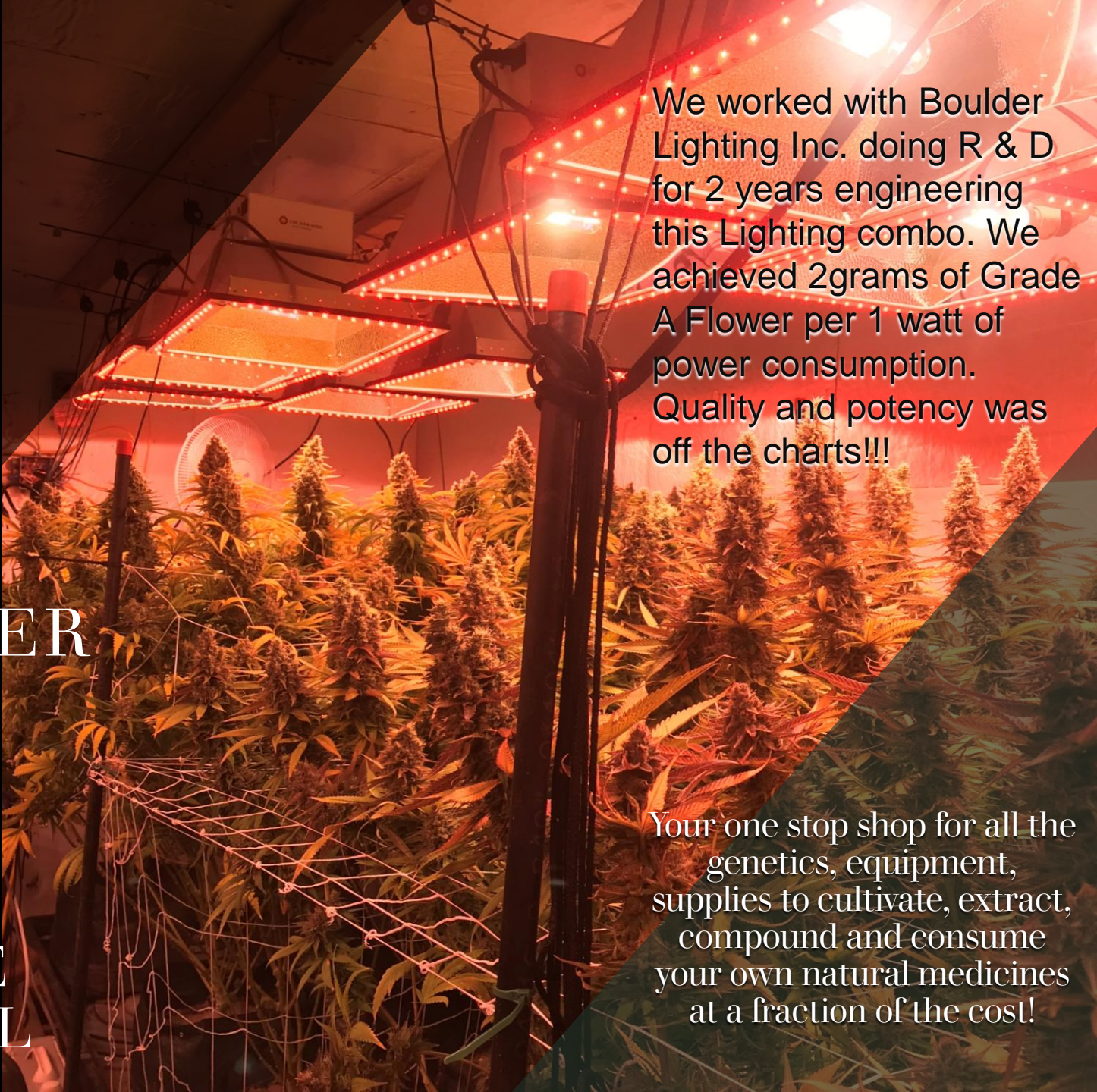


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Hops and Hemp: A Tale of Two 'Sisters'



Hops (*Humulus lupulus*) and Hemp (*Cannabis sativa*). Both belong to the same plant family, and both have been cultivated for centuries, and valued for their relaxing effects. But in the US, they have been treated very differently by the legal system.

Images: Hops by John Navajo; Hemp by Dmytro Tyshchenko/Shutterstock

Why are some plants—and the substances derived from them—beloved and broadly-embraced, while others are vilified, restricted, and viewed with suspicion?

The reflexive answer might be: Some are dangerous, while others are beneficial. But if you take a deeper look, it's seldom so simple.

As an herbalist, I am prone to questions like this. And lately, I've been thinking a lot about the unique and different fates of Hops (*Humulus lupulus*) and Hemp (*Cannabis sativa*)—two widely cultivated and distributed plants here in the US, and abroad.

Many people don't know that these two are related. They belong to the same plant family, *Cannabaceae*, and of the higher order *Urticales*. Let's think of them as sisters sharing similar genetics and traits.

Hemp and hops both have flowers that we humans have used—and abused—owing to their calming and intoxicating effects. The flowering parts of *Humulus lupulus* and *Cannabis sativa* both produce trichomes containing resinous substances, and over the centuries, we have cultivated and bred both of them for specific morphological traits or organoleptic characteristics.

But from a legal and regulatory perspective, these two sisters have been treated very differently here in the United States and in other parts of the World!

Divergent Histories

- For the last 150 or so years, up until very recently, cannabis has suffered stigmatization, criminalization, and scorn in the US, while its sister—Hops—on the other hand, has long been a key component in a multi-billion-dollar legal consumer alcoholic beverage market.
- One report estimates that the global beer market reached \$189 billion in 2020. That's roughly nine times the estimated \$21.3 billion for legal cannabis sales last year.

Beer would not be beer without hops. The alpha acids in hops flowers, especially humulone, and the sesquiterpene, humulene, are the main phytochemicals studied in beer. They minimize the growth of unwanted bacteria, regulate foam production, and give beer its characteristic aroma and flavor.

Compounds within Hops also have a calming effect, though this is not generally the reason for including them in beer recipes.



Hop field in Michigan. Hops are one of the world's oldest and most common commodity crops. They are key component in the brewing of beer, which generates roughly \$189 billion in annual sales worldwide. Despite the fact that hops produce mild relaxants and intoxicants that interact with the human endocannabinoid system, this plant was never vilified or criminalized in the way that hemp has been. (Photo: Michigan State University)

The German government's Commission E—an internationally recognized authority on the evidence-based use of medicinal plants—approved the use of hops for mood disturbances such as restlessness and anxiety as well as sleep disturbances. Though not as widely known as Chamomile (*Matricaria camomillia*), Valerian (*Valeriana officinalis*), and other plants with calming effects, is not unusual to find hops in herbal formulations that “support a good night’s rest.”

The pharmacological mechanisms of action for hops and extracts of hops are still unclear, though that has not limited their use in many accepted traditional pharmacopeia ([Chadwick, L R et al. *Phytomedicine: Intern Journal Phytother and Phytopharmacol.* 2006](#)).

As a commercial crop, hops have a welcome place in the nation’s economy, as well as it’s pantry. Unlike its botanical sister, this member of the Cannabaceae family has never been marginalized or criminalized.

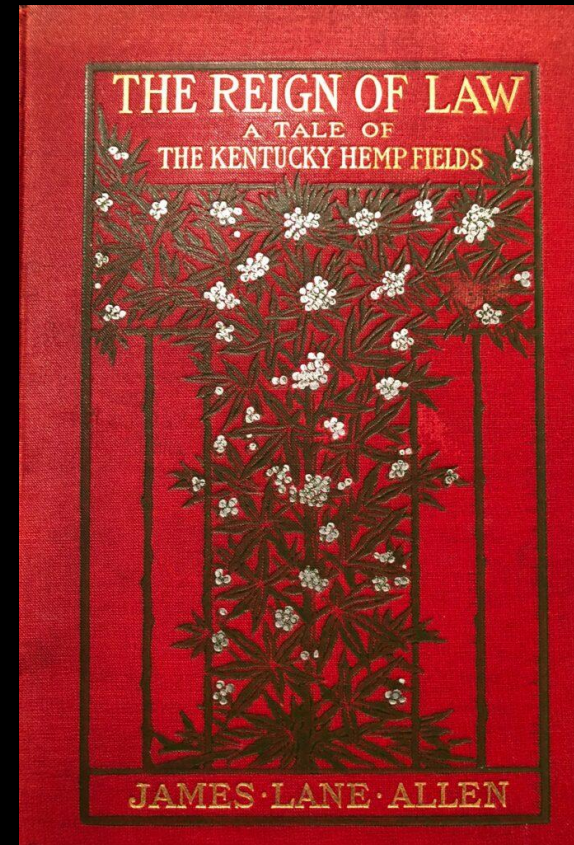
Hemp’s Rise and Fall

Hemp was not always frowned upon. In fact, it was central to the economy of the early US. During the colonial period, and up until the Civil War era, hemp was widely cultivated as a fiber crop. It was essential for making fabric, rope, twine, and sails.

In the opening chapter of his 1900 historical novel, [The Reign of Law: A Tale of the Kentucky Hemp Fields](#), American author [James Lane Allen](#) underscores the economic importance of hemp, especially in middle Southern states like Kentucky:

The record stands that throughout the 125 odd years elapsing from the entrance of the Anglo-Saxon farmers into the wilderness down to the present time, a few counties of Kentucky have furnished army and navy, the entire country, with all but a small part of the native hemp consumed.”

It took roughly 120,000 pounds of hemp fiber to rig the USS Constitution, aka “Old Ironsides,” and that’s not including the sails and the caulking, which were also made from hemp.



The Reign of Law, an historical novel by James Lane Allen, published in 1900, offers insight into the role of hemp in the economy of the American South, and the prevailing attitudes about it among European-Americans at the time.

But by the middle of the 1800s, hemp fiber was largely supplanted by cotton, and hemp-based agriculture suffered a long, slow decline. It no longer had the same industrial impact, though its resinous flowers and leaves were certainly valued by many for their psychoactive properties.

Hops, Hemp & the ECS

The flowers of *Cannabis sativa* L. (Hemp) produce a host of biologically active phytochemicals. Tetrahydrocannabinol (THC) and Cannibidiol (CBD) are certainly the best known and most popular. They've also recently been adopted into the manufacturing standards for botanical preparations of hemp, which have become extremely popular with consumers and practitioners.

But there's far more to this plant than just THC and CBD. Cannabinoid research is booming worldwide, as investigators discover more about these compounds and their receptors within the human nervous system.

Both hemp and hops produce compounds that love to interface with the human endocannabinoid system (ECS), and we are learning more and more about the ECS every day as manufacturers and scientists' race to understand this gateway to so many other major biochemical and physiological systems.

These two sisters also produce a variety of interesting mono- and sesquiterpene compounds. Myrcene and beta-pinene are found in both hemp and hop buds. These chemicals give both plants their distinctive aroma. Other shared terpenoids include humulene and beta-caryophyllene.

In the characteristic flowery prose of his era, James Lane Allen describes this olfactory phenomenon:

“And now, borne far through the steaming air floats an odor, balsamic, startling: the odor of those plumes and stalks and blossoms from which is exuding freely the narcotic resin of the great nettle. The nostril expands quickly, the lungs well out deeply to draw it in: fragrance once known in childhood, ever in the memory afterward and able to bring back to the wanderer homesick thoughts of midsummer days in the shadowy, many-toned woods, over into which is blown the smell of hemp fields.”

From Commerce to Criminalization

The criminalization of cannabis began in the early 1900s. The crop had dwindling value for fiber, but it remained somewhat popular for recreational and medicinal use—in certain communities.

By 1906, various states began redefining *Cannabis sativa* as a drug and/or poison, and by the 1920s, many states prohibited the cultivation, possession, and personal use of cannabis.

Then came the Marihuana Tax Act of 1937, a nationwide move which levied heavy taxes on the sale of cannabis, also known as “Indian hemp” back then. The legislation was spearheaded by Henry J. Anslinger, the first commissioner of the US Treasury Department’s *Federal Bureau of Narcotics*.



Anslinger was a prohibitionist firebrand who laid the groundwork for the so-called “War on Drugs” that continues today. He was no friend of alcohol, but he had a special contempt for cannabis—and the people who used it. In radio PR campaigns described it as: *“the deadly, dreadful poison that racks and tears not only the body, but the very heart and soul of every human being who once becomes a slave to it in any of its cruel and devastating forms. ... Marihuana is a short cut to the insane asylum. Smoke marihuana cigarettes for a month and what was once your brain will be nothing but a storehouse of horrid specters. Hasheesh makes a murderer who kills for the love of killing out of the mildest mannered man who ever laughed at the idea that any habit could ever get him.”*

Henry J. Anslinger, architect of the Marihuana Tax Act of 1937, which criminalized cannabis nationwide. Anslinger was a known racist who promoted the view that use of this plant induces criminal insanity.

It is interesting to note that at the time, the Marihuana Tax Act was opposed by the American Medical Association because the tax applied to physicians and pharmacists who prescribed and dispensed cannabis and its derivatives.

But the tax had powerful allies, including business magnate Andrew Mellon, newspaper mogul William Randolph Hearst, and the DuPont family. Hearst was not pleased about the development of the decorticator—a device that mechanically stripped hemp fiber from its stem, a job that previously had to be done by hand. A re-emergent hemp industry that could easily produce hemp paper was a threat to his holdings in timber for wood pulp.

The DuPonts were heavily invested in developing synthetic fibers like nylon. The possibility of a re-emergent hemp fiber industry did not appeal to them. Mellon, who was Secretary of the Treasury at the time, was heavily invested in the DuPont company.

Facing Racism

Business interests drove the tax, but the cultural vilification of cannabis as incited by Anslinger and his allies, was driven by a different motive: racism.

Historically, use of cannabis was common among people of African, Latin American, and Asian descent, and it has a long tradition of medical and recreational use in many parts of Africa, Asia, South and Central America, and the Caribbean.

But unlike beer and other forms of alcohol made from fermented grains, cannabis was never part of the cultural heritage of Northern Europe.

An African-American former slave breaks hemp stalks using a hand-operated machine. Up until the early 1900s, hemp cultivation was vital to the economy of central southern states like Kentucky, and African-American labor was the backbone of the hemp industry. During this period, medicinal and recreational use of cannabis was common among African- and Latin-Americans, but rare among people of Northern European descent who looked down upon it.



To the dominant US culture—White and of Northern European descent—use of cannabis was “other.” It belonged to the dark-skinned people. In his book, Allen points out that the Anglo-Saxon hemp farmers of Kentucky had no interest in the flowers and leaves of the plant, pointing out that:

“the whole top being thus otherwise wasted—that part of the hemp which every year the dreamy millions of the Orient still consume in quantities beyond human computation and for the love of which the very history of this plant is lost in the antiquity of India and Persia, it’s home—land of narcotics and desires and dreams.”

The criminalization of cannabis went hand in hand with the stigmatization, marginalization, and criminalization of African-Americans, Latin Americans, and Asian and Southern European immigrants. Hops, the sister Cannabacean, also produces mildly intoxicating compounds. But nobody ever went to jail for cultivation or possession of hops.

Anslinger and the early drug warriors tried hard to make a public health case for criminalization, insisting that cannabis was a dangerous, addictive drug that destroyed health and predisposed people to violent crime.

Some physicians at the time, including the AMA’s own attorney, Dr. William Creighton Woodward, refuted Anslinger’s claims as unscientific and nonsensical. They were largely ignored.



William Creighton Woodward, MD, a physician-attorney who represented the American Medical Association, was among a handful of bold doctors who challenged Anslinger's "scientific" case for criminalizing cannabis.

Winds of Change

Today, one would be hard-pressed to convince anyone that cannabis use is inherently more dangerous or "criminal" than drinking beer. But hemp in all its forms still carries a stigma that hops never had.

Currently, hemp has three approved uses as an ingestible substance in the US: Hulled Hemp Seed (GRN765), Hemp Seed Oil (GRN778) and hemp Seed Protein (GRN771).

The Agriculture Improvement Act of 2018 (S.3042), enacted by the 115th Congress of the United States in 2017-2018 and referred to as the Farm Bill, defines and permits the cultivation of industrial hemp (low-THC producing cannabis), but defers regulatory authority to the individual states. All over the US, the rules are in flux. Industry trade groups have coalesced to persuade FDA to deliver clear policy guidelines.

Laws governing the medical and recreational use of high-THC cannabis, and even low-THC cannabidiol (CBD), are highly variable from state to state. The one exception is Epidiolex, a prescription CBD product approved by the FDA in 2018 for treatment of certain types of epilepsy.

But as more states legalize cannabis, it is clear that attitudes are changing. Though many Americans still view cannabis with suspicion, it is not nearly the dangerous “other” that it was portrayed to be in the 1930s and 1940s. I don’t think it is coincidence that the increasing acceptance of cannabis is happening at the same time as our collective reckoning with the ongoing legacy of racism, and with issues of ethnic and cultural diversity. Both are movements in the direction of healing, inclusion, and the righting of historical wrongs. We can envision the day when hemp rejoins its sister, hops, as an ordinary crop free of stigma. Likewise, we can envision—and work toward—a future in which all people, regardless of race, ethnicity, religion, or gender are safe, respected, and treated fairly under the law.



4 OF THE MOST COMMON TERPENES FOUND IN CANNABIS AND HOPS AND THEIR BENEFITS

That crystalline shimmer, sticky texture, and indulgent fragrance of your favorite cannabis strains are all products of *terpenes*. These organic compounds are found in all plant life and result in a wide range of unique aromas and flavors. From sweet fruits, fresh florals, and earthy spices, terpenes can do it all.

There are over 200 terpene varieties found in the cannabis plant. Individual cannabis strains that have their own distinctive flavors and scents are a result of their unique terpene profiles. Many scientific studies into cannabis terpenes have concluded that these essential oils go far beyond simply determining the plant's flavor palette. Much like THC and CBD (cannabinoids) have different influences on your body and mind, various terpene compounds can provide diverse effects and benefits to medical cannabis users.

The Abide cannabis sommeliers have expert knowledge on a large variety of terpene profiles. Every day we proudly provide our patients with insight on how to best utilize specific terpene and cannabinoid combinations to help manage various conditions. In this guide, we will look at the six most common cannabis terpenes, their defining characteristics, and the therapeutic benefits they can provide cannabis-based medicine users.

1) Myrcene Terpene

Myrcene is the most common terpene found in modern commercial cannabis products. While individual strains can produce many different types of terpenes, myrcene is found in over 20% of cannabis terpene profiles on average. Because myrcene is so abundant in medical cannabis it is known in the industry as the “Mother of all Terpenes”.

The Aroma of Myrcene Terpenes

The myrcene compound produces an earthy, herbal aroma, with subtle hints of various spices.

Other Plants That Produce Myrcene Terpenes

Many plants produce differing amounts of the myrcene terpene including bay leaves, lemongrass, and the thyme plant.

The Therapeutic Benefits of Myrcene Terpenes

For centuries, organic plants containing high amounts of myrcene terpenes have been used as a sleep aid in many traditional medicine practices. Research into other potential benefits of myrcene and THC include:

- Anti-anxiety
- Anti-inflammatory
- General relaxation
- Muscle relaxation
- Pain reduction
- Stress relief

Myrcene as an Analgesic from Past to Latest Clinical Research

a limited number of studies have been done on the effectiveness and health benefits of Myrcene, but all of them are showing promise. Some of the early studies. Such as one of them from 1990 found it to have 'Significant' inhibition of nociception, in other words, it decreases the detection of pain in the body by stimulating the release of endogenous opioids,

A study on rats the following year found that a lemongrass infusion (high in Myrcene) had both pain-relieving and sedative effects, which were similar to, but through a different mechanism than, asporon.

Strains containing more than 0.5% myrcene are most likely to induce sedative effects classically attributed to Indica strains.

Similar results were found in a 2012 study that looked at Citral, which contained a mix of the terpenes limonene and Myrcene. It found the mixture to have both pain-relieving and sedative effects on mice, although it should be mentioned they also noticed a slight increase in anxiety levels of the mice.

Myrcene and Cancer Treatment

Multiple studies at major universities concerning multiple lines of treatment indicated that Myrcene might be complementary to traditional cancer therapies by both reducing negative side effects and improving the effectiveness of the conventional treatments. In one study it was even found that Myrcene can assist medications in passing through the blood-brain barrier, which is

instrumental in the treatment of many conditions, including often fatal Aspergillus fungal infections experienced by Leukemia and lymphoma patients who undergo stem cell transplants!

The Candida Fungus

Another application of Myrcene may be in the treatment of the Candida fungus. The Candida fungus exists in all humans but is controlled by the body's immune system. However, the prevalence of disease caused by this fungus is growing worldwide as more people are being treated for cancer or for other conditions which require immunosuppressant drugs (transplant patient's, cancer patient, HIV patients, etc. Furthermore, the fungus is becoming more resistant to traditional anti-fungal drugs due to their widespread use.

Most cancer patients have to battle this fungus at some point, as when Patients undergo chemotherapy the immune system is suppressed or compromised. When the body can no longer control the fungus, Candida can grow out of control, generally leading to mucositis and other issues in the mouth, esophagus, and GI tract. Lemongrass has long been used in folk remedy to treat outbreaks of the Candida fungus, and the reason is for its high concentration of Myrcene.

A 2012 study looked at the role lemongrass played in the treatment of Candida fungus and found that it both prevented the fungus adhering to the mucous membranes of the mouth, but also prevented its growth, with an 80% reduction. So, although Myrcene has not been shown conclusively to treat cancers, it can alleviate some of the side effects, improve the efficacy of traditional treatments, and improve the quality of life for patients undergoing cancer treatments!

2) Limonene Terpene

Limonene is one of the most aromatic terpenes, making its trademark citrusy scent an easy identifier. But because the aroma of limonene is so strong, many cannabis strains that smell citrusy may actually have other more dominant terpenes that are harder to detect by smell alone.

The Aroma of Limonene Terpenes

Limonene terpenes give off a signature aroma of citrus with undertones of various other fruits. The limonene compound can even produce hints of mint and other sharp flavored spices.

Other Plants That Produce Limonene Terpenes

Citrus fruit rinds like lemons, oranges, and grapefruits, contain high amounts of limonene terpenes. It can also be found in the terpene profiles of juniper, peppermint, and rosemary.

The Therapeutic Benefits of Limonene Terpenes

Plants that produce limonene terpenes typically rely on the aromatic oil as a natural insecticide to repel pests and predators. Studies focussing on the combination of limonene and cannabinoids describe other potential benefits as:

- Antibacterial
- Antidepressant Stress relief
- Mood elevation Antifungal

Limonene and Cancer from the Latest Clinical Research

According to a study conducted by the Department of Biology at Purdue University, Limonene does possess anti-tumor activity. In rodents it offers chemo protective benefits against skin, liver, stomach, and mammary cancer (the rodent's version of breasts). In a similar study done at AMC Cancer Research Center in Denver, Limonene is also anti-inflammatory, something that may prevent cancers from occurring in the first place. Inflammation is a critical part of cancer development and progression. This is why so many cancers arise from sites of infection, chronic irritation, and long-term inflammation (short-term inflammation help heal the body while long-term destroys its tissues).

It's believed it is effective because it promotes a process that results in carcinogen detoxification and leads to apoptosis, a circumstance where Cancer Cells go off and die. In other words, eradicated!!! According to the latest clinical research, "Limonene prevents the growth of cancer cells by inhibiting G proteins that are involved in cell signaling pathways that reduce cell growth.."

However, the best results are achieved when the rodent were either injected with or ate foods rich in limonene. It should be noted that these results might not completely relate to humans. After all, injecting a rodent with pure limonene isn't the same as a human smoking cannabis.

Limonene Reduces Skin Inflammation

Usually, severe cases of skin diseases such as psoriatic arthritis don't respond well to prescribed medication, so people are seeking natural alternatives. Studies suggest that if topically applied D-Limonene can soothe aching, burning skin, and improve wound-healing by producing pro-inflammatory cytokine production (cells responsible for some dermatitis symptoms!

What is caryophyllene?

Caryophyllene is a terpene found in cannabis, as well as in many other plants such as hops, cinnamon, basil, oregano, cloves, and black pepper. Sometimes referred to as beta-caryophyllene or BCP, this terpene is known for its pungent peppery and earthy aroma and flavor. In addition, caryophyllene is unique among terpenes for its ability to bind to the cannabinoid receptor CB2. Like some cannabinoids, this allows it to trigger health benefits associated with the CB2 receptor, such as reducing inflammation.

3) Caryophyllene Terpene

What is caryophyllene used for?

Caryophyllene is sometimes used as a flavoring agent in food, given its peppery taste. It is also found in some detergents and topical skin products.

Some also use caryophyllene for medicinal reasons, either as a supplement or as part of their cannabis. While human studies on this are scarce, studies on rodents have found caryophyllene may have pain-relieving properties, reduce anxiety and depression, and could help with treating addiction. In addition, it's been shown to be an antioxidant, anti-viral, and anti-inflammatory agent, and some studies even suggest it could increase lifespan by reducing gene stress.

How do you use caryophyllene?

To use caryophyllene as part of your wellness routine, you can find a variety of caryophyllene

supplements and try incorporating it into your diet. You can also add more foods and spices to your diet that are naturally high in caryophyllene, such as black pepper, hops, cloves, cinnamon, and rosemary. In addition, if you'd like to breathe in some caryophyllene, try using an oil diffuser with caryophyllene-rich essential oils, such as clove or cinnamon oil.

If you'd like to add more caryophyllene into your cannabis regimen, look for strains and products with lab results that show high levels of the terpene. Luckily, this terpene is very common in cannabis. If you don't have access to terpene data, look for strains of cannabis that are naturally higher in caryophyllene such as GSC, Gelato, Bubba Kush, Chemdog, Master Kush, Candyland or Sour Diesel.

Caryophyllene and Cancer Treatment

Many studies have focused on the anti-cancer and anti-tumor properties of caryophyllene and have indicated that it both slows tumor growth and proliferation. This is thought to be due to similar action of CBD in the body's endocannabinoid system. The effects are still not well proven, but the 2016 review did highlight some studies showing positive effects in mice, and in one study with significant effects in humans. But more so, it has been shown to work well in conjunction with traditional cancer therapies, increasing the bioavailability of the chemo drugs. This study also highlighted all the complimentary effects of caryophyllene on the side effects of cancer treatment, most significantly involving chronic and acute pain!

4) Alpha-Pinene Terpene

Anti-inflammatory Properties

In a study done by the Journal of Natural Products, Scientists wanted to expand on previous studies that concluded that Pinene had anti-inflammatory properties. Out of all the compounds that were tested, it was found that a-pinene was the most effective at inhibiting the inflammatory and catabolic pathways. The study concluded that ".....a-pinene(1) being the most promising for further studies to determine its potential value as an anti osteoarthritic drug."

Bronchodilator

Alpha-pinene has been found to be an effective bronchodilator. This means the terpene helps open airways in the respiratory system. The therapeutic values of this mechanism of action can be applied to respiratory ailments such as asthma.

These findings were published in the Journal Inhalation Toxicology. Reseaches suggested, that these effects may be of benefit to office workers and workers who are involved in industrial cleanup operations.

Pinene and Anxiety

For those treating anxiety with cannabis it's important to be aware that Alpha-pinene can increase or speed up thoughts. It has been reported by many users that strains high in a-pinene can sometimes increase anxiety symptoms. Please use caution with products high in this terpene.

There are over 150 addition terpenes present in cannabis that need extensive clinical research to determine their medical benefits!

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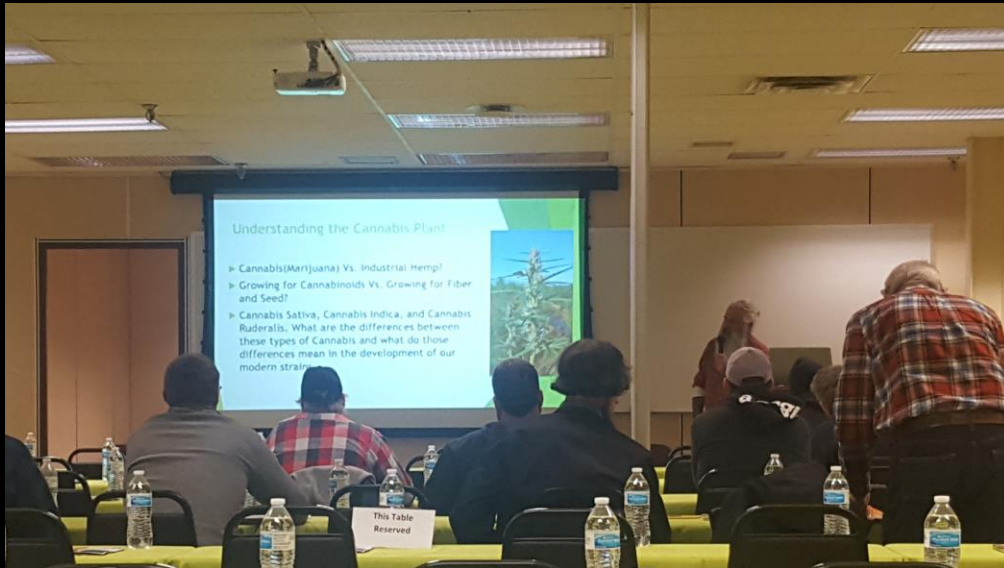
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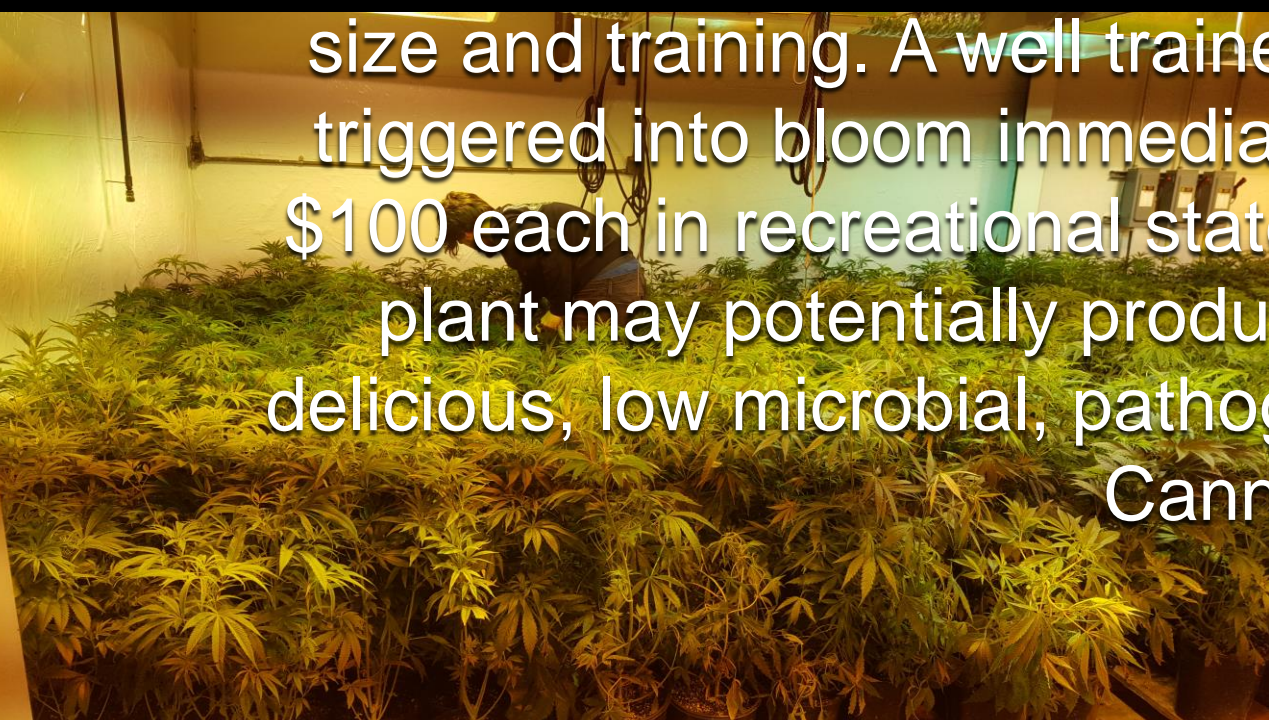
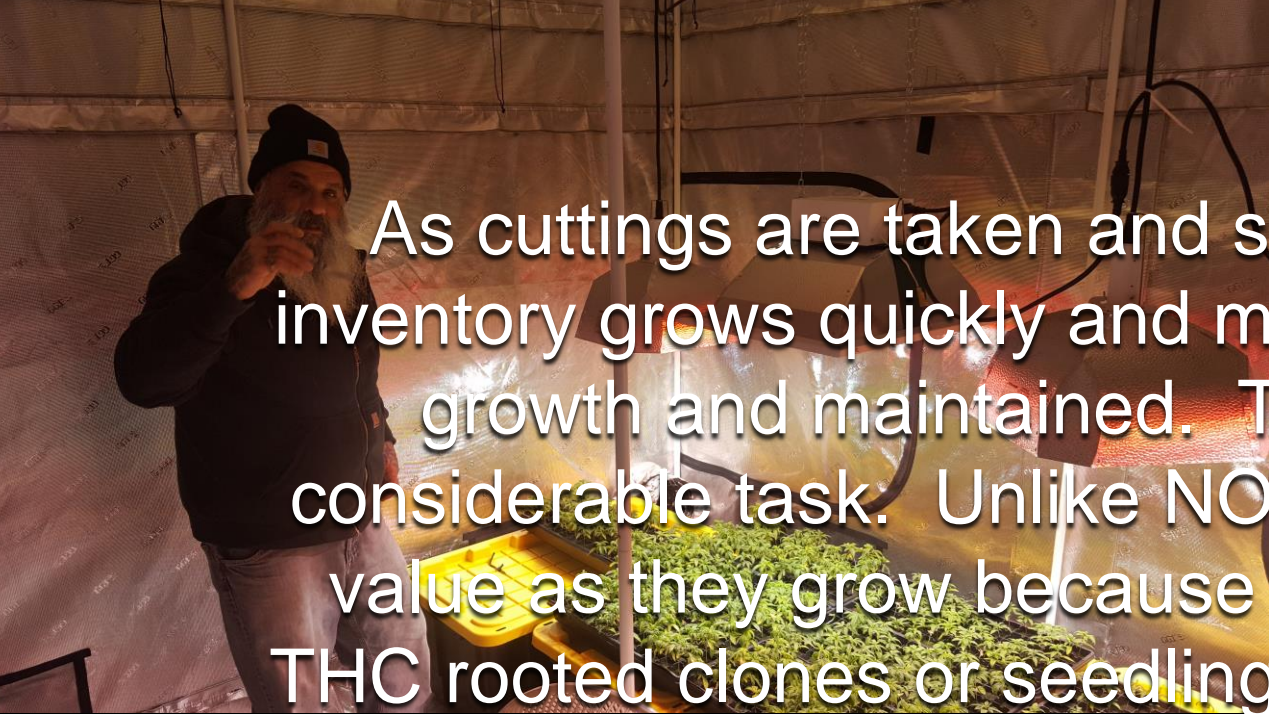
CLASSROOMS TO
ACCOMMODATE 100 STUDENTS



Pre covid we had seminars booked weeks ahead and within the 1st week of open enrollment for the 6 -week course we already had 5 full time students enrolled.



From the original 700 seeds that were purchased as foundation stock in 3 different strains of CBD we produced over 35,000 clones. Seed was planted Dec. 30th, 2019, this picture was taken mid April 2020 after dozens of cuttings had been taken off each mother!



As cuttings are taken and shoot roots weekly, the plant inventory grows quickly and must be up potted with increase growth and maintained. This in itself can become a considerable task. Unlike NON THC clones that never gain value as they grow because end value is low...With high THC rooted clones or seedlings, value keeps increasing with size and training. A well trained 4-foot seedling that can be triggered into bloom immediately can retail for as much as \$100 each in recreational states! Depending on strain each plant may potentially produce as much as 2 pounds of delicious, low microbial, pathogen free, high potency Medical Cannabis!



Light Deprivation Greenhouse at
Bison Hemp Company near Black
Moshannon State Park



SR-1, an extremely high yielding and
high potency CBD Strain that was
flowered through the March and April



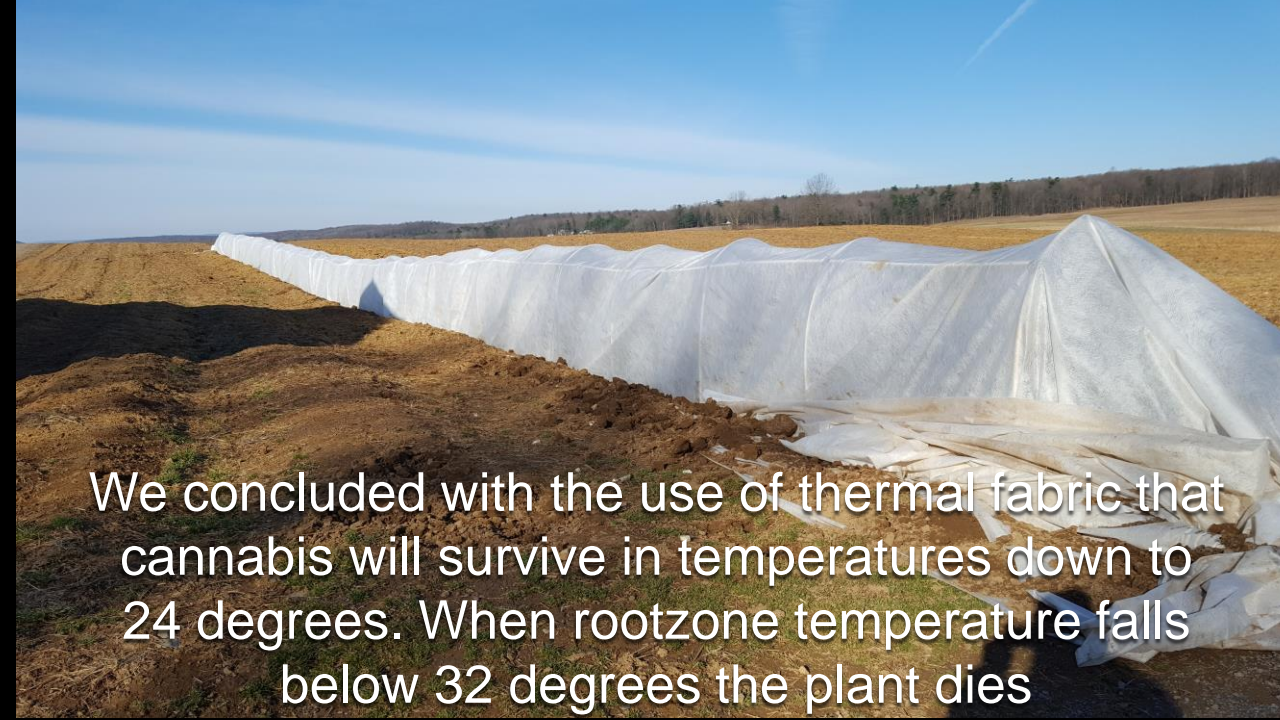
The Clones that populated this greenhouse
came from the first 120 cuttings taken from
the original seed we planted Dec. 30, 2019



Stainless Steel shipping container that
we modified into a high efficiency
dryer for medical grade cannabis



High THC clones this of this size and structure in 1-gallon pots will sell for \$50 - \$100 each depending on genetics



We concluded with the use of thermal fabric that cannabis will survive in temperatures down to 24 degrees. When rootzone temperature falls below 32 degrees the plant dies



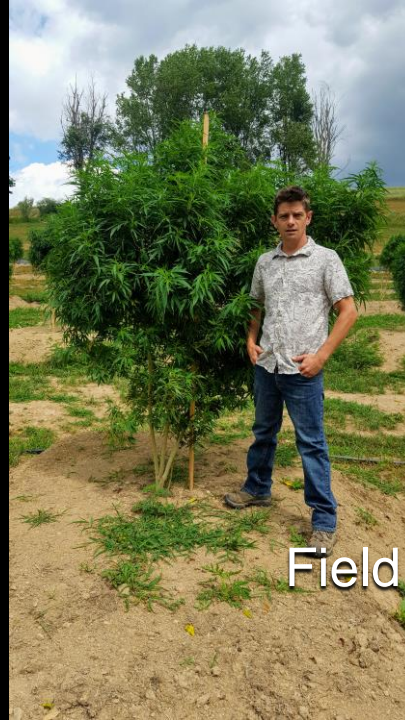
Extensive testing on early season planting to determine the plant's ability to survive extreme temperatures



Multi layer growing made possible using warehouse shelving allowed an excellent environment in minimum space for larger clones

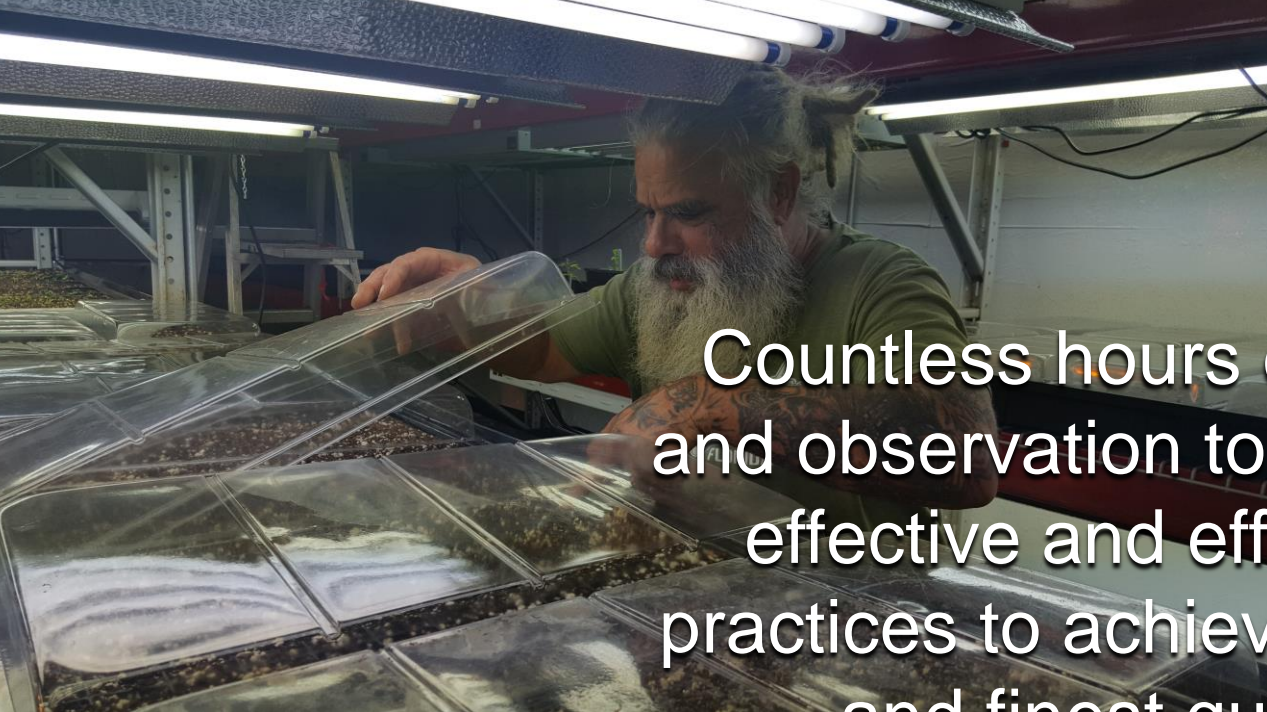


When greenhouse growing in high populations, extensive trimming of understory is necessary to avoid pathogen problems

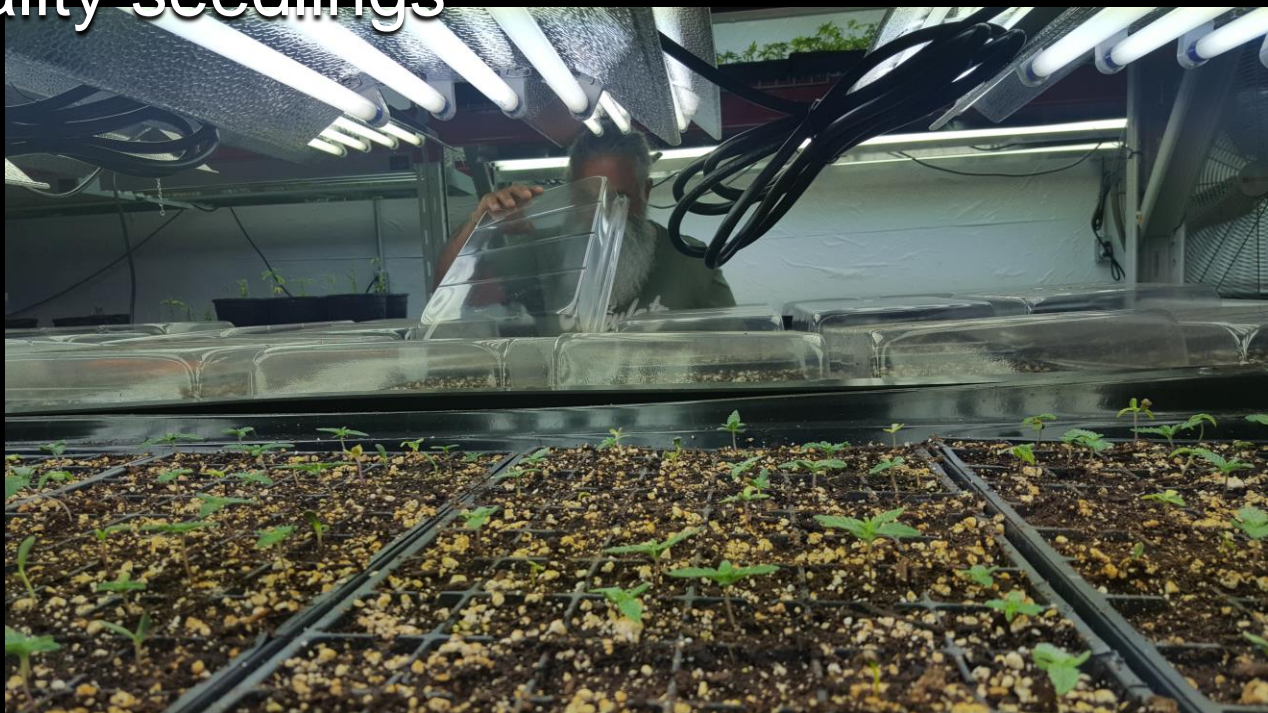
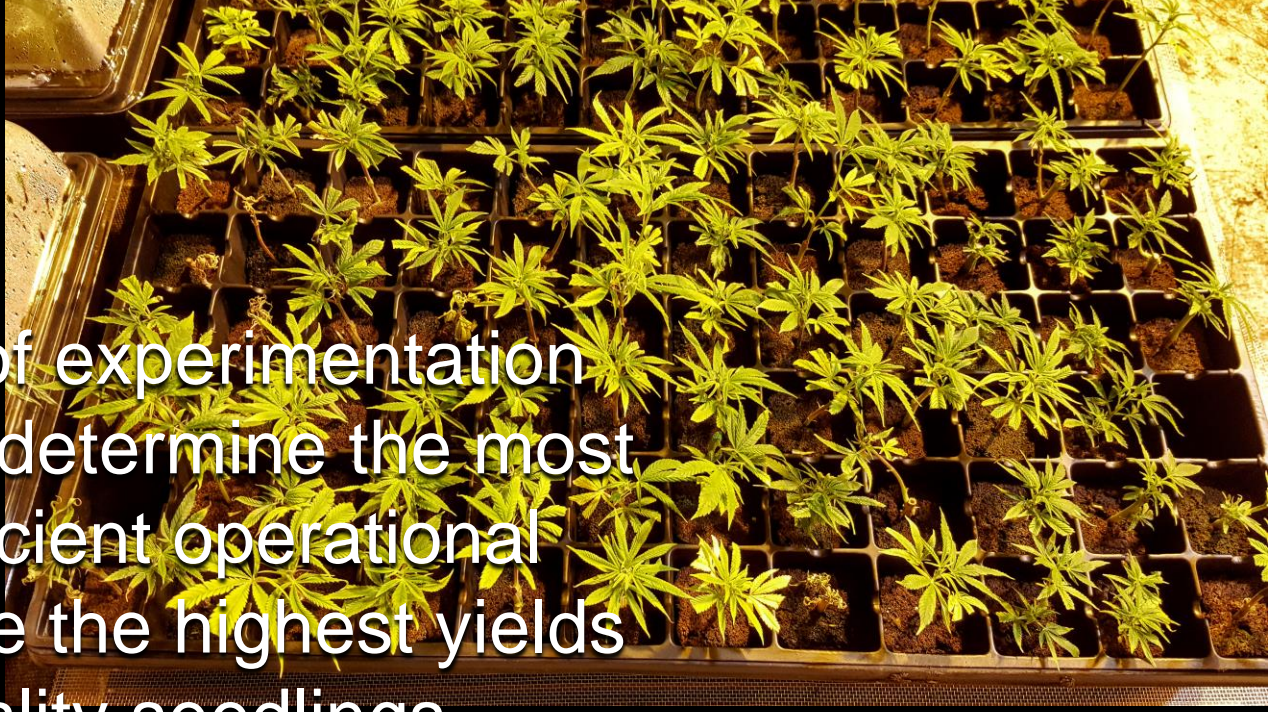


Field planting of mother plants





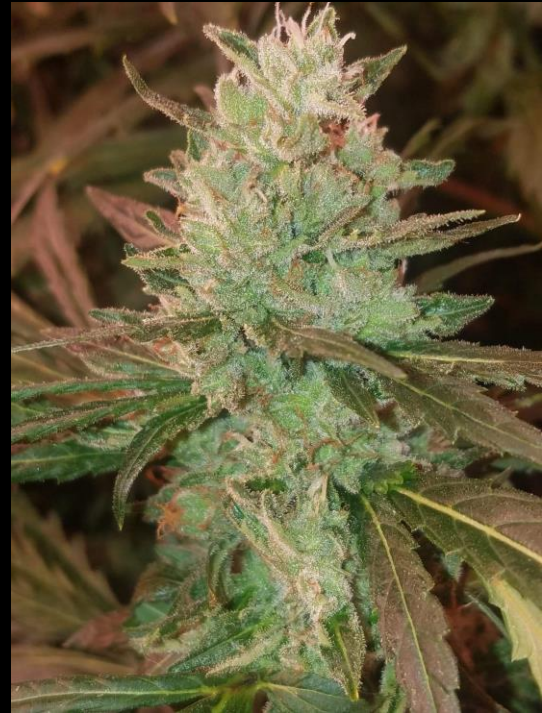
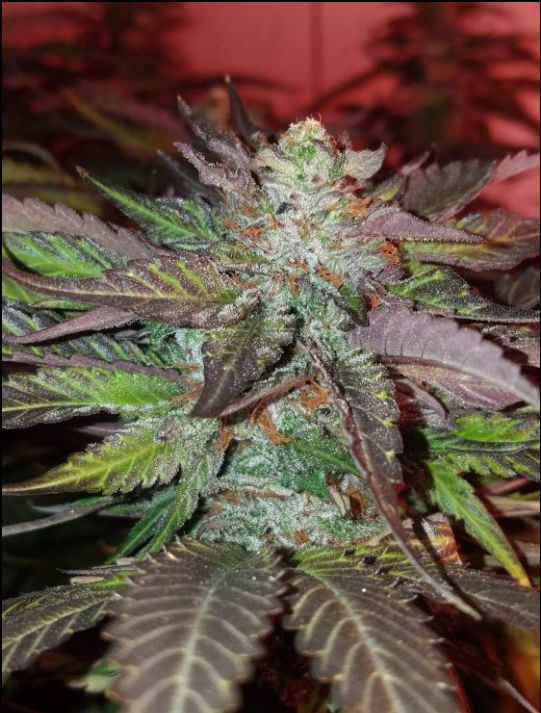
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and observation to determine the most
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practices to achieve the highest yields
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propagating, cultivating,
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Our Revised Mission Statement

The Original concept of the Cannabis College of America was first to establish the Standard Operational Practices in the Industry. Second to provide a quality education with hands-on experience on all phases of Cannabis cultivation. And last but not least all students being competency tested prior to certification as a graduate of any one or combination of curriculums.

The changing climate of the Medical Marijuana has caused us to rethink, revise and evolve our initial operational model. To begin with most of the Medical License holders have initiated their own in-house training programs. Rather than sharing and improving the techniques and methodology on how to best and most efficiently cultivate this amazing plant, knowledge being power. Individual growers produce and compete against each other out of ignorance rather than endeavor to work together to produce the finest products possible at the lowest cost!

When this plant is viewed from a strictly recreational prospective the cost of production is much less of a factor than when it's viewed for its medical value.

Until recently very little clinical research had been done to establish cannabis's exact medicinal value. In fact, 99% of all research dollars for cannabis was used to establish the negative and/or side effects. Very little time and money was put into accurate diagnosis methods for the prescribing of and dosing requirements that would be necessary for the successful treatment of those ailments and diseases diagnosed.

Many of the latest clinical studies from leading Schools of Medicines have concluded that the previous perceived dosages for many ailments fall far short of what dosages are required for effective treatment. i.e. – If it was previously believed that 100 mg. of THC per day per 200 lbs. man was an effective dosage to cure an ailment when in fact the proper dosage required is 2 grams per day per 200 lb. man the cost of treatment would multiply times 20. This in fact would make the cost medical marijuana as a cure prohibited!

The cold hard truth is when the founders of the Medical Marijuana Industry designed and engineered their grow operations they did so without any consideration to the medical aspect of the plant. They designed their grows based off of and around the black market for a Recreational substance. They anticipated the retail price would stay static or only fluctuate slightly with supply and demand . Remember very little clinical research existed 3 to 5 years ago to substantiate the truth about cannabis as a medicine. Because of what the new license holders observed from 80+ years of black market sales and distribution they seen a huge profit margin to be taken advantage of and millions of dollars in gains to be had. The growing facilities they constructed were engineered to limit liabilities for failure but to be manned by inexpensive unskilled labor. Basically, idiot proof. The construction cost of these grow facilities literally made no allowances for a reasonable return on investment if any variable caused a substantial drop in the retail price. The Net result of this line of reasoning is huge inefficiencies that has generated ridiculous costs for producing what is known as medical grade marijuana.

Let's face the facts, Cannabis thrives when grown seasonally outdoor and year-round in greenhouses. Some of the highest yielding, most potent, and highest quality marijuana ever cultivated has been grown outdoors not in laboratories! A perfect example is "Los Suenos" a 40-acre combination Greenhouse and outdoor grow near Pueblo, Colorado. Cresco Labs, which are one of the most progressive and successful Medical Marijuana producers in the country recently acquisitioned this facility for 65 million. As part of this presentation, I'm including an analysis I did of a local greenhouse and outdoor grow facility near Bellefonte, PA. After review it's evident why Cresco made the purchase. The facility near Bellefonte has roughly 1/2 the production capabilities of "Los Suenos". Basically, just as severe of climate with similar latitude.

Changes in the Future of Medical Cannabis

With clinical research catching up to the market and more conclusive evidence daily that Cannabis is true medicine. Studies have shown in many instances it's an effective treatment or even cure for many ailments, including cancers. Much more research is needed. Research to establish realistic and accurate diagnosis. Research to establish effective dosages for treatments. Research to establish consistent delivery methods. Thus is my motivation for a new direction with My Mission. For the average family to have complete and unrestricted availability to this natural medicine which has been forbidden for almost a century. **We will teach them to cultivate, process, compound and improve the quality of their life through the use Cannabis and Hops!**

This is a God given medicine! That every man, woman, and child that can benefit and heal from is intitled to at an affordable price. I have proven in repeated studies that I can grow medical grade, low microbial and pathogen free cannabis for approximately \$25/lb Outdoors and for less than \$100/lb entirely indoors! At these prices this plant can truly be utilized as medicine.....

New Concept

Buds and Brew Superstore

Cannabis College of America

Cannabis Center of Excellence, Terpene & Cannabinoid Research

All Three of these Brands can be housed initially at this location. As business increases, so will our footprint. I believe efficiency is one of the keys to success in any business. You build a monster, you have to feed the monster, but if you start as an infant as business grows so does your wealth. As legalization of Recreational Cannabis and/or full legalization evolves quickly, so will the demand for our equipment and services. Depending on actual demand it is possible for this concept to develop into a chain with multiple locations in numerous major metropolitan areas. Our Cannabis Center of Excellence will maintain constant and ongoing extraction of and R&D of the key components isolating some and re-compounding others to develop the best suited medicines to treat and cure disease.

Company Infrastructure

This Facility will be divided into 5 main departments

1) Equipment sales – This will encompass numerous pre engineered kits for the cultivation of cannabis and the micro-brewing beer. Greenhouses, Grow tents, numerous rootzone and lighting packages. Even solar panel powered zero carbon footprint indoor systems in combination with DC lighting that operate without any energy cost. In addition, we will offer a complete line of extraction equipment designed for the most efficient conversions from premium smokable flower to Live Resin in a cartridge pen. Tinctures, capsules, compounds and various delivery methods can be utilized with these extracted medicinal components of the plant.

2) Parts, Service, and Installations – We will be using one multi line wholesale supplier for most of the equipment and kits we'll offer, Grow Strong Industries. They are well known as leaders in the industry and have the best reputation for quality equipment and guaranteed results! All of their components are rebuildable or replaceable with only a minimal amount of mechanical ability. All of our products are designed and engineered to be user friendly for a lifetime of excellent results. This division will also be responsible for temporary and permanent installations of both grow and micro brewing systems and outdoor Hop plantings. In addition to all warranty services....

3) Education – Our courses are structured around the most efficient methods of information delivery. Both our Core Program and advanced Specialty classes consist of 36 contact hours each. Class schedules are configured to allow the courses to be completed over a six-week period, three hours per day two days per week. Our class scheduling system allows easy integration of your schooling into your existing work schedule, even if you work odd hour shifts. Classes are offered from 8AM till 8PM daily, Monday through Friday. Saturday mornings 8AM till noon! Three-hour Novice Grower Seminars will be offered Friday evenings and Saturday mornings. We will also offer complimentary instruction and support with our larger Kits and Installations.

4) Seed and Genetics – All aspects of our business plan to this point have set the stage for one of the most significant and possibly our most profitable departments. We are going to be sourcing the finest high cannabinoid genetics from the top breeders in the world as soon as capital will allow. Cannabis seeds, even from the highest of THC varieties are 100% legal and compliant with Farm Act Bill of 2018 since they don't contain more than 0.3% THC. In fact, the cannabis plant, in general never exceeds 0.3% THC during the entire vegetative stage of growth. THC does not start ramping up until the plant is triggered into the flowering

stage. This character of the plant will allow us to accumulate our inventory of seed and cuttings well in advance of recreational becoming legal and/or full legalization. All this work, along with a breeding program for CBD, CBG and other minor cannabinoids can be performed with a Hemp and Nursery Permit from the Pa Dept. of Ag. By doing so we will be the first suppliers of such products and services in the state.

The price for the highest quality feminized seed from the Top breeders in the world sells for an average of \$400.00 per 100. Properly equipped from 5,000 seeds (\$20,000) of assorted Strains I have proven I can produce 100,000+ rooted cuttings in 90-120 days. The average value of just one of those clones (rooted cutting) is \$35.00. Thus, the potential inventory value at full production is \$3.5 million dollars within 4 months. The beauty of holding the genetics in advance is that you don't need to crack a seed until you see your timing is optimal. Staged to have high THC clones ready for sale as soon as the law will allow. With cuttings you can keep them in a perpetual vegetative state and keep building and multiplying plant numbers on a constant and ongoing basis right up until you have legal sale. There is no question, "He who controls the genetics, controls the market"!

5) Cannabis College of America Center of Excellence - Terpene and Cannabinoid Extraction and Research Laboratory

Directly off the edge of the back parking lot we will be placing 2 Explosion Proof shipping containers. One will be for the processing and extraction of Terpenes, the other will be a wipe film distillation system that will be used for extraction of cannabinoid from the remaining biomass. The wipe film can also be utilized in transitioning cannabinoids. Transitioning is a reaction that we can convert CBD Isolate into Delta 8 and Delta 9 THC. This practice has already proven protected by the Farm Act Bill of 2018 since the final product originates from CBD hemp.

This facility will establish a dependable local market for local farm grown CBD/CDG& minor cannabinoid Hemp. This plant can change the face of farming in both Penns Valley and Brush Valley that merge in Centre Hall Pennsylvania only 2 miles from our facility. A Brand New Economy for Premium Hemp would have to be created and Trust would have to be restored in the farmers. The failed market that those who tried Hemp as an alternative crop experienced has back in 2019 and 2020 has hurt Hemp farming terribly. With my model we would provide the farmer with rooted seedlings from our select genetics. In addition, we could provide them with specialized planting equipment along with the technology that they could dependably make a Net Profit of \$2,500/acre. Even supplying us at \$5.00/green pound That's roughly 8 times the

potential profit from growing corn or soybeans. 6 times what green beans for human consumption pays.

The type of extraction equipment I'm planning on using is extremely efficient in its recover of 98% pure terpenes. The price is extremely high as well. But the profitability is through the roof. Fact is, the latest clinical research has conclusively shown the medicinal value of terpenes in the treatment of numerous ailments along with the forecast that price will increase rapidly with increased demand in the future. The price of this equipment is what prohibits over 99 % of all farmers cultivating medicinal hemp from doing their own extraction. This remains a huge issue with the profitability of farming hemp at the small farm level in the US today. When in fact if modelled correctly it could be the future and the financial salvation of the small family owned and operated farm. Production of this crop has proven to be very well suited to the Amish.

i.e. - One acre of irrigated crop land prepared and planted in plastic culture at a population of 1,000 plants/acre will produce 1,000 pound of High-quality CBD/CBG flower and biomass. If that product test 2% total terpenes, 1,000 lbs. would be 20 pounds raw. Through the extraction process to achieve a final product that is 98% pure you will sacrifice 50% of the total or end up after processing with 10 lbs.. Ten pounds of cannabis derived terpenes at current market prices is approximately \$50,000.00



SOLVENTLESS TERPENE EXTRACTOR

STX 90

KEY FEATURES

- **Solventless Cannabis Derived Terpenes:** Process 90 pounds in a single 8-hour shift, yielding approximately 200 grams of strain-specific >99% terpene isolate – enough for over 6,000 ultra-premium half-gram vape carts
- **Plug-And-Play:** Easily integrate this unique, non-destructive direct distillation technique prior to your existing cannabinoid extraction process on either dry or fresh-frozen biomass
- **90 L Biomass Vessel:** Allows a wide range of batch sizes, from 5 to 30 lb, allowing you to maintain the ultimate strain-specificity with your solventless terpene isolates - taking your extracts to the next level
- **Fully-Automated Operation:** Integrated 15-inch HMI allows users to program custom tailored extraction recipes, requiring minimal operator involvement and ensuring quality, consistency, and compliance
- **Patented Cryogenic Trap Technology:** Based on decades of experience in the semi-conductor industry, the patented design ensures maximum yields while minimizing run-times
- **Preserves Most Valuable Terpenes:** Collect the most fragrant and thermo-sensitive terpenes prior to extraction, allowing you to harvest the higher boiling point di- and triterpenes as usual, using wiped film distillation



WIPED-FILM SHORT PATH DISTILLATION SYSTEM VKL 75

KEY FEATURES

- **Throughput Capability:** Typically 1.3 L/h, Maximum of 3.5 L/h
- **Optimal Yields and Potency:** Finished distillate contains up to 99.85% total cannabinoids
- **Fully Jacketed System:** Heated from start to finish, negating the use of heating tape or heat guns to keep product moving through the system
- **Regulated Feed Rate:** German engineered gear pump allows for precise feed rate control, which is critical for obtaining consistently optimal results
- **GMP Ready:** This equipment can be customized according to your URS to meet any local or international GMP requirements
- **High Visibility Processing:** Transparent glass system enables operators to maintain optimal processing control by observing conditions inside the evaporator body
- **Expert On-Site Training:** Instructions for operation of equipment and proprietary parameters for producing distillate are included with purchase
- **Service and Maintenance:** Root Sciences offers Gold and Platinum service packages to keep your equipment in top operational condition

Terpene Extraction STX 90 Terpene Extractor 1 \$118,000
Terpene Extraction Spare Parts Kit 1 \$1,500
Extraction ETS Stand Alone Centrifuge (CC30 + Panel) 1 \$122,500
Extraction EFR - Centrifuge Bags Large Kit 1 \$9,960
Filtration Ertel Alsop 4-Stage Filter Skid (Electric 1PH-INT) 1 \$29,968
Filtration Ertel Alsop Media Kit (10 inch) 1 \$4,196
Filtration Spare Parts Package 1 \$5,500
Winterization Ai Glacier 21 Cu Ft -86C Ultra Low Temp Chest Freezer ETL 220V 1 \$11,900
Winterization Infinity Two-Funnel Stainless Steel Winterization Filter Table 1 \$20,150
Winterization Lid For 1-Funnel Infinity Table 2 \$2,400 - \$4,800
Winterization Welch 2085 6.9 CFM Diaphragm Pump With Explosion Proof Motor 1 \$6,930
Solvent Recovery X-Spiral 2.5 Organic Solvent Nanofiltration System 1 \$60,000
Solvent Recovery X-Spiral 2.5 Cartridge - Solvent Recovery 4 \$500 - \$2,000
Decarboxylation Ai 20L Non-Jacketed Glass Reactor With 200°C Heating Jacket 1 \$15,279
Distillation VKL 75 Wiped Film Distillation System (1φ 230V, 60A, 60Hz, UL) 1 \$133,200
Distillation HTF (Relatherm) 1 \$1,250
Distillation OPTIONAL: Residue TCU 1 \$4,900
Services Installation, Training, & SOPs 1 \$19,000
Subtotal \$571,033
5% Increase \$599,585
Shipping TBD
Tax TBD

Total \$599,585