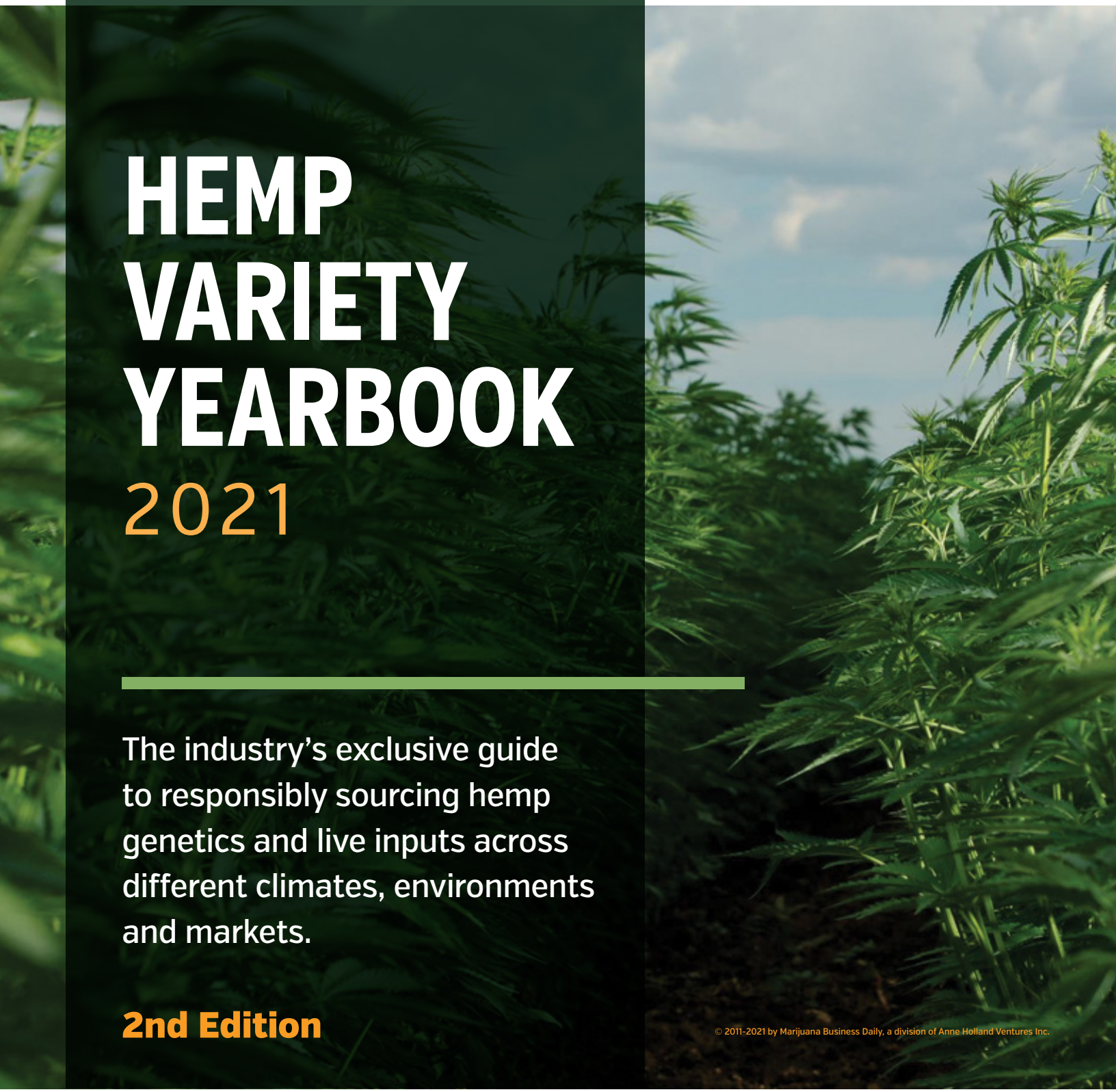
Hemp Industry Daily®

# HEMP VARIETY YEARBOOK 2021



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# FROM THE EDITOR

**Laura Drotleff**
*Hemp Industry Daily*

In the two years since hemp became a legal commercial crop in the United States, producers' challenges haven't subsided. The ability to source a consistent supply of predictable, reliable genetics remains elusive as the industry establishes itself and plant-breeding efforts continue.

But even for a nascent industry, there have been significant advancements in research over the past year that could help farmers improve their understanding of hemp cultivation. And responsible and informed variety selection continues to be the foundation to a successful growing season.

The industry lives and dies by the quality of genetics available and farmers' success in producing them.

That's where we come in.

*Hemp Industry Daily*'s second edition of the industry's only Hemp Variety Yearbook is a comprehensive look at the available hemp genetics on the market. Compared to the first edition in 2020 (which we hope you will continue to reference), the 2021 yearbook features 75 varieties from 18 companies.

In addition to serving as a buyer's guide for sourcing hemp genetics for the upcoming season, the 2021 Hemp Variety Yearbook provides resources to help you prepare for subsequent seasons, through tools that will help you make decisions about how to choose varieties and how to vet suppliers you can trust. We wanted to make this a trusted resource to help growers and provide assets for plant breeders and suppliers who want to develop a reliable supply of hemp varieties to build the legitimacy of the industry.

We compiled this list of hemp genetics because this nascent industry needs a trusted source to research and connect with breeders and young-plant suppliers.

In the following pages, you'll find insights on how best to approach your hemp-production season with eyes wide open, guided by researchers, plant breeders and growers who will clue you in on how to select the hemp genetics and the young plants that will best fit your needs, including:

- Varieties currently on the market, by purpose (flower, fiber, grain and multipurpose).
- Tips for selecting effective live inputs (seed, seedlings, cuttings and clones).
- How to source genetics domestically and internationally.
- Research and resources.

Of course, the hemp industry is still new—as are a lot of the companies that serve it so the information provided here by plant breeders about their respective hemp varieties will vary depending on the date planted, the conditions and climate where they are produced and even the person doing the planting, among other production factors.

Data remains limited for hemp production among the many states, tribes and territories that have been approved for hemp farming, especially within the past year - not to mention the new federal production rules that have only recently been finalized.

That's why information in the Hemp Variety Yearbook should not be considered the final word. Instead, consider this your starting point for understanding the available hemp genetics on the market before you contact individual companies with specific questions. And we've also provided a list of things to be sure to ask.

Meanwhile, if you have any questions about the Hemp Variety Yearbook or want to provide feedback, please feel free to contact me at **laura.drotleff@hempindustrydaily.com**.

Finally, I'd like to take this time to thank Christian Gray, who contributed to the creation of this year's report.

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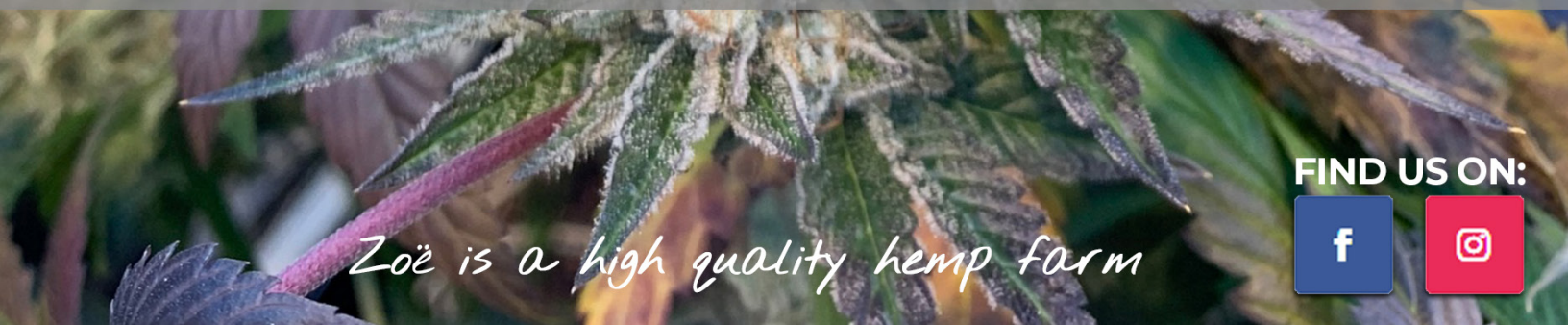

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# USDA UPDATE ON HEMP GENETICS

Since the U.S. Department of Agriculture released its interim rule in October 2019, there has been much debate over the need for a national seed-certification program through the agency.

Under the newly updated final rule, released on Jan. 15, the USDA's Agricultural Marketing Service elected not to establish such a seed-certification program for hemp.

The original decision, explained in the interim rule, was that there was a lack of accurate data and advanced technology needed to develop such a program. However, the term "certification" as it is used within the industry implies that seed is tested and verified, but it's not necessarily certified for genetic purity, according to USDA.

Because there are seed-certification studies underway, as well as seed-certifying agencies that already require seed and genetics review, the USDA recommends that farmers use varieties that comply with the Federal Seed Act and associated regulations and are produced according to standards developed by the Association of Official Seed Certifying Agencies. The latter requires varieties to be screened and tested for purity and properly labeled.

The final rule, according to the USDA, allows flexibility for the industry to continue with variety trials and does not prohibit the use of any varieties within the industry. Instead, it relies on states and tribes to develop their own rules about acceptable varieties.

## THC-TESTING YOUNG PLANTS

The USDA also clarified its rules on testing immature—or young plants—for THC. The interim rule required that vegetative cuttings taken from mother stock would qualify as a "harvest" and therefore be subject to THC testing before plants could be rooted. The final rule states that the agency will not establish an approach for licensees "dealing with" young plants because of the variability in immature plants for producers, states and tribes and the lack of consistency across the many varieties available within the industry.

Operations that grow hemp for clones and microgreens "may not need to meet the same sampling and testing requirements as operations that grow flowering hemp." However, the final rule gives flexibility to states and tribes to determine their own sampling protocols to address this. And states and tribes are allowed to be more restrictive than the federal rules.

## FUNDING FOR GERMPLASM

While the USDA does not have plans to establish a variety-certification program, it is promoting efforts to develop its hemp germplasm research center to allow for better plant breeding. The agency's National Institute of Food and Agriculture launched a competitive grant-funding program for "supplemental crops," including industrial hemp, that will aim to help compile hemp germplasm for the USDA Hemp Germplasm Repository located at Cornell AgriTech in Geneva, New York.

The program will help support breeding, testing and development of "superior performing" industrial-hemp varieties and production practices resulting in "improved cost efficiencies, reduced grower risks and wider use in production systems," the USDA-NIFA program summary notes.

The grants, which are open only to colleges and universities, federal agencies and private-sector entities, will be a maximum of $125,000, and $930,000 is allotted for the program, which also includes canola research. **Requests for funding** must be submitted by March 30, 2021.

# HOW TO SOURCE RELIABLE HEMP GENETICS

Finding reliable hemp varieties that will produce the desired cannabinoid profile and biomass volume, while also performing in the field and testing in compliance with federal THC limits, can feel like a tall order.

Here are some best practices for responsible selection of hemp genetics that can help save money—and potentially an entire hemp crop—at harvest.

### Do the research.

Don't rely entirely on what the internet says will work for a certain climate or growing environment. Talk directly with plant breeders and learn about the varieties they produce.

Ask about:

- The history of the genetics—where they were developed, the evolution of the development, cannabinoid content, germination rate, etc.
- Testing and treatment protocols for dealing with diseases and pathogens.
- Availability of a virus and pathogen indexing and clean stock program.
- Seed certification and feminization reports.
- Where seeds or cuttings/clones are produced—indoor, outdoor or in a greenhouse.
- Any state-specific seed licenses and labels.
- A variety's success in your region and microclimate.
- The ability to provide various certificates of analysis, from multiple seasons and across several regions.
- A variety's average yield per acre.
- The flower response time—how many hours of daylight does it need to remain in a vegetative growing state and to being flowering.
- Disease resistance to powdery mildew and botrytis.
- Technical growing tips to increase yield and molecule concentration.
- Minimum order quantities.
- Price per seed, seedling, cutting or clone.
- Availability.
- Shipping methods and costs.
- Policies for holding orders because of weather or other issues.

### Network.

Talk with veteran farmers in your area or region. Find out what varieties they have produced and what the results were. Ask about the benefits and drawbacks for different genetics and if they're reordering or using different genetics or suppliers for this season and why.

Read, talk with university extension and industry consultants with a knowledge and research base in hemp production and join LinkedIn to connect with hemp professionals. Reciprocate with what you've learned.

### Reference state guidelines.

Many markets have a certifying agency that provides a list of allowed varieties, as well as those that are on a watch list or banned from the state because of a tendency to test over legal THC limits.

If the genetics you want to source are not on the list for your state, talk with a representative from the agency to find out how to get those varieties approved or obtain an exception. Some states do not restrict genetics, but it's important to understand your market's guidelines before you buy. If it doesn't restrict, look at neighboring states or others in your region for guidance or warnings.

### Seek certified varieties.

The Association of Official Seed Certifying Agencies (AOSCA) establishes minimum standards for genetic purity and identity, recommends minimum standards for seed quality for classes of certified seed and coordinates the efforts of seed-certifying agencies.

Most current AOSCA-certified varieties originate outside the United States and are produced for seed, grain or fiber. New West Genetics in Colorado was the first U.S.-based company to receive AOSCA certification for its NWG-Elite variety, in 2017. California-based Arcadia Biosciences just announced AOSCA certification for four varieties, including Umpqua, Rogue, Santiam and Potomac. More U.S.-produced varieties are nearing eligibility for certification. Though it originally only focused on seed-propagated varieties, AOSCA has also developed standards for varieties that are vegetatively propagated and for seed and vegetative transplants (seedlings and clones).

Hemp-plant breeders may apply for AOSCA certification through the organization's Variety Review Boards. Companies that don't have AOSCA certification can access the organization's labs to help verify their seed for customers, in compliance with the Federal Seed Act, and avoid costly lawsuits that come with mislabeled or noncompliant crops, according to Wendy Mosher, president and CEO of New West Genetics.

See more about the benefits of certification, for both plant breeders and growers, on page 13.

### Visit university trials.

Many public universities have set up hemp variety trials over the past few years to test how genetics grow in their unique climates and conditions. Researchers and university extension specialists often host a series of field days in mid- to late summer, inviting industry members to learn about how the selected varieties perform These include a range of criteria, such as:

- Crop time.
- Flower response time.
- Pest and disease resistance or susceptibility.
- Yield data.
- CBD-to-THC ratio.
- Cannabinoid percentages in the growing cycle.

Contact your state's land-grant university—and other research institutions focusing on hemp genetics—to find out about their trialing program and field days, and where they publish trial results.

### Verify before trust.

Seed brokers and clone sellers relish the opportunity to share lab results showing how their varieties perform, but farmers should ask for at least three lab reports to verify results, advises Chris Boucher, who owns Farmtiva in California.

James DeDecker, director of the Michigan State University Upper Peninsula Research and Extension Center, recommends that growers ask for certificate of analysis reports from the clients of seed or clone suppliers—fellow farmers who have produced their genetics—to get an objective view of how varieties actually perform.

Further, don't be afraid to ask more questions than the lab report can answer, especially about where a variety originated and how it was developed. Be cautious and check out the science behind the genetics you're selecting. If it sounds fishy, it probably is.

Vet the breeder or supplier and ask about experience in the market. Ask about standard and basic business steps, including a standard seed-purchase agreement, a material transfer clause or agreement and regular payment terms.

### Test seeds.

Farmers can take another step toward verifying genetics by having seeds tested through an independent lab, according to Jay Noller, a soil scientist at Oregon State University and head of the school's Global Hemp Innovation Center.

Third-party testing can be pricey, but it will offer insight into the CBD-to-THC ratio and whether genetics are likely to run hot. Testing the first or second true leaf of a plant will provide those ratios, as they are fixed into the plant's DNA, Noller said.

### Set up a test plot.

Before dedicating acres to hemp production, start with a small test garden or plot.

This is also a good practice for introducing new varieties, allowing producers to trial genetics in their growing climate and on their own land, according to Jeff Kostiuk, director of agronomy support for Hemp Production Services and a longtime producer in Manitoba, Canada.

Farmers can learn successful hemp cultivation techniques—especially variety-specific practices—only by growing hemp on their own land, and the process will take two to three years.

# PRODUCING AND SOURCING CERTIFIED SEED FROM RELIABLE PRODUCERS

Seed-certification standards are established by the Illinois-based Association of Official Seed Certifying Agencies, better known as AOSCA, and administered at the local level by seed-certifying agencies. The end goal is to enable seed companies to produce and market genetically pure seed. Requirements for producing certified seed include special land requirements, planting eligible stock, field inspections, proper seed labeling and meeting standards based on complete lab analysis, according to Pat Miller, director of state affairs for the Virginia-based American Seed Trade Association.

To be certified, hemp varieties either have to be accepted through the national variety review board or through the U.S. Department of Agriculture's Plant Variety Protection Office. Acceptance also is contingent on the varieties having either a Plant Variety Protection patent or a Plant Patent through the U.S. Patent and Trademark Office.

The process for certifying seed starts when the crop is planted because state- or tribal-certifying agencies, such as the Oregon Seed Certification Service at Oregon State University, must conduct field or greenhouse inspections on the seed crop. An eligible seed variety must be distinct, uniform and stable, and because most varieties start with a plant breeder, a company or entity seeking seed certification for that variety must have permission from the breeder or owner of the variety to produce it as certified seed.

Certifying agencies under the AOSCA umbrella go through a series of inspections when:

- Female flowers are present and plants haven't started pollinating.
- Female flowers are receptive and "pollen donors" are actively pollinating.
- Off-type flowers are present, typically around the seed set.

These inspections verify that production is uniform, the seed is viable, and the field is clear of noxious weeds. Most production for hopeful certified seed is carried out in greenhouses because of a requirement that feminized seed be isolated from any other cannabis pollination. However, for fiber and grain varieties, this requirement is less stringent.

Once harvested, seed must be cleaned at a certified seed warehouse to ensure that the seed has a germination rate of at least 85%. Seed is sampled by the state agency's designated person and taken to a state seed lab, such as the Oregon State University Seed Lab.

Plant breeders and seed suppliers that want to certify seed for sale in different states should work with the certifying organizations for those states. There are also efforts underway through the AOSCA to develop clonal standards to allow producers to use clones to produce certified seed as well as produce certified clones and sell them as certified.

## WHY CERTIFIED SEED?

Obtaining AOSCA seed certification helps with market access. For example, some states, such as Florida and Texas, require growers to use only certified seed varieties. In addition, seed-variety breeders with AOSCA certification can apply for access to international markets through the **Organization of Economic Cooperation and Development** (OECD) certification program.

A certified variety has been grown through at least three cycles–and often more than that—which means it will produce what it promises to produce and is not cross-contaminated or mixed with anything else.

> *Anyone who has developed 'the magic bean' in one year or less is full of it, just run.*
>
> **Adrienne Snow**
> *founder, Western States Hemp*

The AOSCA's website provides a **list of varieties** that are currently certified. The list was most recently updated in July 2020.

## LICENSED SEED SUPPLIERS

Seed producers who intend to sell to farmers must be licensed within each state where they do business, which might require additional certifications and licenses, said Elizabeth Savory, plant health program manager at the Oregon Department of Agriculture.

Seed vendors also must abide by the Federal Seed Act, along with state seed laws that often require companies, both in and out-of-state, to get a seed permit, as many states will not recognize a seed permit from another state. State laws often have been harmonized with Federal Seed Act requirements, but that's not always the case.

Securing a permit means seed vendors must have their seed tested for purity, germination, noxious weeds and THC levels to ensure that what they report on the label is accurate—and federally legal.

State regulators recommend farmers growing hemp buy only from their state's **list of permitted suppliers** and inform regulators if any issues arise.

In addition to checking state-approved seed and licensed seed-producer lists, growers should:

- Ask to see a seed company's regulatory tests for the plants that the seed was harvested from, which should come from an accredited lab, not just the general certificates of analysis (COA) from the seed.
- Read the label—and not buy seed without a label.
- Ask to see purity and germination tests, which should come from a lab with a registered seed technologist or certified seed analyst on staff.
- Look for germination dates.
- Keep a copy of the label for each lot purchased, as well as the receipt. If there is a problem and a state department of agriculture needs to investigate, the label and receipt are important records and proof of purchase.

# IMPORTING GENETICS INTO THE U.S.

Much of the hemp genetics used for fiber and grain has been sourced from outside the United States, which was a challenging endeavor before the 2018 Farm Bill.

That legislation launched changes to ease access to international genetics by removing the U.S. Drug Enforcement Administration's authority to require hempseed permits for import. The USDA's Animal and Plant Health Inspection Service (APHIS) now regulates the import of all plants and seeds for planting to ensure safe agricultural trade.

Here are the basic requirements for safely importing hempseeds and plants into the United States from Canada and other countries:

## USDA'S SEED IMPORT GUIDANCE

The USDA Agricultural Marketing Service issued the following rules for importing hempseed:

- Seeds imported from Canada must be accompanied by either a phytosanitary certification from Canada's national plant-protection organization, verifying the origin of the seed and confirming that no plant pests are detected, or by a Federal Seed Analysis Certificate (SAC, PPQ Form 925).
- Seeds imported from countries other than Canada must be accompanied by a phytosanitary certificate from the exporting country's national plant-protection organization to verify the origin of the seed and confirm that no plant pests are detected.
- Hempseed shipments may be inspected upon arrival at the first port of entry by U.S. Customs and Border Protection to ensure APHIS regulations are met, including certification and freedom from plant pests.

## LIVE PLANT RULES

The USDA issued guidance in October 2019 that hemp plants and clones—not just seeds—can also be imported from other countries.

The policy sets rules for importing hemp plants from Canada and from other countries, including:

- Hemp plants may be imported into the U.S. from Canada if accompanied by a phytosanitary certificate from the Canadian Food Inspection Agency, which verifies plant origins and certifies that plants are free of disease.
- Hemp plants from all other countries must come with a phytosanitary certificate from the country of origin, along with a federal permit used for importing live plant material of any kind.

For questions or requests for information regarding importing hemp plants or seeds, contact APHIS Plant Protection and Quarantine's permit services by phone at 301-851-2046, 877-770-5990 (toll free) or by email at **plantproducts.permits@usda.gov**.

# HEMP RESOURCES FOR FARMERS AND BREEDERS

Because hemp is a legal agricultural commodity, federal and international resources exist to verify hemp genetics and improve farmers' chances to produce a successful crop.

## AOSCA

**What it is:** The Association of Official Seed Certifying Agencies serves as a watchdog for the agriculture industry, promoting verified genetics by bringing together seed-certifying agencies from around the world, including the United States, Canada, Argentina, Brazil, Chile, Australia, New Zealand and South Africa.

**Why it's important:** The organization works with its certifying-agency members to promote seed certification, quality assurance, identity preservation and other services that help facilitate the production and distribution of seed and other plant products in local, national and international markets.

AOSCA-member agencies can evaluate, document and verify that a seed or plant product meets certain accepted standards and issue certificates that assure farmers they are buying quality seed and crop products that have met rigorous production and documentation requirements.

Among other roles, the AOSCA reviews agency genetic standards to ensure compliance with the Federal Seed Act. The AOSCA also cooperates with the Organization of Economic Cooperation and Development and other international organizations that develop standards and regulations to encourage international commerce for approved varieties.

Learn more about the AOSCA, its services and member agencies at aosca.org.

## FEDERAL SEED ACT

**What it is:** The U.S. Department of Agriculture's Agricultural Marketing Service (USDA-AMS) enforces interstate commerce provisions of the Federal Seed Act (FSA) under the Agricultural Marketing Act.

**Why it's important:** The FSA regulates interstate shipment of agricultural seeds, requiring that seed be labeled with information that enables farmers and seed buyers to make informed choices about the varieties they purchase. Seed labeling information and advertisements pertaining to the seed must be truthful to help promote uniformity among state laws and fair competition within the seed trade.

The USDA-AMS provides information about the FSA such as regulations, past enforcement of variety labeling provisions, seed-company records and the Agricultural Marketing Act. Farmers or other seed buyers who believe they have been misled can also file a complaint or request testing services (for a fee) that includes:

- Purity
- Germination
- Moisture content
- Seed content
- Pathogens
- Variety testing

Learn more about the Federal Seed Act at **https://www.ams.usda.gov/rules-regulations/fsa**.

# CLIMATE CHALLENGES: HOW DO PLANT GENETICS AFFECT PERFORMANCE?

In 2020, an average of 5%-20% of hemp crops in each state exceeded the 0.3% THC threshold, according to Washington DC-based advocacy group Vote Hemp. States in the earlier stages of a legal hemp industry often experience the highest failure rates, including:

- Iowa, where farmers saw 13% of fields test hot in in 2020, the state's first year of production.
- Michigan, where the state's second season saw 16% of hemp crops test hot.
- Florida, where 14% of the inaugural crop was destroyed because of genetic performance and testing hot.

Having crops go hot is part of the learning process, according to Scott Burgett, co-owner of Green Earth Cannaceuticals and a participant in the pilot program at Florida A&M University, who said the high-THC crops underscore the importance of having a good testing program.

"Most of these genetics, if allowed to stay in a field past a certain period, will reach a threshold above 0.3% and have to be destroyed," he said. For example, one crop that tested at 0.3% THC was at 0.6% THC 15 days later—the time frame in which the state requires the plant to be harvested after the first test.

## DIFFERENT CLIMATE, SAME BASIC CHALLENGES

Florida hemp growers contend with short daylight cycles, humid weather and a lack of familiarity with some aspects of hemp cultivation. There's also the problem of moisture building in plants during rainy periods, leading to botrytis, or gray mold.

Given Florida's tropical climate, fungal diseases are among the biggest challenges for cultivation. Hemp is planted during rainy season, which sometimes leads to root rot. This year, farmers also saw hemp plants flower as early as May, when they're supposed to be in their vegetative period.

Florida A&M University is working to breed hemp varieties acclimated to the state and trying equatorial cultivars from Costa Rica and Jamaica. But Florida growers can use only cultivars approved by a certifying agency or a university conducting a pilot program.

First-year Texas hemp farmers also struggled with unstable genetics and bad weather, and growers and regulators agreed that spotty genetics were to blame for poor first-year performance.

## BREEDING EFFORTS UNDERWAY

States that have experienced poor performance because cultivars were not suited to the climate have partnered with companies and universities to improve results.

For example, Hawaii destroyed more than 50% of its hemp crop in 2019 because of elevated THC levels. The tropical weather in the state makes it a challenge for farmers working with daylight-sensitive hemp cultivars developed in Colorado, Kentucky and Oregon, according to Sarah Reiter, chief commercial officer for California-based biotech company Arcadia Biosciences.

The company established a cannabis division, Arcadia Specialty Genomics, in 2019 with a 10-acre hemp cultivation facility on the Hawaiian island of Molokai, located between the islands of Oahu and Maui. Its joint venture with Legacy Ventures Hawaii, Archipelago Ventures, expanded a cultivation facility to 30 acres to scale a Hawaiian hemp-cultivation footprint that includes focused tropical-variety breeding efforts on-site.

The new JV has introduced an autoflowering hemp variety to support year-round growth cycles unimpeded by the agronomic constraints of day length.

Arcadia Biosciences also had varieties in nine university trials on the mainland.

Other hemp genetics companies, such as The Hemp Mine in Fair Play, South Carolina, and Front Range Biosciences in Boulder, Colorado, have scaled up their own efforts to develop genetics that initiate flower later, giving them more time to grow vegetatively and produce a larger plant in warmer regions with less daylight than what's available in the northern states. These varieties also have been trialed nationwide.

Research results unveiled by Cornell University in 2020 determined that a hemp plant's genetics have more to do with it going hot than the stress response to field conditions.

The team conducted field trials at two New York sites to study the genetics and chemistry of 217 hemp plants. Differences in growing conditions between the sites had no significant influence on which chemicals the plants produced. But the team found a high correlation between the plants' genetics and the chemicals they produced.

# PHOTOPERIOD CONSIDERATIONS FOR HEMP PRODUCTION

A new tool aims to help growers understand how they can make a horticultural concept called photoperiodism pay off in crop consistency and yield. The interactive **Hemp Planting Map** can help growers determine the best time to plant and harvest hemp, based on their variety's flowering response time. The map was produced in part by Travis Higginbotham, co-owner and head of sales and business development for The Hemp Mine in South Carolina. He collaborated with climatologist Joanne Logan of the University of Tennessee to help growers pinpoint hyperlocal data about frost dates and daylength.

> ***"There's so much risk going into hemp in the first place; this data should allow people to stay calm and to be confident in knowing that they're going to stay compliant, and what they're seeing is what they should be seeing."***
>
> **Travis Higginbotham**
> *The Hemp Mine*

Cannabis is a short-day plant, which means it requires a long period of darkness and forms flowers only when daylength is less than 12 hours. The Hemp Mine wanted to apply horticultural principles that had been successful for growers of other plants with this characteristic, such as garden mums and poinsettias.

## WHY LIGHT MATTERS

Photoperiodism is a physiological response in many plants. It dictates whether the plant is focused on vegetative growth or reproductive growth.

Understanding photoperiodism is crucial because it dictates how hemp and marijuana producers can manipulate their crop yield and plant size through the light cycles and schedule their crops by understanding the vegetative and reproductive stages to ultimately maximize production.

Hemp isn't as straightforward as other crops. Some varieties will flower at 14 hours of daylight and some at 13 hours and 20 minutes. That can also vary based on the region where farmers are growing hemp.

Growers need to understand how soon they can plant to maximize the vegetative growth cycle of the entire production cycle, and the Hemp Planting Map provides data on daylength at specific locations to help determine this.

This information will also dictate the crop density per acre.

With tight restrictions in place for farmers having to contact their state agriculture departments to schedule when authorities come out to sample their crops, the data can help make the sampling and testing process more efficient.

## FLOWERING TIME DRIVES DEVELOPMENT

**Click here** for a more in-depth dive into photoperiodism.

Flowering time has a "major effect" on cannabinoid and biomass accumulation, according to Cornell University researcher George Stack. It also affects hemp plant architecture.

Flowering time is "critical for commercial cultivation," especially for hemp operations that need to time mechanical harvesting with optimal crop maturity, Stack said.

More than half the plants in the Cornell University **high-cannabinoid hemp trials**, which tested 30 hemp cultivars from 12 commercial sources in New York, initiated flowering in late August—consistent with the 14-hour critical photoperiod for cannabis sativa. However, many cultivars in the trials "require further selection for uniform flowering time to improve yields and avoid non-compliant test results if early flowering plants are selected from a non-uniform field."

More studies are needed on cannabinoid ratios for varieties with different photoperiod times. An earlier study noted that the CBD-to-THC ratio decreased as flowers matured for photoperiod-sensitive cultivars and increased in the aging flowers of day-neutral plants.

The Cornell research team recommended that regulatory sampling should be completed soon after terminal flowers for high-CBD cultivars to remain compliant with the 0.3% federal limit for THC. For cultivars that exceeded 7% total CBD in the Cornell trial, there was a one- to four-week window between terminal flowering and exceeding a 0.3% total THC threshold.

# MIDWESTERN HEMP DATABASE

Reliable information about growing hemp remains sparse, and programs to share existing knowledge are fragments. But a group of researchers and growers is working to break down the silos between different groups to improve results across the Midwest.

Last summer, the University of Illinois and the University of Wisconsin-Madison invited growers in their states to submit information about their crops for a new database in exchange for a discount on cannabinoid sampling. The result is the **Midwestern Hemp Database**, which also includes participants from Michigan State University, Purdue University in Indiana and growers from their respective states.

The database includes information about when a particular cultivar was planted, when it started flowering and when it was harvested as well as CBD and THC profiles. Collectively, the data also gives growers an idea of how high CBD levels can get before the plants exceed 0.3% THC, for example, or what soil type is being used most (silt loam) and what planting method is most popular (transplants from seed).

> ***"What's really cool about the hemp database is now you can actually compare what you grew against what other farmers grew, compare your soils, your nutrients, yada, yada, yada, and you can see what's going to yield best in your type of soil."***
>
> **Paul Grethey Jr.**
> *Owner, Simple Livin' Farms*

Participating growers pay $30 for cannabinoid testing—about half the normal cost—per sample at Rock River Laboratory in Watertown, Wisconsin.

The COVID-19 pandemic restricted agriculture officials' ability to collect data from the field last year, so having growers submit their own information was a good way to get data in uncertain times, said Shelby Ellison, an associate professor of horticulture at the University of Wisconsin-Madison.

The universities plan to continue collecting data this year and hope to add participants from other states.

# HOW TO CHOOSE THE RIGHT LIVE INPUTS

Best practices for growing hemp are still practically a matter of interpretation, depending on the climate, growing environment, field or lot size—as well as several other factors that vary from one farm to another. So, when it comes to determining which young plants are best, there is no one-size-fits all approach.

A few options are available that growers can choose from, however, based on crop production needs.

Here are some factors farmers should consider when determining which young plants to use this season.

## SEEDS

Seeds are typically the least expensive option, and they offer farmers a way to use mechanical planters in their fields on their own timeline. Because hempseed is less perishable than other live inputs, farmers have more flexibility in when they plant, which is valuable with unpredictable weather during planting season. That said, direct-sowing seed often takes the longest to establish.

`Seed is often used for broad-acre or large-scale farming, so conventional farmers who are used to planting agricultural commodities, such as corn, wheat or soybeans, tend to prefer it.

Conventional agricultural plant breeding focuses on creating stable parent lines, a scientific process that can take an average of 5-10 years. Hybridizing seed from stable seed lines is a complex process that requires patience and skill, but it is the only way to create stable seed lines that are true to type, consistent and uniform. The hemp industry has few players who have been breeding long enough to produce seed lines through traditional agricultural practices.

> ***"The "early" stage of the development and genetic improvement of the hempseed for food is very important ... so asking questions is very important."***
>
> **Chad Rosen**
> *CEO and founder, Victory Hemp Foods*

Many amateur breeders, however, have become volume suppliers within the industry, so farmers should choose carefully. While some varieties are tested and stable, others aren't, which means they can include several different phenotypes and will vary in quality and uniformity.

If a variety's parent lines are not true breeding, then seedlings will present variations of height, bloom time, quantity and cannabinoid analysis, ranging from high CBD to high THC in the same seed lot. In past seasons, many farmers lost money on unviable seed that did not germinate or on seed that was marketed as feminized but contained male seed.

Hempseed can be washed away if planted in wet fields or just before a rain, causing farmers to have to invest in more seed and replanting costs. Crops from seed also require constant monitoring to ensure plants that are male or hermaphroditic are culled. Growers who can't tell the difference between female, male and hermaphroditic plants should consider investing in vegetatively propagated clones and save themselves the headache, said Tennessee hemp farmer Harold Jarboe.

Feminized seed ratios range from 90%-99%, which means that—in a seed crop grown for cannabinoids, with 2,000-2,500 plants per acre—there could be 20-225 males or hermaphrodites per acre that must be removed before the crop is pollinated. If pollination occurs, the crop will have lower cannabinoid levels, which is less acceptable to processors buying hemp for CBD products.

## PLUGS

Farmers eager to get a jump on their season can buy seed to germinate into plugs or seedlings, or they can purchase seed starts from greenhouse growers.

Plugs provide farmers with up to a five-week head start because, once rooted in the field, the crop will take off faster. This is helpful when the season is delayed because of weather or regulations that cause late distribution of hemp production licenses. Further, unlike clones, plugs have a taproot, which serves as an early anchor to hold the plant upright—though this offers an advantage only if plants are healthy and well-grown.

Seedlings are only as good as the seeds they grow out of, so much of the same variability exists as it does with seeds. Seedlings also cost more than seeds because of the inputs used to produce them in plastic trays, including growing media, fertilizer, biocontrols and labor.

Without special equipment, seedlings require additional labor to plant by hand in the field, which will increase production costs.

## UNROOTED CUTTINGS

Plant cuttings are taken from mother stock plants to root into soil in plug trays, creating liners or clones. This propagation method ensures plants are identical to the mother stock, which offers farmers more predictability—including crop stability, consistency and uniformity of growth, flowering time, yield and cannabinoid analysis—than many current seed varieties on the market.

Unrooted cuttings can be shipped from stock producers to farmers, who can root them on-site if they have a greenhouse or enclosed environment, or to greenhouse producers who specialize in liner (clone) production based on experience with other crops. Vegetative propagation is widely developed in ornamental crops, such as vegetative annuals, perennials and foliage plants. In these mature markets, many plant breeders and specialized plant producers have built offshore facilities in warmer countries with climate conditions that are ideal for year-round production and lower labor costs. This drives down the price of live inputs for growers.

Some young hemp plant producers use tissue culture, a process by which plantlets are propagated in a lab from plant tissue. This helps produce clean mother stock plants for higher-quality unrooted cuttings and, ultimately, clones. Tissue culture plantlets are not sold directly as young plants, as they would be cost-prohibitive for growers.

Purchasing cuttings will cost less than liners or clones, but vegetative propagation takes time, equipment and expertise. Producers offer cuttings in small quantities stored in plastic bags, which are often shipped together in a cooler. They are perishable and require immediate propagation once they arrive.

## LINERS OR ROOTED CUTTINGS

Commonly called clones in the cannabis industry, liners are rooted cuttings that are stuck—or vegetatively propagated—into soil or soilless media in plug trays. Farmers can buy cuttings to propagate or purchase liners through breeding companies, greenhouse producers or brokers. Liners are more expensive than seed, but they offer farmers a quick start to the season, an advantage when the season is delayed.

Specialized young plant producers have many years of experience optimizing rooting and growth for large-scale production, and more are looking to provide clones to the hemp industry. This increased volume should help with both availability and cost, though the specific genetics will also play a role.

Because rooted cuttings are clones of the mother crops, the resulting genetically uniform crop will grow and flower at the same time and produce a consistent cannabinoid analysis. Further, crops produced from liners are female because they are cloned from female plants.

> ***Having the right place to stage your plants upon receipt is critical to success. … I have seen many instances where farmers were not prepared to receive plants and the lack of preparation caused them to lose or seriously damage up to 75% of the plants they received.***
>
> **Josh Schneider**
> *CEO and founder, Cultivaris Hemp*

Fewer young plants are needed per field, and they are often spaced farther apart than seeds. However, because there are few, if any, mechanical options available for planting clones, farmers must factor in labor costs for these live inputs to be planted by hand.

Most hemp genetics currently available in the United States are vegetatively propagated because of the time it takes to produce seed hybrids, and therefore, much of the genetics experience among farmers and breeders for cannabinoid production comes from crops produced from liners.

# INPUTS: BENEFITS OF USING INDOOR-PROPAGATED YOUNG PLANTS

Employing young plant inputs that have been properly germinated and/or rooted can give hemp growers a jump-start on their planting. But growers much weigh the benefits and drawbacks tied to this approach.

For example, producers can save four to five weeks on their season by planting seedlings or liners (clones) instead of waiting to sow seeds directly in the field.

Simply planting earlier risks seeding under an inductive photoperiod, which can cause crops to flower too early.

While the input cost is higher—both for the plants and the labor to put them in the ground—growers might save money and time in the end by using young plants that are already established and can be sexed to reduce time spent culling males later.

At about half the cost of an asexually propagated clone or liner, seedlings or plugs are one option. Farmers can either purchase germinated seeds through greenhouse producers or, if they're experienced, can grow their own plugs. But there are technical aspects that farmers who take this route need to keep in mind.

The hypocotyl or stem of a hemp seedling is large compared to other crops and grows tall and fast. Without any plant-growth regulators that can be used for hemp, growers who aren't used to producing aggressive seedlings will be challenged immediately, according to Tami Van Gaal of Massachusetts-based Griffin Greenhouse Supplies.

If the young hemp plant gets too tall, it will be less robust when it's transplanted into the field.

Vegetatively propagated young plants also provide consistency and genetic stability—characteristics that are lacking in many other genetic source materials for the hemp industry.

## GREENHOUSES BRING EXPERIENCE

Experienced propagators can help maximize the quality of farmers' inputs at the young-plant stage, from improved germination rates to the consistency of rooted cuttings and controlling growth with temperature and light, and then acclimate young plants to the outdoors before shipping to the farmer, according to Travis Higginbotham, co-owner of The Hemp Mine, a hemp-plant breeder and producer based in South Carolina.

This can save farmers on time, production costs and headaches, as even something as simple as a single extreme dry period can cause premature flowering or hermaphrodites later in the product cycle.

Several hemp plant-breeding companies have developed strategic partnerships with greenhouse operations across the country to aid them in producing and distributing hemp young plants for farmers nationwide. Most greenhouses have developed infrastructure and transportation fleets and routes that allow them to execute the logistics of getting young plants from the greenhouse to farmers' fields, according to Jonathan Vaught, CEO of Colorado-based Front Range Biosciences.

With specific plant-growth budgets to keep costs in check and stringent sanitation requirements to ensure growers receive clean product, young-plant specialists have developed methods for growing millions of plugs and liners affordably, scheduled within a specific time window, to be available for farmers to plant in the field when needed.

# RESEARCH & DEVELOPMENT OF HEMP GENETICS

Plant breeders and university researchers have been working to develop high-quality, uniform and stable hemp varieties with desired traits that are consistently compliant with federal regulations.

Here is a sampling of research projects underway at public universities and private breeding labs across the country:

Researchers at Oregon State University's Global Hemp Innovation Center have two breeding projects in the works. The doubled-haploid project by Patrick Hayes and Daniela Carrijo-Resende seeks to develop a technique for the production of doubled-haploid plants. These plants can be produced in a significantly shorter time compared to conventional inbred lines, helping accelerate new variety development. In the second project, researchers Kelly Vining and Brian Knaus are using genome sequencing to study how genes are regulated in hemp. Through this process, they can learn which gene variants cause differences in cannabinoid and terpene synthesis and disease resistance.

OSU's Global Hemp Innovation Center is also leading a nationwide essential-oil hemp-variety testing network in collaboration with 17 land-grant universities across the United States. Data from trials will be used to determine optimal environments to produce essential oil from hemp and minimize the unintended economic consequences of growing the plant.

Researchers at the University of Minnesota have developed a genetic test that can predict whether a cannabis plant will produce mostly CBD or THC molecules. The group, led by the lab of George Weiblen, studied cannabis sativa plants from industrial-hemp growers, native or feral "ditch weed" and marijuana samples from the National Institute on Drug Abuse in Maryland. Researchers compared genetic markers with the CBD-to-THC ratio, verifying that genetics were a good predictor of the ratio, and proposed using the ratio of THC to CBD to separate plants that are THC-dominant versus CBD-dominant instead of by cannabinoid percentage. Understanding the genetics of CBD- and THC-dominant plants could help agriculture regulators certify varieties and improve the consistency and quality of hemp plants.

Native Health Matters, a nonprofit organization and agricultural foundation run by Cherokee tribal citizens in Oklahoma, partnered with Clemson University in summer 2020 to research nine food and fiber hemp varieties grown at historic native sites in South Carolina and Oklahoma. Variety trials will continue in 2021, expanding to Arkansas, Louisiana and South Dakota, with a goal to build opportunities for native farmers through access to thoroughly vetted genetics and ecologically sustainable production methods. Agronomic studies on hemp, focused on phytoremediation of heavy metals and carbon sequestration, are also underway through Native Health Matters with the University of Arkansas.

Michigan State University, in partnership with smaller state schools Bay Mills Community College, Lake Superior State University and the Little Traverse Bay Bands of Odawa Indians, received a $500,000 grant from the U.S. Department of Agriculture National Institute of Food and Agriculture's Tribal College Research Program to enhance research capacity. The schools partnered to conduct grain and CBD research and is working to understand the potential impact hemp can have on economic development and food and agriculture sovereignty for tribal nations.

The Fat Pig Society, a coalition of hemp farmers, and the Agricultural Genomics Foundation, both based in Colorado, are screening seed-propagated hemp varieties to determine which ones might be able to produce mother stock for clones that consistently meet federal THC limits. The project, which grew out of a state-appointed panel of hemp entrepreneurs in Colorado, aims to get more cultivars listed with the global Association of Official Seed Certifying Agencies in Illinois.

# HEMP VARIETIES



# CBD-DOMINANT VARIETIES

** Denotes variety is AOSCA seed-certification eligible*

## ARCADIA BIOSCIENCES

DAVIS, CALIFORNIA

### ROGUE*

A seed-propagated hybrid flower and biomass variety for CBD production.

**Cannabinoid profile:**

- CBD: Near 10%

**CBD-to-THC ratio:** 28:1

**Terpene profile:**

- Subtle caramel aroma with a sweet floral finish
- Bisabolol
- Caryophyllene

**Origin:** Oregon

**Female percentage (for seed):** 99%

**Growth habit/description:** Bushy, stable hybrid derived from inbred parent lines selected for yield and rapid plant growth. Loose plant structure and a round shape with dense, greenish-red flowers.

**Spacing:** 3-6 feet

**Size of plants:** 5 feet

**Germination:** 5-7 days at a 95% rate

**Flowering response time:** < 14 hours

**Maturity:** 8-10 weeks

**Yield range:** 2-2.5 pounds per plant

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via **www.growgoodhemp.com** or through a broker in the Midwest or Canada.

### SANTIAM*

A seed-propagated hybrid variety for CBD flower or biomass production.

**CBD-to-THC ratio:** 28:1

**Terpene profile:**

- Intense spicy aroma upfront with a fresh flower finish
- Caryophyllene
- Bisabolol
- Guaiol

**Origin:** Oregon

**Female percentage:** 99%

**Growth habit/description:** High yield, consistent and early finishing. Tall, upright, conical structure with large, dense, pungent flowers and pink pistils.

**Spacing:** 2-4 feet

**Size of plants:** 6 feet

**Germination:** 5-7 days at 91% rate

**Flowering response time:** 14.75 hours

**Maturity:** 6-8 weeks

**Yield range:** 2-2.5 pounds per plant

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via **www.growgoodhemp.com** or through a broker in the Midwest or Canada.

### UMPQUA*

A seed-propagated hybrid variety for CBD flower and biomass production.

**Cannabinoid profile:**

- CBD: 10%-15%

**CBD-to-THC ratio:** 28:1

**Female percentage:** 99%

**Terpene profile:**

- Intense peppery nose with a piney finish
- Caryophyllene
- Myrcene
- Guaiol

**Origin:** Oregon

**Growth habit/description:** Bushy, stable hybrid derived from inbred parent lines with autoflower lineage. Christmas tree-like structure with a dominant leader, tight internodes and tons of dense flowers. Grows successfully across the United States.

**Spacing:** 2-6 feet

**Size:** 5 feet

**Flowering response time:** 15.5 hours or less of daylight

**Maturity:** 6 weeks

**Net weight:** 1-2 pounds

**Yield range:** 2-2.5 pounds per plant

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via www.growgoodhemp.com or through a broker in the Midwest or Canada.

## BEACON HEMP

WINDSOR, CALIFORNIA

### AUTO BLUNAMI

A seed-propagated F1 hybrid autoflower CBD variety for flower and cannabinoid extraction.

**Cannabinoid profile:**

- CBD: 7-10%
- THC: 0.2%-0.3%

**CBD-to-THC ratio:** 24:1 to 32:1

**Terpene profile:**

- Bubblegum
- Pepper
- Citrus
- Terpinolene

**Origin:** Oregon

**Female percentage:** 99.997%

**Growth habit/description:** Candelabra shape, rapid growth conferred by hybrid vigor. Expansive terminal flowers on all branches, with 50/50 mix of purple and green phenotypes.

**Spacing:** 15,000-18,000 plants per acre

**Size of plants:** 3 feet tall, 2.5 feet diameter

**Germination:**

- 2-3 days in greenhouse
- Transplant at 7-10 days after sowing
- 5-7 days emergence direct seeded in field
- 98% rate for certified and non-certified feminized seed

**Dormant/hard seed:** 0%

**Flowering response time:** Day-neutral autoflower variety

**Planting-to-harvest time:** 75-90 days from sowing to harvest, depending on time of year and environmental conditions

**Yield range:** 2-4 ounces dried flower per plant or 5-6 ounces dried biomass per plant

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct or through approved distributor or broker; www.beaconhemp.com; info@beaconhemp.com

### EARLY WU

An F1 hybrid short day (photoperiodic) CBD variety for flower and cannabinoid extraction.

**Cannabinoid profile:**

- CBD: 8-10%
- THC: 0.3%

**CBD-to-THC ratio:** 24:1 to 32:1

**Terpene profile:**

- Classic kush
- Fuel
- Skunk
- Earthy
- Undertones of terpinolene-rich haze

**Origin:** California

**Female percentage:** 99.997%

**Growth habit/description:** Stout, bushy plants with tight nodal spacing. Dense, round, bright green to bright purple with lower night temperatures.

**Spacing:** 3,600-4,800 plants per acre for early to mid-July planting; 2,200 plants per acre for end of May or early June planting.

**Size of plants:** 5 feet tall, 4-foot diameter

**Germination:** 2-3 days to germination in greenhouse and 4 weeks to transplant from sowing; 95% rate.

**Dormant/hard seed:** 0%

**Flowering response time:** 9 weeks

**Planting-to-harvest time:** Dependent on planting date; finishes Oct. 1-10 at 38°N

**Yield range:** 0.5-4 pounds dried flower per plant, dependent on vegetative time and cultural practices

**Compliance:** 2014 and 2018 Farm Bills.

**Purchase:** Direct or through approved distributor or broker; www.beaconhemp.com; info@beaconhemp.com.

### QUIK SPECTRUM

A seed-propagated, F1 hybrid short-day (photoperiodic) CBD variety for flower and cannabinoid extraction.

**Cannabinoid profile:**

- CBD: 8-10%
- THC: 0.3%

**CBD-to-THC ratio:** 24:1 to 32:1

**Terpene profile:**
- Sweet
- Musky
- Berry

**Origin:** Oregon

**Female percentage:** 99.997%

**Growth habit/description:** Vigorous growth, tall, upright plants, with greater internode spacing. Very long, dense, terminal flowers on all branches.

**Spacing:** 3,600-4,800 plants per acre for early to mid-July planting; 2,200 per acre for end of May or early June planting

**Size:** 6 feet tall, 4-foot diameter

**Germination:** 2-3 days to germination in greenhouse and 4 weeks to transplant from sowing; 98% rate.

**Dormant/hard seed:** 0%

**Flowering response time:** 8 weeks

**Planting-to-harvest time:** Dependent on planting date; finishes Sept. 25-Oct. 5 at 38°N

**Yield range:** 0.5-4 pounds dried flower per plant dependent on vegetative time and cultural practices

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.beaconhemp.com** or **info@beaconhemp.com**, or through approved distributor or broker.

## CHARLOTTE'S WEB
BOULDER, COLORADO

### LINDOREA
A seed-propagated F1 hybrid variety for CBD flower and extract production.

**Cannabinoid profile:**
- CBD: 7-10%

**CBD-to-THC ratio:** 25:1 (average), up to 35:1

**Test date:** 2020

**Terpene profile:**
- Bubble gum
- Citrus
- Melon

**Origin:** Colorado

**Female percentage:** 99.9%

**Growth habit/description:** Vigorous grower with medium internodal spacing. Apical dominance with strong stalk strength observed in all regional trials.

**Spacing:** 2,400-2,600 plants per acre, depending on planting date and crop management

**Size:** 5 feet x 3 feet, will depend on planting date and spacing

**Germination:** Within 7 days; 90% rate

**Dormant/hard seed:** 0%-4%

**Flowering response time:** Flower maturity 10-12 weeks after planting

**Maturity:** Flower maturity 10-12 weeks after planting. Variable depending on planting date and latitudinal position, can be ready to harvest as early as Sept. 20 in lower latitude regions of the U.S. and as late as Oct. 10 in higher latitude regions of the United States.

**Net weight:** 3,000-3,500 pounds per acre average, stems/fiber removed

**Yield range:** 2,100-4,000 pounds per acre

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **seeds@cwhempsupplyco.com** or **www.cwhempsupplyco.com**

## COLORADO BREEDERS DEPOT
CANON CITY, COLORADO

### BERRY BLOSSOM
A seed-propagated, indica-dominant CBD variety for flower and oil production.

**Cannabinoid profile:**
- CBD: 14%-17%
- THC: 0.3%

**CBD-to-THC ratio:** 28:1

**Test date:** Jan. 4, 2020

**Female percentage:** 100% feminized

**Growth habit/description:** Medium height, medium bushy, dense

**Spacing:** 2 feet by 2 feet or 4 feet by 4 feet

**Size of plants:** 6-8 feet tall, with diameter of 2 feet to 4 feet

**Germination:** 3-5 days; 90% rate

**Dormant/hard seed:** 0%

**Flowering response time:** 10-12 days

**Maturity:** 9-10 weeks

**Planting-to-harvest time:** 4-5 months, depending on vegetative

**Net weight:** 1-3 pounds

**Yield range:** 1-3 pounds

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via www.coloradobreedersdepot.com

### BLACK JACK

A seed-propagated, hybrid, indica-dominant variety for CBD flower and oil production.

**Cannabinoid profile:**

- CBD: 18%-22%
- THC: 0.3%

**CBD-to-THC ratio:** 30:1

**Test date:** Jan. 4, 2020

**Terpene profile:**

- Sweet
- Skunky

**Origin:** Colorado

**Female percentage:** 100% feminized

**Spacing:** 2 feet by 2 feet to 6 feet by 6 feet

**Size:** 3 feet by 3 feet to 6 feet x 6 feet

**Growth habit/description:** Bushy, short, stout

**Crop time, seed to harvest:** Suggested June 1 planting; Sept. 21 harvest

**Germination:** 1-3 days; 90% rate

**Dormant/hard seed:** 0%

**Flowering response time:** 7 days

**Maturity:** 7-8 weeks

**Planting-to-harvest time:** 4-5 months, depending on vegetative

**Net weight:** 1-3 pounds

**Yield range:** 2-3 pounds per plant

**Compliance:** 2018 Farm Bills

**Purchase:** Direct via www.coloradobreedersdepot.com

## CULTIVARIS HEMP

SAN DIEGO

### ABACUS

A vegetatively propagated photoperiod sensitive flower variety for CBD production.

**Cannabinoid profile:**

- CBD: 13.63%-16.25%
- CBG: 0.05%-0.12%
- CBC: 0.07%-0.14%
- Total THC: 0.49%-0.69%
- Delta-9 THC: 0.06%-1.14%

**CBD-to-THC ratio:** 24:1

**Test date:** Dec. 10, 2020

**Terpene profile:**

- Mango
- Kush
- Grape
- Earthy

**Origin:** Colorado

**Growth habit/description:** Dense purple buds will produce high yields even with long vegetative internodes, which allows for great airflow. Can stretch in greenhouse during vegetative, medium tall/bushy outdoors, though little stretch after flower initiation.

**Spacing:** Greenhouse, 2-4 foot centers; Outdoor, 4-6 foot centers

**Size:** 3-5 feet

**Flowering response time:** Mid

**Maturity:** Minimum 4 weeks vegetative recommended, 7-9 weeks to harvest

**Net weight:** High

**Yield range:** High

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via www.CultivarisHemp.com; info@cultivarishemp.com

### CANTALOUPE CRUSH

A vegetatively propagated photoperiod sensitive flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 11.46%-14.26%
- Total THC: 0.42%-0.56%
- Delta-9 THC: 0.06%-0.13%

**CBD-to-THC ratio:** 26:1

**Test date:** Dec. 10, 2020

**Terpene profile:**
- Melon
- Cinnamon
- Hops
- Earthy
- Lavender
- Orange

**Origin:** Colorado

**Growth habit/description:** A very compact, bushy plant that will be nearly all flower when its finished.

**Spacing:** Greenhouse, 2-4 foot centers; Outdoor, 4-6 foot centers

**Size:** 3-5 feet

**Flowering response time:** Early

**Maturity:** Minimum 4 weeks veg recommended, 7-9 weeks to harvest

**Net weight:** High

**Yield range:** High

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.CultivarisHemp.com**; **info@cultivarishemp.com**

### CHERRY CRÈME BRULEE

A vegetatively propagated photoperiod sensitive flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 12.67%-13.32%
- Total THC: 0.38%-0.49%
- Delta-9 THC: 0.06%-0.13%

**CBD-to-THC ratio:** 22:1

**Test date:** Dec. 10, 2020

**Terpene profile:**
- Cherry
- Fruity
- Sweet

**Origin:** Colorado

**Growth habit/description:** Tall, well-spaced slender colas, with a purple velvet finish. This is a solid grower with an upright but well-branched habit and good weather tolerance.

**Spacing:** Greenhouse, 2-4 foot centers; Outdoor, 4-6 foot centers

**Size:** 3-5 feet

**Flowering response time:** Mid

**Maturity:** Minimum 4 weeks vegetative period recommended, 7-9 weeks to harvest

**Net weight:** Medium

**Yield range:** Medium

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.CultivarisHemp.com**; **info@cultivarishemp.com**

## DAVIS HEMP FARMS OF OREGON

BEND, OREGON

### EIGHTY-EIGHT

A seed-propagated photoperiod sensitive flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 7%-9%
- Total THC: 0.27%

**CBD-to-THC ratio:** 30:1

**Test date:** Dec. 12, 2020

**Terpene profile:**
- Earthy notes
- Sweet, honey-like, citrus aroma

**Origin:** Oregon

**Female-to-male ratio:** 7,000:1

**Germination:** 1-2 days at 98% rate, per Oregon State University Seed Lab

**Dormant/hard seed:** 2%

**Growth habit/description:** Bushy, multi-tops. Rapid to root and vigorous growing. Hardy and frost-tolerant.

**Spacing:** 4 feet by 5 feet or approximately 2,250 per acre. Earlier plantings may require a lower planting density and later plantings may require a higher density than average.

**Size:** 5 feet tall by 4 feet wide.

**Flower period:** Flower onset at the 45th parallel is in mid-August; late to flower but race to finish.

**Maturity:** 8-9 week flowering period

**Planting-to-harvest time:** 90 to 120 days

**Net weight:** 2-4 pounds for whole, dry plant

**Yield range:** 2-4 pounds per plant of hard flower weight

**Compliance:** 2018 Farm Bill; USDA total THC compliant to current interim final rule testing protocols.

**Purchase:** Direct via DavisHempFarms.com

## PAINTED LADY

A seed-propagated photoperiodic flower variety for CBD production.

**Cannabinoid profile:**

- CBD: 8%-9%
- Total THC: 0.25%

**CBD-to-THC ratio:** 30:1

**Test date:** Dec. 12, 2020

**Terpene profile:**

- Lemongrass
- Citrus profiles
- Gas-like undertones

**Origin:** Oregon

**Female-to-male ratio:** 7,000:1

**Germination:** 1-2 days at 98% rate, per Oregon State University Seed Lab

**Dormant/hard seed:** 2%

**Growth habit/description:** Rapid to root and vigorous growing, hardy and frost tolerant. Highly resinous and colorful flowers with colors ranging from light green to dark purple. Bushy hybrid plants with stout branches and large flowers.

**Spacing:** 4 feet by 5 feet or approximately 2,250 per acre. Earlier plantings may require a lower planting density and later plantings may require a higher density than average.

**Size:** 6 feet tall by 4 feet wide

**Flower period:** Flower onset at the 45th parallel is in mid-August; late to flower but race to finish.

**Maturity:** 8-9-week flowering period

**Planting-to-harvest time:** 90 to 120 days

**Net weight:** 2-4 pounds for whole, dry plant

**Yield range:** 2-4 pounds per plant

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via DavisHempFarms.com

## SKIPPER

A seed-propagated photoperiodic flower variety for CBD production.

**Cannabinoid profile:**

- CBD: 7%-9%
- Total THC: 0.26%

**CBD-to-THC ratio:** 30:1

**Test date:** Dec. 12, 2020

**Terpene profile:**

- Eucalyptus
- Menthol notes
- Sweet citrus
- Pine

**Origin:** Oregon

**Female-to-male ratio:** 7,000:1

**Germination:** 1-2 days at 98% rate, per Oregon State University Seed Lab

**Dormant/hard seed:** 2%

**Growth habit/description:** Tall, multiple-flower tops. Rapid to root and vigorous growing, hardy and frost tolerant. Lime green plant lacking in strong anthocyanin production and bred for drier climates.

**Spacing:** 4 feet by 5 feet or approximately 2,250 per acre. Earlier plantings may require a lower planting density and later plantings may require a higher density than average.

**Size:** 5 feet tall by 4 feet wide

**Flower period:** Flower onset at the 45th parallel is in mid-August; late to flower but race to finish.

**Maturity:** 8-9 week flowering period

**Planting-to-harvest time:** 90 to 120 days

**Net weight:** 2-4 pounds for whole, dry plant

**Yield range:** 1-2 pounds per plant of hard flower weight

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via DavisHempFarms.com

## FARMTIVA
VISTA, CALIFORNIA

### AUTO SUPREME

A seed-propagated, day-neutral autoflower variety for CBD oil and smokable flower.

**Cannabinoid profile:**
- CBD: 10-13%
- THC: 0.19-0.23%

**CBD-to-THC ratio:** 25:1

**Test date:** Oct. 3, 2020

**Terpene profile:**
- Sweet lemon
- Spice aroma
- Pine aroma

**Origin:** California

**Female percentage:** 99% feminized

**Growth habit/description:** Short long spear nodes. Uniform, unique long center kola.

**Spacing:** 15,000 to 20,000 seeds per acre

**Size:** 3-4 feet, average width 2-3 feet

**Germination:** 4-8 days; 97% rate

**Dormant/hard seed:** 0%

**Flowering response time:** 5 weeks

**Net weight:** 3,000 to 4,000 pounds per acre

**Maturity:** 5-7 weeks

**Planting-to-harvest time:** 75-80 days

**Yield range:** 2,800-3,500 pounds per acre

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.Farmtiva.com**; **info@farmtiva.com**

## FRONT RANGE BIOSCIENCES
BOULDER, COLORADO

### PINNACLE PINE

A clonal (vegatively propagated), indica hybrid variety for CBD flower and smokable flower production and oil extraction.

**Cannabinoid profile:**
- CBD: 12%-14%

**CBD-to-THC ratio:** 22-28:1

**Test date:**
December 2020

**Terpene profile:**
- Lemon
- Citrus
- Evergreen
- Very rare Terpinolene dominance
- Caryophyllene
- Myrcene
- Ocimene

**Origin:** Bred in Colorado, field-trialed nationwide

**Growth habit/description:** Tall, upright plant habit with long, skinny leaflets and open Christmas-tree shape. Individualized branches with moderately tight internodes and a few secondary branches. Bud development down the entire branch with heavy trichome production.

**Spacing:** 5 feet by 5 feet when planting early and 4x5ft when planting later in the season.

**Size of plants:** 6-8 feet tall by 4 feet by 5 feet wide

**Maturity:** Early

**Planting-to-harvest time:** 8-week vegetative time and 8-week flowering response time for a total of 16 weeks from planting to harvest.

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via **www.rontrangebio.com**; **sales@frontrangebio.com**

### VALERIE

A clonal (vegatively propagated), sativa hybrid variety for CBD flower production and oil extraction.

**Cannabinoid profile:**
- CBD: 13%-16%
- CBC: up to 3%-4%

**CBD-to-THC ratio:** 25-30:1

**Test date:** December 2020

**Terpene profile:**
- Musk
- Clove
- Herbal
- Citrus
- Wood
- Spice
- Myrcene
- Caryophyllene

**Origin:** Bred in Colorado, field-trialed nationwide

**Growth habit/description:** Very tall, upright, open plant habit allows for high airflow. Branches are individualized and fill in with large, forearm-length colas.

**Spacing:** 5x5 feet when planting early and 4x5 feet when planting later in the season.

**Size:** 6-8 feet tall by 4-5 feet wide

**Maturity:** Early

**Planting-to-harvest time:** 8-week vegetative time and 8-week flowering response time for a total of 16 weeks.

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via **www.rontrangebio.com**; **sales@frontrangebio.com**

## GENFLORA
GILROY, CALIFORNIA

### THE ORIGINAL LEMONHEAD
A seed-propagated, feminized, full-term hybrid variety for cannabinoid and flower production.

**Cannabinoid profile:**
- CBD: 10%-13%
- THC: 0.1%-0.27%


**CBD-to-THC ratio:** 48:1

**Test date:** July 10, 2020

**Terpene profile:**
- Myrcene
- Beta-Caryophyllene
- Alpha-Bisabolol
- Strong lemon scent

**Origin:** California

**Female percentage:** 99.9% (one phenotypic male in 15,000 plants)

**Growth habit/description:** Medium height bushy plant with large flower formation. Dark green dense flowers with purple hue. Tight and compact flower structure.

**Spacing:** 5-foot spacing on center for mid-June planting.

**Size of plants:** 5 feet tall by 5 feet wide

**Germination:** 5-7 days; 95% germination rate

**Dormant/hard seed:** Less than 5%

**Flowering response time:** Late July

**Maturity:** 8-10 weeks from flowering response time

**Planting-to-harvest time:** Early June planting harvests late October-early November

**Net weight:** Average 1.25 pounds per plant

**Yield range:** At 2,500 plants per acre, yield is 3,200 pounds per acre

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **kmoore@genflora.com**

### RUBY KUSH
A feminized, full-term hybrid variety for cannabinoid and flower production.

**Cannabinoid profile:**
- CBD: 12%-18%
- THC: 0.18% -0.3%


**CBD-to-THC ratio:** 40:1

**Test date:** July 10, 2020

**Terpene profile:**
- Myrcene-dominant
- Beta-Caryophyllene
- Alpha-Pinene

**Origin:** California

**Female percentage:** 99.9% (one phenotypic male in 5,000 plants)

**Growth habit/description:** Tall bushy plant with strong lateral branching. Large bright green flowers with purple hues. Strong visible trichome production.

**Spacing:** 6-foot spacing on center for early June planting

**Size:** 6 feet tall by 6 feet wide

**Germination:** 4-6 days at a 90% rate

**Dormant/hard seed:** Less than 5%

**Flowering response time:** Early August

**Maturity:** 10-12 weeks from flower response

**Planting-to-harvest time:** Early June planting harvests late October to early November

**Net weight:** Average 1.5 pounds per plant

**Yield range:** At 2,000 plants per acre, yield is 3,000 pounds per acre

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **kmoore@genflora.com**

## HEMP GENETICS INTERNATIONAL

SASKATOON, SASKATCHEWAN, CANADA

### CBF1

A seed-propagated hybrid variety for CBD flower production.

**Cannabinoid profile:**

- CBD: Up to 10%

**CBD-to-THC ratio:** 30:1

**Terpene profile:**

- Floral and fruity
- Earthy undertones

**Origin:** Canada

**Female percentage:** 99% feminized

**Growth habit:** Bushy

**Spacing:** 2,500 plants per acre

**Size of plants:** 3-4 feet tall

**Germination:** Seed sold on live seed count

**Flowering response time:** Flower initiation in early September, maturity in mid-October

**Yield range:** 1-1.5 pounds per plant

**Compliance:** 2014 and 2018 Farm Bills; AOSCA certified

**Purchase:** Direct via **jeff.kostuik@hempproductionservices.com**

## HIGH GRADE HEMP SEED

LONGMONT, COLORADO

### HG'S ORIGINAL BERRY BLOSSOM

A full-term, seed-propagated flower variety for CBD production.

**Cannabinoid profile:**

- CBD: 9.76%
- THC: 0.24%

**CBD-to-THC ratio:** 40:1

**Test date:** March 3, 2020

**Terpene profile:**

- Extremely floral
- Candied raspberries
- Acai berries

**Origin:** Colorado

**Female percentage:** 99.99%

**Growth habit/description:** Bushy. Squatty frame with tight internode spacing, one main top cola, good wind resistance.

**Spacing:** 60 inches seed spacing and 60 inches row spacing

**Size:** 5-6 foot height and 5-foot width

**Germination:** 2 days; 95% rate

**Dormant/hard seed:** 0%

**Flowering response time:** 8-9 weeks from flowering

**Maturity:** 8-9 weeks

**Planting-to-harvest time:** 5-6 months

**Net weight:** 500 grams per plant

**Yield range:** 2,500-3,000 pounds of dry whole plant material per acre

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.highgradehempseed.com** or **info@highgradehempseed.com**

### HG'S ORIGINAL CHERRY WINE

A full-term, seed-propagated flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 9.10%
- THC: 0.25%

**CBD-to-THC ratio:** 36:1

**Test date:** March 3, 2020

**Origin:** Colorado, USA

**Terpene profile:**
- Cherry floral
- Pine skunk undertones

**Female to male percentage:** 99.99%

**Growth habit/description:** Tall, vigorous bushy tops with dense buds.

**Spacing:** 60 inches seed spacing and 60 inches row spacing

**Size:** 6-8 feet height and 4 feet width

**Germination:** 2 days; 95% rate

**Dormant/hard seed:** 0%

**Flowering response time:** 8-9 weeks from flowering

**Maturity:** 8-9 weeks

**Planting-to-harvest time:** 5 months

**Net weight:** 500 grams per plant

**Yield range:** 2,500-3,000 pounds of dry whole plant material per acre

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.highgradehempseed.com** or **info@highgradehempseed.com**

## INFINITE TREE

GRANTS PASS, OREGON

### OREGON GUAVA

A seed-propagated, hybrid craft flower variety for CBD production.

**CBD-to-THC ratio:** 22:1

**Test date:** November 2020

**Terpene profile:**
- Tropical fruit
- Lemon zest

**Origin:** East Fork Cultivars, Takilma, Oregon

**Female-to-male ratio:** Pending results

**Growth habit/description:** 2019 Cultivation Classic Bronze Winner in Hemp Category. Uniform development with large colas, dense bud structure.

**Spacing:** 5 feet x 5 feet

**Size of plants:** 5-6 feet tall by 5 feet wide

**Germination:** 7 days; rate pending

**Dormant/hard seed:** Pending results

**Flowering response time:** Photoperiodic flowering at 12-hour daylength

**Maturity:** Photoperiod sensitive, latitude dependent

**Planting-to-harvest time:** In most regions, recommend a June 1 planting.

**Yield range:** 0.5-2 pounds per plant

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **hello@infinite-tree.com**

### OREGON SWELL

A seed-propagated, hybrid craft flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 11.51%
- THC: 0.42%

**CBD-to-THC ratio:** 28:1

**Test date:** November 2020

**Terpene profile:**
- Zesty citrus
- Earthy pine

**Origin:** East Fork Cultivars, Takilma, Oregon

**Female-to-male ratio:** Pending results

**Growth habit/description:** Bushy pincushion, excellent field characteristics. Uniform development with large primary colas and a dense bud structure.

**Spacing:** 5 feet x 5 feet

**Size:** About 5-6 feet tall by 5 feet wide

**Germination:** 7 days; rate pending

**Dormant/hard seed:** Pending results

**Flowering response time:** Photoperiodic flowering at 12-hour daylength

**Maturity:** Photoperiod sensitive, latitude dependent

**Yield range:** 0.5-2 pounds per plant

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via hello@infinite-tree.com

### SUZY'S GIFT

A seed-propagated, hybrid craft flower variety for CBD production.

**Cannabinoid profile:**

- CBD: 12.5%
- THC: 0.45%

**CBD-to-THC ratio:** 28:1

**Test date:** November 2020

**Terpene profile:**

- Sweet pine
- Clean linen

**Origin:** Morrisville, Vermont

**Female-to-male ratio:** Pending results

**Growth habit/description:** Bushy pincushion, excellent field characteristics. Uniform development with large dense primaries and secondaries with exceptional resin production. Most economical to trim.

**Spacing:** 5 feet x 5 feet

**Size:** About 5-6 feet tall by 5 feet wide

**Germination:** 7 days; rate pending

**Dormant/hard seed:** Pending results

**Flowering response time:** Photoperiodic flowering at 12-hour daylength

**Maturity:** Photoperiod sensitive, latitude dependent

**Yield range:** 0.5-2 pounds per plant

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via www.Infinite-Tree.com or hello@infinite-tree.com

## KADENWOOD BIOSCIENCES DBA ECOGEN BIOSCIENCES

NEWPORT BEACH, CALIFORNIA

### CHERRY BLOSSOM 3G

A seed-propagated, photoperiodic CBD variety grown for flower and oil extraction.

**Cannabinoid profile:**

- CBD: 11-14%
- THC: < 0.3%


**Test date:** December 2020

**Terpene profile:**

- Sweet
- Berry
- Cherry
- Light hint of earthy notes

**Origin:** Colorado

**Female percentage:** 100%

**Growth habit/description:** Very large bushy plant with multiple branch shoots allows for greater air movement. Expect thicker buds.

**Spacing:** 5 feet

**Size:** 4-6 feet tall

**Germination:** 7-10 days on average; 99% rate

**Maturity:** First week in October

**Yield range:** 2-5 pounds outdoor

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via www.ecogenbiosciences.com, www.kadenwoodbiosciences.com or eric@kadenwoodbiosciences.com

### HEADIMEDI

A photoperiodic variety grown for flower and oil extraction.

**Cannabinoid profile:**
- CBD: 10-14%
- THC: < 0.3%


**Test date:** December 2020

**Terpene profile:**
- Berry
- Floral
- Sweet
- Some skunky notes

**Origin:** Colorado

**Female percentage:** 100%

**Growth habit/description:** Does better in dry climates at higher elevation. Very large and dense colas. This plant is 70%/30% indica/sativa.

**Spacing:** 5 feet

**Size:** 4-6 feet tall

**Germination:** 7-10 days average; 99% rate

**Maturity:** Last week in September to first week in October

**Yield range:** 1-4 pounds outdoor

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via www.ecogenbiosciences.com or info@ecogenbiosciences.com

### TCB

A seed-propagated, photoperiodic CBD variety grown for flower and oil extraction.

**Cannabinoid profile:**
- CBD: 10-14%
- THC: < 0.3%


**Test date:** December 2020

**Terpene profile:**
- Skunky
- Earthy
- Light fruity notes

**Origin:** Colorado

**Female percentage:** 100%

**Growth habit/description:** Plant has very dense buds. Grows shorter but with robust multi-branch system.

**Spacing:** 5 feet

**Size:** 4-5 feet tall

**Germination:** 7-10 days; 99% rate

**Maturity:** Last week in September

**Yield range:** 1-4 pounds outdoor

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via www.ecogenbiosciences.com or info@ecogenbiosciences.com

## KOLA SEED

SALINAS, CALIFORNIA

### BUBBATONIC

A seed-propagated, hybrid flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 12-15%
- THC: 0.2%-0.3%

**CBD-to-THC ratio:** 1:50

**Test date:** Dec. 14, 2020

**Terpene profile:**
- Potent and gassy

**Origin:** California

**Female percentage:** 99.97% (1:2,000 female-to-male ratio)

**Growth habit/description:** Upright, bush type; upright main cola with at least four other secondary branches that also grow upright.

**Spacing:** 2 feet in row and 40 inches center-to-center

**Size:** 4-5 feet

**Germination:** 1 day; 96% rate

**Dormant/hard seed:** 0%

**Flowering response time:** 40 days

**Maturity:** 2 weeks

**Net weight:** 1-2 pounds dried flower removed from stem

**Planting-to-harvest time:** 90 days

**Yield range:** 1-2 pounds dried flower removed from stem

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via www.kolaseed.com or george.workman@kolaseed.com

### DR. CHUNK

A seed-propagated, hybrid autoflower variety for CBD flower production.

**Cannabinoid profile:**
- CBD: 8%-9%
- THC: 0.3%

**CBD-to-THC ratio:** 28:1

**Test date:** August-October 2019

**Terpene profile:**
- Potent chemicals
- Sweet fruit

**Origin:** California

**Female percentage:** 99.97% (1:2,000 female-to-male ratio)

**Growth habit/description:** Upright with compact lower branching

**Spacing:** 14 inches in-row and 40 inches center-to-center

**Size:** 3.5 feet

**Germination:** 1 day; 96%-98% rate

**Dormant/hard seed:** 0%

**Flowering response time:** 35 days

**Maturity:** 1 week

**Planting-to-harvest time:** 65-75 days

**Net weight:** 3 ounces dried flower removed from stem

**Potential yield range:** 3-6 ounces per plant

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.kolaseed.com** or **george.workman@kolaseed.com**

### SOUR KUSH

A seed-propagated, hybrid flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 11-13%
- THC: 0.2%-0.3%

**CBD-to-THC ratio:** 48:1

**Test date:** Dec. 14, 2020

**Terpene profile:**
- Mangoes soaked in gasoline
- Strong, pungent odor

**Origin:** California

**Female percentage:** 99:97% (1:2,000 female-to-male ratio)

**Growth habit/description:** Upright bush type; upright main cola with at least four other upright secondary branches.

**Spacing:** 2 feet in row and 40 inches center-to-center

**Size:** 4-5 feet

**Germination:** 1 day; 96% rate

**Dormant/hard seed:** 0%

**Flowering response time:** 40 days

**Maturity:** 2 weeks

**Planting-to-harvest time:** 90 days

**Yield range:** 1-2 pounds dried flower removed from stem

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via **www.kolaseed.com** or **george.workman@kolaseed.com**

## KUMBAYA FARMS

ROYAL OAKS, CALIFORNIA

### BIHEMP 13.24 *(MARKETED AS HEAVENLY PEPPER)*

A seed-propagated hybrid variety for CBD flower production.

**Cannabinoid profile:**
- CBD-A: 16.5%
- THC-A: < 0.3%
- CBG-A: 0.9%

**CBD-to-THC ratio:** 20:1

**Test date:** Sept. 20, 2020

**Terpene profile:**
- Beta-caryophyllene, co-dominant
- Limonene, co-dominant
- Myrcene
- Humulene

**Origin:** Monterey, California

**Female percentage:** 99.9%

**Growth habit/description:** Robust and bushy, squat full plants with purple inflorescence.

**Spacing:** 24-36 inches, dependent upon planting date

**Size:** 3x5 feet

**Germination:** 2 days; 92% rate

**Dormant/hard seed:** 98.9% purity

**Maturity:** 6-8 weeks

**Flowering response time:** Flowers are noticeable by August and/or within two weeks of short-day exposure.

**Planting-to-harvest time:** 3-5 months, dependent upon planting time

**Net weight:** 1 pound

**Yield range:** 0.5-2 pounds

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.kumbayafarms.com**

### BIHEMP 16.81 *(MARKETED AS LEGENDARY OG)*

A seed-propagated hybrid variety for CBD flower production.

**Cannabinoid profile:**

- CBD-A: 16%
- THC-A: < 0.3%
- CBG-A: 0.5%

**CBD-to-THC ratio:** 29:1

**Test date:**
Sept. 20, 2020

**Terpene profile:**

- Limonene
- Beta-caryophyllene
- Humulene

**Origin:** Monterey, California

**Female percentage:** 99.9%

**Growth habit/description:** Bushy and tall. Extremely vigorous with hybrid structure.

**Spacing:** 24-48 inches

**Size:** 4x6 feet

**Germination:** 2 days; 95% rate

**Dormant/hard seed:** 99.9% purity

**Maturity:** 6-8 weeks

**Flowering response time:** Flowers are noticeable by August and/or within two weeks of short-day exposure.

**Planting-to-harvest time:** 3-5 months, dependent upon planting time

**Net weight:** 1 pound

**Yield range:** 0.5-2 pounds

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.kumbayafarms.com**

### BIHEMP 26.BX *(MARKETED AS LEGENDARY JACK)*

A seed-propagated hybrid variety for CBD flower production.

**Cannabinoid profile:**

- CBD-A: 16%
- THC-A: < 0.3%
- CBG-A: 0.2%

**CBD-to-THC ratio:** 53:1

**Test date:** Sept. 20, 2020

**Terpene profile:**

- Terpinolene-dominant
- Beta-caryophyllene
- Myrcene

**Origin:** Monterey, California

**Female to male percentage:** 99.9% female

**Germination:** 2 days; 95% rate

**Dormant/hard seed:** 98.9% purity

**Growth habit/description:** Symmetrical, equally bushy as tall. Vigorous and Christmas tree-shaped.

**Spacing:** 18-36 inches, dependent upon planting date

**Size:** 3x5 feet

**Maturity:** 6-8 weeks

**Flowering response time:** Flowers are noticeable by August and/or within two weeks of short-day exposure.

**Planting-to-harvest time:** 3-5 months, dependent upon planting time

**Net weight:** 1 pound

**Yield range:** 0.5-2 pounds

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.kumbayafarms.com**

## MERISTEM FARMS

MORRISVILLE, VERMONT

### CHARLEQUIN

A photoperiodic flower variety for CBD production.

**Cannabinoid profile:**

Untrimmed:

- CBD: 6.77%
- Total THC: 0.07%

Trimmed:

- CBD: 18.79%
- Delta-9 THC: < 0.05%

**Test date:** No. 4, 2020

**Terpene profile:**
- Lilac
- Mint
- Basil

**Origin:** Vermont

**Growth habit/description:** A beefy, well-branched, upright plant with sparkly flower forming grass green pillars.

**Spacing:** Greenhouse, 2-4-foot centers; Outdoor, 4-6-foot centers

**Size:** 4-6 feet

**Maturity:** Minimum 4 weeks vegetative growth recommended, 7-9 weeks to harvest

**Net weight:** Medium

**Flowering response time:** mid/late

**Yield range:** Medium

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Available exclusively from www.CultivarisHemp.com or info@cultivarishemp.com

## CUCUMBER DIESEL

A photoperiodic flower variety for CBD production.

**Cannabinoid profile:**

Untrimmed:
- CBD: 7.58%
- Total THC: 0.24%

Trimmed:
- CBD: 12.94%
- Delta-9 THC: < 0.05%

**Test date:** Nov. 4, 2020

**Terpene profile:**
- Cucumber
- Celery
- Watermelon
- Diesel

**Origin:** Vermont

**Growth habit/description:** A stocky, well-branched, upright plant with hints of purple in flower forming long, slender colas.

**Spacing:** Greenhouse, 2-4 foot centers; Outdoor, 4-6 foot centers

**Size:** 3-5 feet

**Maturity:** Minimum 4 weeks vegetative growth recommended, 7-9 weeks to harvest

**Flowering response time:** mid/late

**Net weight:** Medium

**Yield range:** Medium

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Available exclusively from www.CultivarisHemp.com or info@cultivarishemp.com

## SKIPJACK

A photoperiodic flower variety for CBD production.

**Cannabinoid profile:**

Untrimmed:
- CBD: 11.48%
- Total THC: 0.19%

Trimmed:
- CBD: 16.7%
- Delta-9 THC: 0.06%

**Test date:** Dec. 15, 2020

**Terpene profile:**
- Citrus
- Cinnamon
- Pine
- Pepper

**Origin:** Vermont

**Growth habit/description:** A sprawling, vigorous plant with airy, upright, open structure between buds, Jack sativa structure. Grows as wide as it does tall.

**Spacing:** Greenhouse, 2-4 foot centers; Outdoor, 4-6 foot centers

**Size:** 3-5 feet

**Maturity:** Minimum 4 weeks vegetative growth recommended, 7-9 weeks to harvest

**Flowering response time:** mid/late

**Net weight:** Medium

**Yield range:** Medium

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Available exclusively from www.CultivarisHemp.com or info@cultivarishemp.com

## NBS AGTECH

HENDERSON, NEVADA

### MASTER KUSH AUTOFLOWER (MK AUTO)

An autoflower variety for CBD production.

**Cannabinoid profile:**

- CBD: 10%-12%
- THC: 0.3%

**Terpene profile:**

- A-pinene
- B-myrcene

**Origin:** Hindu Kush Mountains bordering Afghanistan and Pakistan; bred with ruderalis autoflower from Southern Argentina.

**Growth habit/description:** A universal hybrid strain that is not photo-dependent on a light cycle for growth and results are a hearty hemp genetic able to withstand many weather, soil and insect conditions.

**Spacing:**

- For transplants, 24-inch plant-to-plant spacing on 4-foot centers
- For direct seed, 12-inch spacing on 4-foot centers (direct seeding recommended)

**Size:** Varies between 2-5 feet tall, depending on time of year, temperature, water and soil conditions; up to 7 feet tall in perfect conditions.

**Planting-to-harvest time:** 75-80 days

**Yield range:** For 5,500 transplants per acre or 10,000 direct sown seeds, 2,000-2,500 pounds of dried flower at 10% moisture content per acre with optimal conditions.

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via www.nbsagtech.com or info@nbsagtech.com

## OREGON CBD

MONMOUTH, OREGON

### LIFTER SEEDLESS

A seed-propagated, triploid F1 hybrid seedless flower variety for CBD production.

**Cannabinoid profile:**

- CBD: 14-16% (in manicured flower)
- Total THC: 0.5%-0.7%

**CBD-to-THC ratio:** 28:1

**Terpene profile:**

- Sweet and fruity funk
- Heavy undertones of fuel

**Origin:** United States

**Female percentage:** Seedless, cannot pollinate or be pollinated by others; around 1 phenotypically male in 4,000 plants

**Growth habit/description:** Bushy, vigorous growers that turn into bushes.

**Spacing:** 4 feet by 6 feet spacing for early June planting

**Size:** 4-8 feet tall by 4-8 feet wide

**Germination:** 5-10 days under optimal conditions; 95%

**Dormant/hard seed:** Less than 1%

**Maturity:** 4-6 weeks

**Flower period:** Mid-July-late September

**Net weight:** 1-5 pounds

**Planting-to-harvest time:** Planting date dependent, as little as 4 months but generally 5 months

**Yield range:** 1-5 pounds

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct info@jackhempicine.com or www.oregoncbdseeds.com

### SOUR SUVER HAZE SEEDLESS

A seed-propagated, triploid F1 hybrid, seedless flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 14-16% (in manicured flower)
- Total THC: 0.5-0.7%

**CBD-to-THC ratio:** 28:1

**Terpene profile:**
- Terpinolene
- Twisted sour apple

**Origin:** United States

**Female percentage:** Seedless, cannot pollinate or be pollinated by others; around 1 phenotypically male in 4,000 plants

**Growth habit/description:** Bushy, vigorous growers that turn into bushes.

**Spacing:** 4 feet by 6 feet spacing for early June planting

**Size of plants:** 4-8 feet by 4-8 feet

**Germination:** 5-10 days under optimal conditions; 95% rate

**Dormant/hard seed:** Less than 1%

**Maturity week:** 4-6 weeks

**Net weight:** 1-5 pounds

**Flower period:** Mid July-late September

**Planting-to-harvest time:** Planting date dependent, as little as 3.5 months but generally 5 months

**Yield range:** 1-5 pounds

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct **info@jackhempicine.com** or **www.oregoncbdseeds.com**

## PURPLE MESA

LOS ANGELES

### PURPLE MESA

A photoperiod sensitive flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 10.3%-13.6%
- CBG: 0.1%-0.3%
- Total THC (finished flower): 0.35%-0.46%
- Delta-9 THC: 0.1%-0.16%

**CBD-to-THC ratio:** 25:1

**Test date:** Dec. 10, 2020

**Terpene profile:**
- Pepper
- Thyme
- Grape
- Hops

**Origin:** Colorado

**Growth habit/description:** A beautifully compact, bushy plant that grows well in both the greenhouse and field. Low stretch. Wide indica leaf structure, easy trimming.

**Spacing:** Greenhouse, 2-4 foot centers; Outdoor, 4-6 foot centers

**Size:** 3-5 feet

**Maturity week:** Minimum 4 weeks vegetative growth recommended, 7-9 weeks to harvest

**Flowering response time:** Mid

**Net weight:** Medium

**Yield range:** Medium

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via Cultivaris Hemp at **info@cultivarishemp.com**

### PURPLE SUNSET

A photoperiod-sensitive flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 12.01%-13.8%
- Total THC (finished flower): 0.42%-0.57%
- Delta-9 THC: 0.04%-0.11%

**CBD-to-THC ratio:** 23:1

**Test date:** Dec. 10, 2020

**Terpene profile:**
- Pepper
- Grape
- Citrus

**Origin:** Colorado

**Growth habit/description:** A slightly taller and more upright grower with solid, well-spaced nodes that produce well.

**Spacing:** Greenhouse, 2-4 foot centers; Outdoor, 4-6 foot centers

**Size:** 3-5 feet

**Maturity week:** Minimum 4 weeks vegetative growth recommended, 7-9 weeks to harvest

**Flowering response time:** Mid

**Net weight:** Medium

**Yield range:** Medium

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via Cultivaris Hemp at info@cultivarishemp.com

### SCARLET

A photoperiod-sensitive flower variety for CBD production.

**Cannabinoid profile:**

- CBD: 8.5%-10.3%
- CBG: 0.4%-0.16%
- Total THC (finished flower): 0.34%-0.41%
- Delta-9 THC: 0.1%-0.09%

**CBD-to-THC ratio:** 25:1

**Test date:** Dec. 10, 2020

**Terpene profile:**

- Hops
- Earthy
- Orange
- Cinnamon
- Wood

**Origin:** Colorado

**Growth habit/description:** An upright-bushy grower with a medium height, this variety does not stretch like many others at flowering. Easy trimming.

**Spacing:** Greenhouse, 2-4-foot centers; Outdoor, 4-6-foot centers

**Maturity week:** Minimum 4 weeks vegetative growth recommended, 7-9 weeks to harvest

**Net weight:** Hight

**Size:** 3-5 feet

**Flowering response time:** Early

**Yield range:** High

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via Cultivaris Hemp at info@cultivarishemp.com

## ROYALE BOTANICALS

LARKSPUR, COLORADO

### CHERRY ABACUS

A vegetatively propagated flower and biomass variety for CBD production.

**Cannabinoid profile:**

- CBD: 12%-16%
- THC: 0.2%-0.3%
- Minor cannabinoids present include CBG and CBC

**CBD-to-THC ratio:** 30:1

**Test date:** October 1, 2020

**Terpene profile:**

- Beta-myrcene
- Beta-caryophyllene

**Origin:** Colorado

**Growth habit/description:** Grows upright, allowing for dense planting. Dense bud structure with light green buds and orange hairs. Grows with many branches and buds.

**Spacing:** 3 feet by 3 feet at 3,500 to 4,500 plants per acre

**Size:** 5 feet tall by 4 feet wide

**Maturity:** 7-8 weeks from flower initiation

**Flowering response time:** 14 hours and 30 minutes of daylength

**Planting-to-harvest time:** 4 months from transplant as rooted clone

**Net weight:** 1-2 pounds per plant

**Yield range:** 1-2 pounds per plant; 3,500-7,000 pounds per acre

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via www.Royale-Botanicals.com or Sales@royale-botanicals.com

### DUTCH DELIGHT

A vegetatively propagated flower variety for CBD production.

**Cannabinoid profile:**

- CBD: 11%-14%
- THC: 0.2%-0.3%
- Minor cannabinoids present include CBG and CBC

**CBD-to-THC ratio:** 30:1

**Test date:** Oct. 1, 2020

**Terpene profile:**
- Beta-myrcene
- Beta-caryophyllene
- Alpha-pinene

**Origin:** Colorado

**Growth habit/description:** Orb-shaped plant with dense bud structure. Light green buds are covered in crystals with a cheesy aroma.

**Spacing:** 4 feet by 4 feet at 2,500-3,500 plants per acre

**Size:** 3 feet tall by 3 feet wide

**Maturity:** 8-9 weeks from flower initiation

**Flowering response time:** 13 hours and 45 minutes of daylength

**Planting-to-harvest time:** 4 months (from transplant as rooted clone)

**Net weight:** 1-2 pounds

**Yield range:** 1-2 pounds per plant; 2,500-5,000 pounds per acre.

**Compliance:** 2018 Farm Bill Compliant

**Purchase:** Direct via **www.Royale-Botanicals.com** or **Sales@royale-botanicals.com**

## THE HEMP MINE

FAIR PLAY, SOUTH CAROLINA

### BELLE

A hybrid variety for CBD oil and smokable flower production in the field.

**Cannabinoid profile:**
- CBD: 9%-12%

**CBD-to-THC ratio:** 29:1

**Terpene profile:**
- Juicy fruit

**Growth habit/description:** Upright habit; high yields and disease resistance. The flower has bright pink pistils and terpene content more than 2%. This variety stacks early and total THC spikes late.

**Spacing:** 5 feet

**Size:** 5 feet tall by 5 feet wide

**Flowering response time:** Initiates flower at 13:55 (H:M)

**Net weight:** 2.25 pounds dry weight

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **sales@thehempmine.com** or **www.thehempmine.com**

### LUCK IMPROVED

A hybrid variety for CBD oil production in the field.

**Cannabinoid profile:**
- CBD: 9%

**CBD-to-THC ratio:** 26:1

**Growth habit/description:** Upright habit, purposefully selected for low terpene production, based on research showing terpene content lures damaging moths. Initiates flower later, which is beneficial for regions under the 45th parallel, as it will grow vegetatively longer and produce a larger plant. Above this parallel, it can be a risky cultivar choice. Later flower initiation time coincides with a later finish time.

**Spacing:** 5 feet

**Size:** 6 feet tall by 6 feet wide

**Flowering response time:** Initiates flower at 13:31 (H:M)

**Net weight:** 2 pounds dry weight

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **sales@thehempmine.com** or **www.thehempmine.com**

### THM JACK

An indoor, high-yielding sativa hybrid smokable flower variety for CBD production.

**Cannabinoid profile:**
- CBD: 9%-12%
- CBG: 1%

**CBD-to-THC ratio:** 25:1

**Terpene profile:**
- Pine
- Turpentine

**Growth habit:** Indoor only; spacing dependent on vegetative time

**Flowering response time:** Must have 18+ hours of light to stay vegetative

**Net weight:** 50 grams per square foot

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **sales@thehempmine.com** or **www.thehempmine.com**

## TRIANGLE HEMP

RALEIGH, NORTH CAROLINA

### BAOX IMPROVED

A CBD grown for extraction and smokable flower.

**Cannabinoid profile:**

- Not available, check with supplier

**CBD-to-THC ratio:** 29:1

**Terpene profile:**

- Pungent, syrupy sweet smell
- Myrcene
- Beta-caryophyllene

**Origin:** North Carolina

**Growth habit/description:** Bushy and round, grows as wide as it is tall. Strong and sturdy branching. Prolific flowers and aggressive growth make for heavy yields.

**Female percentage:** 99.9%

**Yield range:** 3,200 pounds of biomass per acre

**Purchase:** Direct via **www.trianglehemp.com** or **info@trianglehemp.com**

### BLACKBERRY PUNCH

An autoflowering CBD variety for smokable flower production.

**CBD-to-THC ratio:** 24:1

**Terpene profile:**

- Pungent sweet berry smell

**Origin:** North Carolina

**Female percentage:** 99.9%

**Growth habit/description:** Strong apical dominance; deep purple hemp flowers. Aromatic, ideal for smokable flower.

**Size:** Finishes between 18-24 inches tall

**Flowering time:** 65-75 days from germination to harvest

**Purchase:** Direct via **www.trianglehemp.com** or **info@trianglehemp.com**

## TRILOGENE SEEDS

DENVER

### CHERRY SUNRISE

A seed-propagated hybrid variety for CBD production.

**Cannabinoid profile:**

Pre-harvest:

- CBD: 6.4%-9.5%
- THC: 0.2%-0.3%
- CBG-A: 0.7%

Harvest:

- CBD: 11%-13.7%
- THC: 0.35%-0.5%

**CBD-to-THC ratio:** 73:1

**Terpene profile:**

- Molasses
- Maraschino cherries
- Smoky and dark roast

**Test date:** Oct. 30, 2020

**Origin:** Colorado

**Female percentage:** 99%

**Growth habit/description:** Uniform, fast-growing, vigorous plant that thrives in many climates. Large, fan leaves and dark green bud structure with a yellow and black fade at the end of the flower cycle.

**Spacing:** 5 feet by 5 feet

**Size:** 8-9 feet

**Germination:** 3 days; 92% rate

**Dormant/hard seed:** 0%

**Maturity:** 8-9 weeks

**Flowering response time:** Full term

**Planting-to-harvest time:** Mid-October

**Yield range:** 1.5-4 pounds per dry plant

**Compliance:** 2018 Farm Bill

**Purchase:** Direct or via broker, **www.trilogeneseeds.com** or **Matt@trilogeneseeds.com**

### SUPERWOMAN S1

A seed-propagated hybrid variety for CBD production.

**Cannabinoid profile:**

Pre-harvest:
- CBD: 5%-8.1%
- THC: 0.1%-0.2%
- CBG-A: 0.3%

Harvest:
- CBD: 10%-14.8%
- THC: 0.4%-0.8%

**CBD-to-THC ratio:** 43:1

**Test date:** Sept. 30, 2020

**Terpene profile:**
- Cheesy funk
- Sweet cherries
- Garlic pepper

**Origin:** Colorado

**Female percentage:** 99% female

**Growth habit/description:** Uniform and consistent, balanced hybrid designed for its unique ability to thrive in multiple climates. A complex profile of 50 shades of green intertwined with a light to dark series of orange pistils.

**Spacing:** 5 feet by 5 feet

**Size:** 7- 8 feet

**Germination:** 3 days; 97% rate

**Dormant/hard seed:** 0%

**Maturity:** 9-10 weeks

**Flowering response time:** Full term

**Net weight:** 2-5 pounds per plant

**Planting-to-harvest time:** Mid-October

**Yield range:** 2-5 pounds per dry plant

**Compliance:** 2018 Farm Bill

**Purchase:** Direct or via broker, **www.trilogeneseeds.com** or **Matt@trilogeneseeds.com**

### ULTRA VIOLET

A seed-propagated indica-dominant hybrid variety for CBD and minor cannabinoid production.

**Cannabinoid profile:**

Pre-harvest:
- CBD: 5.6%-12.5%
- THC: 0%-0.7%
- CBG-A: 0.47%
- CBG: 0.28%

Harvest:
- CBD: 17.4%-19.7%
- THC: 0.4%-0.8%

**CBD-to-THC ratio:** 173:1

**Terpene profile:**
- Sweet cherry nose
- Grapefruit sugar smell
- Pepper
- Soil

**Test date:** March 24, 2020

**Origin:** Colorado

**Female percentage:** 99%

**Growth habit/description:** A tight and uniform plant that requires finesse to perfect. Multicolored with purple, yellow, black and red colors. Trichomes are heavy and very sticky.

**Spacing:** 4 feet by 4 feet

**Size:** 6-7 feet

**Germination:** 3 days; 91% rate

**Dormant/hard seed:** 0%

**Maturity:** 8 weeks

**Flowering response time:** Full term

**Net weight:** 1.5-3 pounds per plant

**Planting-to-harvest time:** Early/mid October

**Yield range:** 1.5-3 pounds per dry plant

**Compliance:** 2018 Farm Bill

**Purchase:** Direct or via broker, **www.trilogeneseeds.com** or **Matt@trilogeneseeds.com**

## YABBA CANNABA

DENVER, COLORADO

### CHERRY WINE

A hybrid variety for CBD flower production.

**Cannabinoid profile:**
- CBD: 8%
- THC: 0.3%

**CBD-to-THC ratio:** 26:1

**Terpene profile:**
- Merlot wine
- Sweet cherry

**Origin:** Colorado

**Female percentage:** 99.99%

**Growth habit/description:** Taller/stretchier, medium density on buds with large colas.

**Spacing:** 1,800-2,000 per acre

**Size:** 3-5 feet tall by 1-3 feet wide

**Germination:** 7-15 days; 99% rate

**Dormant/hard seed:** less than 1%

**Maturity:** 6-8 weeks

**Flowering response time:** 12 hours

Planting-to-harvest time: 6-8 weeks

**Yield range:** 4-9 ounces per plant

**Compliance:** 2018 Farm Bill; homogenized sample compliant

**Purchase:** Direct via www.yabbacannaba.com

### HOT BLONDE

A hybrid variety for CBD flower production.

**Cannabinoid profile:**

- CBD: 8%
- THC: 0.3%

**CBD-to-THC ratio:** 28:1

**Terpene profile:**

- Spicy
- Peppery
- Citrus

**Origin:** Colorado

**Female percentage:** 99.99%

**Growth habit/description:** Shorter bushy plant with tight node spacing

**Spacing:** 1,800-2,000 per acre

**Size:** 2-4 feet tall by 1-3 feet wide

**Germination:** 7-15 days; 99% rate

**Dormant/hard seed:** less than 1%

**Maturity:** 6-8 weeks

**Flowering response time:** 12 hours

**Planting-to-harvest time:** 6-8 weeks

**Yield range:** 4-9 ounces per plant

**Compliance:** 2018 Farm Bill; homogenized sample compliant

**Purchase:** Direct via www.yabbacannaba.com

### QUEEN DREAM

A hybrid variety for CBD flower production.

**Cannabinoid profile:**

- CBD: 8%
- THC: 0.3%

**CBD-to-THC ratio:** 30:1

**Terpene profile:**

- Sweet
- Citrus
- Melon
- Earthy

**Origin:** Colorado

**Female percentage:** 99.99%

**Growth habit/description:** Taller/stretchier with dense buds and spaced-out node.

**Spacing:** 1,800-2,000 per acre

**Size:** 3-4 feet tall by 2-3 feet wide

**Germination:** 7-15 days; 99% rate

**Dormant/hard seed:** Less than 1%

**Maturity:** 6-8 weeks

**Flowering response time:** 12 hours

**Planting-to-harvest time:** 6-8 weeks

**Yield range:** 4-9 ounces per plant

**Compliance:** 2018 Farm Bill, homogenized sample compliant

**Purchase:** Direct via www.yabbacannaba.com

## ZERA FARMS

WESTLAKE VILLAGE, CALIFORNIA

### BIHEMP 050924 *(BRANDED AS GUAVA JAM)*

A seed-propagated hybrid variety for flower production.

**Cannabinoid profile:**

- CBD-A: 8%
- CBDVA: 8%
- THC-A: 0.2%

**CBD-to-THC ratio:** 40:1

**Terpene profile:**

- Beta-caryophyllene
- Limonene
- Humulene
- Sweet guava aroma

**Test date:** March 26, 2020

**Origin:** Oxnard, California

**Female percentage:** 99.9%

**Growth habit/description:** Tall and bushy. Very robust and vigorous.

**Spacing:** 2-4 feet

**Size:** 6 feet by 8 feet

**Germination:** 2 days; 92% rate

**Dormant/hard seed:** 1.1%

**Maturity:** 6-8 weeks

**Flowering response time:** Flowers are noticeable after two weeks of short-day exposure.

**Planting-to-harvest time:** 3-5 months

**Net weight:** 1 pound

**Yield range:** 0.5-2 pounds

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.zerafarms.com** or email **hello@zerafarms.com**

### BIHEMP 09S123 *(MARKETED AS GRAPE JAM)*

A seed-propagated hybrid variety for CBD flower production.

**Cannabinoid profile:**

- CBD-A: 8%
- CBDVA: 8%
- THC-A: 0.2%

**CBD-to-THC ratio:** 29:1

**Test date:** March 26, 2020

**Terpene profile:**

- Myrcene
- Beta-caryophyllene
- Limonene
- Fragrant grape aroma

**Origin:** Oxnard, California

**Female percentage:** 99.9%

**Growth habit/description:** Bushy and tall. Extremely vigorous with hybrid structure.

**Spacing:** 2-4 feet, depending on planting date

**Size:** 4 feet by 6 feet

**Germination:** 2 days; 95% rate

**Dormant/hard seed:** 1.1%

**Maturity:** 6-8 weeks

**Flowering response time:** Flowers are noticeable by August and/or within two weeks of short-day exposure.

**Planting-to-harvest time:** 3-5 months, dependent on planting time

**Net weight:** 1 pound

**Yield range:** 0.5-2 pounds

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.zerafarms.com** or email **hello@zerafarms.com**

### BIHEMP 24.52 *(BRANDED AS PINEAPPLE JAM)*

A seed-propagated hybrid variety for flower production.

**Cannabinoid profile:**

- CBDVA: 16%
- CBD-A: 3.5%
- THC-A: 0.3%

**CBD-to-THC ratio:** 50:1

**Test date:** March 26, 2020

**Terpene profile:**

- Ocimene
- Limonene
- Pinene
- Bright pineapple aroma.

**Origin:** Oxnard, California

**Female percentage:** 99.9%

**Growth habit/description:** Bushy and tall with large flowers that stretch along branches.

**Spacing:** 2-4 feet, depending on planting date

**Size:** 4 feet by 6 feet

**Germination:** 2 days; 92% rate

**Dormant/hard seed:** 1.1%

**Maturity:** 6-8 weeks

**Flowering response time:** Flowers are noticeable after two weeks of short-day exposure.

**Planting-to-harvest time:** 3-5 months, dependent on planting time

**Net weight:** 1 pound

**Yield range:** 0.5-2 pounds

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.zerafarms.com** or email **hello@zerafarms.com**

# CBG-DOMINANT VARIETIES

## GENFLORA
CUPERTINO, CALIFORNIA

### GENFLORA CBG


A feminized, full-term hybrid variety for cannabinoid and flower production.

**Cannabinoid profile:**
- CBG: 8%-10%
- CBD: 2%-4%
- THC: 0.01% -0.1%

**CBD-to-THC ratio:** 100:1

**Test date:** May 29, 2020

**Terpene profile:**
- Strong citrus scent

**Origin:** California

**Female percentage:** 99.9% (1 phenotypic male in 7,000 plants)

**Growth habit/description:** Tall bushy plant, light green flower formation, bright orange pistils.

**Spacing:** 5-foot spacing on center for early June planting

**Size:** 5 feet tall by 5 feet wide

**Germination:** 5-7 days; 85% rate

**Dormant/hard seed:** 5%

**Maturity:** 9-11 weeks from flower response time

**Flowering response time:** Late July

**Planting-to-harvest time:** Early June planting harvests early-mid October

**Net weight:** 1 pound per plant

**Yield range:** At 2,500 plants per acre, yield is 2,500 pounds per acre

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **kmoore@genflora.com**

## HIGH GRADE HEMP SEED
LONGMONT, COLORADO

### MATTERHORN CBG

A full-term, seed-propagated flower variety for CBG production.

**Cannabinoid profile:**
- CBD: 14.5%
- THC: <0.2%
- Total cannabinoids: 8%

**CBG-to-THC ratio:** 130:1

**Test date:** March 2, 2020

**Terpene profile:**
- Effervescent lemon and lime
- Skunky notes of hops

**Origin:** Switzerland

**Female percentage:** 99.99%

**Growth habit/description:** Big and bushy. Tall, stretches 3 times vegetative height when it goes to flower.

**Spacing:** 60-inch seed spacing and 60-inch row spacing

**Size:** 2 meters tall

**Germination:** 2 days; 95% rate

**Dormant/hard seed:** 0%

**Maturity:** 8-9 weeks

**Flowering response time:** 8-9 weeks from flowering

**Planting-to-harvest time:** 5 months

**Net weight:** 500 grams per plant

**Yield range:** 2,500-3,000 pounds per acre (dry whole plant material)

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.highgradehempseed.com** or **info@highgradehempseed.com**

## OREGON CBD
MONMOUTH, OREGON

### WHITE CBG SEEDLESS
A seed-propagated, triploid F1 hybrid, seedless flower variety for CBG production

**Cannabinoid profile:**
- CBG: 14%-16%
- Total THC: 0.1%-0.2%

**CBD-to-THC ratio:** 100:1

**Terpene profile:**
- Creamy lemon
- Diesel

**Origin:** United States

**Female percentage:** Seedless, cannot pollinate or be pollinated by others; around 1 phenotypically male in 4,000 plants

**Growth habit/description:** Bushy, vigorous growers that turn into bushes.

**Spacing:** 4 feet by 6 feet spacing for early June planting

**Size:** 4-8 feet by 4-8 feet

**Germination:** 5-10 days; 95% rate

**Dormant/hard seed:** Less than 1%

**Maturity:** 4-6 weeks

**Flower period:** Mid July- late September

**Net weight dry mass:** 1-5 pounds

**Planting-to-harvest time:** Planting date dependent, as little as 3.5 months but generally 5 months

**Yield range:** 1-5 pounds

**Compliance:** USDA, 2014 and 2018 Farm Bills

**Purchase:** Direct via **info@jackhempicine.com** or **www.oregoncbdseeds.com**

## ROYALE BOTANICALS
LARSKPUR, COLORADO

### DUTCH CBG SOUTH
A vegetatively propagated flower and biomass variety for CBG production.

**Cannabinoid profile:**
- CBD: 12% to 16%
- THC: 0%
- CBD: 0%

**CBG-to-THC ratio:** 15% CBG with no detectable THC

**Test date:** Oct. 1, 2020

**Origin:** Colorado

**Growth habit/description:** Very large and bushy plants. Large bud structure due to late flower initiation and long vegetative growth.

**Spacing:** 3 feet by 3 feet at 3,500 to 4,500 plants per acre

**Size:** 4 feet tall by 3 feet wide

**Maturity:** 8-9 weeks from flower initiation

**Flowering response time:** 13 hours and 30 minutes

**Planting-to-harvest time:** 4 months from transplant as rooted clone

**Yield range:** 1-2 pounds per plant; 3,500-7,000 pounds per acre

**Compliance:** 2018 Farm Bill

**Purchase:** Direct via **www.Royale-Botanicals.com** or **Sales@royale-botanicals.com**

## TRIANGLE HEMP
RALEIGH, NORTH CAROLINA

### SWEET RELIEF
A CBG variety for extraction or smokable flower production.

**Cannabinoid profile:**
- CBG: Up to 15% in finished flower
- Total THC: 0.19% at maturity

**Female percentage:** 99.9%

**Terpene profile:**
- Earthy
- Black pepper
- Garlic

**Growth habit/description:** Slightly taller than it is wide at harvest. Offers very dense flowers for efficient extraction or smokable flower with bag appeal.

**Flowering time:** Early

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.trianglehemp.com** or **info@trianglehemp.com**

# GRAIN AND FIBER VARIETIES

** Denotes variety is AOSCA seed-certification eligible.*

## BIJA HEMP, A DIVISION OF INTERNATIONAL HEMP SOLUTIONS

DENVER

### HENOLA*

A seed-propagated monoecious variety for grain production.

**Cannabinoid profile:**

- CBD-A: 0.82%
- CBD: 0.08%
- THC: 0%

**Test date:** September 2019

**Terpene profile:**

- Pinene
- Caryophyllene
- Humulene

**Origin:** Institute of Natural Fibers and Medicinal Plants of Poznan, Poland

**Female percentage:** Less than 5% female-to-male percentage; hermaphroditic plant population greater than 94%

**Growth habit/description:** Tight panicle development, but short as compared to other hemp varieties suitable for grain production.

**Spacing:** 20 pounds per acre

**Size:** 6 feet tall

**Germination:** 7-10 days from seeding; 87%-93% rate

**Dormant/hard seed:** Less than 5%

**Maturity:** 11 weeks for fiber, 15 weeks for grain

**Flower period:** 70-75 days

**Planting-to-harvest time:** 105-110 days

**Yield range:** 3,050 pounds of grain per acre

**Compliance:** 2014 and 2018 Farm Bills, previously listed on OECD Seed Scheme

**Purchase:** Direct at 833-937-4367, info@bijahemp.com or www.BijaHemp.com

### BIALOBRZESKI*

A seed-propagated monoecious variety for grain and fiber production.

**Cannabinoid profile:**

- CBD: 0.23%
- CBD-A: 1.87%
- THC: 0%

**Test date:** September 2019

**Terpene profile (0.044% total):**

- Pinene
- Caryophyllene
- Humulene

**Origin:** Institute of Natural Fibers and Medicinal Plants of Poznan, Poland

**Female percentage:** Less than 5% female-to-male percentage; hermaphroditic plant population greater than 94%

**Growth habit/description:** Tall

**Spacing:** 55 pounds per acre

**Size:** 7-11 feet tall, depending on production practice

**Germination:** 7-10 days from seeding; 87%-93% rate

**Dormant/hard seed:** Less than 7%

**Maturity:** 11 weeks for fiber, 15 weeks for grain

**Flower period:** 70-75 days

**Planting-to-harvest time:** 75 days for fiber and 105-110 days for grain

**Yield range:**

- Straw: 10 tons per acre
- Raw fiber: 2 tons per acre
- Grain: 1,025 pounds per acre

**Compliance:** Both Farm Bills; previously listed on OECD Seed Scheme

**Purchase:** Direct at 833-937-4367, info@bijahemp.com or www.BijaHemp.com

## FARMTIVA
VISTA, CALIFORNIA

### JINNMA/OG AMERICAN HEMP
A seed-propagated, dioecious landrace hybrid sativa variety for fiber production.

**Cannabinoid profile:**
- CBD: 3%
- THC: 0.14%

**CBD-to-THC ratio:** 40:1

**Test date:** Nov. 15, 2020

**Terpene profile:**
- Pine tree scent

**Origin:** China via California

**Female-to-male percentage:** Dioecious 55% female and 45% male

**Growth habit/description:** Grows very tall and fast, bamboo-like structure tops with very little nodes.

**Spacing:** 45-50 pounds per acre

**Size:** 12-16 feet

**Germination:** 4-8 days; 80% rate

**Dormant/hard seed:** 2%

**Maturity:** 6 weeks

**Flowering response time:** 6 weeks

**Planting-to-harvest time:** 100- 120 days

**Yield range:** 4-6 tons

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.farmtiva.com** or **info@farmtiva.com**

## PARKLAND INDUSTRIAL HEMP
DAUPHIN, MANITOBA, CANADA

### CANDA*
A monecious variety grown for grain and fiber production.

**Origin:** Manitoba, Canada

**Female-to-male percentage:** Less than 5% female to male; greater than 94% hermaphroditic plants.

**Growth habit/description:** Tall, dual-purpose variety. Grain produces GLA levels up to 7.9%.

**Spacing:** For grain production, plant 25 pounds per acre. For fiber production, plant 35-40 pounds per acre.

**Size:** 59-98 inches tall (150-250 centimeters) in Canada

**Germination:** 7-10 days from seeding; 85%-95% rate

**Maturity:** 11 weeks for fiber; 16 weeks for grain.

**Flowering response time:** 55-70 days to flower

**Net weight:** 6,061 pounds per acre (variable)

**Yield range:** 1,609 pounds of grain per acre

**Purchase:** Through approved U.S. seed distributors or direct via **www.pihg.net** or **office@pihg.net**

### JOEY*
A seed-propagated monoecious variety for grain and fiber.

**Origin:** Manitoba, Canada

**Female-to-male percentage:** Less than 5% female to male; greater than 94% hermaphroditic plants.

**Growth habit:** Tall, dual-purpose variety used for grain and fiber production.

**Spacing:** For grain production, 25 pounds per acre; for fiber production, 35-40 pounds per acre

**Size:** 70-108 inches tall (180-275 centimeters) in Canada

**Germination:** 7-10 days from seeding; 85%-95% rate

**Maturity:** 11 weeks for fiber; 16 weeks for grain.

**Flowering response time:** 55-70 days to flower

**Net weight:** 6,612 pounds per acre (variable)

**Yield range:** 1,496 pounds of grain per acre

**Purchase:** Through approved U.S. seed distributors or direct via **www.pihg.net** or **office@pihg.net**

# MULTIPURPOSE VARIETIES

** Denotes variety is AOSCA seed-certification eligible*

## BIOTECH INSTITUTE/ZERA SEEDS

WESTLAKE VILLAGE, CALIFORNIA

### BIHEMP 050924 *(BRANDED AS GUAVA JAM)*

A seed-propagated hybrid variety for flower and grain production.

**Cannabinoid profile:**

- CBD-A: 8%
- CBDVA: 8%
- THC-A: 0.2%

**CBD-to-THC ratio:** 40:1

**Terpene profile:**

- Beta-caryophyllene
- Limonene
- Humulene
- Sweet guava aroma

**Test date:** March 26, 2020

**Origin:** Oxnard, California

**Female percentage:** 99.9%

**Growth habit/description:** Tall and bushy. Very robust and vigorous.

**Spacing:** 2-4 feet

**Size:** 6 feet by 8 feet

**Germination:** 2 days; 92% rate

**Dormant/hard seed:** 1.1%

**Maturity:** 6-8 weeks

**Flowering response time:** Flowers are noticeable after two weeks of short-day exposure.

**Planting-to-harvest time:** 3-5 months

**Net weight:** 1 pound

**Yield range:** 0.5-2 pounds

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.zerafarms.com** or **hello@zerafarms.com**

## COLORADO BREEDERS DEPOT

CANON CITY, COLORADO

### BOAX I OTTO II

A seed-propagated, sativa-dominant, tri-crop variety for seed, fiber and grain production.

**Cannabinoid profile:**

- Cannabinoids: 8-12%
- THC: 0.3%

**CBD-to-THC ratio:** 35:1

**Test date:** Jan. 4, 2020

**Origin:** Colorado

**Female percentage:** 50%

**Growth habit/description:** Tall, lengthy. Sativa structure, tall, thin, fluffy nugs.

**Spacing:** 6 inches by 6 inches to 2 feet by 2 feet

**Size:** 9-12 feet tall

**Germination:** 3-5 days; 88% rate

**Dormant seed:** 0%

**Maturity:** 7-9 weeks

**Flowering response time:** 10-14 days

**Planting-to-harvest time:** Depending on vegetative growing period, 4-5 months.

**Yield range:** 1-3 pounds

**Compliance:** 2014 Farm Bill

**Purchase:** Direct via **www.coloradobreedersdepot.com**

## FARMTIVA
VISTA, CALIFORNIA

### AUTOTIVA - MICRO GREEN

A semi-day-neutral, seed-propagated hybrid variety for microgreens, juicing, smokable flower or oil production.

**Cannabinoid profile:**
- CBD: 11%-13%
- THC: 0.13%-0.23%

**CBD-to-THC ratio:** 25:1

**Test date:** Oct. 3, 2020

**Terpene profile:**
- Earth Pine scent alpha
- Beta pinene
- Citrus lemon haze aroma

**Origin:** California

**Female percentage:** 70%

**Growth habit/description:** Structure short and long buds. Well-structured long spear kolas/flowers.

**Spacing:** 36 inches at 6,000 seeds per acre or 200 seeds per tray for microgreens

**Size:** 4-7 feet

**Germination:** 4-7 days; 94% rate

**Dormant/hard seed:** 1%

**Maturity:** Microgreens, 4 weeks; flower, 6-8 weeks

**Flowering response time:** 6-8 weeks

**Planting-to-harvest time:** 80-110 days depending on latitude

**Net weight:** 0.5-1.5 pounds

**Yield range:** 1,500-2,000 pounds per acre

**Compliance:** 2014 and 2018 Farm Bills

**Purchase:** Direct via **www.farmtiva.com** or **info@farmtiva.com**

## HEMP GENETICS INTERNATIONAL
SASKATOON, SASKATCHEWAN, CANADA

### CFX-2*

Dioecious variety grown for flower, seed, grain and fiber.

**Cannabinoid profile:**
- CBD: 0.5%-2.7%
- THC: < 0.3%

**CBD-to-THC ratio:** 6-12:1

**Test date:** 10 years of data

**Female percentage:** 60%

**Growth habit/description:** Vigorous grower during establishment and tall stature provide weed control and allows plant to absorb nutrients when soil fertility is limited.

**Spacing:** Density depends on end purpose and production system.

**Size:** 130-150 centimeters tall (Canada)

**Germination:** 3 days at 85%-95% rate

**Kernel weight:** 16 grams/1,000 seeds

**Planting-to-harvest time:** 103 days

**Flower period:** 53 days after seeding

**Maturity (Canada):** 103 days

**Net weight dry mass:** 4,610 pounds

**Yield range:** 1,949 pounds of grain per acre

**Purchase:** Through approved U.S. seed distributors or direct via **www.hempgenetics.com**

### CRS-1

Dual production variety grown for CBD, grain and fiber

**Cannabinoid profile:**
- CBD: 0.5%-2.7%
- THC: < 0.3%

**CBD-to-THC ratio:** 6-12:1 (variable)

**Test date:** 10 years of data

**Female-to-male ratio:** 60% female

**Growth habit/description:** Used in organic production systems for additional weed competition thanks to its tall stature

**Spacing:** Density depends on end purpose and production system

**Size:** 59-79 inches (150-200 centimeters) tall (Canada)

**Kernel weight:** 0.7 of an ounce (20 grams) per 1,000 seeds

**Crop time, seed to harvest:** 110+ days

**Germination:** 3 days at 85%-95% rate

**Flower period:** 55 days after seeding

**Maturity (Canada):** ~110+ days

**Net weight dry mass:** 5,914 (variable)

**Yield range:** 1,891 pounds (858 kilograms) of grain per acre

**Purchase:** Through approved U.S. seed distributors or direct via **www.hempgenetics.com**

### KATANI

Photoperiod-dependent variety grown for flower, seed and grain.

**Cannabinoid profile:**
- CBD: 0.5%-2.7%
- THC: < 0.3%

**CBD-to-THC ratio:** 6-12:1 (variable)

**Test date:** 5 years of data

**Female-to-male ratio:** 60% female

**Growth habit/description:** Medium-sized, high-grain yielder. Best suited for northern states and southern Canada

**Spacing:** Density depends on end purpose and production system.

**Size:** 28-43 inches (70-110 centimeters) tall (Canada)

**Kernel weight:** 0.5 of an ounce (15 grams) per 1,000 seeds

**Crop time, seed to harvest:** ~105+ days

**Germination:** 3 days at 85%-95% rate

**Flower period:** 55 days after seeding

**Maturity (Canada):** ~105+ days

**Net weight dry mass:** 470 pounds (2,028 kilograms) variable

**Yield range:** 1,820 pounds (826 kilograms) of grain per acre

**Purchase:** Through approved U.S. seed distributors or direct via **www.hempgenetics.com**