

Best Practices: Cannabis Cultivation



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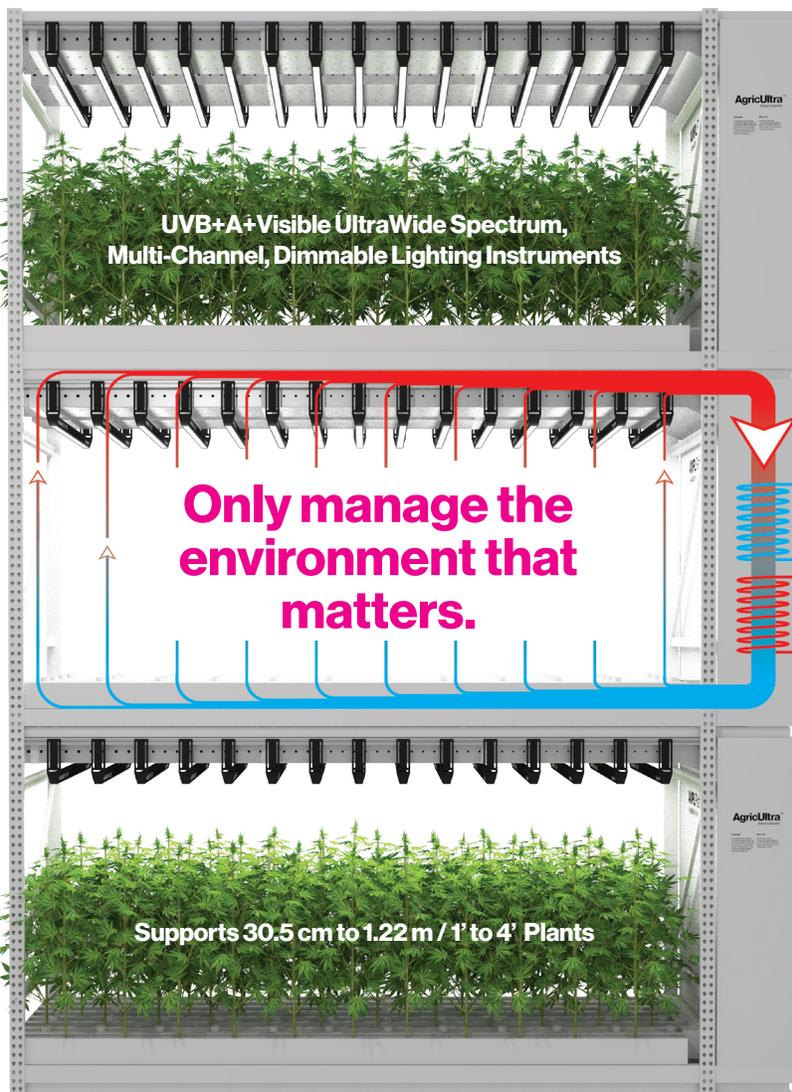
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BEST PRACTICES IN CANNABIS CULTIVATION



Bart Schaneman

MJBiz Daily
Cultivation & Extraction Reporter

Welcome to this special report on Best Practices in Cannabis Cultivation, produced by the team at *Marijuana Business Daily*.

The cultivation sector is the foundation of the entire cannabis industry, but growers have been notoriously tight-lipped about sharing what they know and have learned while growing marijuana.

Now we have, all in one place, strategies across the board for thinking about better methods to grow cannabis.

According to the 2019 Marijuana Business Factbook, of the total 175,000-215,000 full-time workers in the cannabis industry, cultivation employs 42,000-52,000 of them—and that number is expected to more than double to 95,000-115,000 by 2023.

Although cannabis growers have been operating in the shadows for decades, licensed marijuana companies in the nascent legal industry need a manual on best practices when it comes to all facets of cultivation.

This report should give growers a leg up.

We provide information on what dozens of cannabis company executives and workers have learned about how to grow cannabis, including insights on improving:

- Trimming
- Watering
- Lighting
- Nutrients
- Cost of production

The bulk of the information in this report comes from a series of stories I produced over more than a year for *Marijuana Business Magazine*, for which I interviewed roughly 30 executives in the cannabis industry.

There's no one right way to grow cannabis, but the tips collected here are tried and true and will help get you on the right path.

If you have any questions or want to provide feedback, please contact me at barts@mjbizdaily.com.

Best regards,

Bart Schaneman
Cultivation & Extraction Reporter



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Living soil can create plants so robust they don't need pesticide or fungicide applications. Courtesy of Aster Farms

LIVING SOIL

Cannabis growers are increasingly seeking out an alternative way to grow healthier plants and save money, something to move them beyond premixed fertilizers and bagged dirt. Enter living soil.

Living soil is often thought of as planting material that centers on compost and has active microbiology and biodiversity, which can include worms and their castings, protozoa, healthy bacteria, amoebas, kelp extracts and even glacial rock dust.

Growers who create a biodiverse growing media skip the need for fertilizers because microbes eat and digest compounds that create bioavailable fertilizers. Plus, they report getting larger yields and better terpenes as a result.

Creating your own living soil can eliminate the need for costly bottled nutrients and, some growers argue, lead to plants so healthy that pesticides are unnecessary because robust cannabis plants can naturally fend for themselves.

If you're trying to build a business, and you're trying to build something that's going to last and be profitable, living soil is by far the most cost-effective way to be around in 20 years.

Dave Perkins

Lead cultivator for The Emerald Cup

COST SAVINGS

For a 10,000-square-foot grow, one cultivator estimates it would cost about \$120,000 to fertilize for a year with liquid nutrients. With living (or amended) soil, that cost would drop to about \$20,000.

An outdoor cannabis grower might buy 40-80 yards of bulk compost per year for a 1-acre outdoor grow and a separate 5,000-square-foot, mixed-light cultivation facility.

The grower would let the compost cure over the winter and then apply it directly to the cultivation beds. That material would cost about \$40-\$45 per yard. Production costs would be about a quarter of the bottled nutrient cost.

A RECIPE FOR SUCCESS

In an indoor operation that uses hydroponics, a cultivator can't run a strictly living soil system, but similar techniques and ingredients can be employed.

By blending in-house fertilizers and building teas, cost of production can be reduced.

Hydroponic grows could include water-soluble microorganisms such as bacillus subtilis in the grow medium, which creates compost teas that foster bacteria and fungi.

A grower can also administer beneficial bacteria, fungi and protozoa about six times throughout the life cycle of the plant. With this system, it's necessary to reapply the microbes because there is no growing media for them to inhabit.

Outdoor growers might consider adding both worms and worm castings to the compost. Using live worms is a good way to save a little money rather than just buying castings.

Test the soil regularly and amend it accordingly. For example, if the test reveals the soil is deficient in phosphorous, add fish or blood meal to get the level back up.

Some cultivators are strong proponents of using manure from dairy cattle to grow cannabis, because cattle have ruminant digestion with four stomachs that break down organic materials effectively. Growers can also add rice hulls, grape pomace or grape harvest waste material. All those materials are regionally available.

If possible, let the compost sit for three to five months before applying it. As it decomposes, more "soil critters" come into play. The fungal levels also increase, as do amoebas and protozoa.

YIELDS AND HEALTH

Several growers say their yields have gone up using living soil growing principles, and their plants are healthier to boot.

Using compost teas can result in a much healthier plant, and healthier plants can fight off pests and pathogens. Some cultivators use the teas not only for a soil application but also as a foliar spray to fight off powdery mildew.

Aim for about 4-6 pounds per plant. It's not uncommon to see outdoor-grown plants test at 25%-32% THC content.

Because of this system, growers can worry less about botrytis or powdery mildew. Instead of fending off pests and disease, cannabis can focus its energy on growing high-potency, terpene-rich flower.

As far as learning how to develop your own soil, read as much as you can and experiment. Jeff Lowenfels' book, "Teaming with Microbes," and the teachings of Dr. Elaine Ingham are both good educational sources.

Another way to learn is to find someone in your area who is using living soils and volunteer to help that person.

HOW TO GROW BETTER CANNABIS FOR EXTRACTION

A grower looking to dial in best practices when optimizing plants for oil production should consider:

- The quality of the source material and genetics.
- Which cultivation methods create the desired plant and extract.
- How the plant is harvested, trimmed and cured.
- Pest management and how that can influence resin production.

“You can make distillate from really poor-quality flower, but what’s better is to have really high-quality goods that you make an even better-quality oil out of,” said Jeff Thorne, cultivation manager for Calgary, Alberta-based Sunniva, a provider of marijuana services and products.

GO FOR GOOD GENETICS

Focus on selecting strains that produce a high amount of resin, which contains the cannabinoids, terpenes and raw material desirable for quality oil.

For a strong resin output, choose strains of the Kush variety—provided they’re the real deal from Southwest Asia and not the California-style Kush plants.

But don’t be fooled by a plant with a lot of crystals or trichomes. Just because the flowering part of a plant outwardly looks to contain a lot of resin doesn’t mean the inside of the leafy plant material will.

Acquire genetics from a stable producer or cuts from someone you know has stable genetics. Understand the specific phenotypical traits that you’re looking for.

Also think about choosing OG strains if you’re extracting for cannabinoids and general high-potency concentrates such as distillate. If you’re looking for terpenes for product such as live resin, select genetics based on how a plant smells. Fruity aromas in strains such as Grape God and Purple Punch usually equal good terpene yields.

HAVE A FAVORABLE GROWING ENVIRONMENT

While the genetics typically drive how much resin a plant creates, cultivation environment can help to refine and finish the process.

Use a tightly controlled greenhouse climate to help generate large resin heads. Start plants with a warmer, wetter room, then trend toward cool and dry to finish the growth cycle.

The second-most-important focus should be cultivation methodologies and techniques.

Dial in production to formulate and tweak nutrient supplements to ensure high yields.

FINISHING MOVES CAN HAVE AN IMPACT

Once you’ve selected the right strains and grown them properly, it’s important to shepherd them through the last stage to provide the best possible plant material for extraction.

You should harvest extraction-designated plants slightly earlier than flower for retail shelves. Freeze cut plants immediately rather than drying, curing and trimming them.

Doing it this way preserves some of the terpene content for live resin and helps to reduce labor costs. You can skip paying an army of trimmers, for one.

Growers can also re-create the “whole-plant experience” within a facility by lowering the maximum temperatures at the end of the plant cycle to help preserve terpenes in the extracted oil.

Others might find harvesting early helps to preserve the terpene profile. While the total amount of oil recovery might be less if the plant hasn’t grown as large and dense, harvesting early retains the aromatic qualities of what the live plant smells like.

The timing of the harvest is crucial. Have an adequate number of workers on hand to cut and trim dried product. Without a properly managed schedule, producers risk allowing plants to age out of their peak trichome production time frame.

On the flip side, don’t rush the drying and curing stage—that will reduce your return on yield.

PEST MANAGEMENT IS KEY

What and when pesticides are applied can have a major impact on plants at the end of the growth cycle.

Growers might see a drop in resin production and yield for concentrates when a cultivation facility experiences powdery mildew or mite infestations.

Some cultivators try not to use any pesticides at all. Very heavy botanical, oil-based products tend to hinder the extraction process.

Also, stay away from some approved pesticides and fungicides because of the damage they do to the product. For example, potassium bicarbonate can be sprayed up to the day of harvest, but it lessens the quality of the extracted material.

HOW TO ENSURE AN OPTIMUM AMOUNT OF LIGHT IN AN INDOOR GROW

In addition to water and nutrients, indoor-grown cannabis plants need the proper amount of light to grow and thrive. Optimum light allows plants to conduct photosynthesis efficiently and produce healthy, robust flower.

Other factors need to be accounted for, including temperature and humidity. But an edge can be gained by perfecting lighting techniques around:

- Pruning
- Plant arrangement
- Levels
- Type

“Lighting is critical to your success,” said Gord Kline, head of cultivation at High Street, a vertically integrated cannabis company based in Canfield, Ontario.

PRUNING PERFECTION

Increase light penetration into the canopy by defoliating plants and removing the fan leaves.

Do this once in the initial growth phase, after planting clones in 1-gallon containers.

Prune fan leaves during the flower stage, about two weeks into the cycle and again around four weeks.

By allowing light to penetrate deeper into the canopy, lower leaves receive more photosynthetic radiation to provide more resources to the rest of the plant.

Also, try to push the limits on how much pruning plants can take before there are diminishing returns.

PROPER SPACING IS KEY

Keep plants spaced in accordance with your lighting system, but experiment with the arrangement to ensure the most effective layout. Here’s an example of how to set up two different arrangements for testing:

In one grow operation, space plants out under high-pressure sodium (HPS) bulbs. The goal is to create a much larger bud structure. Pull apart the upper branches and remove the small branches from the bottom.

On the other side, arrange plants more tightly together but with light-emitting diodes (LEDs) installed above. This arrangement employs a more “sea of green” canopy style. With this arrangement, you’ll get a more top-based product with trellised plants and smaller buds, but you can pack more plants into the space.



As technology evolves, it helps to have a dedicated space to try new lights.
Photo Courtesy of High Street

If plants are crammed together in the vegetative room, they’ll grow taller and longer, rather than squat and bushier, because they’ll compete for light.

When plants are growing into each other, you’ll get what’s known as a shade-avoidance response, which also causes plants to grow upward rather than outward—something to be avoided in the early stages of a plant’s life.

FINE-TUNING LIGHT LEVELS

Attempt to mimic natural lighting conditions with the lights.

Make sure the lights aren’t too close to the plants, so they are not overloaded—but do push the limit. The industry standard for micromoles (a scientific measurement for light particles) is 800-1,000 per square meter, but don’t be afraid to run a more intensive system than that.

A good rule of thumb is about 18 hours of light per day during the vegetative stage and 12 hours of light during the flowering stage.

Measure the light levels with a laser temperature gun. Shoot the laser at the leaf surface of a plant, hoping for 76-78 degrees. Too much light will give you a higher temperature reading.

Drooping leaves are another sign a plant has received too much light. This signals the plant is trying to minimize the surface area of its leaves to decrease the amount of light it’s taking in. That could also cause plants to flower less prolifically.

VARYING THE LIGHT SPECTRUM

Cultivators commonly use cooler lights such as metal halides in early, vegetative growing stages and switch to hotter, red-spectrum HPS lights during flowering.

The blue spectrum of metal halide lights increases vegetative growth and helps to build plant structure—great for early stages. HPS lights, the red spectrum, help spur flower growth.



Plants are automatically watered and fed via this fertigation room at Green Thumb Industries. If levels are not perfect, the cultivation team can adjust them using mobile devices.
Courtesy Photo

IRRIGATION STRATEGIES

In typical marijuana cultivation operations, water acts as a vehicle to deliver nutrients and minerals that cannabis plants need to thrive.

Outdoor growers in regions such as the Emerald Triangle in Northern California rely on captured rainwater, which often naturally contains minerals at levels that can be beneficial to cannabis.

But indoor growers—especially those in urban environments—can't just use the municipal water. Straight-from-the-tap city water contains too many unknowns, including chlorine and other contaminants.

Savvy marijuana cultivators test their water frequently and adjust the nutrient mix and soil amendments accordingly.

It's such an intensely grown crop and such a high-value crop. (Proper watering techniques will) help you achieve your maximum potential.

Alessandro Cesario

Director of cultivation for Desert Grown Farms

SEVERAL WAYS TO WATER

Municipal water isn't completely off limits, but you need to know what's in it and how to adapt your system for that.

It's smart to filter out any contaminants, but if the water is tested regularly (at least once each quarter), a cultivator can create a nutrient mix that incorporates some of the naturally occurring minerals in the water. Just reach out to a local laboratory to have your water tested.

A grower using rainwater can rely on the soil to provide a buffer in a way that a hydroponic medium doesn't, which will help mitigate or break down any unwanted minerals or contaminants.

Large-scale cultivators will want to remove any variability from the water supply. If a cultivator really wants to create a consistent, reliable irrigation system, buy a reverse osmosis (RO) system, which removes contaminants from water by forcing it through a porous membrane.

It can be a little wasteful—as you pull the particulate out, you lose water volume—but RO creates a blank canvas to work on.

FILTRATION

If the city you're operating in has a comparatively high number of dissolved solids and other unwanted elements, run it through a high-efficiency particulate air (HEPA) filter to block any large particles, a carbon filter to trap the chlorine and two RO machines for purification.

One RO system can fill a 3,000-gallon tank; on a heavy day, a cultivator can process roughly 8,000 gallons for 25,000 square feet of canopy, which is irrigated with a hydroponic system.

The RO water is at least 99% pure, and a grower will then need to formulate nutrients to add to it.

But that water doesn't want to stay pure and can experience wild changes in pH.

To stabilize the pH, add a buffer, which typically includes potassium bicarbonate. A common pH range for water is 5.5-6.5, but that can vary depending on the strain, grow media or the stage of the plant's life cycle.

While the expense for the RO machine can vary based on a number of factors, including size and amount of filtration, the price consumers pay for cannabis can justify the equipment cost.

Working with an RO system and building a nutrient program around that pure water can also help your team develop standard operating procedures for multistate operations. That "clean slate" water can be replicated, provided the out-of-state grow operation also uses RO.

One criticism of RO is that it can be resource intensive. Often, the dissolved solids that are removed from the water reduce the overall volume considerably.

To help conserve moisture, reclaim condensation that forms around the HVAC system.

As far as maintenance, test the machine and water frequently—even daily—to ensure everything is flowing as it should.

RAIN CATCHMENT

With tanks that hold 80,000 gallons of rainwater—enough to irrigate two 10,000-square-foot sections—some growers never have to use supplemental water to make it through the year.

With such a tank setup, an outdoor grower could use a Netafim drip irrigation system that is buried in the ground, under the plants. That helps water loss due to evaporation.

The underground system causes the roots to stretch downward, which causes some stress on the plant, but this way, the roots aren't looking to the surface for water.

HOW TO FIGHT MOLD AND MILDEW

Mold and powdery mildew can ravage a cannabis grow and lead to lost time and money and even total eradication of the crop.

Vigilant growers can take these steps to guarantee that microbes don't contaminate their marijuana:

- Ensure the people entering and leaving your facility are not carrying any harmful pathogens on their persons or clothes.
- Control the environment—including temperature, humidity and air flow—to inhibit the growth of undesirable microorganisms.
- Keep your plants healthy and correctly arranged to give them a fighting chance.
- Detect early signs and symptoms of mold and mildew to quarantine or eradicate the affected plants in the event of an outbreak.



Alex Cooley uses compost teas at Solstice Cannabis to prevent powdery mildew.
Courtesy Photo

*The best prevention is preventative.
If you have a clean facility with good
HVAC (heating, ventilation and cooling
system), you're 95% there.*

Mark Krytiuk

President of Nabis Holdings

EXCLUDING UNWANTED VISITORS

Powdery mildew is often present in the environment, and keeping it out is the first step to maintaining a clean grow room.

One sure-fire way to bring unwanted microbes into a cultivation operation is on the shoes or clothes of a visitor.

Growers should require full-coverage suits and booties for anyone entering the facility. Advanced cultivation rooms often have blow-down rooms with specialized high-pressure fans to knock off any would-be tagalongs from outdoors or other sites.

Also ensure the cleanliness of the entryway, where visitors can don Tyvek suits or grow-only clothes and shoes before entering the cultivation area.

ENVIRONMENTAL CONTROLS

Indoor growers have the luxury of controlling all the variables in the grow room. Temperature, humidity and airflow can all influence the proliferation—or lack thereof—of mold and powdery mildew.

One critical technique: Keep air moving in your facility.

When moisture is stagnant around the plant—particularly the buds—the risk of microbial growth increases.

The danger zone in a grow room is 65% relative humidity or above.

Keep plants at roughly 82-83 degrees Fahrenheit during the day and avoid large drops in temperature at night, which makes your plants especially susceptible to mold.

As plants age through the life cycle, gradually step down the relative humidity until it's around 35% at harvest time.

Another crucial element is having an adequate HVAC system and proper supplemental fans to maintain an optimal environment.

PLANT HEALTH AND SPACING

Growers should be cognizant of giving their plants enough space to lessen the opportunity for microbial growth. Pathogens can fester where leaves and branches overlap.

Correctly pruning plants can also have a big impact on airflow and, therefore, on keeping out microbials.

Cultivators shouldn't be afraid to cull strains that easily succumb to microbial outbreak under the conditions of their grow. Keeping plants as healthy as possible is one of the best defenses against pathogens.

Create a living soil with beneficial fungus, bacteria and insect frass to create strong, robust cannabis.

Also watch for nitrogen toxicity, a common problem in marijuana, where the leaves take on a dark-green color. Once cannabis plants have developed the toxicity, they'll be more prone to a microbial outbreak.

RESPONDING TO AN OUTBREAK

In the event of an outbreak—which is more of a when than an if—growers can either try to contain the spread or destroy all the plants, sanitize the facility and start over.

How to mitigate the damage from an outbreak depends on what stage the plant is in.

If the plant is still in the vegetative state and hasn't flowered, a grower could use hydrogen peroxide as a foliar spray to try to control it.

If the plants are closer to harvest, small outbreaks may still be mitigated through culling and isolation.

But in a mold- or mildew-infested HVAC facility, whole rooms can be contaminated. In those cases, growers will need to fog the entire room and HVAC system with miticide or fungicide spray.



Your plant arrangement—particularly how far apart you space your plants—will greatly influence light penetration and how tall or squat your plants grow.

Photo Courtesy of Shift Cannabis

HOW TO CONTROL ODORS

Even if you love the smell of cannabis, your neighbors or nearby business owners might not.

Depending on where a marijuana cultivation operation is located, local ordinances could require business owners to mitigate or control the odor. Odor control can also foster positive relationships in the community through efforts to just be a good neighbor.

A number of options exist for odor control, but cultivators will want to find one that doesn't negatively alter the environment in the grow facility or affect plant health and product quality.

Keep in mind that, no matter what, there's no odor control out there that's going to be 100%

Dr. Laura Hauptert

Director of research and development for OMI Industries

SELECTING THE RIGHT SYSTEM

One option for combatting odors is a carbon filter system connected to exhaust fans for indoor grows. Porous carbon filters allow air to pass through as the odors bind to the carbon, trapping in the offensive smells.

For a greenhouse system, carbon-filtration systems tend to be too expensive for the entire grow, and they also disrupt airflow. An effective alternative is a system that sprays a mix of water and orange peel oil into the air as it leaves the greenhouse and works as a kind of an air freshener.

The ongoing maintenance that's required to keep carbon filters clean can be a drawback, and carbon filters remove only odor, not other microbials.

Another choice is to use a purification system mounted in the air ducts to help control microbials, including mold and mildew, as well as the outgoing cannabis aroma.

A cultivator can also use a high-efficiency particulate air (HEPA) filter that traps particles and can be wall-mounted or part of an HVAC system.

Yet another system uses natural plant oils to neutralize the odor for outdoor and greenhouse grows. The broad-spectrum blend of plant oils is intended to neutralize odors across a variety of different strains.

This odor-control system is set up as close as possible to the vent on the outside the greenhouse.

The unit is either wall-mounted or sits on a stand above a 55-gallon drum, depending on how the cultivation operators configure their canopies. This is connected to vapor ducting where the plant oils combine with the cannabis to neutralize the smell.

IMPACT ON THE GROW ENVIRONMENT

Carbon filters don't affect the temperature or humidity in the room, but they can have an impact on airflow. Air circulation is important for efficacy.

The later the plants are in the flower cycle, the more pungent they become, therefore more odor mitigation is required.

Also critical: Outside plant oils need to make contact with the odor molecules, but they should never touch the actual cannabis.

OTHER BUILDING FACTORS

Aside from the filters and plant-oil products, it's essential the grow facility is correctly constructed. Cultivators will want to ensure the corners, cracks and doorjambes in the grow are sealed to prevent gaps that could allow odors to escape.

Growers should even consider putting a filter on the bathroom fan.



Otis Gardens in Hood River, Oregon, operates on a 10-week flower cycle. *Courtesy Photo*

TIPS ON CUTTING, HANGING AND DRYING CANNABIS

Properly executing the harvest is a critical step after the hard work of getting a cannabis crop all the way through the vegetative and flowering stage.

Depending on the cultivation facility, the workforce and desired end product, cultivators should consider the following:

- The best method for achieving the sought-after results.
- How to get the plants ready to be cut down.
- How to prepare the crop area so employees can harvest the plants efficiently.

The key is balancing efficiency and quickness with doing it right without harming any of the flower.

Brandon Pollock
CEO of Theory Wellness

SELECT A METHOD

A crew could harvest the crop one of two ways, depending on how the plants ultimately will be used.

With the first method, the cannabis is “bucked down,” so that the flower components are removed from the main stalk.

Choose this method to use the cannabis for extraction to produce concentrates, such as hash oil, shatter and budder. It accelerates the drying process because the flower is no longer connected to its main water source, the stem.

While this method takes less time, it might cost terpenes. But if the material is to be extracted with a CO₂ machine, it will likely be distilled only for THC or CBD, so that’s not a concern.

After the plant is bucked, the material will be dried on a baker’s rack, which flattens one side of the flower.

For the second method, a harvest crew leaves more on the stalk and hangs the plants to dry. If the facility isn't set up to allow for hanging the entire plant, each plant can be cut into four to six colas (large flower sections). This flower can eventually be sold on retail store shelves.

Hanging the plant helps it retain the integrity of the flower's shape and structure. It also saves time for trimmers who don't have to reshape the bud.

Hanging plants also slows the drying process and helps to retain terpenes.

PRE-HARVEST TECHNIQUES

For some cultivators, adjusting growing conditions before the harvest is as important as cutting down the plants. Before a crew cuts down the whole plant, start dialing down the temperature and humidity.

One method: Lower the temperature to the mid-60 degrees Fahrenheit from the 80s. The cooler temperatures help increase the trichome production and plant color.

For example, if a strain has purple genetics, the violet hue will shine brighter at lower temperatures, which is more appealing on a retail shelf.

The color expression of strains is akin to how leaves of deciduous trees change colors in the fall.

The idea is to mimic the conditions a plant would experience in an outdoor environment at the end of its life cycle.

Turning down the humidity also helps reduce the risk of any mold or mildew growth.

PREPPING THE CROP AREA

To keep a whole staff on the payroll full time, use the trimmer crew to help with the harvest.

For example, if harvest is on Monday, the staff sets up the harvest room on Friday with all the necessary tables and trash cans.

Part of the preparation process also involves pruning the plants before harvest.

In one cultivation operation, it takes the team about eight hours to harvest 400-500 plants.

Before harvest, a crew fully sanitizes the drying room to make sure they avoid potential contaminants such as mold and mildew.

HOW FLUSHING CAN SEAL THE DEAL

Before cannabis can be harvested, a common practice is to flush out all the nutrients so the flower will smoke and taste free of additives such as premixed nutrients or fertilizers.

Run water that's been filtered via reverse osmosis through the plants for about two weeks before harvest.

Flushing also helps to push the plants to fully ripen and use up any nutrients they're still carrying.

You're looking for a clean, white ash when the flower is smoked.

Another method: Start bringing down the nutrient concentration about three weeks before harvest.

That's partly because the plant might not even take up the nutrients at that late stage in the growing cycle. The runoff will show that the plant isn't absorbing any more nitrogen, for example.

Growers also caution against giving cannabis too much nitrogen at the end of its life. That could change the structure of the flower to be excessively leafy, for instance.



Lead Grower Pieter Summs of Otis Gardens hangs plants to dry if they will be sold to consumers as flower. *Courtesy Photo*

HOW TO CURE AND TRIM TO CREATE A QUALITY END PRODUCT

After months of growing and caring for their cannabis plants, diligent cultivators pay close attention to the curing and trimming processes to ensure the product delivered to consumers is of the utmost quality.

If a grower messes up the cure or trimming, the whole product can be lost.

Cultivators looking to hone their trimming and curing practices should consider:

- How the length of time allocated to curing can affect the final product.
- Whether hand- or machine-trimming is the best method.
- Organizing your operation to keep a steady crew of trimmers.

A customer should pick up a well-trimmed and cured bud, twist it around and see the trichomes sparkle and smell the terpenes that properly express the particular strain of flower.

It's like running a race. Everyone wants to start out strong, but you have to finish strong.

Ryan Gomez

Co-founder and head of cultivation for PürLife

TAKING THE CURE

Don't rush the product to market. One company said its curing process takes about six weeks.

If you rush the cure, chlorophyll and sugar get locked in the plant, and that results in a harsher smoke with poorer taste.

Properly cured flower has a moisture content of 11%. Keep the humidity in the upper 50% to lower 60% range and around 75 degrees.

Flower can be cured in food-grade plastic storage containers. "Burp" them by opening the containers to circulate air as often as necessary, depending on moisture content.

Or you can hang your plants for seven days before placing them into mahogany curing boxes.

These boxes are temperature- and humidity-controlled and can shave about five days off your curing time. With the expedited process, it takes about 10 days to cure flower after harvest.

Other cultivators cure from two weeks to a month with temperatures in the low 60s and relative humidity around 60%.

Every strain is different, but some growers like the buds to be spongy to the touch. Keeping the flower relatively dry is paramount, as too much humidity can rot the bud.

HAND-TRIMMING

Although it may lead to a higher cost of production, some cultivators trim by hand to preserve as much trichome content as possible. Cannabinoids are concentrated in trichomes.

Using humans rather than machines also means the flower is inspected again before it's sent to retail.

Hand-trimming is a critical step in landing flower on the top shelf at a retail store.

Others also eschew machine-trimming as they feel it breaks down bigger buds into "little nuggets."

Trimming by hand helps to retain more weight. A machine can cut off too much and reduce your yield.



Plants need to be cared for as meticulously at the end of the growth cycle as they are in the vegetative stage. Photos Courtesy of Revolution Enterprises

LABOR FORCE

Deciding not to use machines also helps to keep your human trimmers employed full time, so the company isn't relying on seasonal trim crews who might not have as much commitment to the business.

Hand-trimming is more expensive in terms of labor, but some believe the expense is worth it.

A full-time trim crew can help with harvesting, pruning and cleaning, as well as regular trimming duties. For every 20 grow lights, a company can employ three to five workers.

Beyond the benefit of consistently having full-time employees on staff, by being around the plant through harvest and pruning, the workers also become familiar with how each cultivar should express its unique characteristics.



LED lights typically need less wattage and therefore omit less heat. Photo by Black Dog LED

ENERGY COSTS

While growing the plant well is the most important element, a key to a successful and profitable operation is keeping production costs down. One crucial component to shaping the bottom line: energy consumption.

When looking to make your grow consume less juice, the three main areas to highlight are:

- Lighting
- HVAC systems
- Type of facility

“We would estimate lights require about 50% of your energy consumption and HVAC another 50%,” said Av Singh, a cannabis cultivation adviser based in Nova Scotia, Canada.

LEDS WIN OUT

When comparing high-pressure sodium (HPS) lights to LEDs in terms of energy consumption, LEDs require less wattage to create the same amount of light, and less wattage means the lights put out less heat.

If your lighting accounts for 40% of total energy costs, and you can save 25% on lighting costs with LEDs, then you’re looking at a 10% reduction in total energy costs.

One trick for a greenhouse operation is to include a light bar that will move over your plants as supplemental light.

An automated light bar rolls on a track above the canopy and bathes cannabis in light for about 90 seconds every four or five minutes.

That will save you money on equipment and energy costs compared to hanging lights across your entire facility.

A grower could also use LEDs in areas that will provide rebates for less-energy-intensive equipment. For example, some provinces in Canada with energy-efficiency programs will offer rebates of \$200-\$250 per light.

While lighting can save you money on energy costs, HVAC and dehumidification technology have the ability to move the needle a lot more than lighting does.

DON'T SKIMP ON HVAC

The first step you should take if you want to reduce your energy consumption is to buy a purpose-built HVAC system—meaning one designed specifically for cannabis cultivation facilities. Several brands are available, including some that double as HVAC systems for indoor swimming pools.

Standard residential HVAC systems aren't capable of handling the unique challenges of a marijuana facility. Growing marijuana plants creates a large amount of moisture, for one, and grows often are located in climates, such as Nevada, that are not ideally suited for cannabis production.

One approach is to use a desiccant-based HVAC system. A conventional HVAC system will use more power to remove moisture from the air, while a desiccant-focused system uses a wheel made of corrugated material to draw water from the environment.

Another tip: Gradually power up and turn off your lights to reduce the demand on your HVAC system. When you quickly turn off all your lights, your HVAC system immediately must work harder to catch up to that change. Instead, program your lights to mirror dusk's slow fade to dark and the gradual brightness of dawn.

INDOOR OR GREENHOUSE

The steep decline in wholesale prices in mature recreational cannabis markets such as Colorado makes it tough to stay profitable when operating an indoor cultivation facility. The cost of production—primarily energy costs—can be extremely high with indoor grows.

Consider instead a greenhouse or hoop house. The energy savings in using sunlight could add up to \$100-\$250 off your cost of production per pound of cannabis.

If you're building a greenhouse, double-paned windows will help with insulation.

Another tip is to use LEDs for supplemental lighting.

Even in Canada, the major issue with greenhouses is keeping them cool. It's crucial you don't let the temperature exceed 84-85 degrees.

OTHER TIPS

Some growers have had success with a voltage stabilizer, which helps to deliver a constant voltage load, depending on the power grid. If your system sees a lot of surges, you might end up using more power than you require.

Sensors also come in handy. You can use voltage meters to determine if your fans are drawing too much power, for example. If, for some reason, your equipment is using power it shouldn't, evaluate and adjust accordingly.

Also, check if your power provider offers a discount for energy consumption during off-peak hours.

Another avenue to explore is cogeneration, the simultaneous production of at least two forms of energy from one source of fuel. Utilizing natural gas to generate electricity on-site could save you money, depending on the cost of the gas. Natural gas-generated electricity might be cheaper than the energy you buy from the power company.