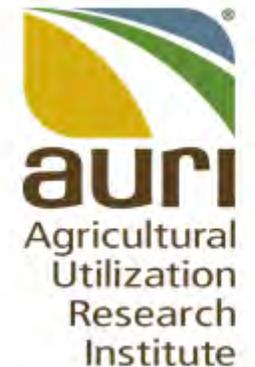
JBF-0001	EXP 01 APR 2018
VOC Content: N/A	VOC Emissions: N/A
Declaration Status	<input checked="" type="checkbox"/> LBC Red List Free
	<input type="checkbox"/> LBC Compliant
	<input type="checkbox"/> Declared

INTERNATIONAL LIVING FUTURE INSTITUTE®



MN Fiber Processing & Market Opportunities

- ▶ None currently exists
- ▶ Small scale and Mobile decorticating may be a good option in the near term to get smaller acreages processed and to do testing
- ▶ Central processing facility to accommodate MN acres will be the goal once feasibility of markets are identified
- ▶ Team up with other surrounding states (ND, WI?)
- ▶ Currently an opportunity to become a processor of state acreages
- ▶ Carriage before the horse (end markets vs processing)
- ▶ MN interests are conducting feasibility studies in the fiber space to identify viable markets.





AT A GLANCE



Cannabidiol

Forecasted Projections for Minnesota

OVERVIEW: CBD OIL

Cannabidiol (CBD) is a non-intoxicating chemical compound derived from the cannabis sativa plant. It is one of the 104 chemical compounds known as cannabinoids found in the cannabis or marijuana plant. The main psychoactive constituent of medical marijuana is the narcotic delta-9 tetrahydrocannabinol (THC), which has been shown to provide relief from nausea and improve appetite in patients. Industrial hemp has less than 0.3 percent THC, but contains many other bioactive components such as the non-psychoactive cannabinoids. CBD does not have a psychoactive effect; however, it has several potentially beneficial pharmacological properties that are currently being actively researched in several countries. Commonly reported benefits to using CBD include relief of seizures and epilepsy, anti-anxiety effects, pain relief or anti-inflammatory and digestive relief. Although CBD is technically legal as a result of the Farm Bill that passed December 2018, the legal marijuana economy is still fragmented as a result of the federal illegality. Currently, 33 states and Washington, D.C. have legal medical markets while 10 states (plus Washington D.C.) permit recreational use.

Hurdles

With the legalization of hemp after the passage of the farm bill at the end of 2018, the U.S. Food and Drug Administration (FDA) has been given the authority to regulate all products that contain cannabis or cannabis-derived compounds under the Federal Food, Drug, and Cosmetic Act. Currently, the FDA's stance on CBD in food products is that it is not legal, but the FDA is taking steps to legalize it. The FDA will continue the process to determine if CBD can be given generally recognized as safe (GRAS) status and be allowed to be used as a food ingredient.

While CBD may not be allowed as a food ingredient, the FDA has allowed companies to use CBD in dietary supplements if they do not make any therapeutic claims. The use in dietary supplements is allowed since the FDA does not consider them food, but substances that help to supplement one's dietary needs, such as vitamins or minerals. The biggest issue facing companies who put CBD into dietary supplements is the threat of false claims or misbranding. There are companies currently on the market who claim CBD can do things like improve Alzheimer's patients' conditions, cure addiction and reverse cancer cell growth. All of these are unsubstantiated and are against FDA regulations. With time, the FDA will be able to set precedent in shutting down these baseless claims and the market will hopefully stabilize. Another issue facing the CBD dietary supplement industry is misbranding. While CBD companies cannot make specific claims on their product, they can make claims such as contains "X" mg/mL or "X" mg/bottle. Some companies are finding out that the concentrates they receive to make their CBD products are not at the level claimed by their supplier and thus are adding much less to no CBD to their products. This leads to a misbranding claim and an eventual recall.

Technology/ Extraction Issues

Extraction choices include supercritical or cold carbon dioxide (CO₂), ethanol, butane, propane, or methanol are currently used for extraction of CBD. With many opinions on what is the superior, long term technology, it remains to be seen what the prevailing technology will be. Much due diligence is needed to select any one piece of equipment. AURI recommends obtaining testing and a performance guarantee from the manufacturer before making a purchase. As of publication, there currently are no certified standard testing method for cannabinoids in hemp products (ex. AOAC, AOCS, etc.) and only one certified lab in Minnesota is testing for cannabinoids in products. There are also a lack of standards and regulations on the production of products containing Cannabinoids.

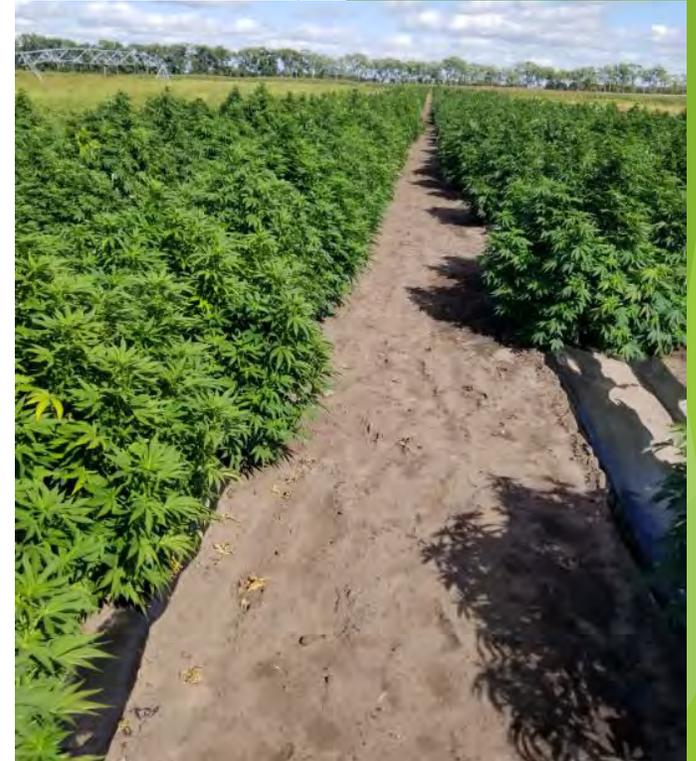
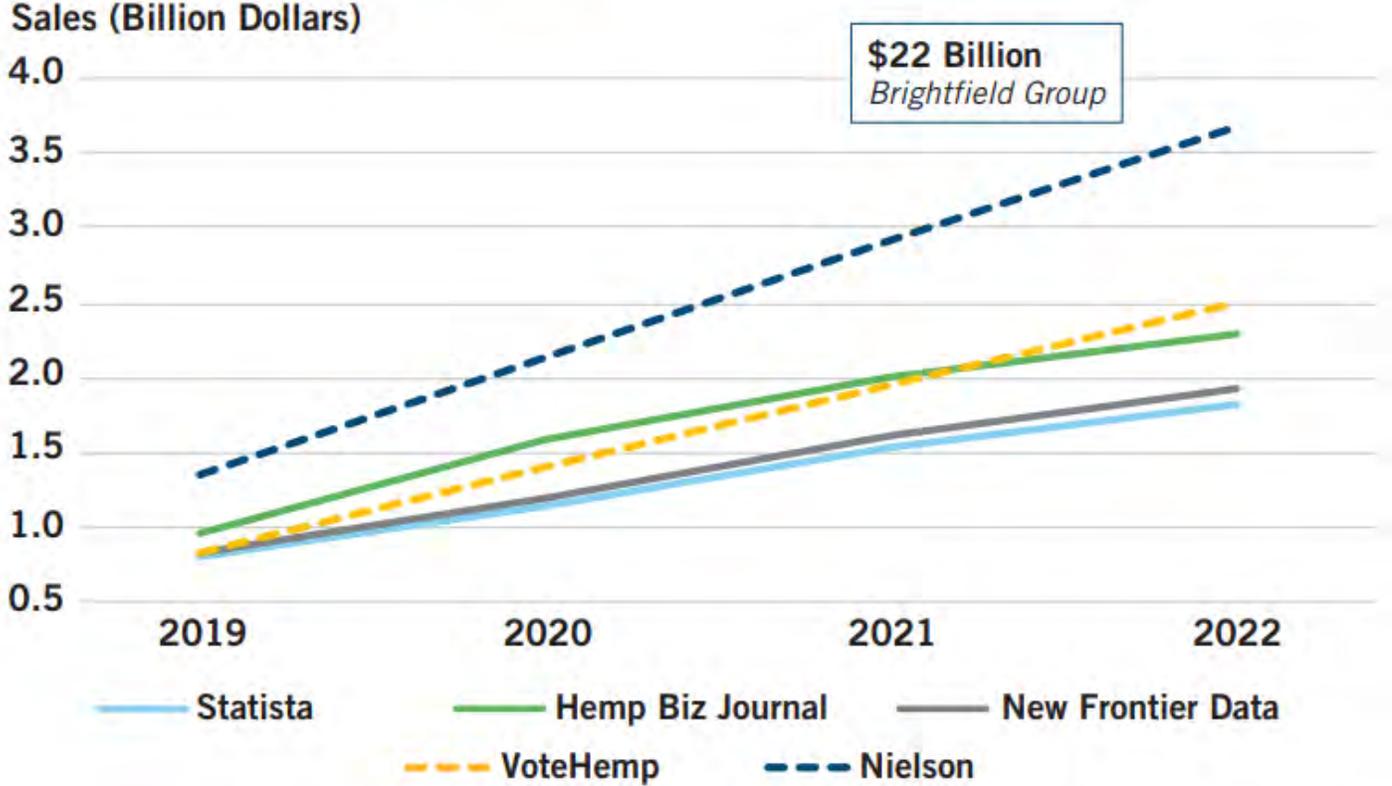






EXHIBIT 2: CBD Sales Outlook



Note: Dotted lines represent linear interpolations between project points given by the data source.

Sources³: Statista, Hemp Business Journal, New Frontier Data, Vote Hemp, Brightfield Group and Nielsen.



Current CBD Economics

\$1-\$3/seed

Labor intensive crop

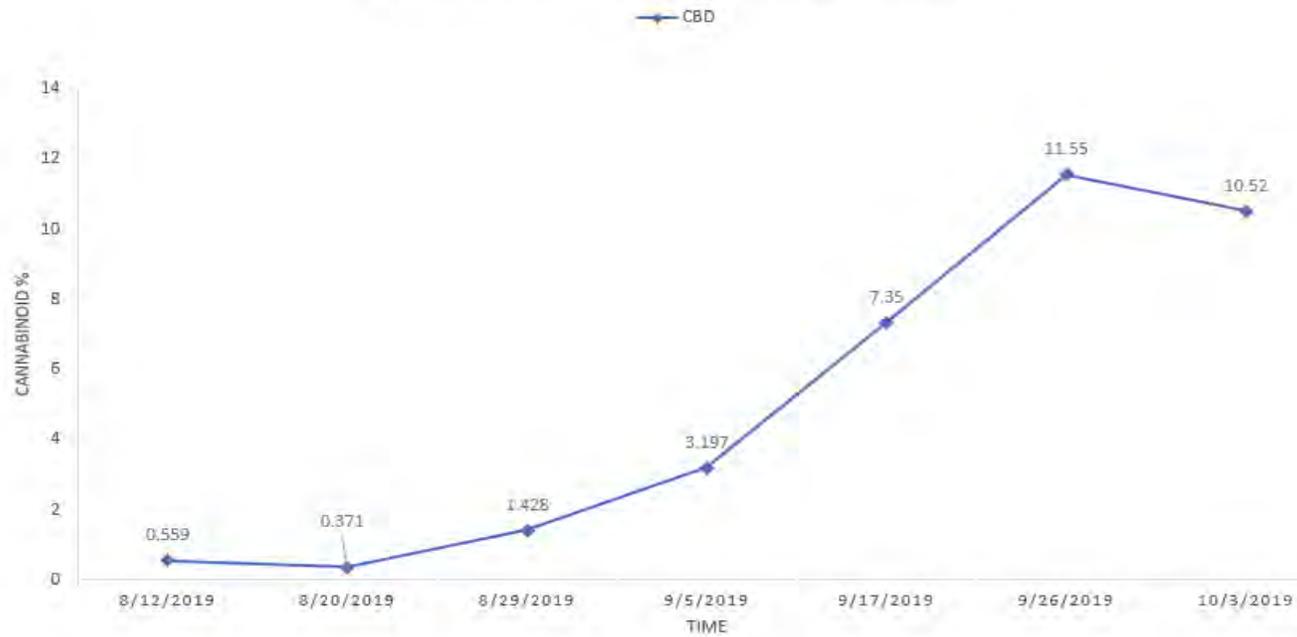
\$5 - \$75 per pound of CBD flower, depending on CBD content (\$3-\$5 per percentage point of CBD)

About 2000lb of dry flower per acre is an average reported yield, which at 10% CBD would equate to \$60,000 to \$100,000 per acre

Yields vary greatly depending on seed genetics, harvesting techniques, post harvest handling, extraction efficiencies, etc.



GREENHOUSE CANNABINOID LEVELS



FIELD TESTING CANNABINOID LEVELS

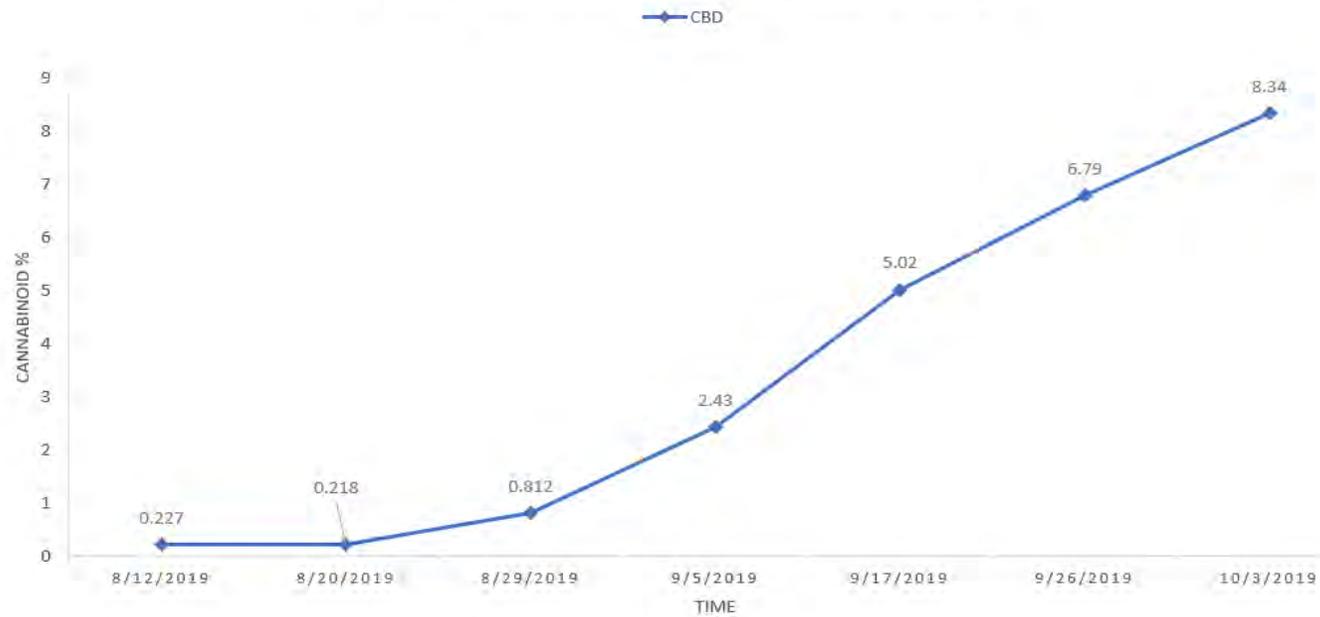




Table 1.
Value of hemp hurd to be competitive with other fuel commodities on the market based on dollar/million BTUs.

	Natural Gas \$7/therm	Propane \$1.25/gal	Wood \$180/ton	Shell Corn \$3.50/bushel
Hemp Hurd Comparative Value:	\$89	\$178	\$139	\$80

AT A GLANCE



Hemp Fuel Value and Supply Chain

Forecasted Projections for Minnesota

OPPORTUNITY FOR HEMP HURD AS FUEL

Minnesota has been at the forefront of renewable energy for several years. Supports given to ethanol and bio-diesel production in Minnesota are examples of the commitment this state has made to promote renewable energy.

The opportunity Minnesota has to offer for biomass crops and renewable energy is evident through various programs that support the use of renewable fuels along with industries within the state that are utilizing solid biomass fuel resources to power their industries. This analysis focused on renewable energy opportunities that exist focusing on the hemp industry. Hemp coproducts such as the hurd, extracted flower and cake all have high heating values. The hemp seed oil can also serve as a feedstock to make biodiesel, with the end product competing with the properties of soy-based biodiesel. Utilizing hemp coproducts as fuel sources is a potential opportunity, however the materials will likely have higher values in other areas and there are a few hurdles that will be faced including meeting pellet fuel standards as well as having a competitive market price with other leading fuel sources.

Table 1.
Value of hemp hurd to be competitive with other fuel commodities on the market based on dollar/million BTUs.

	Natural Gas \$7/therm	Propane \$1.25/gal	Wood \$180/ton	Shell Corn \$3.50/bushel
Hemp Hurd Comparative Value:	\$89	\$178	\$139	\$80

The values in the table above were calculated by taking into account the fuel value of each commodity and combustion efficiency variations to compare fuel sources based on an equivalent cost per energy unit.

As seen in Table 1 above, if you can source any of the hemp ingredients for less than the comparative value column, hemp hurd may offer a competitive alternative to use as a fuel source. Note: Capital cost of biomass heating systems and potential pelleting cost of around \$90/ton is not taken into account in the projections. Hemp oil can also be competitive with soybean oil for biodiesel production, providing another opportunity here in the state with existing biodiesel plants.

Hemp flower and hemp cake both have high energy contents which would serve as a good fuel source. However high protein and energy feed values show that these commodities will likely capture a greater value as a livestock and poultry feed.

ADDITIONAL INFORMATION

pelletheat.org | auri.org/hemp | fpl.fs.fed.us/documnts/techline/fuel-value-calculator.pdf

Hemp Related Projects to Date



Hempcrete Research

Seed Cleaning and Processing Equipment Selection & Testing

Cannabinoid Testing

Pelleting of Flower and Leaf Material Pre/Post-Extraction

Hemp Twine & Rope Study

CBD Hemp Drying/Curing Space Design

Fiber Market Feasibility Studies

2019 AURI HEMP ACTIVITY MAP



- Food Processing Locations
- Fiber Processing Locations
- CBD Processing Locations
- Equipment Manufacturers
- C - Cleaning Equipment/Services
- P - Processing Equipment
- H - Harvesting Equipment

One processor goes online, second is planned in New York State

CNY Hemp Processing, Canastota, New York, recently went online and will produce hemp oil, fuel pellets and animal bedding, according to company president Stephen Halton.

The company also is taking fiber waste from CBD producers and turning it into bedding material for farm animals

Meanwhile, Canada's Canopy Growth Corp. announced this week it will build its first American-based production facility after it was granted a hemp license in New York.

GenCanna Global USA Expands with Facility in Graves County, Kentucky

We use 100% of the hemp plant

Pelletized Animal Bedding

Eco friendly, and biodegradable, controls odors, antimicrobial and antibacterial properties, not to mention DUST FREE. 40 pound bag.

Cold Pressed Raw Hemp Seed Oil

Omega-6 and Omega-3 fatty acids, supports healthy skin hair and nails as well as supports the immune system. Not just for humans, horses, livestock and even your "fur-babies" can benefit from our product. 8oz bottle

Pelletized Hemp Seedcake

Hemp is high in protein, fatty acids and minerals. Has been shown to help animals immune system. Also has shown weight gain improvements in calves, butchering steers as well as pigs when using while finishing. 40 pound bag **STILL IN RESEARCH AND DEVELOPMENT STAGE**

Hemp Heat Pellets

Hemp pellets can be used in 80% of pellet stoves sold in the United States, that means that if your stove burns better with hardwood or softwood, hemp is the pellet for you. It burns cleaner and the BTU's are comparable to wood products. 40 pound bag.

Waseca Coproducts Lab

Equipment

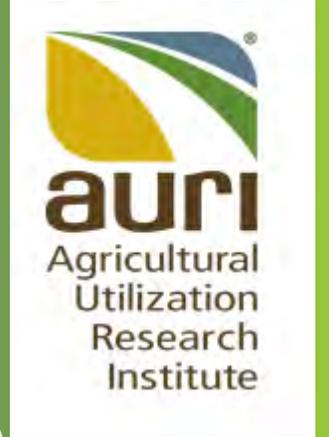
- ▶ Pellet Mill
- ▶ Decorticator
- ▶ Fluid Bed Dryer
- ▶ Hammer Mills
- ▶ Cold Oil Press
- ▶ Oil Filter
- ▶ Aspirator
- ▶ Mixers

Coproduct Opportunities

- ▶ Animal Feed
- ▶ Hempcrete
- ▶ Paper
- ▶ Animal Bedding
- ▶ Mulch
- ▶ Absorbents
- ▶ Fuel Source
- ▶ Others?

Hemp Coproducts

- ▶ Press Meal
- ▶ Hemp Seed Hulls
- ▶ Spent Flower
- ▶ Stalks
- ▶ Hurd



AURI Analytical Capabilities of Hemp Analysis

• MDA Industrial Hemp Pilot Program Certificate

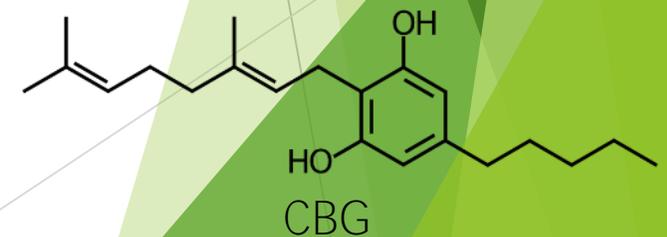
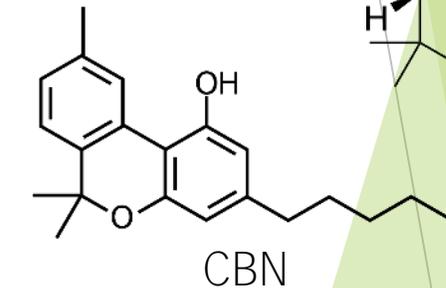
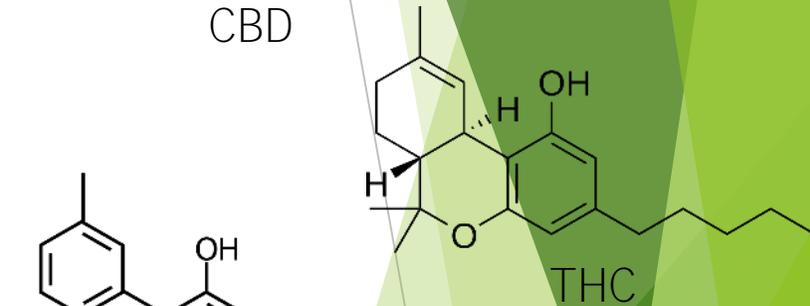
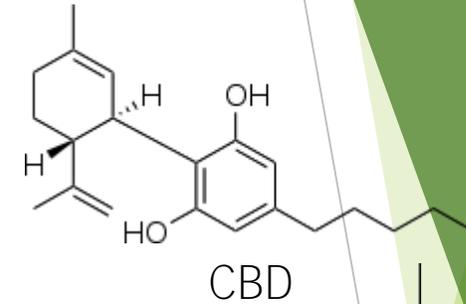
- Certificate for growing and processing/testing industrial hemp
- Processing at Waseca and Marshall Labs

▶ Hemp seed analysis

- ▶ Oil extraction
- ▶ Oil Filtering
- ▶ Protein
- ▶ Fatty acids of the oil

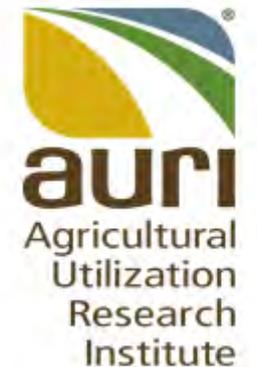
▶ Cannabinoid analysis (HPLC)

- ▶ Cannabidiol (CBD & CBDA)
- ▶ Tetrahydrocannabinol (THC & THCA)
- ▶ Cannabinol (CBN)
- ▶ Cannabigerol (CBG)



It ain't what you don't know that gets you into trouble. It's what you know for sure that ain't so.

Mark Twain [*The Big Short*]



Questions, concerns or ideas regarding Hemp in Minnesota are welcome.



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Riley Gordon
Rgordon@auri.org
218.281.7600 Ext.130



Beyond the Hype: Value Added Opportunities in Hemp

Panel Discussion

Charlie Levine

- Owner, Hemp Acres; President, Hemp Association

John Strohfus

- Founder and CEO MN Hemp Farms, Inc.

Sara Kietzer

- Owner-Grower, Journey Organics LLC

John Lupien

- Founder, Hemp Fast Forward

Moderator: Harold Stanislawski, AURI

Charlie Levine

- Owner, Hemp Acres
- President, Hemp Association





John Strohfus

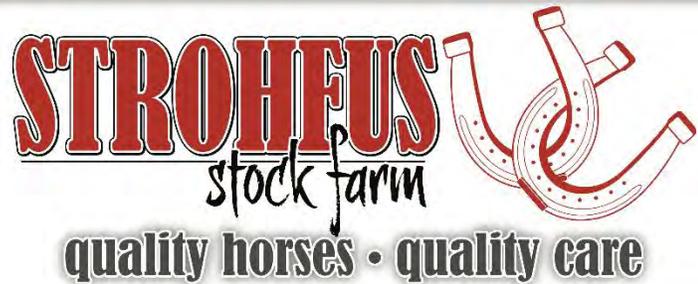
- Founder and CEO MN Hemp Farms, Inc.

MINNESOTA HEMP FARMS

Company Overview
&
The Future of Hemp



About Us - Prior to Hemp...



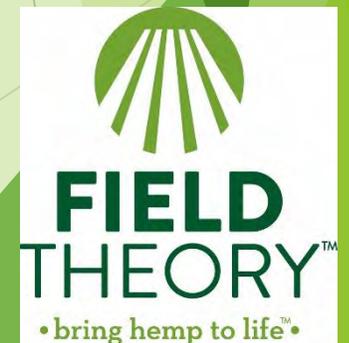
- ▶ Strohfus Stock Farm, LLC (www.strohfusstockfarm.com)
- ▶ Our location is southeast of St. Paul/Minneapolis in Hastings MN.
- ▶ 45+ Years of Commercial Horse Boarding
- ▶ Hay & Forage Production, Corn & Soybeans
- ▶ Direct to Consumer Beef Operation
- ▶ 19 Year IT Career off-farm until 2017



About Us - Since Hemp...

MINNESOTA HEMP FARMES

- ▶ Minnesota passed legislation allowing Hemp in December 2015.
- ▶ First to grow hemp in Minnesota since 1950.
- ▶ Contracting Organic and Conventional Acres in Minnesota, North Dakota and Wisconsin
- ▶ New Company Minnesota Hemp Farms, Inc formed in 2016 with production and bulk wholesale focus. (www.mnhempfarms.com)
- ▶ **Field Theory™ brand created in 2016 with retail focus.** (www.fieldtheoryhemp.com)
- ▶ Largest USA vertically integrated bulk hemp foods company.
- ▶ US Grown Strategy Implementation, Retail / Private Label Opportunities



Why Hemp?

Plant-based Proteins Key Mega Trend

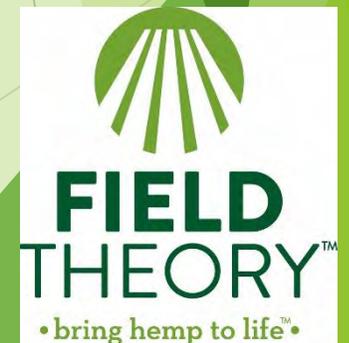


Google Chairman Eric Schmidt named the number one “game-changing” trend of the future as the consumption of plant-based proteins.

Schmidt has dedicated his career to identifying worldwide technology trends, and discussed plant-based foods as one of the six upcoming technologies that will significantly improve society and the quality of life.

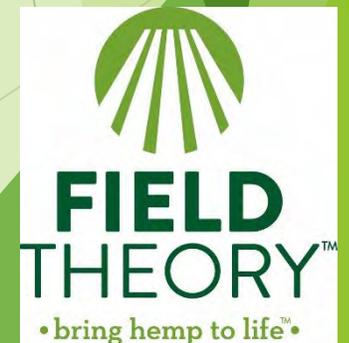
QUOTE: 2016

©2019 Minnesota Hemp Farms, Inc

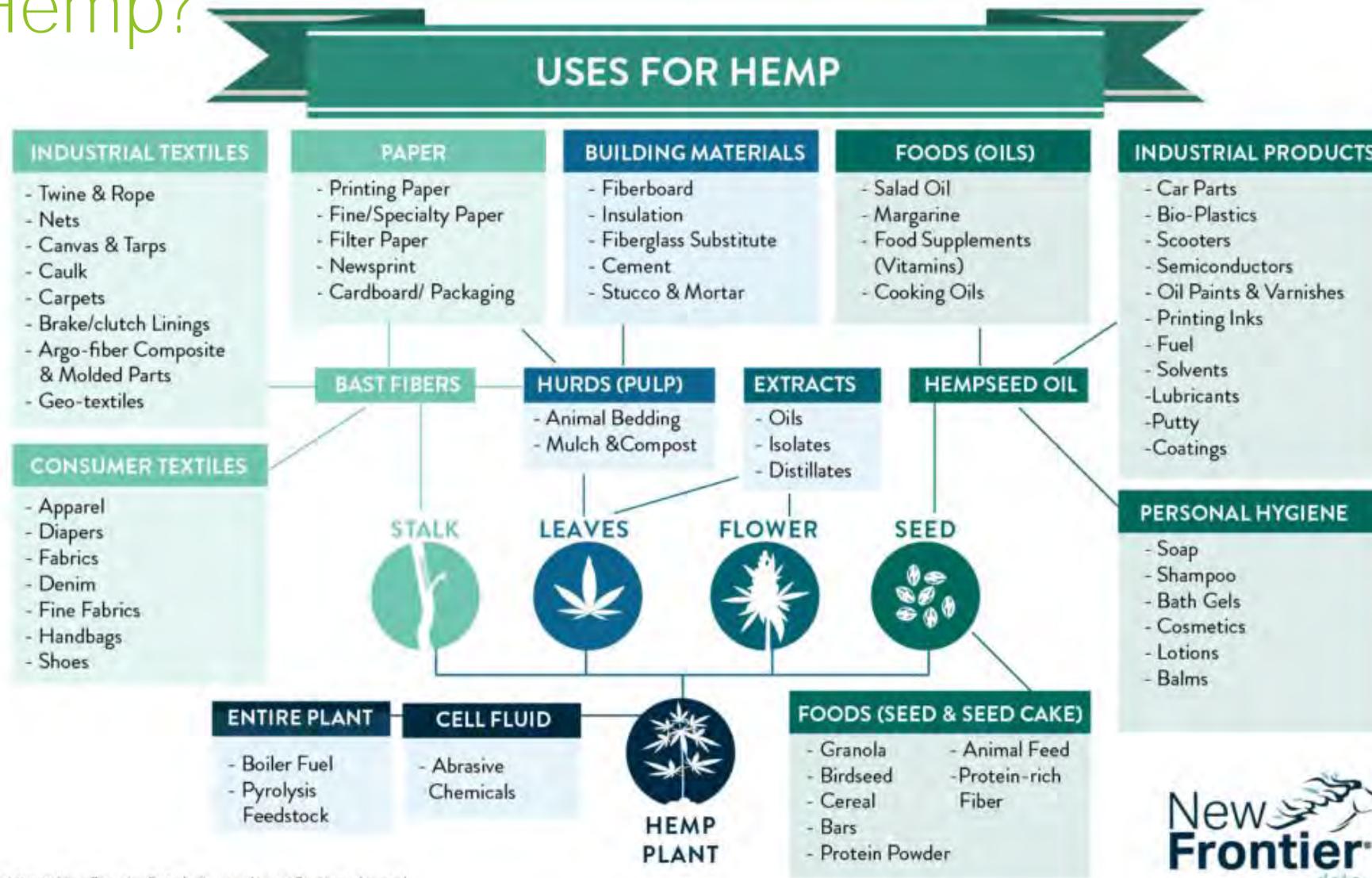


Why Hemp?

- ▶ Plant Based Protein. Non-GMO. Gluten Free. Vegan. Kosher.
- ▶ **USA is the largest hemp importing country...since the 1990's**
- ▶ Ground floor opportunity for US Production and Marketing
- ▶ Great Challenges often equal great rewards
- ▶ US is largest consumer base but Hemp still has little market penetration < 1%. That is huge upside opportunity especially in US with deregulation being a marketing spring-board to exponential growth. #FarmBill2018 #GameChanger
- ▶ Versatility. **“over 20,000 uses of hemp”** is an over used and misleading phrase but just in the FOOD sector the product is versatile (hulled hempseed, oil, **powder, blending...**). **Good for innovators, brand leaders and market makers.** #LeadNotFollow
- ▶ CBD - Helping People Have Healthier Lives!

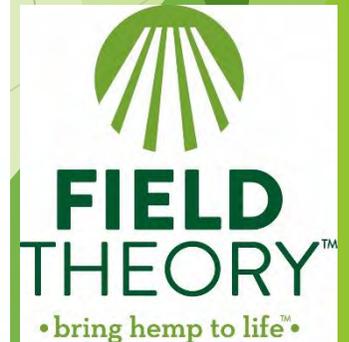


Why Hemp?



© 2018 New Frontier Data | Source: Hemp Business Journal

©2019 Minnesota Hemp Farms, Inc



Retail Products

Shelf Line Up Final



FIELD THEORY™

ENJOY THIS OIL OF WHOLESOME LIVING

Hempseed Oil is delicious and nutritious. It contains Omega 3 and 6 fatty acids, is Non-GMO, Gluten Free and Vegan.

Bring Hempseed Oil To Your:

- Bread Dipping
- Salad Dressings
- Pesto & Sauces
- Pastas & Vegetables

•bring hemp to life™•

WWW.FIELDTHEORYHEMP.COM



8 53713 00709 1

GREAT FOR SALADS!



FIELD THEORY™

•bring hemp to life™•

EXTRA VIRGIN hempseed oil



NET WT 8 OZ (236ml)

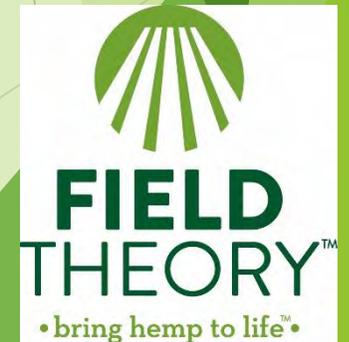
Nutrition Facts Servings: 16, Serv. Size: 1 tbsp (15mL), Amount Per Serving: **Calories 120**, Total Fat 13g (17% DV), Sat. Fat 1g (5% DV), Trans Fat 0g, Polyunsat. Fat 10g, Monounsat. Fat 2g, **Cholest.** 0mg (0% DV), **Sodium** 0g (0% DV), **Total Carb.** 1g (0% DV), Fiber 0g (0% DV), Total Sugars 0g (Includes 0g Added Sugars, 0% DV), **Protein** 0g, Vit. D (0% DV), Calcium (0% DV), Iron (0% DV), Potassium (0% DV)

INGREDIENTS: COLD-PRESSED HEMPSEED OIL

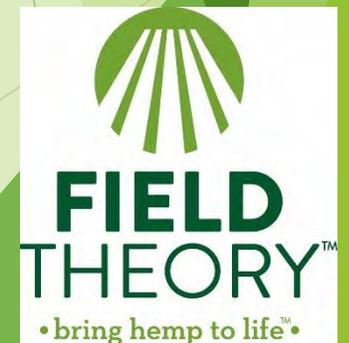
REFRIGERATE AFTER OPENING

NOT SUITABLE FOR HIGH HEAT / FRYING

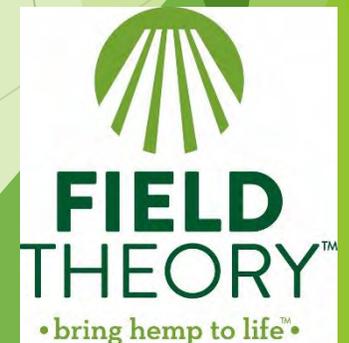
MANUFACTURED BY: MINNESOTA HEMP FARMS, INC.
HASTINGS, MN 55033
WWW.MNHENPFARMS.COM



Retail Products - Hemp Extract (CBD)



FARMING ("Hemp" x 3)



Growing For Grain

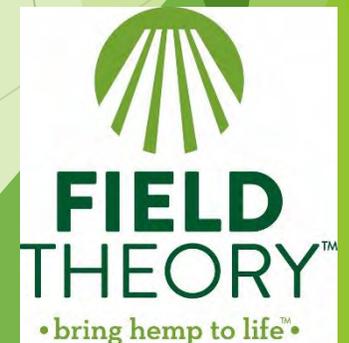


Planting was LATE (June 17, 2016). The first in the State of Minnesota since approximately 1950

PRO TIP: 7.5" Row Spacing at $\frac{1}{2}$ - $\frac{3}{4}$ inch depth. Plant down to moisture at a rate of 25# per acre up to 30# per acre if Organic or higher than average weed pressure.

Landoll Grain Drill - Courtesy Value Implement - Ellsworth, WI

©2019 Minnesota Hemp Farms, Inc



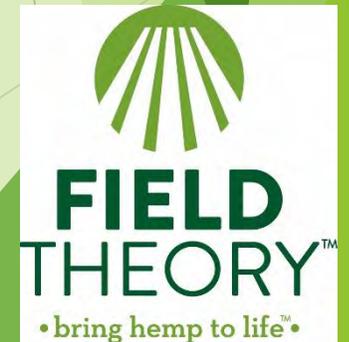
Growing For Grain

- ▶ Good emergence just 4.5 days after planting!



©2017 Minnesota Hemp Farms, Inc

- ▶ 2" root to crown just 4.5 days after planting!



Growing For Grain

▶ 12 Days!



▶ 22 Days!



Growing For Grain



Growing For Grain



Growing For Grain



Limited Pests

July vs. August



2017 Season



The Fun Stuff! - Growing For Grain

► Harvesting Grain (90-105 Days)



Growing For Grain



Growing For Grain (cleaning)



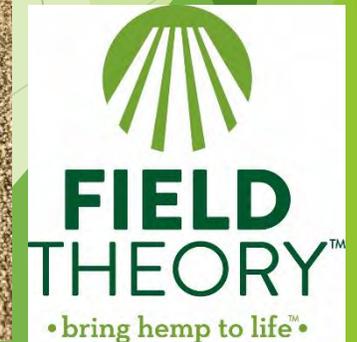
Market Value

\$1.25/lb Organic

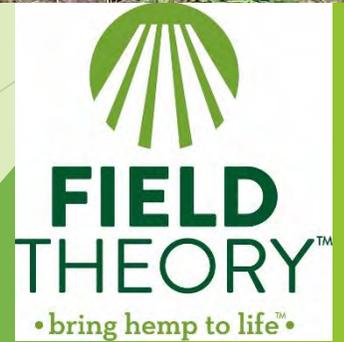
\$.40/lb Conventional

Cleaned and Dry →

44# per Bu
1,000#-1500# per acre



Growing For Fiber



Growing For Fiber



Market Value
\$100 - \$200 per ton



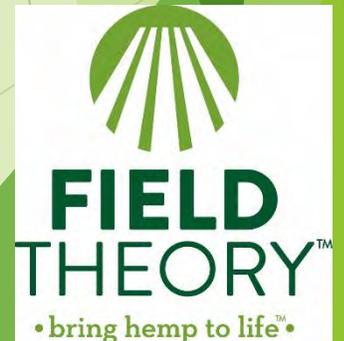
Growing For “CBD” (aka Flower / Biomass)



\$1.00 per Seed!

\$3.00 per Plant!

NO Certified Seed!

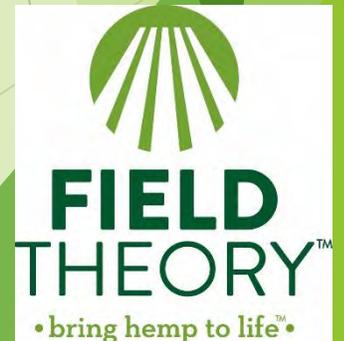


Growing For “CBD” (aka Flower / Biomass)



800 Plants Per
Acre Shown

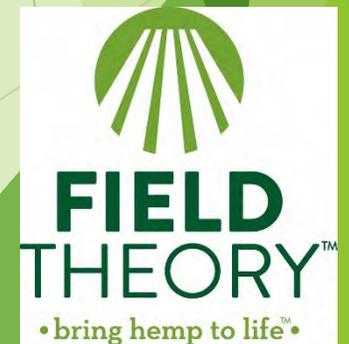
Typically 5'x5'
Spacing and 2,000
Plants Per Acre



Growing For “CBD” (aka Flower / Biomass)



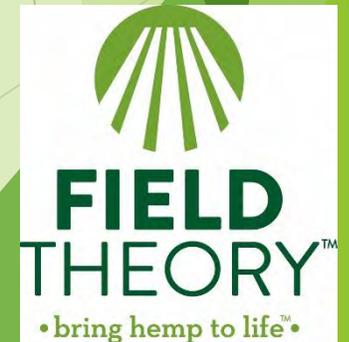
Market Value
\$20-\$200
per plant!



Growing For “CBD” (aka Flower / Biomass)

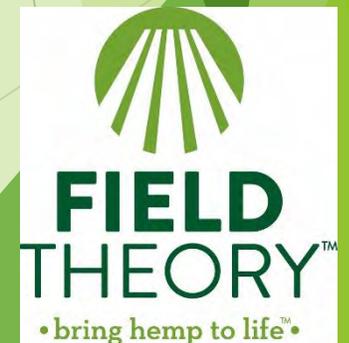


Must Have Good Labor!



Market Outlook

- ▶ Higher US Consumption in 2019. 2018 Farm Bill is a game changer!
- ▶ Lower cost Canadian and Chinese Hemp Production will continue to commoditize grain prices.
- ▶ **Organic Hemp will be most in demand (following consumer trends...)**
- ▶ Food sector growth will come from Protein Isolates (like peas)
- ▶ 100+% year on year growth to continue with largest segment being Hemp Extract (CBD) products in the near term.
- ▶ **Fiber Markets will come...eventually.**
- ▶ SPECULATION: Northern States (Montana, North Dakota, Minnesota and Wisconsin) will eventually produce the most hemp. Colorado and Kentucky have a jump start but it is mostly Hemp Extract (CBD) Focused



Market Outlook

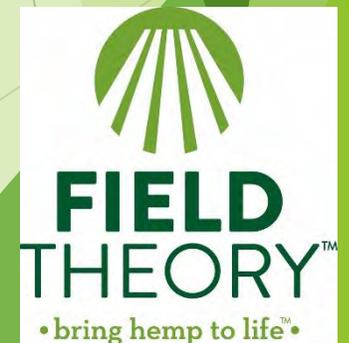
FOR IMMEDIATE RELEASE

Contact: Eric Steenstra - [\(202\) 681-4389](tel:(202)681-4389)
09/05/2019

VOTE HEMP RELEASES 2019 U.S. HEMP GROWER LICENSE REPORT DOCUMENTING PLANNED HEMP CULTIVATION IN THE U.S.

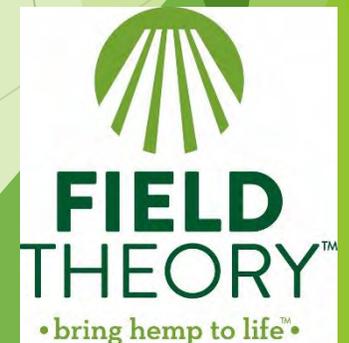
LICENSED HEMP ACREAGE QUADRUPLES OVER 2018

- The number of acres of hemp licensed across 34 states totaled **511,442** in 2019—more than quadruple the number of acres licensed from the previous year.
- State licenses to cultivate hemp were issued to 16,877 farmers and researchers, **a 476% increase over 2018**.
- Minnesota 2019 - 300+ Growers Est. 8,000 Acres

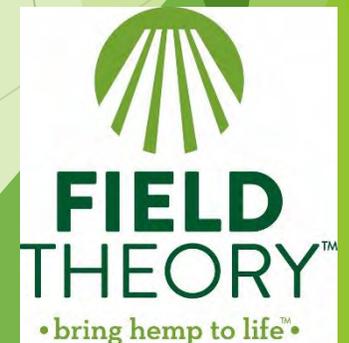


Tactical Challenges

- ▶ CBD - **FDA is the new DEA? You're messing up the Food markets too!**
- ▶ Will USDA Rules be helpful or make it worse? We will find out soon, maybe, **possibly? The Farm Bill 2018...USDA got run over by an iceberg.**
- ▶ Banking, Lending and Credit Card Processing - Please stop the madness! **Regulators listen to Congress' intent!**
- ▶ Interstate Commerce - Federal vs. States. Food Products and CBD Flower Materials in Jeopardy
- ▶ **The hold out states...Idaho and South Dakota...are you for real? SD Gov. Noem just says "No"??**
- ▶ **Pesticides and Herbicide Use (Canada has it but we don't).**
- ▶ Livestock Feed - Please, someone, anyone do this!
- ▶ CBD Genetics - Terrible, not enough of it and too costly! Scammers Exist!
- ▶ Crop Insurance - Will it ever be truly available AND affordable?



RESOURCES



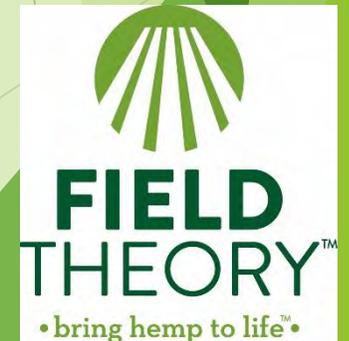
Resources - Planting Seed

- ▶ Grain/Fiber Seed Costs in 2019 were \$4/lb FOB Hastings, MN
- ▶ Grain Seeding Rate 30 lb/acre (\$120/acre) **Organic Recommend 35#
- ▶ Fiber Seeding Rate 35-40 lb/acre

GRAIN CERTIFIED VARIETIES (Genetics are very important!)

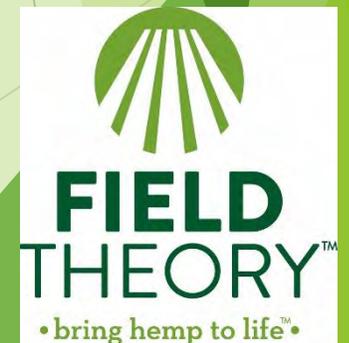
- ▶ Hemp Genetics International - <http://www.hempgeneticsinternational.com/>
 - ▶ CRS-1 - Tallest, viable for grain or fiber.
 - ▶ CFX-2 - Medium Stature. High Yielding
 - ▶ Katani - Shortest. High Yielding. Slightly faster emergence (**Organic benefit).

***MHF is a distributor



Resources - General

- ▶ Canadian Hemp Trade Alliance
 - ▶ eGuide <http://www.hemptrade.ca/>
- ▶ Minnesota Department of Ag Hemp Program
 - ▶ <https://www.mda.state.mn.us/plants/hemp>
- ▶ Minnesota Hemp Farms, Inc. -
 - ▶ www.mnhempfarms.com
 - ▶ www.facebook.com/mnhempfarms
- ▶ Hemp Genetics International
 - ▶ <http://www.hempgeneticsinternational.com/>
- ▶ Hemp Industries Association <https://thehia.org/>
- ▶ National Hemp Association <https://nationalhempassociation.org/>
- ▶ NoCo Hemp Expo <https://noco hempexpo.com/>

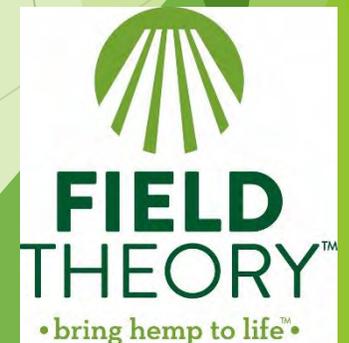


Resources - General

- ▶ “Hemp For Victory” (USDA Propaganda Film 1942)



https://youtu.be/blxFhYVv_Gk



MINNESOTA HEMP FARMS

HOW TO CONTACT US:

John Strohfus

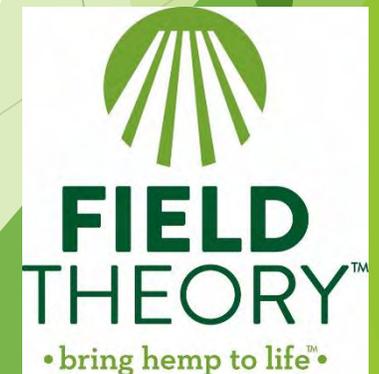
612.268.5588

john@mnhempfarms.com

mnhempfarms.com

fieldtheoryhemp.com

Facebook: www.facebook.com/mnhempfarms



Sara Kietzer

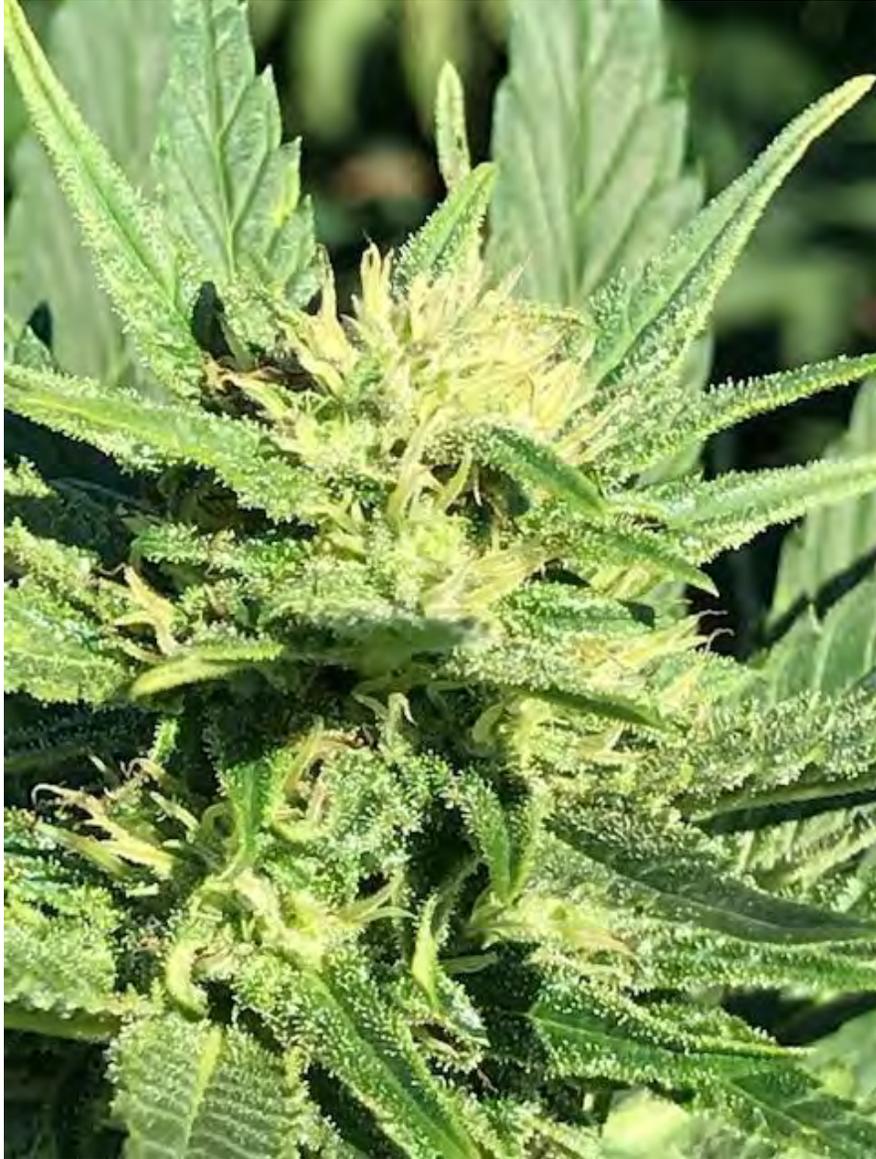
- Owner-Grower, Journey Organics LLC











John Lupien

- Founder, Hemp Fast Forward



HEMP

FAST FORWARD

Farm to Processor

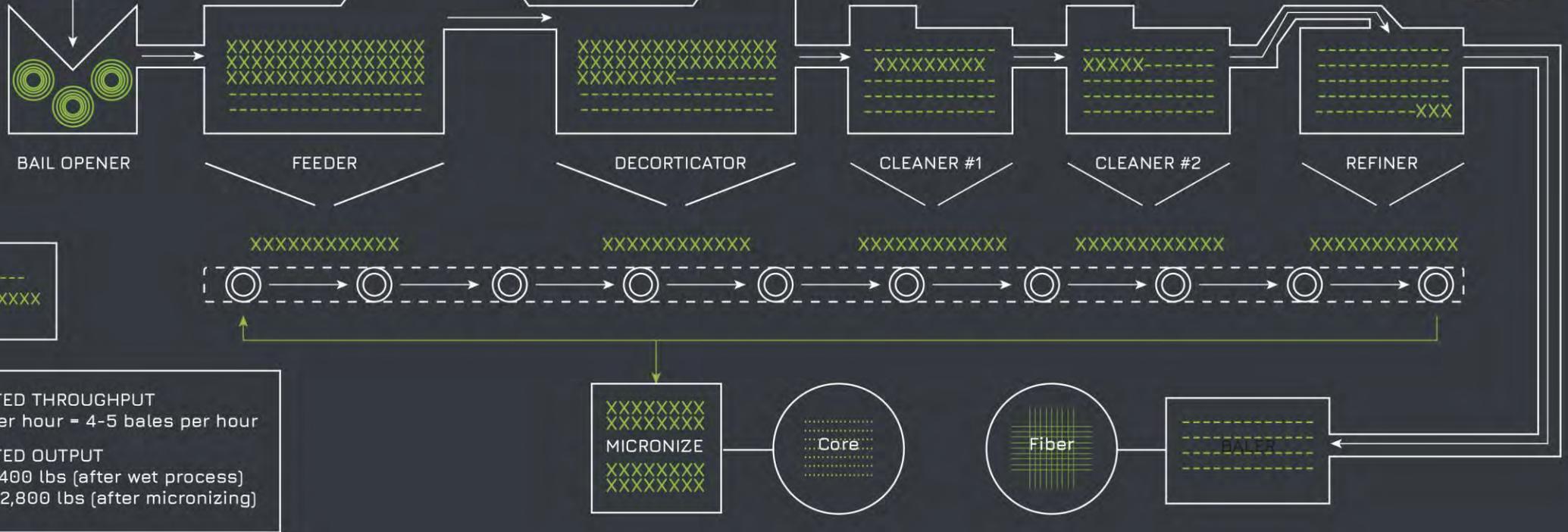
Hemp

- Little to no branching
- Cut 8" off ground
- Baled at 12% moisture content
- Large Square Bales 4'x4'/3'x8' or Large Rounds

Pricing

- Based on fiber content and harvest time
- Dual CBD/Grain and Fiber 18-36 lb/ac seeding = \$100-150 ton
- Dedicated Fiber 40-60 lbs/ac seeding and harvested at male flowering = \$250 ton

RAPID INSTALL - FUTURE INNOVATION



HEMP **FF**



- Group Discussion
- Q&A



Panel

Value Added Opportunities



Innovators in Minnesota's Hemp Industry

Chat

Joe Radinovich

- President, Minnesota Hemp Association

David Ladd

- Minnesota Industrial Hemp Association

Chat Host: Dan Skogen, AURI

- Discussion
- Q&A



Chat

Innovators in MN Hemp

Networking Break





Critical Industry Supports

Discussion

Whitney Place

- Assistant Commissioner, MDA

Cody Wiberg

- Exec. Director, MN Board of Pharmacy

Mark Kaster

- Partner, Dorsey and Whitney

Steve Peterson (Moderator)

- Owner and Manager, Peterson Farms

- Group Discussion
- Q&A





Lessons Learned

Discussion

Tony Cortilet

- Plant Protection, MDA

Margaret Wiatrowski

- Industrial Hemp Program Coordinator, MDA

Dr. George Weiblen

- Professor, University of Minnesota-
Department of Biological Sciences

Moderator: Dr. Michael Stutelberg, AURI

- Group Discussion
- Q&A



Discussion:

Lessons Learned



Closing Comments

Closing Comments

Shannon Schlecht

- Executive Director, AURI

Thanks for attending!



auri.org

