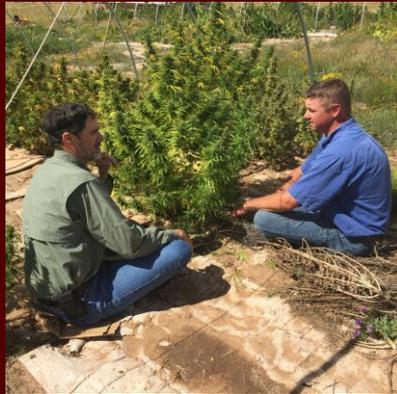


# Industrial Hemp & Texas— *Beginning to Learn*



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Texas—November 2019



# Texas A&M AgriLife's Role in Hemp

- ⦿ Past Session of the Texas Legislature (2019):
  - ⦿ Neither for nor against legislation
  - ⦿ Answer questions when asked and provide other input
  - ⦿ Recognizing potential opportunity for Texas producers
- ⦿ Texas A&M AgriLife does not take on a regulatory role—that is the responsibility of Texas Dept. of Agriculture. But AgriLife may advise on regulatory issues like seed quality and certification, possibly sampling for THC, etc.

# Texas A&M AgriLife's Role in Hemp

- ⦿ AgriLife Extension is an educational agency
- ⦿ AgriLife Research, AgriLife Extension & Main Campus will engage in research
- ⦿ In time AgriLife will develop Texas-based and research-based resources and recommendations for production

# Industrial Hemp Discussion Today

- ⦿ Explain
- ⦿ Question
- ⦿ Project
- ⦿ Anticipate
- ⦿ Think things through



# Texas A&M AgriLife and Hemp

- ⦿ We are not here to promote industrial hemp.
- ⦿ We are here to help you **decide** if this is something you may want to try.
- ⦿ We are here to help you **learn** more about some of the many considerations—agronomic, economic, farmer/contractor relationships, levels of risk—you face about this crop.

# Overemphasis on Hemp for CBD?

- ⦿ In this information, there may appear to be a dominant emphasis on CBD aspects of hemp
- ⦿ This is where the most interest currently lies thus also the greatest need for clarity in terms of what you read and here and the decisions you may make
- ⦿ As further information becomes available, this document will be updated regularly

# For You as a Prospective Hemp Grower

- ⦿ Information to help you think through the many issues related to contracting, preparing for, growing, maintaining, harvesting, drying, and marketing industrial hemp
- ⦿ You may conclude that industrial hemp farming is not for you
  - If so, then AgriLife is fulfilling its role in education
- ⦿ Realism
- ⦿ Recognition and Pros & Cons of financial aspects

# Recognizing Capabilities and Limitations of Typical Texas Producers

- ◎ Is hemp farming for you?
- ◎ Why or why not?

# Recognizing Capabilities and Limitations of Typical Texas Producers

- ⦿ Trostle's 20+ years of experience in working with sunflower and conducting Extension programs on the crop: "Half the Texas farmers I know should never grow sunflower."
- ⦿ There are a couple of key management issues that often get messed up, leading to major economic losses.



- ⦿ **What about Texas farmers and industrial hemp? More than half?**

# We Can't Cover Every Topic Today



# Industrial Hemp and YOU!

© What is YOUR objective?

# The Hemp Plant



- ◎ In contrast to most other plants, *Cannabis sativa* plants are **either male or female**. A very few are both (hermaphrodites).
- ◎ CBD and other cannabinoids are primarily sought from female plants. Female plants that are pollinated by the male will likely produce substantially less amounts of CBD.
- ◎ Though not all hemp farming for CBD necessarily is female only plants. Some production occurs by planting regular seed which then produces about 50% each of male and female plants.
- ◎ Some seed is “feminized” which is treated chemically and should develop only female plants (preferred for CBD production). These seed may retail for up to \$1 per seed, with 1,000 to perhaps 3,000 seeds per acre.

# Male Hemp Plant

- ⊙ For CBD production most hemp growers have a 'zero tolerance policy' for male plants. Pollination of female plants will curtail further CBD production, thus reducing harvest CBD levels. But large-scale farming might find a means to greatly reduce production costs (including clones or feminized seed) and reduce the cost of CBD.
- ⊙ Hemp is a broadleaf, but not a legume.



# Hemp Products

- ◉ CBD, a substance on the floral structures
  - There are other cannabinoids that may become important in time: CBG, CBN, etc. (and are currently far more valuable if you have a variety that produces them)
- ◉ Grain
- ◉ Fiber
  - **Bast**—the external fibers, just under the bark
  - **Hurd**—pithy material inside the stalk

# CBD Products

- ⦿ They are not regulated by FDA or states (though this could happen).
- ⦿ The price mark-up is excessive.
- ⦿ If you buy a CBD product do you receive a guarantee of analysis?

# The Value of CBD Products a Farmer Gets

- Many consumers like to know that the farmer who produced the milk, the wheat in your bread, or the cotton in your jeans gets a good proportion of the sales revenue of a commercial product.
- This is often not the case.
- Examples;
  - **Milk**, a dairy farmer might receive about 1/3 of the sales price of a gallon of milk
  - A \$2.19 loaf of **wheat** bread has about \$0.15 worth of wheat (7% to the farmer)
  - A pair of blue jeans that weighs 2 lbs. and sells for \$30, the **cotton** farmer gets about \$1.30 (~4%)
  - **What about CBD products?**

# CBD Retail

- Are CBD products way over-priced?
- This certificate of analysis is for bottle labeled as 900 mg of CBD.
- It actually contains 1,010 mg.
- The THC content is legal—0.118%.
- On sale for \$72 (0.8% to grower).

**AURUM LABS**
**Certificate of Analysis**

**Cannabinoid Potency and Contaminant Analysis Report**

Sample Name:	Lot 07022019 - 900mg	General Processing LLC
Sample Type:	Ingestible, Tincture, Other	18668 B50 Rd
Sample ID:	1907AU0183.09413	Delta, CO 81416
Batch ID:		(970) 249-3398
METRC Tag:	1A4000712681366000001904	Lic. #403H-75142.1

**Cannabinoid Profile**

Analyte	LOQ	Amount	Amount
	mg/unit	mg/unit	mg/g
THCa	4.80	ND	ND
Δ9-THC	4.80	35.30	1.18
Δ8-THC	2.24	ND	ND
CBDa	4.80	ND	ND
CBD	4.80	1010.08	33.67
CBDVa	2.24	ND	ND
CBDV	2.24	ND	ND
CBN	2.24	ND	ND
CBGa	2.24	ND	ND
CBG	2.24	23.14	0.77
CBCa	2.24	ND	ND
CBC	2.24	35.62	1.19
CBL	2.24	ND	ND

**Total Cannabinoids**

Analyte	Total*
THC	35.30 mg/unit
CBD	1,010.08 mg/unit
CBG	23.14 mg/unit
CBC	35.62 mg/unit
CBDV	<LOQ

\*Total is the sum of the neutral (active) cannabinoid and the completely converted acidic cannabinoid.

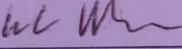
**Sample Photo**



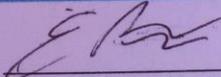
**Residual Solvent Analysis**

Analyte	LOQ	Limit	Amount

**Final Approval**



Results Approved By:  
Lucas Mason, M.S.  
Lab Director



Results Analyzed By:  
Joshua Reilly  
Analyst

**Microbial Contaminants**

Analyte	Limit	Amount

Received: 07/23/2019
Tested: 07/23/2019
Reported: 07/24/2019

Definitions: LOQ= Limit of Quantitation, ND = Not Detected, CFU/g = Colony Forming Units per Gram  
 This product has been tested by Aurum Labs using validated testing methodologies (unless specified in this report) and a Quality System as required by state law. Values reported related only to the product tested. Uncertainty information available upon request. Aurum Labs makes no claims as to the efficacy, safety or other risks associated with any detected or non detected levels of any compounds reported herein. This Certificate shall not be reproduced except in full, with the written approval of Aurum Labs.



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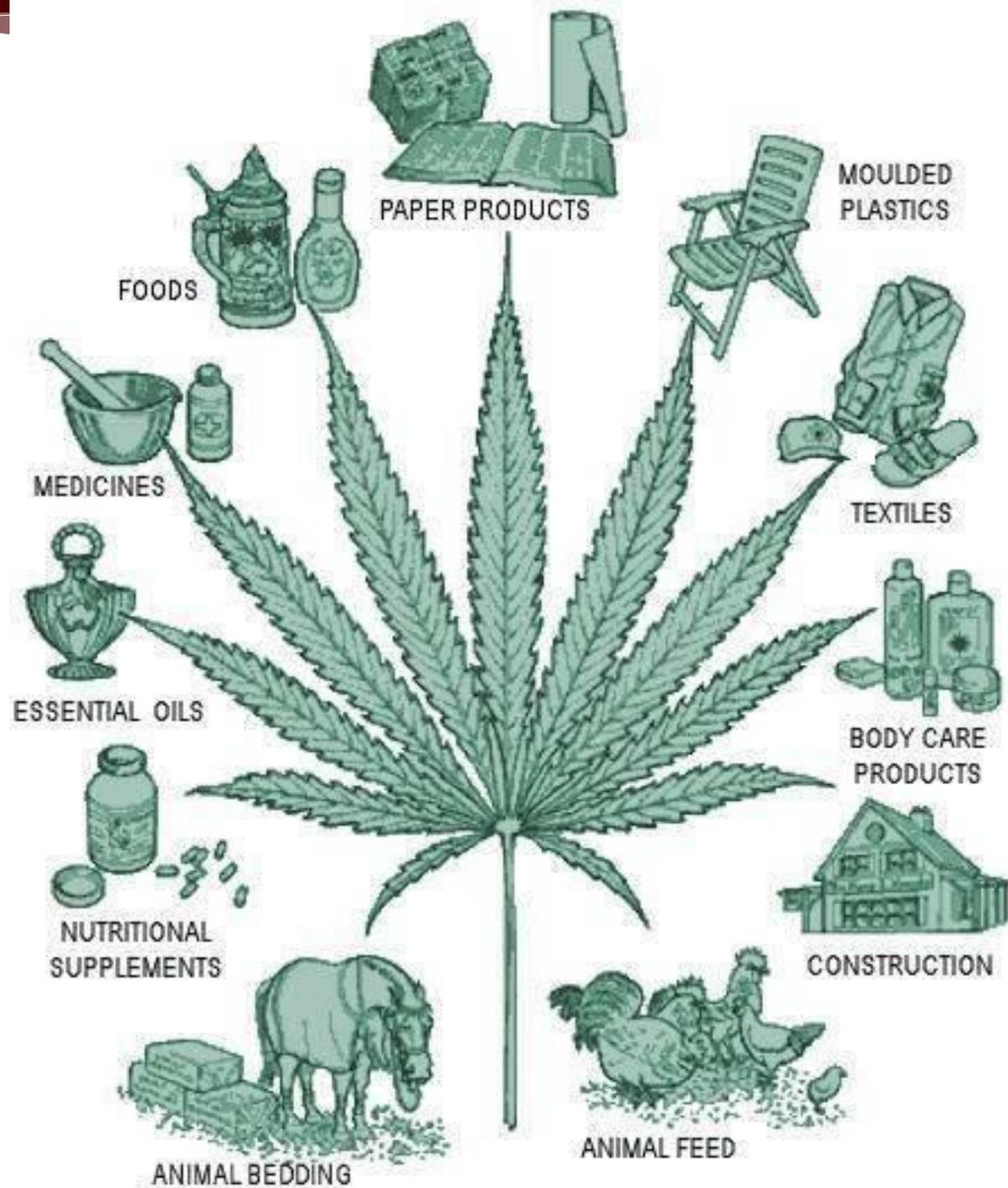
# The Value of CBD Products a Farmer Gets

- ⦿ **What about CBD products?**
- ⦿ For the previous example, I assume pricing of \$3 per lb. per each percent of CBD in dried material (1,000 lbs. of biomass per acre, 9% CBD, and 90% extraction efficiency)
- ⦿ For the 900 mg product selling for \$72 the farmer receives only 60 cents of the retail value. That is about 0.8%!
- ⦿ You can see the markup in retail CBD products.
- ⦿ You can calculate this yourself with link at <http://lubbock.tamu.edu/hemp>
- ⦿ A farmer in the above example growing 25 acres produces enough CBD for 1,000,000 bottles.
- ⦿ You can see that it doesn't take that many acres to produce a massive number of retail CBD units.

# The Value of CBD Products a Farmer Gets

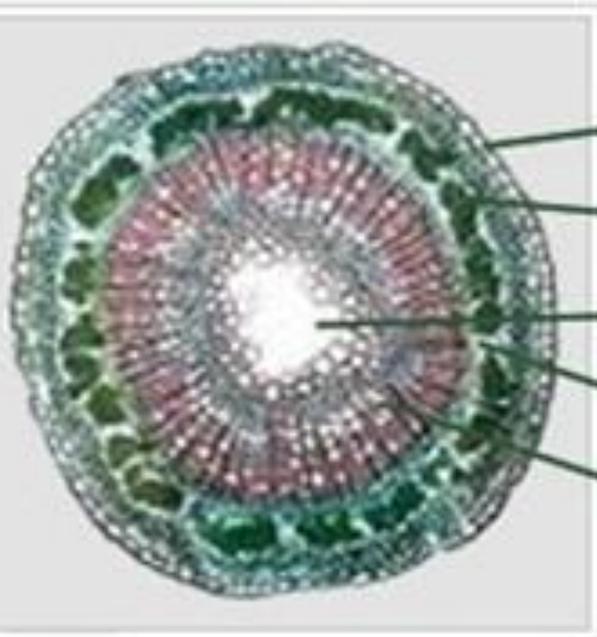
- ◎ You can see that it doesn't take that many acres to produce massive amounts of CBD.
- ◎ This is another example of AgriLife's concerns about over supply of CBD due to more states now growing hemp and a significant increase in acres—which have already led to lower farm prices.
- ◎ Will this affect retail sales prices?

# Hemp Uses





# Hemp Fibers



BARK

BAST FIBER \*\*

AIR

PECTIN

CORE FIBER \*\* (hurd)

**Hurd (wood core)**

**fiber board**    **mulch**  
**insulation**    **fuel**  
**hemcrete**    **paper**

**Bast Fiber**

**rope**  
**cloth/textiles**  
**composites/plastics**

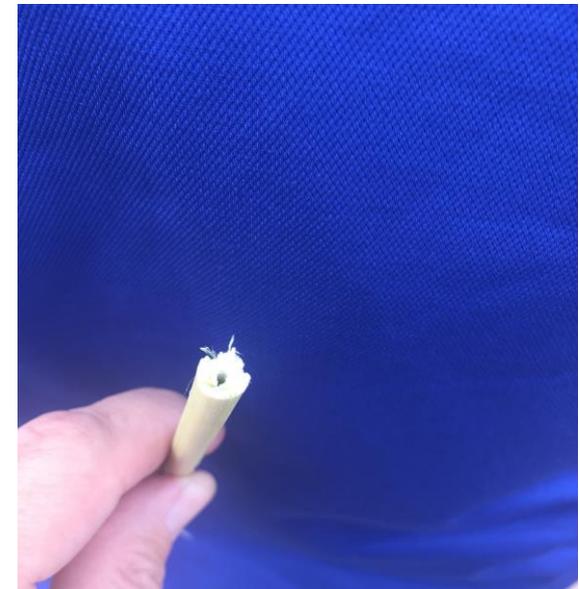
**Hemp**  
**Stalk**



# Industrial Hemp Facts

## *Fiber*

- ◎ Hemp for fibrous material—very versatile
  - ◎ One acre of hemp produces as much woody matter as four acres of timber in 60-90 days.
  - ◎ “Bast” is the external fiber. It is not necessarily like bark, but it strips off the outer stalk (upper right).
  - ◎ “Hurd” is the internal portion of the stalk, the pith. Sometimes considered waste material, but has significant industrial uses (lower right).



# What about hemp byproducts and waste materials for animal feed?

- ⦿ Because Cannabis was a federally controlled substance (drug) any changes in rules that would allow use of foliage, grain, left-over meal after CBD extraction, etc. have not yet been addressed.
- ⦿ So currently hemp is not approved federally for use in animal feed.
- ⦿ Texas A&M AgriLife has not yet studied any available published scientific reports that discuss potential feed value, palatability, etc.
- ⦿ Colorado growers report that cattle do not appear to readily graze hemp forage.

# Learning about Hemp

There is a lot we do not know about hemp for Texas. Information from other regions may not be applicable.

(Learning how a hemp plant grows with Jack Rose, MM Hemp, Corona, NM; Sept. 20, 2019)



# Key Comparisons and Chemicals of Hemp

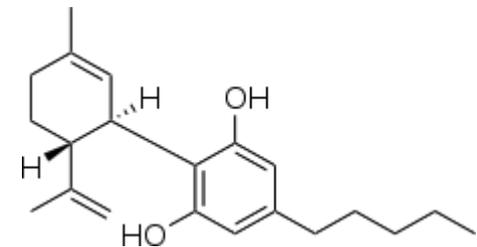
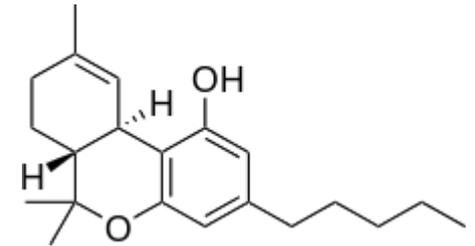
- ⦿ All hemp, whether for drug use or industrial uses, is either *Cannabis sativa* or *Cannabis indica*. There is conflicting information in the literature if these types are separate species or rather subspecies of the same plant.
- ⦿ One cannot look at a hemp plant and know if it is marijuana or another cannabis/hemp type
- ⦿ The legal definition of “hemp” or “industrial hemp” is that it contains  $\leq 0.3\%$  THC (technically, this is the narcotic delta-9 THC plus the acid non-narcotic form THCa, which is readily converted to THC).

# Key Comparisons and Chemicals of Hemp

- ⦿ **Cannabinoids** are a large class of similar compounds found in the Cannabis plant. There are over 100, often nearly identical in chemical makeup.
- ⦿ There are many potential uses for cannabinoids in health, chemical, and industrial applications that are being researched, and many more to be discovered.

# Key Comparisons and Chemicals of Hemp

- ⊙ **THC, or tetrahydrocannabinol**, specifically the  $\Delta^9$ -THC, or “delta-9” form, which is psychoactive. There are slight variations (isomers) of this chemical, but legally it is  $\Delta^9$ -THC that is tested to determine legality of  $\leq 0.3\%$ . Total THC could be more than that.
- ⊙ **CBD, or cannabidiol**. Non-psychoactive. This cannabinoid has some proscribed medical uses for epilepsy and a few other conditions. It is the subject of other research, but many more health claims.
- ⊙ Other cannabinoids may become important in the future including CBG, CBN, etc.



# Industrial Hemp Facts

- ⦿ Legal hemp cannabidiol (CBD) is **NOT** an oil in the traditional sense like an oil pressed from seed (which hemp seed has); although CBD is a lipid (fat) upon extraction from biomass, particularly floral structures, it can be refined into a crystalline form, then reconstituted in a carrier oil (like coconut)—hence **CBD oil**.
- It is proscribed medically for epilepsy, seizures; other uses need further research, but there is some promise as an anti-inflammatory aid
- The production of industrial hemp would permit the procurement of the CBD from a non-narcotic cannabis plant.
- The chemical industry is scaling up to produce CBD synthetically (what will this mean for the hemp CBD industry?)
- Increasingly you will hear of other cannabinoids, e.g. CBG, CBN, etc. that might in time be of even greater interest than CBD.

# Some “First Things” to Remember...

- ⦿ There is an incredible amount of hype in industrial hemp, especially surrounding CBD.
- ⦿ There are some producers that have in fact made some of the high revenue and profits you have heard about—but they were first adapters, and the economics have already changed. The potential to saturate the hemp market for CBD is real. Some CBD hemp growers & businesses in other areas of North America are already exiting.
- ⦿ **A lot of mis-information and even fraud around hemp.**
  - ⦿ Expensive seed that is not what it is claimed to be
  - ⦿ Promises of profits that are not realized; producers do lose money
  - ⦿ Consider openness and verification of possible partners.

# Texas A&M AgriLife and Hemp

- ⦿ As of November 1, Texas A&M AgriLife has no public agreement or contractual relationship with any hemp organization, company, or individual.
- ⦿ Claims that Texas A&M AgriLife is “working with” a particular individual or entity are not true.
- ⦿ Texas A&M AgriLife does not have our own research yet, and it will take a couple of years to develop data; we will help clientele assess potential opportunities, identify pitfalls, and provide professional assessment within limits for agronomics, economics, etc.
- ⦿ Texas A&M AgriLife are not in regulatory role (that’s for TDA)

# Major Questions for a Texas Hemp Industry

- ◎ *How can I best sort through the common “hemp hype,” especially for CBD oil? Patience required. Be skeptical? Talk to others with experience, especially if they are not in promotion or sales. Read lots. “If it sounds too good to be true...” Know that 2019 economics will likely be outdated by 2020 (and hemp prices decreased)*

# Major Questions for a Texas Hemp Industry

- ⦿ *Are there major financial risks to CBD production if acres are greatly expanded?* Absolutely! It is uncertain how much market there really is for CBD. Technically, anyone making medical and health claims for CBD are in violation of U.S. Food & Drug Administration (FDA) guidelines. In 2018 there were about 78,000 acres of industrial hemp production approved in the U.S. (almost all for CBD). In 2019 states issued permits for over 500,000 acres though much of that (even 2/3) was probably not planted. Oversupply can happen quickly. There may not be enough processing capacity.
- ⦿ Oversupply is not a concern for fiber (little current processing capacity) and grain.

# Major Questions for a Texas Hemp Industry

- ⦿ *Can CBD be manufactured synthetically, and is this a potential threat to the CBD oil hemp industry? Yes.*  
Synthetic CBD should be free of the rules or hemp CBD though there is a question about chemically converting CBD into THC.
- ⦿ *What agronomic and per-acre yield potential information is available to prospective hemp farmers and processors?*  
There is no Texas data. Some info. from Kentucky might be applicable in East Texas. CO & NM data for West Texas. We can't say yet what these numbers will be.

# Major Questions for a Texas Hemp Industry

- ⦿ *How will hemp production with its level of regulations compare to growing other major or alternative Texas crops?*  
Record keeping will likely be similar to organic farming.  
Much more effort, including when industrial hemp is transported.



# Major Questions for a Texas Hemp Industry

- ◎ *Is all the hype surrounding hemp, especially for CBD oil, just like the Texas emu fiasco in the late 1980s and early 1990s?* For CBD possibly so. The discussion and projection of excessive revenue and profit leads many individuals to make poor, uninformed decisions. Grain and fiber—no. What is different is hemp grain, CBD, and the fiber all have inherent value in a way that emu oil and meat never did.

# Industrial Hemp Considerations

- ⊙ **Early AgriLife comment, now discounted:** “*Requires 1/2 the water need for cotton with little herbicide/pesticide required*” (no, no, no); producers in similar environments like SE Colorado, Oklahoma are irrigating at near cotton levels, and even more in some cases; AgriLife is unsure at this point about viability of dryland, especially for high-input cost CBD production.
- ⊙ An early projection by Trostle suggests that Texas field grown hemp for CBD (not fiber) should consider  
At-plant soil moisture + in-season rainfall (four months)  $\geq 15$ ”

# Industrial Hemp Considerations

- ⦿ One hemp farmer with four years experience in Colorado says “You can’t starve a hemp crop into profitability.” Meaning low inputs are not the way to go.
- ⦿ He estimates that hemp can be grown on about 40% less water than corn, but you would not hold back any irrigation if you have doubts about whether you should irrigate more.
- ⦿ With the excessive amount of production costs, you would not risk poor production if you could have irrigated more.

# Hemp Seed

Grain from hemp plants for CBD production. Individual seeds are wrapped in a husk-like structure (green). These seeds are likely immature as CBD harvest has not yet occurred. The dark seed is a specific type of seed called an 'achene,' which is similar to sunflower (external seed husk, internal 'meat' or seed).



- ⊙ Single hemp plant for CBD production. Floral structures all the way to the bottom of the plant. Harvest method? Will have to process whole plant in order to get all floral structures for CBD extraction. Hand harvest and drying of plants then later hand removal of floral buds gives high %CBD but is very time consuming.



Trichomes (small protruding structures) produce cannabinoids. Note the sticky appearance.



© More trichomes



# Poor stand, Roosevelt Co., NM, 2019

Planted in early June (late)



NM 2019: Five visually different distinct plant types in a “variety.” Other types may not visual as different genetics may not be visually distinct.



Colorado hemp production for CBD. Underground drip lines for irrigation but no plastic sheeting for weed control. 60" wide rows X 60" in-row spacing, from feminized seed. Harvest mechanically? Drying?



Another hemp field, Colorado. 6' tall plants. It is not clear how this field will be harvested for CBD since the biomass is great.



Dryland hemp field for CBD and seed, southeast Colorado.  
August, 2019 (deep soil moisture @ planting, near avg. rainfall)



Field planted with regular seed at lower cost so field is 50% male plants (lighter colored plants). Mechanical harvest of a “top crop” for about 12-16” for grain and remaining raw material for CBD extraction. It is uncertain if the %CBD levels will be high enough to be marketable.

Poor quality feminized seed that had low germination and poor vigor was planted in early June in northeast New Mexico (at least 1.5 months too late?) when seed became available). The farmer's seeding rate if he had paid commercial retail rates would have been about \$3,400 per acre, but the contractor provided the seed, bearing much of the risk. Irrigated.



Southern High Plains, 2020. Poor stand (planting date unknown) coupled with unchecked weed issues. Is this worth harvesting (by hand)? Likely a huge financial loss to the producer. The field was irrigated.



# Large Scale Hemp vs. Small Scale Crop

- ⦿ Most of the pictures you just saw are for larger field-scale production.
- ⦿ There is another side that involves greenhouse, and “hobby farm” production that is about 1 acre or less. This likely involves complete hand production—establishment, maintenance, harvest, drying, and isolating dried flower.
- ⦿ There is some interest in using lower cost “hoop houses” for production which can extend the production season forward as well as later in the fall.

Greenhouse production, courtesy North Carolina State University. These are older woody plants so the production goals are uncertain.



# Hoop House

- ⊙ For climates with cold weather, these can extend the growing season up to 45 days on each end.
- ⊙ 30' X 100', ~\$8,500 (FarmTek); roof sheet replacement about \$1,500 (5.2 oz./12 mil)



# Prior to CBD

## Extraction

- ⊙ Material for CBD extraction is ground and then any seeds removed (another step required).
- ⊙ The seeds at right are likely immature and should not be planted (some have been sold as planting seed little or no poor germination).
- ⊙ An independent germination test should reveal this low seed quality—**if you can get the seed in advance to test it.** (Make that your condition for purchase.)



# Clones for CBD Production (Female only)

- ⊙ One means of getting all female plants in a field for higher CBD is to use cuttings from mother female plants, maintained under controlled lighting.
- ⊙ Cuttings are treated then placed in a growth medium for rooting then later transplanted in the field.
- ⊙ Clones are expensive and likely used only for small-scale high CBD production.



# Industrial Hemp & Texas— *Field & Business*



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Texas—November 2019



consider possible growing demand (though that demand is on proven medical benefits). Since other countries don't produce there a possible export market if import regulations are practical.

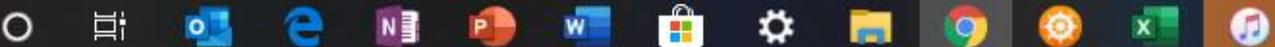
# AMERICA IS GROWING 8X THE AMOUNT OF CBD HEMP IT CAN CONSUME AND PRICES ARE CRASHING

Before farming hemp this year, it might be a good time to panic. The US can only reasonably consume 22.5M lbs of 10% CBD Hemp in a year, and we're currently growing closer to 180M. Here is a link to look at the current hemp surplus we are staring in the face:

Is America Growing Too Much Hemp? You Might Be Surprised...

RECENT POSTS

hemp-plant-farm-....jpg ^



# There is more than one way to grow CBD hemp

- ⦿ You will read or hear about individual producers that believe their way is best. They might even say that other methods, like planting straight run seed and not rogueing males, or the %CBD you might get from that practice, are not possible.
- ⦿ This depends on grower objectives
- ⦿ Remember, in any crop producing maximum yield is NOT the most profitable
- ⦿ It takes too much effort or cost to maximize.

# There is more than one way to grow CBD hemp

- For CBD, there are many different production practices:
  - **Seed type**: planting straight-run seed (meaning field will have males and female plants; some growers rogue the males out and some don't), feminized seed, transplants (of feminized seed), clones.
  - **CBD content in dried material**: at little as 2% (a few extractors will handle this material due to economic considerations) to ~14% (preference is ~8% and higher)
  - **Planting pattern**: 5' rows with 5' between plants (~1,750 plants per acre), 30" rows with seeds 24" apart, even drilled.

# There is more than one way to grow CBD hemp

- ⦿ For CBD, there are many different production practices:
  - ⦿ **Irrigation**: surface drip irrigation under a plastic sheet (helps control weeds), pivot irrigation (sprinkler during establishment then LEPA drag socks), even furrow irrigation. What about dryland?
  - ⦿ **Harvest**: by hand—harvest, hanging up to dry or possibly mechanical handling, threshing out floral structures; increasing levels of mechanization to the point that hands never touch the crop in harvest, baling, drying, threshing out any seed, etc.

# Major Hemp Issues that Lead to Failure

- ⦿ Poor quality seed or other genetic resources
  - ⦿ Most varieties grown for CBD have a marijuana background so have been grown in pampered environments. Field conditions are tougher, and this has led to many failures. These “varieties” are also more prone to become “hot” with THC.
- ⦿ Varieties for grain and fiber may be more hardy, and less likely to develop an issue with THC.

# Major Issues that Lead to Failure

- ⦿ Lack of openness among some in the hemp industry—statements and promises about A) the profits you can make, B) how many growers or acres a hemp contractor might have
- ⦿ There no guarantees
- ⦿ Underestimating the cost and time of production
  - ⦿ One Colorado farmers estimates land prep through the point of extraction, \$13,000 per acre; USDA's national composite average is \$19,000 per acre (and revenue of ~\$25,000 acre—**on past prices**).

# Major Issues that Lead to Failure

- ⦿ Not understanding the agreement with a buyer
- ⦿ Not having a legally binding contract with that buyer
- ⦿ Not having that agreement reviewed by your attorney before signing
  - ⦿ An attorney is there to protect YOU!
  - ⦿ They have a version of “fiduciary” responsibility to you in recognizing what is best for you
  - ⦿ You might find it hard to follow their advice if you want to grow hemp really bad, or you are afraid you might “miss out”
- ⦿ Remember, contract terms should be negotiable; if not then at least consider another buyer

# Germplasm & Seed

- ⦿ Purity of genetics and seed
- ⦿ Sources
- ⦿ “Approved” varieties vs. certified varieties
  - ⦿ Not yet determined how Texas Dept. of Agriculture will address certification
  - ⦿ This may be a challenge since so many hemp lines are not pure
- ⦿ Adaptation of varieties to different regions of Texas and suitability for cannabinoid production vs. grain vs. fiber

# Germplasm & Seed

- ⦿ Adaptation of varieties to different regions of Texas and suitability for cannabinoid production vs. grain vs. fiber
- ⦿ It appears that in general hemp varieties are widely adapted
- ⦿ You would likely not plant a well-adapted corn hybrid in Texas to North Dakota, but a sunflower hybrid that performs well in different Texas regions is also likely to perform well in North Dakota.
- ⦿ I think hemp varieties and adaptation might be more like sunflower

# Germplasm & Seed

- Will there be **certified varieties** in the way you are accustomed to in wheat, cotton, corn, peanuts? (And who would administer a program?)
- What protections could a grower have on seed, transplants, or clones?
- Use an escrow account for seed/transplant/clone payment until grower is satisfied the genetics is what it is claimed to be?
- Obtain a seed sample of the same lot of planting seed you would buy to run a germination and vigor test on before you purchase?

# Different Flower Types among Hemp Lines

- ⦿ Hemp has two general types of varieties: the more common **photoperiod sensitive** (PS) and **determinant** (or 'autoflower', the term the hemp industry uses).
- ⦿ PS lines in general enter the reproductive phase based on days becoming shorter (actually it is longer nights). So if planted early in the year vs. a month or two later, the plants may start to flower about the same time (though this is not always the case, which might be due to the difficulty in assessing a specific 'variety' because the seed is not purely one genetic line).

# Different Flower Types among Hemp Lines

- ⦿ Indeterminant/autoflower varieties will at some point enter reproductive growth base on “maturity”. This means that a generally fixed number of days (or ‘heat units’, the cumulative effect of heat over time) will trigger reproductive growth.
- ⦿ An indeterminant variety will begin reproductive growth and reach flowering quicker in a hot environment (e.g., perhaps 50 days) where if the environment is moderately warm it will take longer (perhaps 60 days)

# Different Flower Types among Hemp Lines

- ⦿ Texas A&M AgriLife will research the differences of photoperiod sensitive and indeterminate hemp lines at different locations across the state using different planting dates.
- ⦿ This will take time.
- ⦿ We will include the use of variety trials to help accomplish this.
- ⦿ The work will apply to all hemp uses, whether CBD, grain, or fiber.
- ⦿ Your seed provider may have some recommendations for hemp type you plant

# Genetic Types

(and a long-time hemp farmer's suggested maximum price for 2019-2020)

- ◎ Straight run seed—50% male & 50% females. Will you rogue males or not (CBD)? Cost? (maybe \$1 per pound)
- ◎ Feminized seed, \$1 per seed (\$0.80 max)
- ◎ Transplants, \$3-5 each? (\$2.25 max)
- ◎ Clones (no tap root), up to \$10 each (\$4 max)
- ◎ Larger operators want to produce their own (“we can trust ourselves”)

Hemp seedlings being prepared for feminized seed production.



Hemp plants producing feminized seed in a controlled environment. Outside air is filtered to remove possible introduction of male pollen.



# Major Questions for a Texas Hemp Industry

- ⦿ Will herbicides, fungicides and insecticides be readily available for hemp production? There are no labeled crop protection chemicals currently available. A short list of products recently cited by EPA for possible labeling in hemp were organic products only, which are not likely sufficiently effective (and cost effective) for large-scale production.
- ⦿ It will likely be at least 2 to 3 years minimum before traditional commercial herbicides, insecticides, and fungicides are labelled for commercial use (will depend on whether chemistries are adapted from other crops, or new testing is required).



# Soils & Suitability for Hemp

- ⦿ **Industrial hemp does not like poorly drained soils.** No prolonged “wet feet.” Optimum soil pH appears to be 6.0 (slightly acidic) to 7.0, possibly up to 7.5 but we see hemp growing well in Colorado on soils with pH approaching 8.0 (slightly alkaline, or basic).
- ⦿ Little soil testing research or development of nutrient response curves has occurred. Some farmers suggest that nutrient needs are comparable to a corn crop’s yield potential under the same field production conditions.
  - ⦿ Possibly 25-50% more than a cotton crop on same field?
- ⦿ **Tests for “Hemp Soil”?** No need to spend extra money, standard soil tests are just fine.

# Soils & Suitability for Hemp

- ⦿ In addition to nitrogen (**N**) growers do believe that phosphorus (**P**) and potassium (**K**) have a significant role in hemp production.
- ⦿ Little is known about possible micronutrient needs in hemp like iron (Fe), zinc (Zn), etc.
- ⦿ The **Texas A&M Soil Test Lab** (<http://soiltesting.tamu.edu/>) is evaluating using soil test data from other universities until Texas can generate our own data. For specific questions on soil testing for hemp contact Trostle or Dr. Tony Provin, A&M soil test lab director, (979) 845-4816, [soiltesting@tamu.edu](mailto:soiltesting@tamu.edu)

# Labeling for Pesticides for Hemp

- ⦿ For evaluation in an EPA program for limited acreage crops for possible labeling (2019):
  - ⦿ Herbicide: [bromoxynil](#) (a limited use weak broadleaf herbicide that often is better in a tank mix; the most common brand name is 'Buctril', but there are many generics)
  - ⦿ Fungicide: [azoxystrobin](#) (this is a major fungicide; Quadris, Dynasty, etc.))
- ⦿ **No insecticides currently labeled.**
- ⦿ A limited number of growth regulators and a few other chemicals labeled. Also, some other materials (12, mostly for organic) that don't require tolerance testing.

# Labeling for Insecticides for Hemp

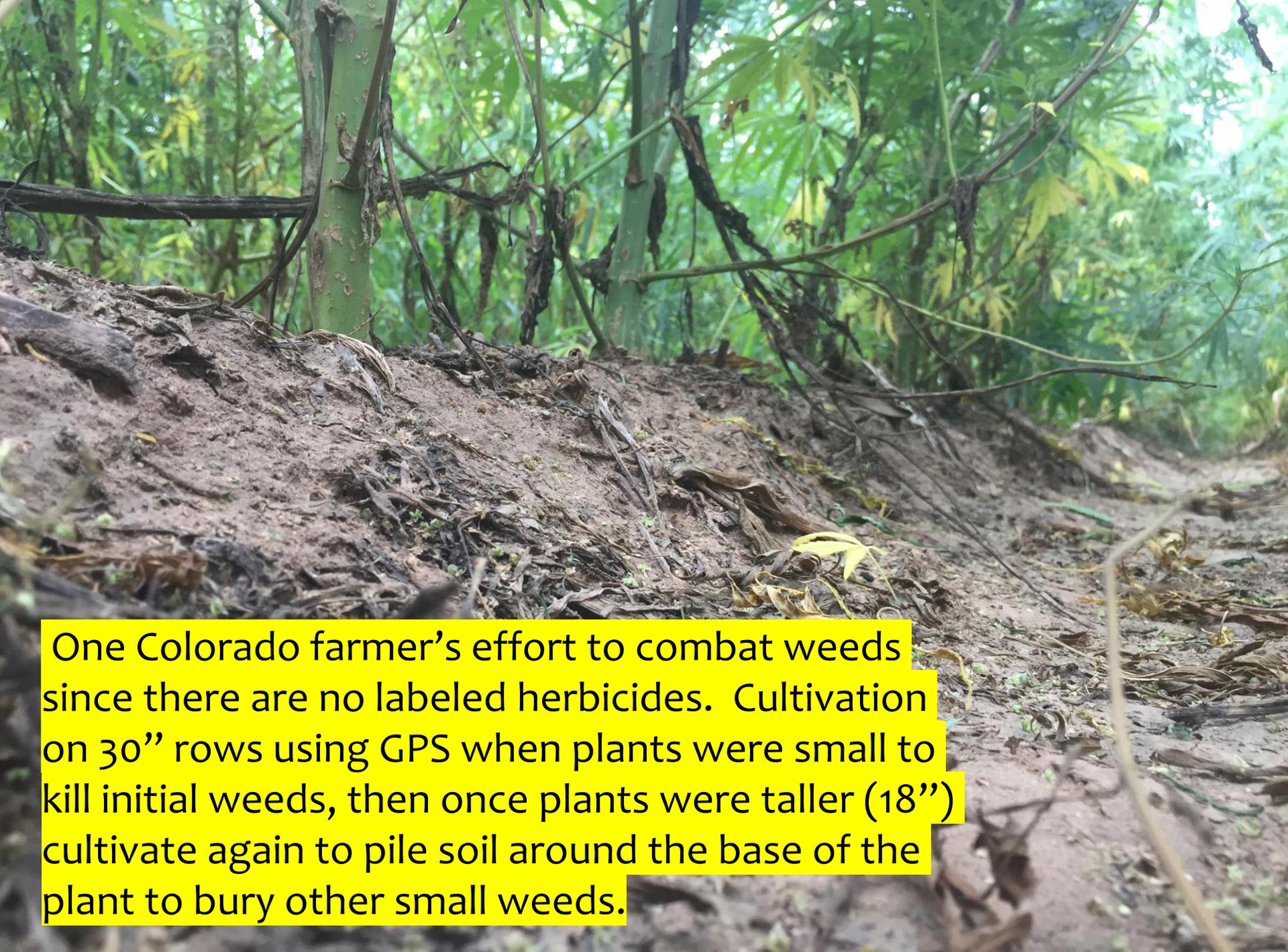
- ⦿ No insecticides currently labeled.
- ⦿ From other states, starting to hear about fall army worms, corn earworm/cotton bollworm and similar insects. Grasshoppers?
- ⦿ Will these insects feed on the general leafy foliage or damage floral structures which have high CBD?
- ⦿ Role of beneficial insects in hemp?
- ⦿ What other insects might become an issue in Texas hemp?
- ⦿ Different species of stink bugs, white flies and the numerous diseases they transmit, aphid species?

**Got Weeds?**



# Weeds

- ⦿ **Hemp is NOT for your weedy ground**
  - ⦿ In Texas we even say this for crops like guar and sesame which DO have a few labeled herbicides
- ⦿ A major issue in hemp—no labeled herbicides.  
**Most common weeds I hear:** pigweed/Palmer amaranth/carelessweed, also bindweed masses get into biomass in mechanical harvest
- ⦿ Plant early to get ahead of weeds? (Probably won't work very well in Texas)
- ⦿ Cultivating, possibly mulch, hand hoeing (several hundred \$ per acre)



One Colorado farmer's effort to combat weeds since there are no labeled herbicides. Cultivation on 30" rows using GPS when plants were small to kill initial weeds, then once plants were taller (18") cultivate again to pile soil around the base of the plant to bury other small weeds.

# Hemp as an Accumulator of Pesticide Residues, Heavy Metals, Etc.?

- ⦿ Texas A&M AgriLife has not studied this issue yet, but a common concern we hear is that hemp accumulates residual chemicals from the soil (or maintains these residues in the plant) like herbicides, insecticides, etc.
- ⦿ This concern also includes heavy metals (lead, cadmium, mercury, etc.)
- ⦿ This issue was raised first by marijuana users and that industry's concerned about possibly inhaling other chemicals
  - Note the irony!
- ⦿ A potential issue in hemp consumable products?
- ⦿ We are unsure this is actually the case. We will look for evidence in published scientific literature.

# Sources of Label Information & *AgriLife Extension Weed Scientists*

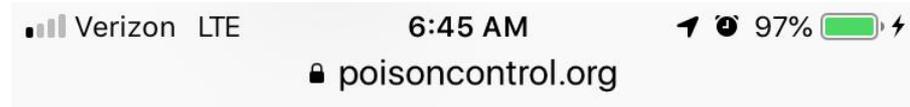
- ⦿ Labels for herbicides, insecticides, fungicides, seed treatments, growth regulators, etc.—access through <http://www.cdms.net>, click ‘Label Database’ then ‘Search’ then conduct either of two searches:
  - ⦿ **A)** Enter product name then choose the specific product then its label or supplemental label (most common use)
  - ⦿ **B)** Click “Other Search Options” (register for a free password) to search by active ingredient (looking for a generic?), find a class of chemicals (herbicides, fungicides, insecticides) labeled for a particular crop, etc.
- ⦿ **Texas High Plains**—Dr. Pete Dotray, Lubbock, (806) 746-6101, [pdotray@ag.tamu.edu](mailto:pdotray@ag.tamu.edu)
- ⦿ **\*Central Texas**—Dr. Scott Nolte, College Station, (979) 845-4880, [scott.nolte@tamu.edu](mailto:scott.nolte@tamu.edu)
- ⦿ **South Texas**—Dr. Josh McGinty, Corpus Christi, (361) 265-9203, [joshua.mcginty@ag.tamu.edu](mailto:joshua.mcginty@ag.tamu.edu)

# Texas Poison Center Network

⦿ <http://www.poisoncontrol.org>

⦿ (800) 222-1222

⦿ Put this in your  
Cell Phone!



**POISON CENTER NETWORK**

# Plant Diseases



- ◎ Texas A&M AgriLife Extension plant pathologist Dr. Tom Isakeit, [t-Isakeit@tamu.edu](mailto:t-Isakeit@tamu.edu)
- ◎ Preliminary write-up for more likely potential diseases to industrial hemp
- ◎ **Cotton Root Rot**, expected susceptibility in Texas; powdery mildew in humid/coastal areas.
- ◎ Others? Pythium, viruses

# Hemp & Animal Pests

- ◎ Is hemp susceptible to animal pests?  
**Wild hogs?** **Deer?**
- ◎ Texas A&M AgriLife has not heard of deer affecting hemp in other regional states. If this were an issue I think we would have heard about it by now.
- ◎ Wild hogs—we do not know if wild hogs will damage hemp, bed down in the fields, try to eat the seed or transplants. The general moderate odor of hemp plants might be a repellent.



# Hemp Planting Seed & Seed Treatments

- ⦿ No use yet of the most basic of seed treatments like metalaxyl (nothing labeled!) to prevent damping off and seedling death.
- ⦿ No known need yet for a seed insecticide—in other states.
  - ⦿ Wireworms, beetles, etc. When you plant such expensive seed you would like to have this protection
- ⦿ Southern High Plains observations: Hemp plants 10-12” tall dying for no observable reason.
- ⦿ All seed potential seed treatments need to be tested on hemp to ensure no interference with germination

# Planting Dates for Texas?

- ⦿ A lot of thought needed here. AgriLife research on this topic won't be here for you for at least two years.
- ⦿ Contrasts: **Lower Rio Grande Valley** vs. **High Plains**. Hot temperatures in the Rolling Plains vs. rainy season in **East Texas**.
- ⦿ Effect of planting date on harvestability (if mechanical), cannabinoid content, fiber yield and quality, etc.

# Planting Dates for Texas?

- ◎ Soil temperatures? “Like corn”, that is a minimum of about 50° F. But is that too early, especially for fragile seed?
- ◎ Avoid any freezing temps on seedlings?
- ◎ To what extent is photoperiod sensitivity a factor?
- ◎ Many failures in nearby states attributed to planting late in early summer when soil conditions may be hot
- ◎ Fall planting in Alabama in Sept. 2019; recent October variety trials planted in Florida

# Hemp & Crop Rotation

- ⦿ As a general principle, crop rotation is a sound management practice for maintaining healthy productive soil.
- ⦿ Crop rotation also reduces the possibility that damaging plant diseases or soil pests will reduce production.
- ⦿ There is little if any data on crop rotations that include hemp in the U.S.

# Hemp & Crop Rotation

- ⦿ Hemp should be a favorable rotation with grass crops (corn, grain sorghum, wheat/small grains).
- ⦿ There is some question about the degree of rotation benefits with broadleaf crops including cotton.
- ⦿ Crop rotation is still likely favorable to the other crop, but there is the possibility that some plant diseases—more likely from a broadleaf crop—could also be a pest for hemp. We don't know yet.
- ⦿ At this time Texas A&M AgriLife would not recommend growing hemp in consecutive years on the same field.

The following pictures are examples of large scale hemp farming for CBD production.

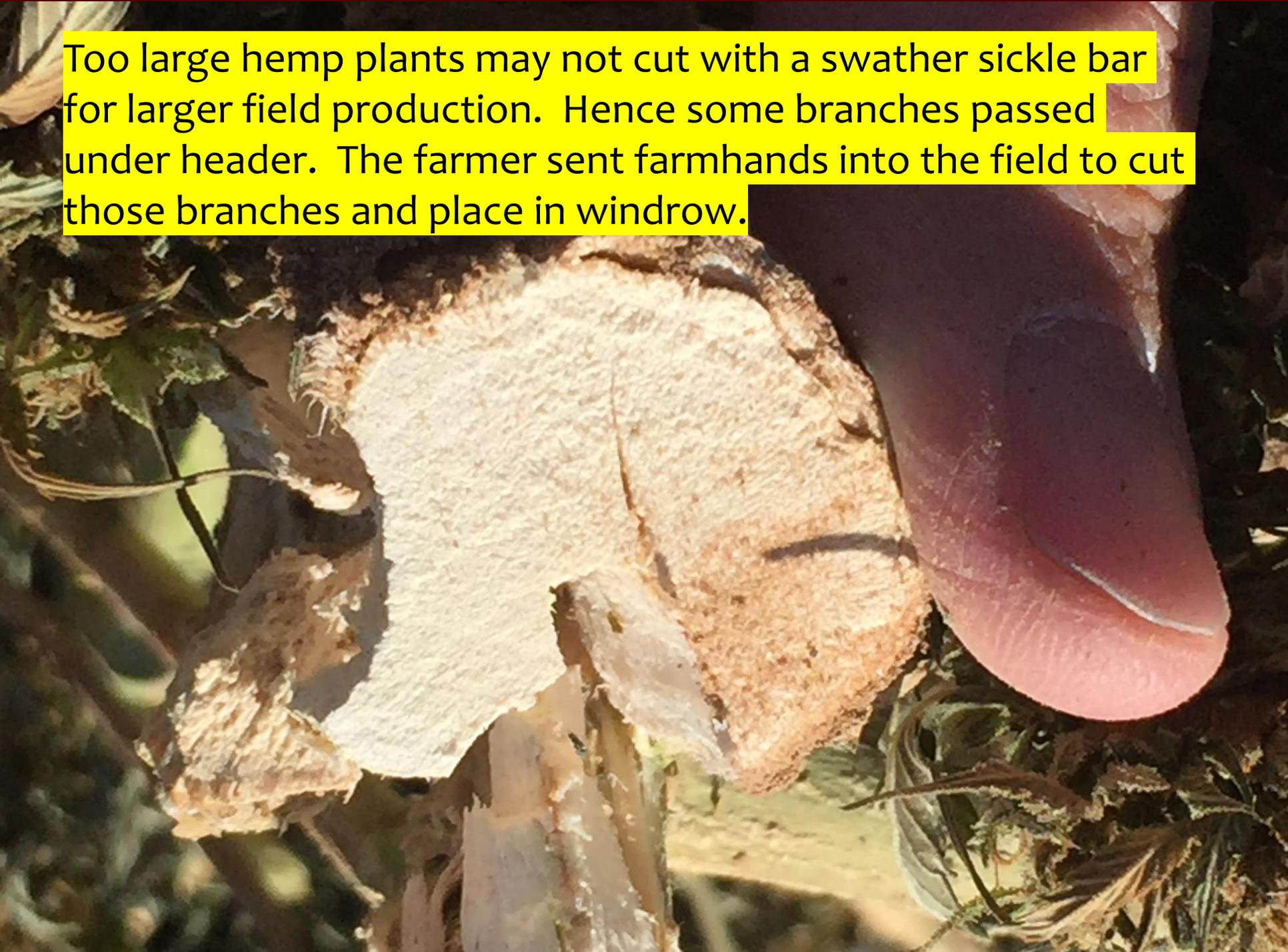
Colorado CBD hemp harvest: plants cut by hand, conveyed into old peanut drying trailer (has perforated floor) then hooked up fans to force air through plants for drying). This is in contrast to hanging up to dry by hand.



Colorado CBD hemp harvest: Common method for larger acreages. Draper header drops plants in windrow for baling. Ideally this is done for green plants for 1-2 days of field drying before baling. This this poor field crop froze at 19 F on October 9, 2019, so plants are excessively dry and floral structures and trichomes are falling off, losing CBD.



Too large hemp plants may not cut with a swather sickle bar for larger field production. Hence some branches passed under header. The farmer sent farmhands into the field to cut those branches and place in windrow.



Western Colorado: Swathed hemp field cut just before a freeze that is ready for baling. Field used surface drip irrigation under a biodegradable plastic sheet. Field planted transplants through the sheeting on 60” rows, plants 24” apart within the row.



Baler model gathers field hemp (up to 80% moisture) using computer programming to control the density of the bale in order to accommodate < 24 hours of forced-air drying to about 12-14% moisture.



Bales from McHale baler set on end with ambient air (or slightly warmed) being forced upward through the bale for 8-12 hours. This operation is handling about 1,500 acres of production for CBD.





Bales are then turned upside down to continue drying. Moisture is probed by hand for ~14% moisture, and if needing more drying remain on the floor for the next cycle as new bales are added.



Large acre harvest in eastern Colorado for CBD. Grain is removed from sample and biomass for CBD collected in a trailer behind the rotary combine.

The dilemma of over-drying in the field or the effect of a strong freeze: plant tissue are very dry, crumble, and lead to lost CBD production.

Some farmers in the Southern High Plains conduct harvest operations at night similar to alfalfa farmers, who bale & rake at night in order to gather the most important component of alfalfa—the leaves—in the forage harvest.





Fibrous hemp material that collects around the combine. Some fiber materials will wrap around bearings and other moving parts in combine harvest (used if gathering seed, or trying to remove it before CBD extraction).

Trailers pulled behind combines to collect biomass for CBD extraction.





Another bale type of baler that receives the bulk CBD biomass (in this case must be dry) then bales and wraps for transport to a processing facility. The baler is >\$500,000.



Indoor drying of hand harvested plants. Farmer may not have enough capacity. The plants, which were not dried in the field (probably should have been at least one day?) may be packed too tightly to dry properly risking mold. Large fans are needed at the end of the building to force air, but air will move over—not through—the plants for ineffective drying.



- ⦿ Rack drying of hand harvested plants.
- ⦿ This hemp for CBD **tested 2.7% THC** and discussion is occurring with the state dept. of agriculture to see if limited processing might be allowed else who crop is destroyed—full 100% financial loss.



Example of small stripper machine that removes floral structures from hand harvested hemp for high % CBD extraction.



# Hemp Industry Concerns for CBD

- ⊙ A concerning number of farmers still don't seem to know how they are getting their crops out of the field and dried.
- ⊙ Many are crossing their fingers for a solution to present itself at the last minute. Mother nature could still do serious damage.

# Hemp Industry Concerns for CBD

- ⦿ One of the largest farming and processing companies in Kentucky has hit a roadblock in their expansion project and the effect is rippling to farmers and operators across the state.
- ⦿ Many didn't plan on equipment or crews to get their crops harvested, dried, and processed.

# Forthcoming AgriLife Guidelines: *Hemp Business/Contractor Relationships*

- ◎ Texas A&M AgriLife Extension has a faculty member of Department of Agricultural & Applied Economist who is an agricultural law specialist and an attorney. A document is being prepared to help guide prospective growers in the developing Texas hemp industry.
- ◎ [Agrilife.org/texasaglaw](http://Agrilife.org/texasaglaw), Tiffany Dowell-Lashmet, J.D., Amarillo AgriLife Extension

# Beware of contracts that have many 'outs' in favor of buyer/processor

- ⦿ A concern raised by AgriLife Extension ag. economist Dr. George Knapek, College Station: Many contracts appear to provide the buyer/processor with many “outs”, which they can use to escape contractual obligations.
- ⦿ This leaves the farmer holding a crop with no immediate buyer, now trying to find another market.

# Grower Arrangement – Buyer/Processor

- ⦿ There is a wide range of agreements (CBD)
- ⦿ If just a few acres or less, you are more likely going to foot the bill for all costs, your own drying, etc.

# Grower Arrangement – Buyer/Processor

- ⦿ On one hand: Growing for a **flat fee**, say \$1,000 per acre (may pay irrigation, split fertilizer bill)
- ⦿ Reimbursed for all other expenses (make sure you get it; better to have buyer pay bills directly—they will need to be well capitalized)
- ⦿ **Your upside is limited** (no \$XX,XXX gross per acre); **your downside risk on failure is nil.**
- ⦿ You wouldn't need crop insurance.
  - ⦿ The buyer would like to have it, but they are not a “grower” and do not have five years of farm yield history

# Grower Arrangement – Buyer/Processor

- ◎ On the other hand: **Paying all the costs, taking the full risk of loss, profit, etc.**
  
- ◎ Is this for you?
  
- ◎ Whole Farm Revenue Protection crop insurance will be available in 2020, but:
  - ◎ **You must have** 5 years of farm income
  - ◎ **You must have** a contract with a buyer

# Advice to Prospective Growers 1

- ⦿ Ask lots of questions. Ask for verification of claims. If you can't get straight answers, then that is a **red flag**.
- ⦿ Are the people you are talking to truly interested in farmers?
- ⦿ AgriLife Extension recommends that no prospective hemp grower—CBD, fiber, grain—initiate production without a legally binding contract reviewed by an attorney of your choice.
- ⦿ If your attorney asks for revisions or changes in terms, do not ignore them. They are hired to protect you. If a production contract does not satisfy you, and differences can't be ironed out, then walk away.

# Advice to Prospective Growers 2

- ⦿ Because risk of impure seed or seed that is not what it is claimed to be (for example, “feminized” seed which should be free of male plants but is not), growers should consider:
  - ⦿ **A) an escrow account** that withholds payment to the seed (or transplant or clone) supplier until the grower is assured the seed germinates, establishes, and is free of males;
  - ⦿ **B) an arrangement in which your contractor shares the farming risk by supplying the seed or planting material** and bears its full cost. (An **established contractor** should better recognize issues with planting stock reliability; they can make the purchase at a better price since they should know what is too much to pay.)

# Advice to Prospective Growers 3

- ⦿ If you meet anyone that seems to “have all the answers” then be cautious. There is as of 2019 no single farmer that has grown hemp under Texas conditions
- ⦿ Exception: there are a few legally licensed growers of medical Cannabis in Texas.
- ⦿ We don't yet know how hemp genetics that perform adequately in other regions will perform in different Texas environments.

# Advice to Prospective Growers 4

- ⦿ **What about growing hemp or the business that you don't understand?** Then ask those questions and seek answers.
- ⦿ There are numerous organizations and websites vying for your attention in Texas. Vet them carefully. Is the leadership local and appear to represent your interests as a farmer?

# The Reality of 2020 Hemp Processing in Texas

- ⦿ USDA interim rules have been released and now Texas Dept. of Agriculture will submit a state plan.
- ⦿ Licenses in 120 days? (grower & processor)
- ⦿ Nov. 5, TDA representative speaking to AgriLife's Wichita Falls hemp conference **suggested TDA may not be ready to receive and review licenses until March.**
- ⦿ Will TDA be able to handle possibly several thousand applications quickly?
- ⦿ Implications for Texas planting esp. South Texas?
- ⦿ We are learning from other states that earlier planting may be advised (a major issue for initial Texas A&M AgriLife experimental work)

# The Reality of 2020 Hemp Processing in Texas

- ⦿ Let's say that in the Lower Rio Grande Valley or the Texas High Plains that planting occurs March 15
- ⦿ It appears that a mid-February planting is potentially optimum in the Lower Rio Grande Valley
- ⦿ The High Plains, maybe March 15 is indeed too early and mid-April might be better (especially if we learn that light freezes are to be avoided)
- ⦿ Some hemp for CBD is running about 120 days to harvest, but perhaps a determinant/"autoflower" variety is ready for harvest in 80 days.

# The Reality of 2020 Hemp Processing in Texas

- ⦿ In the former scenario (120 days), will there be processing facilities in Texas to receive your crop no later than Aug. 1, 2020?
- ⦿ If not, what do you do? What are your options as a grower?
- ⦿ Drying and storage become important.

# The Reality of 2020 Hemp Processing in Texas

- ⦿ How long could hemp be stored dry?
- ⦿ Would it be stored by the grower or the processor?  
Does the buyer take possession of the hemp and pay you?
- ⦿ A grower/buyer contract should address.
- ⦿ For the grower, if facilities are not ready to process your crop this delays payment (and if you have borrowed money to grow then a delay further complicates lack of immediate market delivery)

# The Reality of 2020 Hemp Processing in Texas

- ⦿ If the crop is properly dried, are you willing to store? Do you have indoor storage? For how long? Or can the crop be hauled to another state? (assumed to be contractor's expense, unless you are paying fully for the production crop)
- ⦿ If you have a contract your attorney OKs, but there are no processing facilities yet, should you sign?
- ⦿ How likely is it that we will see construction of CBD processing facilities in Texas by the time licenses are available and planting would start? (Fiber plants surely will come later.)
- ⦿ **If construction has not started by planting time, should you NOT plant?**

# How Delays May Affect Texas Hemp in 2020

- ⦿ Delays may occur due licenses coming late
  - ⦿ It already appears for some would-be Texas hemp growers in 2020 that licenses will not likely be in hand prior to what appears to be optimum planting time.
- ⦿ Delays could occur due to lack of processing facilities
- ⦿ **What to do?**
- ⦿ If faced with these circumstances, and it appears to be getting late—perhaps too late—to plant hemp, is a grower prepared to pull the plug on hemp farming in 2020 and wait for 2021?

# How Delays May Affect Texas Hemp in 2020

- ⦿ You may face pressure to plant anyway...
  - ⦿ You want to plant hemp now, really bad... (that's dangerous)
  - ⦿ You are afraid you might “miss out” if you don't plant now
  - ⦿ Your contractor insists you plant anyway. (Who is taking the risk of a possible poor stand or poor crop—you the grower or the contractor?) Should your contract with a buyer/processor have a clause that addresses what will be done if hemp can't be planted by a specific date?
  - ⦿ Someone invested in your hemp farming and insists you plant anyway, even if late (this was a factor in some of the largest hemp failures I heard about in 2019).

# Hemp & Any Sense of Urgency

- ⦿ We all know we need to be careful regarding hemp. But will we be? Will we conduct all necessary due diligence?
- ⦿ There is a lot to learn, and hemp farming is a lot more than just growing the crop.
- ⦿ So consider the following statements—you might hear them, you may think them.

# Hemp & Any Sense of Urgency

- ⊙ “I have to get started with hemp farming now...”
- ⊙ “Production contracts are filling up fast, you need to sign now..., or you will miss out.”
- ⊙ “My investor or landowner insists I plant anyway...”
- ⊙ “I have got to find a loan so I can get started farming hemp now...”

# Hemp & Any Sense of Urgency

- ⦿ “An attorney advised me we needed more time to evaluate and negotiate a fair contract...”
- ⦿ “A contractor said they ‘never had a problem’ with their basic grower agreement’... So do I ignore my own concerns and sign anyway?”
- ⦿ “I committed to plant in hemp in 2020 no matter what...”
- ⦿ “I can’t afford to wait until 2021...”

# Preliminary Resources

- ◎ Be prepared to read a lot. If you are truly interested in growing hemp read, talk, ask. Get the answers you need. It will require time.
- ◎ Texas A&M AgriLife Extension agency website, <https://agriflifeextension.tamu.edu/hemp/>
- ◎ This includes a list of Texas A&M AgriLife faculty and staff with roles in hemp education and future research
- ◎ Consider private & commercial websites, but also especially universities and state departments of agriculture



# The Future of Hemp in Texas?

- ⦿ Hemp is highly risky due to establishment and production costs.
- ⦿ Prospective producers must use due diligence to ensure viable supply and market partners.
- ⦿ How soon will fiber markets develop?
- ⦿ Don't spend money you can't afford to lose
  - ⦿ A grower who stated he was "strapped for cash" and how could he afford the costs/borrow \$ to grow hemp should walk away. Don't plan on hemp 'saving the farm.'

