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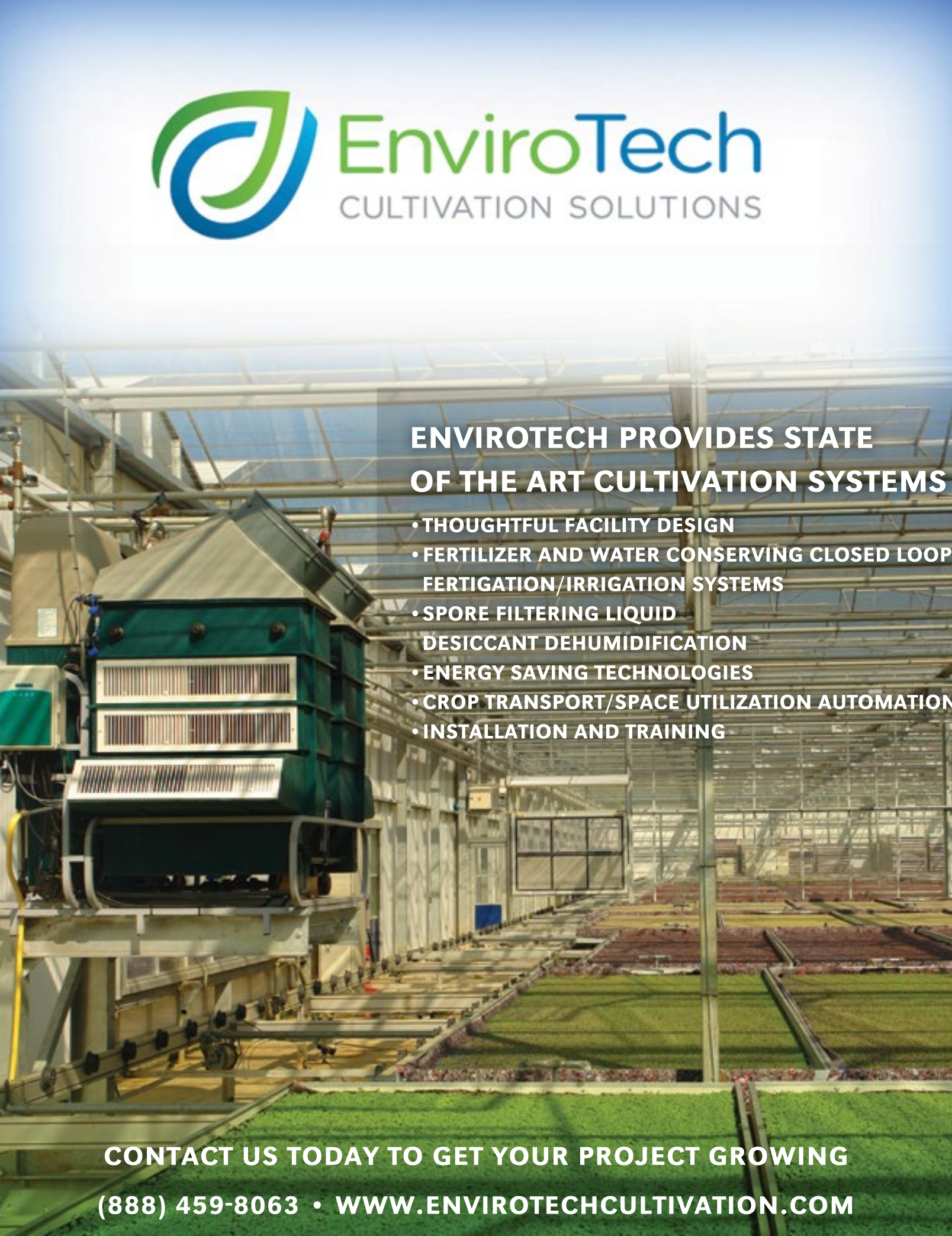
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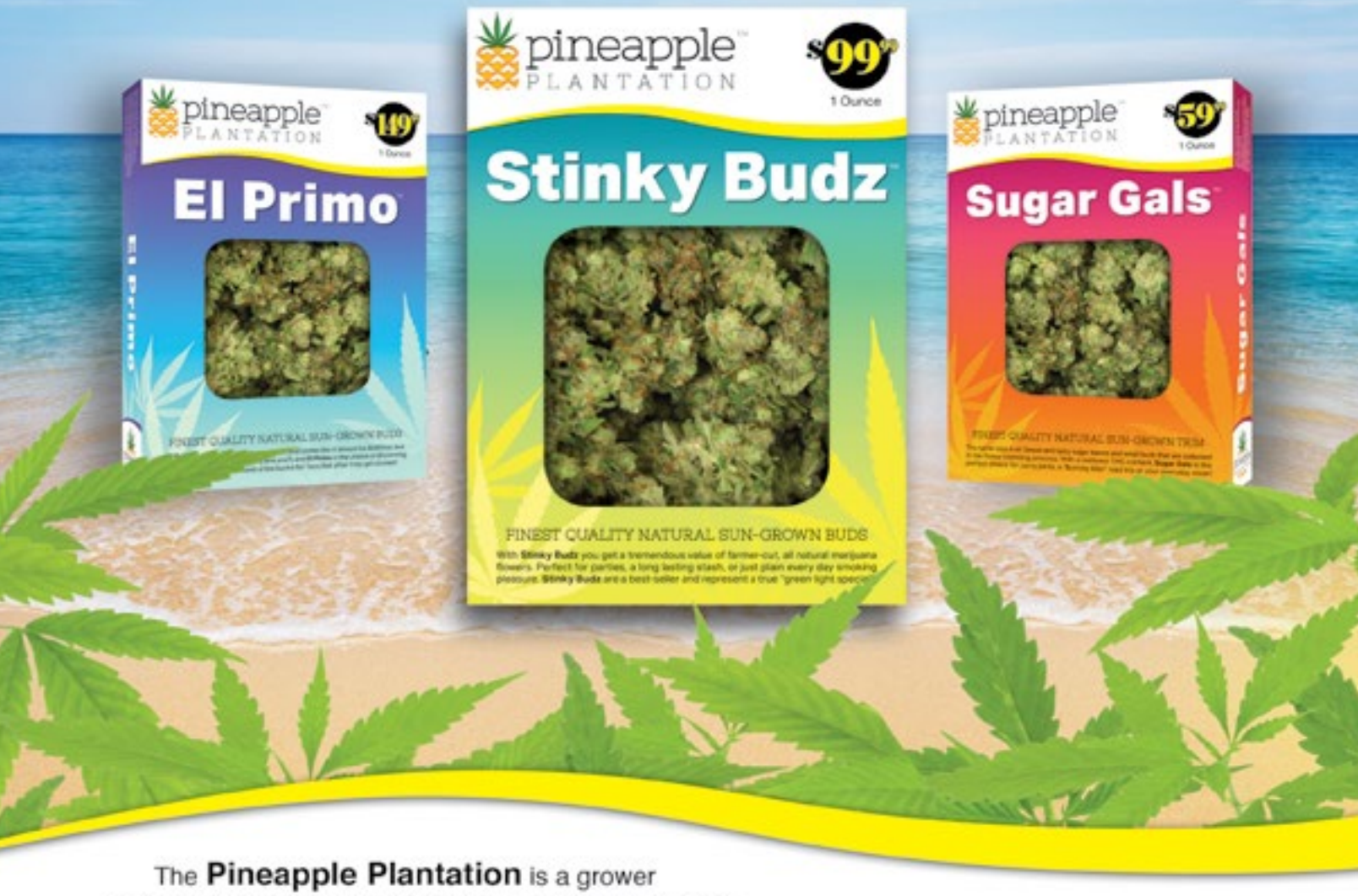

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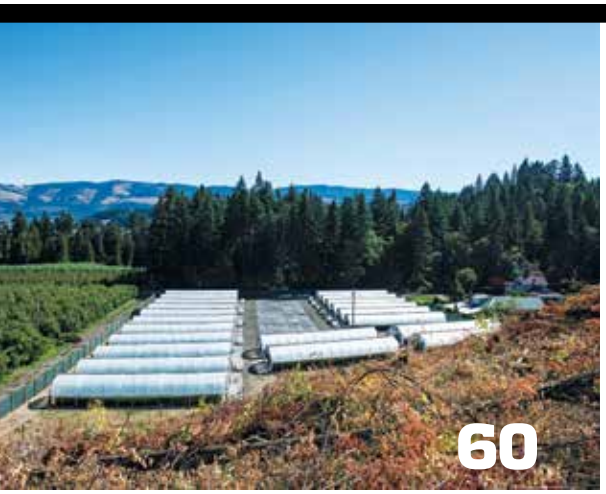

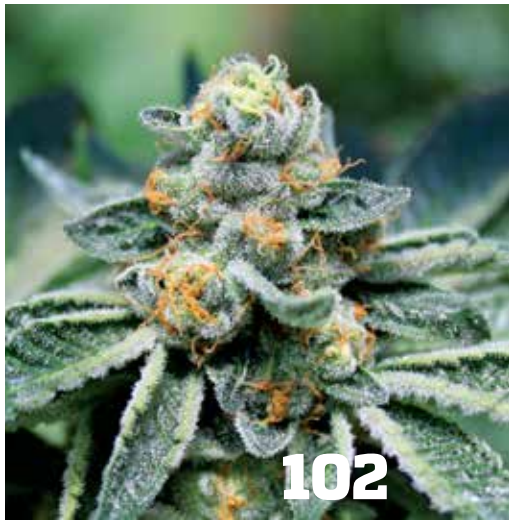

About the Cover: Tom Buggia thinks big. The Columbia Valley Farms boss has gathered more than a dozen state-licensed grow operations on a property that is expected to produce upwards of 30,000 pounds of cannabis. Photo by Gary Delp.


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CONTENTS

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GRO-ALLIANCE

SunGrower & Greenhouse features articles by leading experts in their fields, with an emphasis on academia and focused specialties.

CLIFF TOMASINI
is the product manager for Quest Dehumidifiers (questhydro.com), which manufactures some of the most energy-efficient dehumidifiers in the world. Quest has supported the cannabis industry for more than a decade, working with growers to improve the quality of their plants through clean growing processes.

GARY DELP
is a portrait and commercial photographer servicing clients in Washington and Oregon. He has a degree in industrial technology and has 30 years of experience as a full-time professional photographer. His background in fruit horticulture and nursery production, combined with a keen interest in soils and gardening, help produce effective images for agriculture clients. He can be contacted at garyadelp@gmail.com.

RICHARD FREEMAN
designs ecological cannabis agriculture systems, including soil-building, integrated pest management and waste-reduction/reuse programs with his company, Eco Paradigm (growecology.com). His prior experience includes research and development of residential permaculture food and composting systems and ecological forest planning and management. He has a Ph.D. in forest management, a master's degree in environmental studies and certifications in permaculture and food forest design.

JOY BECKERMAN
is the principal at Hemp Ace International (hempace.com), a Seattle-based consulting and brokerage firm. After opening the first hemp store in NY in the early 1990s, she served as secretary to the Vermont Hemp Council upon passage of the first Vermont hemp bill in 1996. She is an internationally respected speaker who works directly with legislators and policymakers. She is an advisor to and board member of multiple cannabis associations and entities.

by GREG JAMES

Look beyond the cannabis industry

Welcome to the second issue of *SunGrower & Greenhouse*. I'm super excited to announce that SunGrower was picked up by Ingram and Media Solutions for national distribution. This means that like Marijuana Venture, this publication will immediately be available in all 50 states through major retail chains like Barnes & Noble and Books-A-Million. It's also a big sign of approval, and shows that we created another product that is seen as valuable to people in the industry.

The cannabis industry has been advancing at a breakneck speed. As I write this, fall is here, and commercial sun-growers in Washington, Oregon and Colorado are poised to harvest record-breaking crops. I've toured numerous grow facilities this summer, and I've been extremely impressed by what I've seen. Whether crops were grown in big commercial greenhouses or planted directly in the soil, most of the plants looked incredibly big and healthy. However, when I say "most," it means that there have been some challenges. I'm not as sure about Colorado, but troublesome broad mites and russet mites have reared their ugly heads and have hit some Washington and Oregon farms badly late in the summer.

Unlike twospotted spider mites, the much smaller broad mites are virtually impossible to see until growers have a big problem. SunGrower and Marijuana Venture will continue to publish articles from experts in the field, such as Suzanne Wainwright-Evans, precisely because in the world of commercial cannabis cultivation, one big slip-up can mean disaster. With a seasonal crop like cannabis, a second chance might not come up until the next spring.

We're really serious about publishing solid information that benefits growers, no matter where it comes from. Yes, we love to get articles and information from people in the marijuana business, but we also feel like the cannabis industry has a tendency to look inward too much. So here's my tip for this issue: The University of Arizona has some really great short courses on hydroponics and greenhouse management. They are taught by experts in the field who have decades of research experience. The short courses are Jan. 2-7 (Hydroponic Greenhouse), and April 3-7 (Greenhouse Crop Production and Engineering). I strongly urge our readers to go to the University of Arizona website and look into the school's Controlled Environment Agriculture Center for more information. The courses aren't about cannabis, but they will be packed with valuable insight into hydroponics and greenhouse production techniques.

Enjoy the Fall issue of SunGrower & Greenhouse and pass it on to other growers who love the plant and see sunlight as the perfect partner for cannabis.

Greg James
Publisher

sungrower & GREENHOUSE

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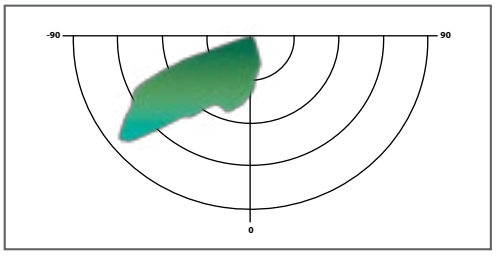

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A red barn provides a striking backdrop to the vibrant green cannabis plants at Washington's Finest Cannabis in Deer Park, Washington. Photo by Ken Pedevilla.

The colors of fall mean harvest season is just around the corner at The Happy Crowd in Eastern Washington. Photo by Ken Pedevilla.

A view of the glass ceiling of a commercial greenhouse and the rows of potted cannabis plants. Photo by Gary Delp.

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A visitor takes a look at hundreds of healthy cannabis plants at a grow operation in Eastern Washington. Photo by Greg James.

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Ed Rhinehart strolls through his farm in the Methow Valley on a gorgeous late summer day. Photo by Greg James.

by PATRICK WAGNER

PHOTO BY DARIENNE ZOA

Joy Beckerman

Principal, Hemp Ace International

Over the summer, Joy Beckerman was awarded the 2016 Excellence in Regional Cannabis Activism Award by Seattle Hempfest. Beckerman has been an avid hemp activist for decades, having opened the first hemp store in New York in the early 1990s. She's currently the principal at Hemp Ace International, a Seattle-based consulting and brokerage firm, in addition to serving on numerous cannabis committees and boards.

SunGrower: You've been instrumental in pushing hemp legislation forward in Washington. Tell us where that stands currently, and what has it taken to get us there? When do you think farmers might be able to begin growing hemp in Washington?

Joy Beckerman: After three years of hemp bills, we passed a hemp bill just this year. It's now known as ESSB 6206. It became law on March 29, but once the law passed, it didn't just go gangbusters. It's going to head into the rulemaking phase, so that is where we are at right now.

The rulemaking is in preparation for the 2017 growing season. Hopefully the rules program will be completely done in time for license applications to be created and made available for folks who are eligible, and then farmers would need to apply for a license and then be granted that license. So the 2017 growing season is the goal — but we can't guarantee that is going to happen.

SunGrower: Why has Washington — in some ways a leader in progressive marijuana laws — fallen so far behind places like Oregon, Colorado and Kentucky in terms of hemp?

JB: We wouldn't have been, because we had bills in the hopper just like they had. But our bills didn't get passed because we had competing bills and a ridiculous fiscal load at one point.

Our problem is that we had a House Republican bill and a Senate Democrat bill and I swear, that in and of itself, caused ours to take a little longer.

What happened — if I am being perfectly honest — was that I realized that I need to walk hand-in-hand with the Washington State Department of Agriculture, instead of fighting the WSDA. When I presented to them and told them what my goals were and how we really need to work this, they were like, 'Oh, we agree. We need to be compliant.'

It was almost like a double team. So through law and academia I positioned myself, and the Legislature could not argue. I have probably lost about $10,000 of actual money and income because I lived in Olympia for two months on my own dime — but it worked. Even though there were competing bills, the Legislature cannot deny the law, the WSDA and the hippie that says, 'Yeah, what they said — we say it together.'

SunGrower: You've invested 25 years and a good amount of your own income to further this cause. Where did your passion for hemp come from?

JB: If I could dump hemp, I totally would.
At a Grateful Dead show in 1990 I was handed a flyer about industrial hemp. At the time I thought we were killing the planet. The planet is going to be killed by humans and we should all be really nice to each other and be peaceful loving humans while we kill it. I don't believe everything I read, but when I got that flyer, every cell in my body reacted to the letters and words on the page.

I didn't know that there would be any type of a solution to all of these problems that we were facing, but not only did I learn that there is this solution, I learned that the solution was illegal. It changed the trajectory of my life. That flyer, that day, it changed the way I thought about the world.

It so infected me that I went on to open the first hemp store in Woodstock, New York in the early '90s. I became very active.

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SunGrower: Since you have been involved in the reformation of the hemp industry for the past 25 years, would you say now is the best time for people to become involved?

JB: Oh yes. We're here. Now is the time for vigilance. We are re-introducing this crop state by state. The feds have created a pathway. There is other pending federal legislation to help completely remove industrial hemp from the Controlled Substances Act. It's actually called the Industrial Hemp Farming Act.

So yes, it's here. We said back in 1990 that it was going to be in five years, and then in 1995 it was five years and then in 2000 it was five years. Now, it has been 25 years and we're here. It's happening.

SunGrower: Now that the U.S. is on the cusp, what business ideas or research projects related to hemp are you most excited to see come to fruition?

JB: That's an interesting question because I'm really excited to see our most basic needs met by hemp because of the environmental impact. It's hard not to answer that question without saying paper and clothes. But now let's talk about the exciting stuff.

There is now stuff happening in hemp that we didn't even see coming 25 years ago because we didn't have the technology to understand the value of industrial hemp cellulose.

Cellulose, as it turns out, is the most valuable bio-mass on planet earth. So super-capacitors and nano-technology and, of course, bio-fuel. Super-capacitors are energy storage — think light-rail or monorail.

Industrial hemp nano-cellulose, also known as nano-crystals, are tremendous for energy — basically giant batteries that can hold energy, store it and emit it instantly in giant amounts.

When we talk about the most exciting things happening in the U.S., it's the fractionalization technology that has been patented by PureVision Technology that separates the hemp bio-mass from the cellulose, sugars and lignin.

We can make thousands, if not tens-of-thousands of commercial applications from those separated components: the cellulose, lignin and sugars. One of those applications, of course, is bio-fuel methane.

Building materials are also a huge passion of mine because more than 50% of land waste each year is directly attributed to the construction industry, which has taken to building non-breathing, toxic, temporary homes that last for 40 to 80 years — whereas hempcrete, for example, would last hundreds of years, if not thousands.

SunGrower: So can we expect to see huge impacts from hemp cellulose in the near future?

JB: Well, under our state law, just like in Canada and some other states, our hemp farmers will not be allowed to collect the flowers and leaves, and we will not be allowed to extract from them. I get people calling me all the time saying, 'I'm going to be a hemp farmer and grow CBD hemp.' Well, not Washington, because we'd have to first change the law.

In this state, under our research bill, if it is for topical use, ingestion or inhalation, only the seeds can be processed. There will be no extraction of cannabinoids, so there is not going to be CBD hemp — that's illegal in this state. It's illegal in Canada also, where hemp has been legal since 1998. They're trying like hell to change it and we'll be trying to change it too. But this forces our state to look at hemp as an oil, seed and fiber crop. Hemp CBD is a new thing that we did not see coming. It's only been in our face for about three years.

Hemp is an oil, seed and fiber crop. Cannabinoids should be extracted from a high-resin crop known as marijuana.

Hemp advocate Joy Beckerman snaps photos while visiting a state-licensed marijuana farm in Eastern Washington.

SunGrower: You have mentioned in the past that you dislike classifying hemp, or CBD specifically, as non-psychoactive. Can you explain?

JB: We see it all the time, the word 'non-psychoactive' when it comes to hemp. Or we say CBD is non-psychoactive. It's in the laws, the bills and the fancy-pants medical journals. But it's inaccurate. Of course CBD is psychoactive, or it would not engage with the receptors for mood or euphoria or anything that would be effective for PTSD or any type of depression.

It's time to get folks to start saying 'non-intoxicating.' We need to try and move away from this inaccurate term that is straight-up incorrect.

SunGrower: Will we ever see hemp used as a building material or textile on a commercial scale here in the U.S.?

JB: Absolutely. It will probably not be in the form of hempcrete, although prefabricated hempcrete will help on a commercial level. But more, we think we will see it applied to 3-D printing on a commercial level.

It's such a great aggregate. People put rocks and wood pellets in cement just to fill it up and make it strong. Hemp is a fantastic bio-aggregate and blender for building materials. ■

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Story by ERIC HISS *Photos by* JOHN JANOVEC

First Line of Defense

Can 'living soils' provide a solution to over-abundant pesticide use?

Jason D. Wells (right), a horticulture consultant for CannaGrow Holdings, oversees construction of the company's greenhouse in Colorado.

Arguably the biggest buzz within the cannabis industry has nothing to do with the latest high-potency strain, but how to wrangle with the toxic issue of pesticide-related recalls. There have been more than two dozen statewide recalls in Colorado this year, not including recalls initiated by the city of Denver. Washington has also had problems with pesticides, which will likely continue to be a trend with the state's recent overhaul of the unregulated medical program.

Murky, still-evolving regulations, lack of proper pesticide testing, the hindrance of outdated federal laws and limited knowledge of correct application protocol all play into the issue. Then there is a problematic element of outliers in the industry who knowingly use unsafe pesticides in the pursuit of higher yields and profits.

With so many facets to the problem, it's clear the issue will not be resolved overnight. But according to one industry veteran, there's no reason to go into the bunker mentality of government versus grower.

THE LIVING SOILS SOLUTION

John P. Janovec, Ph.D., a licensed grower and consultant in Colorado, believes one part of the solution is right under our feet — literally. Janovec says implementing probiotic soil regimens can buffer and sustain the natural chemical defense systems present in all plants, including cannabis. This would allow the industry to simultaneously foster healthy, clean yields and keep authorities out of the equation by greatly reducing or eliminating the use of applied chemicals altogether, he says.

In addition to being the chief operations officer of CannaGrow Holdings, Janovec is also a published academic, explorer and bot-

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MILLER SOILS

John Janovec spent 15 years classifying rainforest plants in Peru.

anist who spent the last 15 years in the Peruvian Amazon classifying rainforest plants and cultivating an experimental Amazonian plant nursery for the commercial market.

Janovec's botanical explorations included extended treks through vast, dense wilderness with his business associate, Jason D. Wells, now a CannaGrow horticultural consultant. They're now bringing to the cannabis industry an approach deeply embedded in plant science. But what they've found is a culture of misinformed growers using practices like overzealous pesticide and chemical nutrient applications. They believe these techniques could be alleviated by a more thorough scientific approach to underlying issues.

To help the industry turn the troubling trend around, Janovec says he and Wells have been advocating for an organic, science-based solution called "living soil."

Janovec defines living soil as a growing medium that integrates organic ingredients such as peat moss and seasoned compost with vegetable and rock mineral amendments. This provides a perpetual, slow-release mechanism of the essential macro and micro nutrients required by plants for optimal growth and metabolism. As he puts it, "What we're striving for is a truly living soil that integrates all the fungi, bacteria, protozoa, nematodes, arthropods and other organisms that enable a whole biotic ecosystem that maximizes plant nutrition, and thus plant health."

This makes grow operations that use living soil authentically organic, but since that term cannot be applied to cannabis because of federal restrictions, Janovec refers to them as probiotic.

BUSINESS APPLICATIONS

Janovec says living soils optimize the interaction between plant roots and microorganisms, such as beneficial fungi that act as bridges for transporting nutrients or making nutrients available for plant uptake.

By contrast, over the past two decades he has observed canna-

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Janovec's extensive study of plant science has made him a proponent of probiotic soils. Below: Wells mixes a fresh batch of soil.

bis growers dosing plants with chemical fertilizers and nutrients in the form of pellets, powder or liquid concentrates without truly understanding what these nutrients do.

"The result is that you have growers now who are only managing disease," Janovec says. "There's no efficiency and people are not succeeding because they're pushing the plant past its genetic and ecological limitations while trying to stay within regulatory boundaries."

Instead of the "fast and furious" chemical model, Janovec says living soils reduce losses caused by pests by simultaneously improving both plant and soil health as part of one healthy ecosystem.

"The bottom line is that a plant's natural chemical defense system is 100% dependent on the effective integration of atmospheric elements like oxygen and carbon with mineral macro- and micronutrients," he says. "The plant must have all of these essential building blocks to stay ahead of pests, especially arthropods and fungi in the case of cannabis."

To implement a living soils regimen, Janovec suggests using the following products and equipment:

- A pre-mixed base or do-it-yourself soil-based grow medium that combines organic matter (seasoned compost, humus, etc.), amendments (kelp meal, rock minerals, etc.) and inert materials for aeration (lava rock pebbles, rice hulls, etc.).
- Equipment and tools to handle soil-based grow media.
- A long-term top-dressing program of growing media with mixtures of organic nutrients and minerals, as well as additional organic and inert materials as soil components break down and decrease in volume in the bed or container.
- A set of analytical tools for testing and monitoring pH levels and other characteristics of soils, such as salt levels.

INCORPORATING BOKASHI

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Over the summer, Janovec was appointed administrator of CannaGrow's Buffalo Ranch Project.

Denver-based Innovative Organics, a supplier of organic soil amendments such as worm castings, to provide some of the materials necessary to implement living soil grows. Innovative Organics founder Victor Restrepo left a career in finance to go deep into vermiculture, and has since developed a solid client base in the cannabis industry. But he has also upgraded the organic soils paradigm by borrowing from a method developed in Japan — bokashi — which creates another critical component of the organic soils practice by naturally speeding up composting through fermentation.

Christian Raez, owner of Chronorado, a Denver-based medical marijuana dispensary and grow operation, has found a renewed passion for the business by utilizing bokashi. Within the last year, he has pivoted away from synthetics and sworn off chemicals.

"It all started when I had some compliance issues," he says. "My timers weren't feeding properly and things were getting complicated. I took some time off, did some research and after meeting Victor, decided to go the organic route."

During the learning period, he experienced some uneven results, but he asked a lot of questions and now enjoys what he considers sustainable success.

Prior to focusing on bokashi, Restrepo spent a year experimenting with traditional composting. He says it's obvious why so many in the industry refrain from the practice: "It's hard, dirty work that takes up a lot of space and can take nine months to yield usable compost," he says.

Bokashi, on the other hand, produces results in as little as one week. It essentially pickles pulverized vegetable and fruit waste in fermenting bins that are inoculated with beneficial bacteria while taking up a much smaller footprint.

As a medical dispensary owner, Raez feels a particular responsibility to do his part to keep his clients healthy.

"At the end of the day, I want to provide a quality product, especially if you're calling it medicine," he says. ■

by SUE VORENBERG

Buyer's Guide: Trimming Machines

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Greatland Ganja's first harvest awaits the blades of a Twister.

PHOTO BY CHEVELLE ABEL

There may never be a winner in the debate of hand trimming versus machine trimming, or wet trimming versus dry trimming — but in the growing world of consumer cannabis, there seems to be room for all varieties.

Deciding between those options generally comes down to where producers want to be on a store's shelves. Gourmet consumers who are willing to pay top dollar demand high-quality, hand-trimmed buds. But for the much larger percentage of everyday customers, the difference between hand trim and machine trim isn't nearly as important, says Brad Zusman, owner of Canna-Daddy's, one of the largest dispensaries in Portland, Oregon.

"There are several consumers in the market," Zusman says. "The connoisseur wants top-shelf, nice and tight, no trim left over, hand trim. But the average consumer, they're more interested in a deal or price break. They don't care as much about hand trimmed or machine trimmed."

Machine trimming can save a significant amount of money compared to paying a crew of hand trimmers, especially for large operations. For small, craft growers, the cost of hand-trimming may be worth it because it adds value to the shelf price of cannabis. However, as with any consumer product, the number of premium products that can be successful are always outnumbered by middle-of-the-road and budget brands. And the costs rise significantly for growers who have to process much larger amounts of flower more quickly.

Jim Mullen, co-owner of The Herbery, a three-store Washington chain, says hand trimming is mostly a niche, top-shelf phenomenon. The trimming quality of machines has improved significantly over the years to where it's considered "very close" to hand trimming, he says.

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An employee at Olympic Growers trims excess leaves from harvested flowers.

PHOTO BY KRISTEN ANGELO

"Tight trimming, whether it's hand or machine, that matters to people," Mullen says. "But there's also the value weed, where people understand it won't be trimmed well, but they like it anyway because of the price."

WET VS. DRY

Trimming machines have evolved quite a bit since they first started appearing about 15 years ago.

The first generation of machines were all wet trimmers, which use a vacuum to pull the buds down into a tumbler that trims off the sugar leaf.

Trimpro, one of the first trimming machine companies, started out with a base unit that had a basic grate over a blade on a motor. The blade has flaps that pull buds toward the motor, and the blades clip off wet leaves when the buds are sucked onto the grate.

"It creates a soft downdraft to coax leaves down onto the grate slots," says Laurent Saint-Jacques, a sales rep for the Canadian company. "Then the blades chop off excess leaves, and the trimmed buds stay on top of the grate."

Trimpro now manufactures more than a dozen varieties of trimming machines, ranging from small units all the way up to large-scale industrial machines, in addition to the new Trimpro Bucker, which was designed to facilitate the removal of flowers from the stem. However, the base unit remains basically the same as the original, Saint-Jacques says.

"With a wet trimmer, the moisture content keeps the structure of the flower, so you're not breaking down the context of it," he says. "That makes the buds look very nice."

One major advantage of wet trimmers is that they save space — especially for large farms that don't have room to hang-dry their buds before processing them. With wet trimmers, farms can trim immediately after harvest.

All machine trimmers cause a bit of damage to the buds, and shake off more of the trichomes than hand trimming does. But for THC content, which is what most consumers care about, the loss is generally a fraction of a percent, Saint-Jacques says.

"I wouldn't say it's completely unaffected, but the loss is minimal."

For overall quality, many machines come within about 85-90% of the quality of a hand trim, he adds.

Dry trimmers are a more recent innovation, and they're considered a gentler method of removing sugar leaf from marijuana buds.

In dry trimming, growers hang-dry their plants before using the machine, which causes the sugar leaf to curl around the bud flower.

With dry trimmers, buds are dried to about 8-10% moisture, then the stems are removed and the buds are packed into a machine that lightly tumbles them, breaking the dried sugar leaf off

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Many growers prefer dry trimming, provided they have enough space to properly cure harvested buds.

PHOTO BY GARY DELP

and funneling it out using an air current.

Some people claim that wet trimming changes the smell of the final product, giving it an odor of hay, rather than fine cannabis.

Tim Cullen, owner of Colorado Harvest Company, disagrees.

He hasn't noticed a significant difference in smell between wet trimming and dry trimming. He says the scent is based on the flower itself and comes out more in the curing process.

"I think the scent is related more to the genetics," he says. "Although wet buds in a machine do shake some trichomes loose. But the scent, most of that is in the bud itself."

"If people have drying room capabilities to cut plants and hang them quickly, I don't think there's anybody who would continue with wet trimming," says Leslie Peeples, Washington sales manager for GreenBroz.

Another advantage of dry trimmers is that the low moisture tends to reduce the threat of microbial contamination, which can ruin an entire harvest.

"In wet trim, if there's bud mold, it gets mixed in with the wet material, and if you don't clean the machine properly, that can contaminate subsequent batches," Peeples says.

And with dry trimming, the excess trim material has a broader range of uses.

"That material, dry trim, can be bagged as shake and sold in trim bags, used for rolling or baking," she says. "It can also go straight into joints or cones — or you can extract the kief and dry sift or press it for rosin."

Wet trim is mostly used to make concentrates like oil or wax, but it's generally too wet to be used for those other functions. Dry trim can be used for all of those purposes and also to make oil or wax, Peeples says.

RENTING VS. BUYING

Baylee Sweet, co-owner of Harvest Helper, a trimmer rental and rent-to-own company in Olympia, Washington, says there's plenty of demand for both styles of machine trimmer at her shop.

"Wet trimmers, those are still used by large outdoor farms, although there's a bit more THC loss," Sweet says. "But the dry trimmers, really that's ideal. There's less chance of contamination and better quality."

For both types of trimmer, cleaning is a critical component, she says.

"One of the biggest threats to any farm is microbial contamination," Sweet says. "An advantage of dry trimmers is that they're easier to clean. Tumble-style wet trimmers, when those come back, they're trashed — they need to be power-washed and cleaned with a sanitary solution. Dry trimmers like GreenBroz, they're generally cleaned with an air compressor, a brush and a

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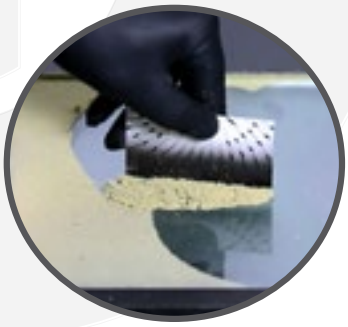

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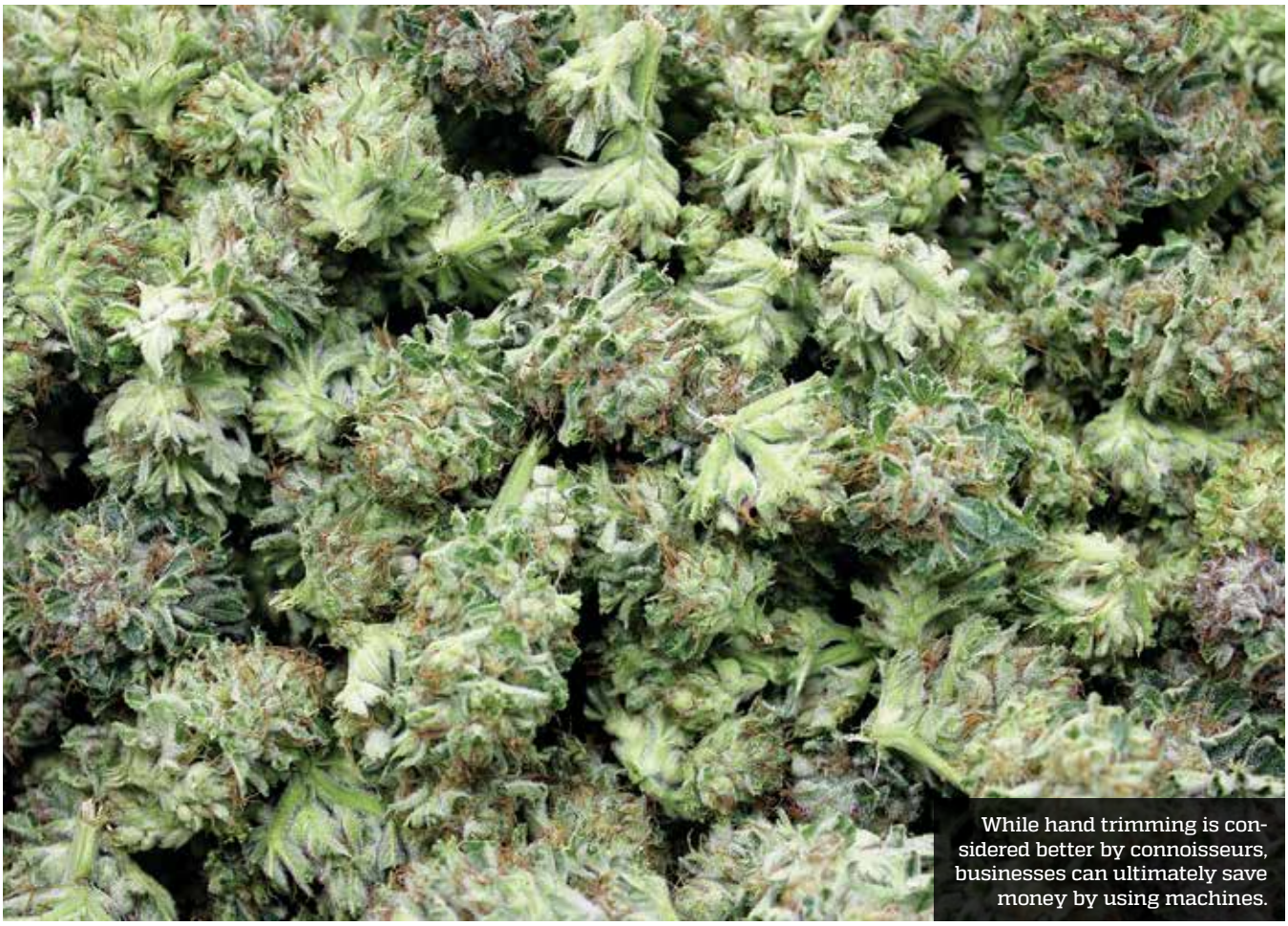

While hand trimming is considered better by connoisseurs, businesses can ultimately save money by using machines.

PHOTO BY CHEVELLE ABEL

food-grade sanitation solution."

The Maestro, a dry trimmer from Genuine Industries, actually has a built in cleaning system that can be used between flower batches at the push of a button.

"That way your next batch is protected from contamination by the previous batch," says Rudi Wiedemann, the company's chief operations officer. "And it also kills any of the smell from prior batches."

The Maestro also has a feature that allows operators to sift kief in three different grades, he says.

The result of wet trimming is a denser bud, which makes leaves easier to remove, but overall, Sweet says she sees more advantages to dry trimmers.

The advantage of a service like Harvest Helper is that farmers can try out a variety of trimmers before deciding to spend several thousand dollars on a model of their own. Small rentals through Harvest Helper cost about $295 a day for a machine that processes up to four pounds an hour. Larger machines that can process 10 to 14 pounds an hour cost $495 a day. But if growers end up buying the machine, Sweet discounts that rental cost from the end price, she says.

A MIXED APPROACH

Of course, farmers don't have to select just one option.

Cullen says he's developed a mixed method of trimming over the past several years that is ideal for his business.

"We actually landed on a hybrid method," he says. "We do wet trimming by hand, then we do a pass through in a wet-trim machine, and then we dry them for a week, cure them for seven days and touch it up by hand," Cullen says. "It really works pretty fast and we find we get good quality that way."

Cullen says his farm uses machines manufactured by Twister, which is capable of trimming .

Zusman has also used a mixed approach when trimming products for his store.

"When we were growing last year, we would hand-trim the tops (colas) and then run the mid and lower grade through the trimmer," Zusman says, adding that he prefers Trimpro models. "There are great machines out there now that make the buds look nice and fluffy."

Trimming the top colas by hand while machine processing the rest also lets stores sell different grades of cannabis from each plant.

In an ideal world, it would be great to be able to have all hand-trimmed product, but in the end that's just not feasible, Cullen adds.

"It really is just a balance of cost to quality of product," he says. "If we could pay hand-trimmers the same as it costs to trim with a machine, we'd love to do that. But we process more than 100 pounds of marijuana a month, and that's just not practical." ■

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by DAVID KUACK

From one flower to another

Ornamental expert addresses cannabis production from a traditional horticulture perspective

Fred Green grew cut flowers in Massachusetts for three decades before transitioning to cannabis consulting.

PHOTO BY NANCY PITNEY

Greenhouse production is the future of cannabis, says Fred Green of Fred Green Cannabis Consulting in Princeton, Massachusetts.

"It may take three, five or even 10 years, but based on the projects that I have worked on and what I know about the industry, it is economically unsustainable to build indoor warehouse cannabis facilities," Green says. "Because of the huge operating costs associated with these operations, I don't expect them to be able to continue.

"Right now the margins are great and the supply of cannabis is often limited. When I work on a project, I try to get the investors to think about what the conditions will be in five or 10 years. It is important that the facility they build today is efficient so they will still be profitable when others are forced out of business because they're no longer able to make money."

Green grew cut flowers in Massachusetts for more than 30 years, before selling his business in 2010. Two years later, Massachusetts legalized medical cannabis. Since then, he has consulted on the design and operation of warehouse and greenhouse production facilities in Massachusetts, Alaska, Colorado, Maryland, Washington, Canada and Australia.

"Many commercial cannabis growers started out as closet growers," Green says. "They know how to grow five, 10 or maybe 20 plants. But in the warehouse and greenhouse facilities that are now being constructed, production has increased to hundreds and even thousands of pots per week. From an ornamental plant perspective, a thousand plants per week for a greenhouse grower is nothing. Most cannabis growers are doing 400-500 pots per week. That is a huge stretch for someone who has only grown five or 10 plants at a time."

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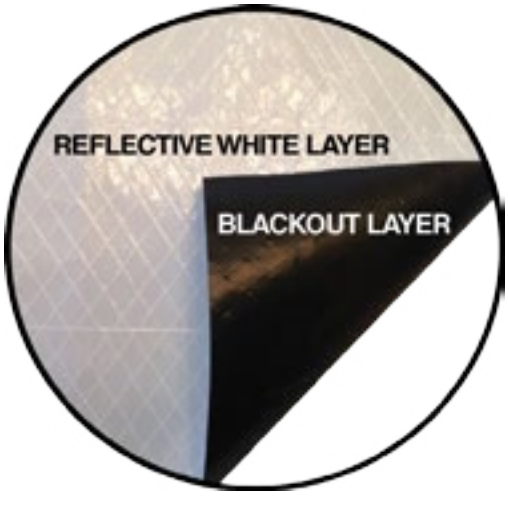

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Seven Hills Farms owner Roy Arms installs a screen on an exterior fan of his Eastern Washington greenhouse.

PHOTO BY GARY DELP

Green says growing cannabis is very similar to growing chrysanthemums, a cut flower crop he grew for many years, but proper humidity control is even more vital when growing cannabis.

THE PROPER ENVIRONMENT

Cannabis is highly susceptible to powdery mildew. It's one of the top concerns for growers, who also have to follow specific rules regarding pesticides and chemicals. Depending on state regulations, growers may be forced to destroy an entire crop if they're caught using an illegal pesticide.

"If the cannabis is being used for medicinal purposes, no contaminants of any kind are allowed," Green says. "There can be no residues from any kind of pesticide. When growing cannabis in a greenhouse, which is open to the outside environment, it is very difficult to ensure that the product is 100% pristine."

Green says humidity control is a major issue with greenhouse production. The problem is that there are very few cost-effective humidity control options, other than the standard methods of heating and ventilating. Fungicide options are also limited.

"In Colorado and other western states like Arizona, where it is so dry and there is low humidity, the greenhouses can use fan-and-pad cooling quite effectively," he says.

However, in states with higher humidity, Green eventually stopped using fan-and-pad cooling.

"The plants were too soft," he explains. "The pads add a tremendous amount of moisture and humidity to the air, so the plants didn't have to work as hard to pull the moisture out of the growing substrate. The plant's root system wasn't as big and the plants weren't as big. The plants didn't pull up as many nutrients."

Many facilities don't have adequate dehumidification or cooling to maintain the ideal growing environment.

"The lack of dehumidification comes from a lack of understanding by the HVAC engineers that when plants give off moisture into the air through transpiration, that process creates heat," Green says. "So a lot of these facilities don't have adequate cooling because the design engineer didn't take into account how much water the plants put into the air through transpiration and over what period of time."

Green says another environmental control issue with cannabis is temperature control. Although cannabis prefers warmer climates, there is a point where the heat begins to have a detrimental effect on the plants.

"When the temperatures start to go above 85 degrees Fahrenheit, it can impact the THC," Green says. "THC deteriorates

Electricity-conscious growers like Oregon-based Terra Mater are having success with LED lights.

PHOTO BY GARRETT RUDOLPH

rapidly under high temperatures. Like chrysanthemums, cannabis plants are very sensitive."

Another issue with warm temperatures is the potential for spider mites.

"This is usually more of a problem in the western states," Green says. "Spider mites like hot and dry conditions. In Massachusetts, which experiences high summer humidity, spider mites aren't usually a problem.

"Growers can use biological controls. … It depends on who is doing the testing and what the regulations are in a particular location," he says.

SUPPLEMENTAL LIGHTING

Green advocates for the use of LED lights for cannabis production.

"One of the reasons that cannabis growers have shied away from using LED lights is the poor-quality Chinese fixtures that have flooded the market over the last several years," he says. "These poor-quality LEDs have left a bad taste in the mouths of growers. But this is an indication of a bigger issue with some 'closet' cannabis growers who lack a scientific background and don't understand what makes a good LED. In some instances, they don't understand the difference between the light spectrum of high-pressure sodium and LED lamps."

Although LEDs are considerably more expensive than HPS lamps, Green says all of the growers he knows who have installed LEDs have received substantial financial rebates from their local utility company, making the energy-efficient fixtures more affordable. Green says one grower in the New England area received a rebate for 70% of the cost of his LEDs.

"In the northeastern U.S., where the availability of electricity is limited, there are electrical companies that have quotas to reduce the amount of electrical use," he says. "The issue is that there is not enough electrical power and it is so difficult to build new power plants. The older power plants that burn coal are being phased out for environmental reasons.

"The electrical companies are not only giving rebates on lights, but they are also offering rebates for high-efficiency chiller systems, rather than using the standard wall-mounted split system or rooftop units. The highly efficient chilled-water cooling systems are more cost-effective as well, and offer much better control than the roof units."

Green says LEDs are a logical way to reduce the need for expensive cooling systems.

"With LEDs, the lighting bill is 50% of what it would be with high-pressure sodium lamps," he says. "But an even bigger impact of

Scaling up to commercial sizes is one of the biggest challenges "closet" cannabis growers face.

PHOTO BY STEVEN CONLEY

installing LEDs is that the cost of the HVAC equipment is considerably lower, because the facility only requires half the cooling capacity."

But not all LED fixtures are ideal for greenhouses. Large panel LEDs create shadows and block sunlight from reaching the plants.

FUTURE OF GREENHOUSES

Green says the hardest part about working with people who are investing millions of dollars in cannabis production facilities is convincing them that there is a better way to grow marijuana. "Part of the cannabis grower community is very reticent to doing anything they didn't do in their closet or their basement," he says. "Some of the concepts that have been used for years in ornamental and vegetable production are so foreign to them. The biggest challenge for me is convincing people that I am helping them and not going to ruin their crop."

Because the legal cannabis industry is still very young, it's going to continue to develop rapidly as legalization progresses.

"Ten years from now I expect the cannabis industry will be producing plants from tissue culture, just like what is already happening in the commercial horticulture industry," he says. "There will be patented strains and growers will be paying royalties, but the strains will be far more productive so that paying a royalty is justified. Also, the strains grown in Colorado will be exactly the same as those grown in Massachusetts and Washington."

While most growers prefer "traditional" cannabis strains that are controlled by photoperiod, Green believes many greenhouse growers will shift their focus to autoflowering or day-length neutral varieties.

He says these strains reduce the need for light-deprivation curtains.

"These strains usually flower in nine weeks whether they are under long days or short days," he says. "But there are currently relatively few of those strains and most can't match the yield and potency of traditional strains.

"My prediction is that greenhouse production will be mostly autoflowering strains that will be used primarily for extraction. When oil is extracted from a cannabis plant, the extraction process eliminates and filters out the mildew, the insects, all of the contaminants so that what is left is 100% pure."

But the seismic shift will be when universities, either in the United States or Canada, gain full clearance to begin studying the cannabis plant. It might not be that far down the road that some of the top researchers in North America get the opportunity to identify the best growing conditions, nutrient regimens and lighting solutions. ■

David Kuack is a freelance technical writer in Fort Worth, Texas. He can be reached at dkuack@gmail.com.

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THE STORY OF APPLEGATE JANE

Oregon's legacy growers brace for change

Story by GARRETT RUDOLPH // *Photo by* TEYA JACOBI

Jane Fossen's passion is evident in her soothing voice, her calming demeanor and the surprising ferocity with which she defends Mother Nature.

For Fossen, it's not just about growing premium, all-natural cannabis. It's about a connection with the earth and a commitment to an organic lifestyle, and there may be no better place for that than Southern Oregon's Applegate Valley.

"Some of us consider it the best place on the planet to grow marijuana," she says.

Growers from the region have long touted its nearly magical terroir, created by clean air, long summers, excellent soil and some of the purest water you'll ever find.

"I also believe the diversity surrounding our gardens adds much to the overall vigor and improved terpene profiles," Fossen says.

Her garden is full of other plants and herbs, including Echinacea, mullein, calendula, lemon balm, star jasmine, sage, oregano, comfrey, spearmint, peppermint and a host of vegetables and native shrubs.

"This plant diversity draws in a variety of pollinators, improves the soil food web and may even effect the terpene profiles and other aspects by simply sharing space," she says.

And the area is teeming with wildlife, ranging from hummingbirds to eagles, deer and bears and all varieties of reptiles.

It's no wonder Fossen devotes so much energy to preserving the local environment. She doesn't use any toxic chemicals and doesn't trust the OMRI List. Instead, she utilizes essential oils and predatory mites for pest control, and her own compost of alpaca and chicken manure, lemon balm, cannabis stalks, sunflower and other natural components provide the necessary fertilizers. After all, she says, we can't afford to destroy the world we live in.

"Yes, it takes more effort to pull a few weeds by hand," she says, "but people need to stop being so lazy."

Fossen will never say she grows the best cannabis.

But, "A lot of old hippies say mine is their favorite," she says with a laugh.

When Oregon voters approved Measure 91 in the fall of 2014, thousands of entrepreneurs began drawing up their plans to cash in on the Green Rush. With licensing of marijuana retail stores expected to begin in October, many individuals look forward to a lifelong dream coming true.

But not everybody is looking to strike it rich with Oregon's most profitable crop. Many of the state's legacy growers, particularly in southern Oregon, are concerned that the emergence of the recreational market will spell the end of a way of life that began back in the 1970s with the back-to-the-land movement.

They feel they may eventually have to make a difficult decision: conform to the new regulatory model or retreat back underground.

Fossen is one such grower who is weighing her options, including the possibility of applying for a micro-canopy grow license. The proprietor of the Applegate Jane brand, Fossen has managed her medicinal garden for about 10 years. She would prefer to continue as a medical grower, which allows her to sell product to dispensaries as well as donate cannabis to patients for free and sell product to dispensaries.

To a certain degree, she sees the overhauled state regulations as a money grab from the state. Even though she says 75-80% of sales through medical dispensaries are for recreational use, government officials don't understand that many patients cannot afford the medicine they need.

"Canna-bigotry is alive and well," she says.

Upheaval in Oregon's medical market could have the unintended consequences of driving growers back into the black market.

For those like Fossen who have been deeply involved in the cannabis community for years, it's a time of uncertainty.

"I want to keep doing what I do," she says, "keeping the prayer in the medicine." ■

NEW FRONTIERS

With a background in growing fruit and medical marijuana, Mitch and Hank Evans are using all-natural growing techniques to minimize their environmental impact

Story by RACHEL CAVANAUGH // *Photos by* LEO YORK

Mount Adams looms in the distance beyond Frontier Farms in Hood River, Oregon.

The Evans brothers learned several vital lessons from their background in fruit agriculture.

Farming comes naturally to Mitch and Hank Evans.

The brothers grew up working on their parents' farms, tending to hundreds of acres of pears, apples, peaches, blueberries, cherries and other crops throughout the Columbia River Gorge.

With all of that experience, it wasn't a huge leap to use their skills as agriculturalists to launch Frontier Farms, a state-licensed cannabis farm in Hood River, Oregon.

"The farmer mindset is always looking for a new commodity to farm," Mitch says. "My dad definitely understands that mindset. That's the same mindset that has been passed down for generations.

"We have always been interested in cannabis, and have many years of experience as medical growers. When Oregon legalized cannabis for recreational use, we decided it was finally time to use a portion of our family's land for cannabis production."

Mitch says the marijuana industry allows them to carve out their own career path.

"There's more opportunity to enter into that market because it's a new thing," he says. "I think that was a big part of what made it attractive to us too. We don't have to go work for my dad. We could start our own business — that's a lot harder to do if you're growing vegetables.

"We are able to continue this legacy of being farmers, but with a new crop."

Both brothers say their background in agriculture has given them a major advantage over other growers. They've already learned hard lessons of business from farming other crops.

For example, farming peaches taught the Evans brothers not to let their personal preferences bear weight on decisions about what to plant. One year, they grew an unusual variety of peach that they agreed was absolutely delicious. It tasted so good they were certain it would be a profitable hit.

Yet, local stores didn't show any interest. Grocers simply wouldn't buy them. It turned out that it didn't matter how good the peaches tasted, or how much the brothers believed in the product. Without demand, the fruit was useless.

"The local stores had moved onto other varieties that people were asking for," Mitch says. "So instead of continuing (to farm) those be-

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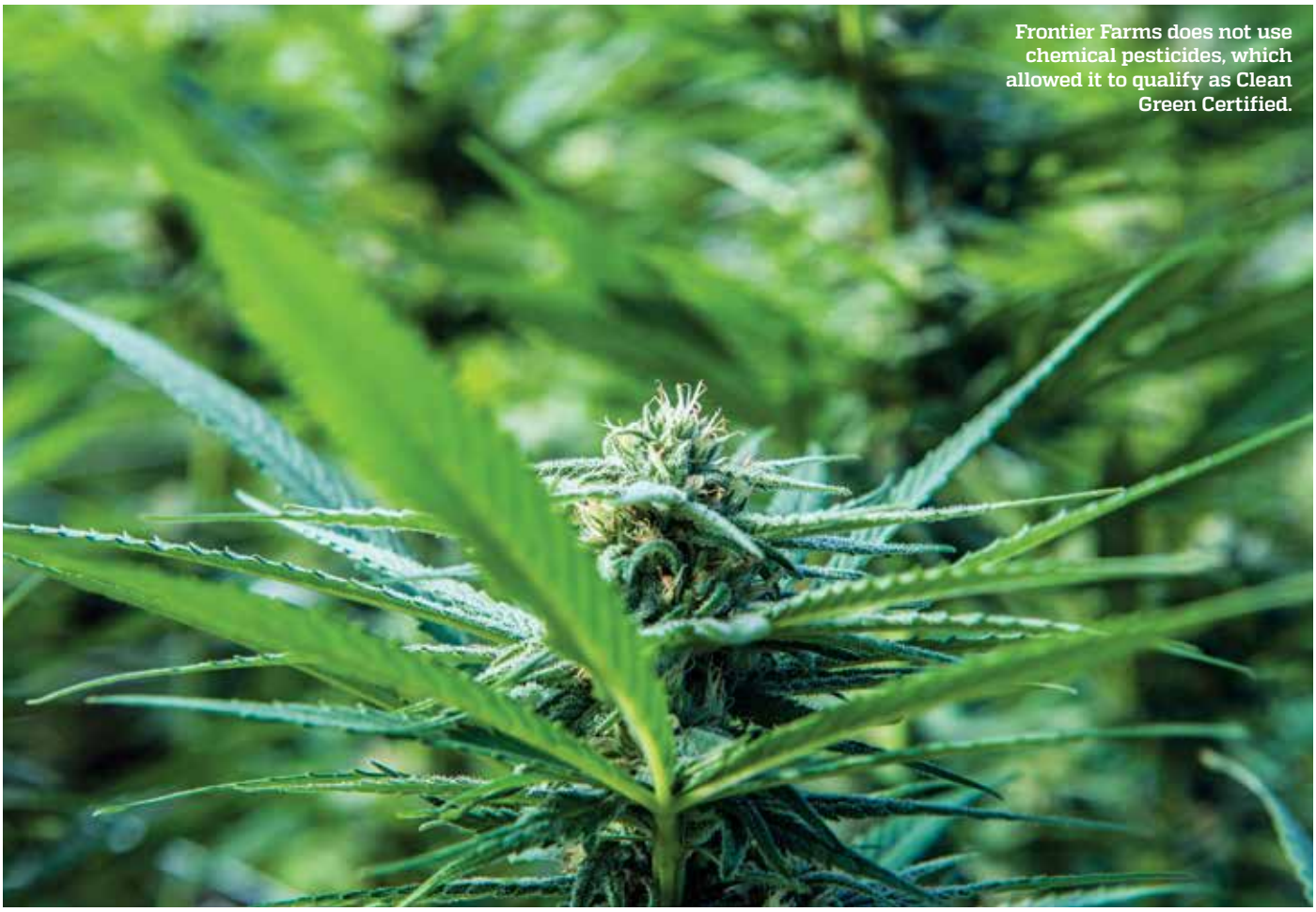
Frontier Farms' 21 greenhouses are surrounded by a dense forest of Douglas firs.



Frontier Farms does not use chemical pesticides, which allowed it to qualify as Clean Green Certified.

cause we liked them, we had to make the decision to remove them."

The producer doesn't create the demand, he says. The public does that and farmers have to be adaptable.

Now that they've switched over to cannabis, they evoke lessons like the peaches when they think about strains, marketing techniques and sales strategies.

"It helps us notice market characteristics and respond very quickly to them rather than telling ourselves, 'No, we're going to show everyone that this is the best variety we can be growing,'" Mitch says.

It's an insightful approach to a business that has been flooded with passionate growers trying to dictate consumer demand. From a business standpoint, the "best" product — whether it's peaches or cannabis — is far less valuable than the best-selling product.

Above all else, traditional agriculture taught the Evans brothers how to evolve.

They understand there's no such thing as a perfect formula in business. Companies always have to be changing to keep pace with the demand, Mitch says.

"We know that the first few years are going to be different than five or 10 years down the road as far as what the retail shops want, or what the customers want, so we plan to adapt as the industry evolves."

Although marijuana cannot be labeled "organic," Frontier Farms has been Clean Green Certified, a third-party inspection that verifies growers are following similar best practices required by the National Organic Program. The Evans brothers don't use any chemical fertilizers or pesticides on the plants. Instead, they use an integrated pest management program, incorporating predatory mites and other beneficial insects.

Additionally, they use organic soil amendments and compost to provide plants with the nutrients they need, Hank says.

"We also use compost teas to further inoculate our soil beds with beneficial microbes, which help cycle nutrients to promote faster growth and resistance to plant pathogens," he adds.

Mitch says the combined approaches are better for the environment and cleaner for the consumer.

The key to being successful at Clean Green farming, he says, is taking preventative measures.

"That's what's important with organic farming," Mitch says. "You want to prevent it because if you try to treat it after it's there, it's not like you're spraying some powerful chemical pesticides on it. It's already too late if you have an outbreak."

Knowing your plants is the key, he explains. This is another takeaway from traditional farming.

For example, it's rare for the average farm to have an unknown pest arise.

"You know what you're vulnerable to, so you make the plan before it's there to stay on top of things," Mitch says.

Frontier Farms uses light-deprivation greenhouses to utilize the full spectrum of sunlight, while protecting the plants from the elements. The result is cannabis with a greater terpene profile, and a

The Evans brothers believe greenhouses are the future of cannabis production.

Well-pruned plants allow better airflow to reduce the potential for mold and mildew.

smaller carbon footprint than indoor-grown cannabis, Hank says.

Prior to starting the farm this spring, the brothers grew medical marijuana for about 15 years. Now that they've scaled up their operation with the legalization of recreational cannabis, they're focusing on perfecting their craft.

Because the greenhouses don't use supplemental lighting, the Tier 2 farm is allowed up to 40,000 square feet of canopy. Frontier Farms employs 16 year-round workers. During harvest season, its workforce will double.

Although Mitch calls this "high-intensity farming," he says they make sure each plant receives the same level of attention as if they were only growing a small handful of plants. "Every day you can find many staff members pruning and caring for each plant individually," Mitch says. "Pruning the right way not only gives the plant the energy it needs to develop great flowers, but it also creates the airflow needed to reduce the likelihood of pests, molds and mildew."

Frontier Farms' location, combined with its dedication to eco-friendly practices, has an impact on the flavor, the Evans brothers say.

"We've had the water tested and it's probably some of the purest water in the world," Mitch says. "It basically comes passively down the mountain from Mount Hood, which I think is gonna show in the finished product of the cannabis we're growing. The better the water is, the cleaner and better the cannabis can turn out."

Hank agrees.

"We're growing the plant to the fullest without any residues of fertilizers or anything like that," he says.

They've got a variety of strains to suit consumers' preferences.

"Some are super-high THC strains," Hank says. "We have indicas, sativas, hybrids. We have strains that have really interesting flavors."

Hank believes the terpene content of organically-grown cannabis brings out nuances in the flavor and smell of the finished product. But more importantly, it results in a cleaner carbon footprint, making it both eco-friendly and smart business.

"I think the way we're doing it is kind of the future of the industry," Mitch says. "We have a product that's superior to outdoor-grown weed, because it's protected from the elements, but we're able to do it much cheaper." ■

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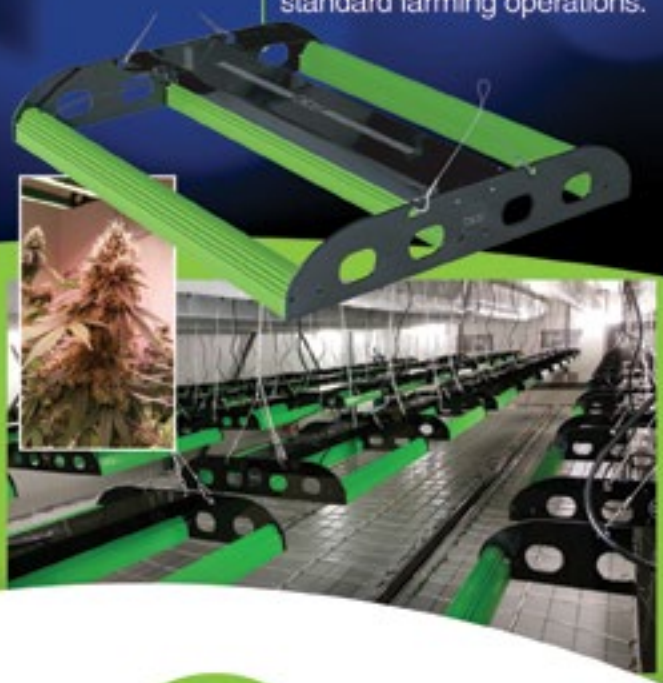

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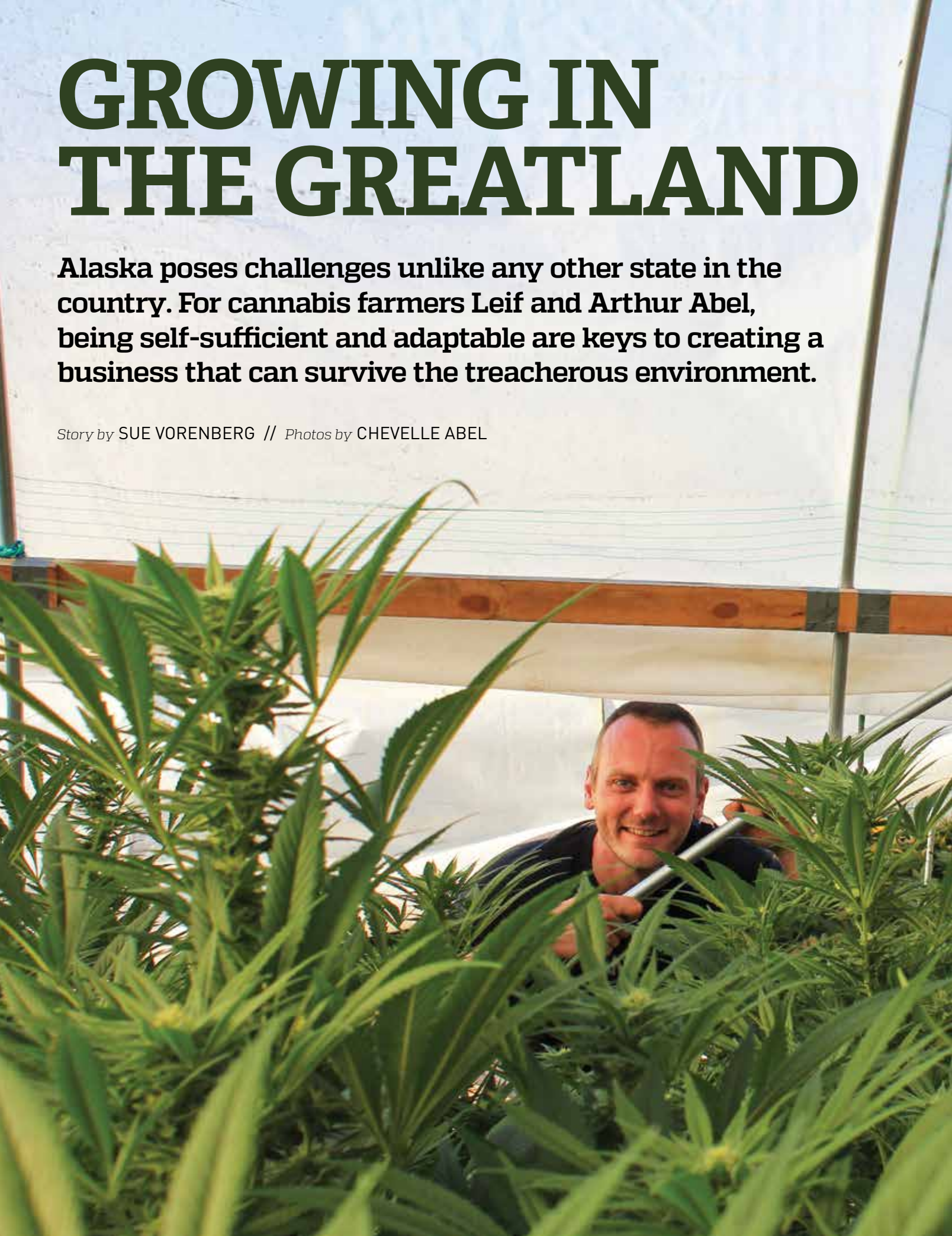
A drone photo by Chase Windsor shows the layout of Frontier Farms' 21 greenhouses for cannabis production, surrounded by fruit orchards and Douglas firs.

GROWING IN THE GREATLAND

Alaska poses challenges unlike any other state in the country. For cannabis farmers Leif and Arthur Abel, being self-sufficient and adaptable are keys to creating a business that can survive the treacherous environment.

Story by SUE VORENBERG // *Photos by* CHEVELLE ABEL



Brothers Arthur (left) and Leif Abel were among the first licensed cannabis growers in Alaska.

Arthur Abel shows off the bounty of the company's first harvest. At right: Greatland Ganja's G13-Cheese cross performed beautifully in the Alaskan climate.

Growing up along the banks of the erratic and powerful Yukon River may have been the perfect training to launch one of Alaska's first licensed cannabis farms.

The river, which often flooded out crops and structures during its yearly cycle, taught brothers Leif and Arthur Abel how to manage chaos and be self-sufficient. The rugged setting also forced the Greatland Ganja co-owners to learn how to grow plants in a region where total darkness and extreme cold play a major role.

The Abel brothers learned to use every organic component available for farming.

"We're also builders. We both have construction backgrounds," Leif says. "In Alaska, we've had to learn to do a lot of things on our own."

Those skills were especially helpful when the pair built their first greenhouses in Kasilof, a small town on the Kenai Peninsula about three and a half hours south of Anchorage.

Buying supplies and receiving shipments on time are notoriously difficult in The Last Frontier; Abel says orders for greenhouses and other components often take several months to arrive.

"I have fans on order that are two months late," Leif says. "I also have street light parts on order for security — those are about three months late."

But for Greatland Ganja's first season, waiting for greenhouse parts simply wasn't an option if the company was going to harvest a sun-grown crop in 2016. So in the spring they built their first 4,800 square feet of greenhouse space by hand, creating long, narrow structures covered in a strong material that traps sunlight to allow more photosynthesis time.

"We made the whole thing ourselves," Leif says. "We didn't order anything except the covering. We bent the metal conduit ourselves. We built the structures ourselves. We learned how to do all this after building on the Yukon. And we plan to keep building out our farm in coming years."

Building the structure themselves also saved the brothers a good chunk of money.

"We actually built it from electric conduit and wiring we got from our local hardware store," Arthur says. "It was about a tenth

While some strains essentially stopped growing as soon as the temperature dropped below 50 degrees, others like the Northern Lights thrived.

of the price of a greenhouse out of a box, if you want to call it that."

The Alaska Marijuana Control Board approved the first cannabis licenses in early June. The process was complicated by licensing discussions between the state and the Kenai Peninsula Borough. Licenses were originally supposed to be issued in May, so the late start cut into the farm's planting season.

"It wasn't that the town was asking for anything unreasonable, it was just a slow process for the borough and the state to get things aligned," Arthur says.

The delay meant pushing back harvest times into the late August rainy season, which is when total darkness starts to creep over the landscape, Leif says.

"It may sound funny, but around here you want to harvest in early August," he says. "This year we had to plant a little late and harvest a few weeks into the rainy season. Delays like that can end up reducing your yield."

According to Leif, cannabis plants tend to grow about a third of their weight in the last two weeks before harvest, which makes it a challenge to keep the crop healthy once the rainy season starts.

During the sunny portion of the year in Alaska, growers have to pay special attention to controlling the light cycle. With days of 24-hour sunlight, it's easy to overheat your greenhouse and fry your plants.

"That's the trick — controlling the light cycle without overheating," Leif says. "In Alaska, when you have the good sunlight and temperatures, you have to darken your greenhouse efficiently."

Greatland Ganja uses Americover eight-mil reinforced white and black covers to control the light cycle.

The brothers also built a 2,300-square-foot metal-sided building for drying, curing, vegetation and mother plants. And they're working on a structure for indoor crops so they can grow and harvest year-round.

"We'll have a hydroponic setup indoors for winter crops, but we concentrated heavily on outdoors first because of the price point, and because we wanted to have a lower carbon footprint," Leif says.

The indoor part of the operation will balance out the farm so it can provide product in winter months, but summer sun-grown crops are much less expensive for consumers and for the farm.

"We basically get one shot at outdoor each year, because of the

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The Abel brothers use eight-mil plastic sheeting to protect its crops and provide the necessary light deprivation.

Greatland Ganja will supply some of the first products on the market when Alaskan retail stores open this winter.

short season," Leif says. "But June and July are so great for sunshine — it's 24 hours a day, and the plants just go crazy in that."

Eventually the Abels want to transition to more sturdy, double-walled greenhouses that will protect crops from inclement weather, and potentially allow them to harvest at least two sun-grown crops per year. But that's a project for further down the road, Leif says.

Greatland Ganja emphasizes the importance of using growing techniques that mirror organic standards as close as possible, despite the fact that state regulations prohibit cultivation facilities from labeling marijuana as organic.

The U.S. Department of Agriculture won't let cannabis companies use its Organic certification because the drug is still a Schedule I controlled substance according to the federal government. (Currently, there are no regulations against companies using an independent inspector, such as Clean Green Certified or Certified Kind, as long as the products are not labeled "organic." However, the Marijuana Control Board is the ultimate arbiter of what is acceptable, says Cynthia Franklin, director of the state Alcohol & Marijuana Control Office.)

The Abel brothers learned long ago about natural amendments they can use in the local environment to encourage plant growth.

"We use organic Alaska fish fertilizer, bone meal, shrimp and crab meal and other natural things," Leif says.

Greatland Ganja began harvesting its first strain about three weeks into August — a Critical Mass variety that pretty much shut down as soon as the temperature started to drop, Leif says. "We had a night in August where it got down to 48 degrees, and that just stopped that strain in its tracks," he says. "That said, it smells really good. I think people will like it."

A handful of other strains continued growing through the late August rains.

"It's been a challenge, but we're happy so far with our results," Leif says.

As the Abel brothers continue their buildout, they hope to eventually turn the site into a tourist destination. They plan to build a lodge and tasting area, and provide tours of the farm.

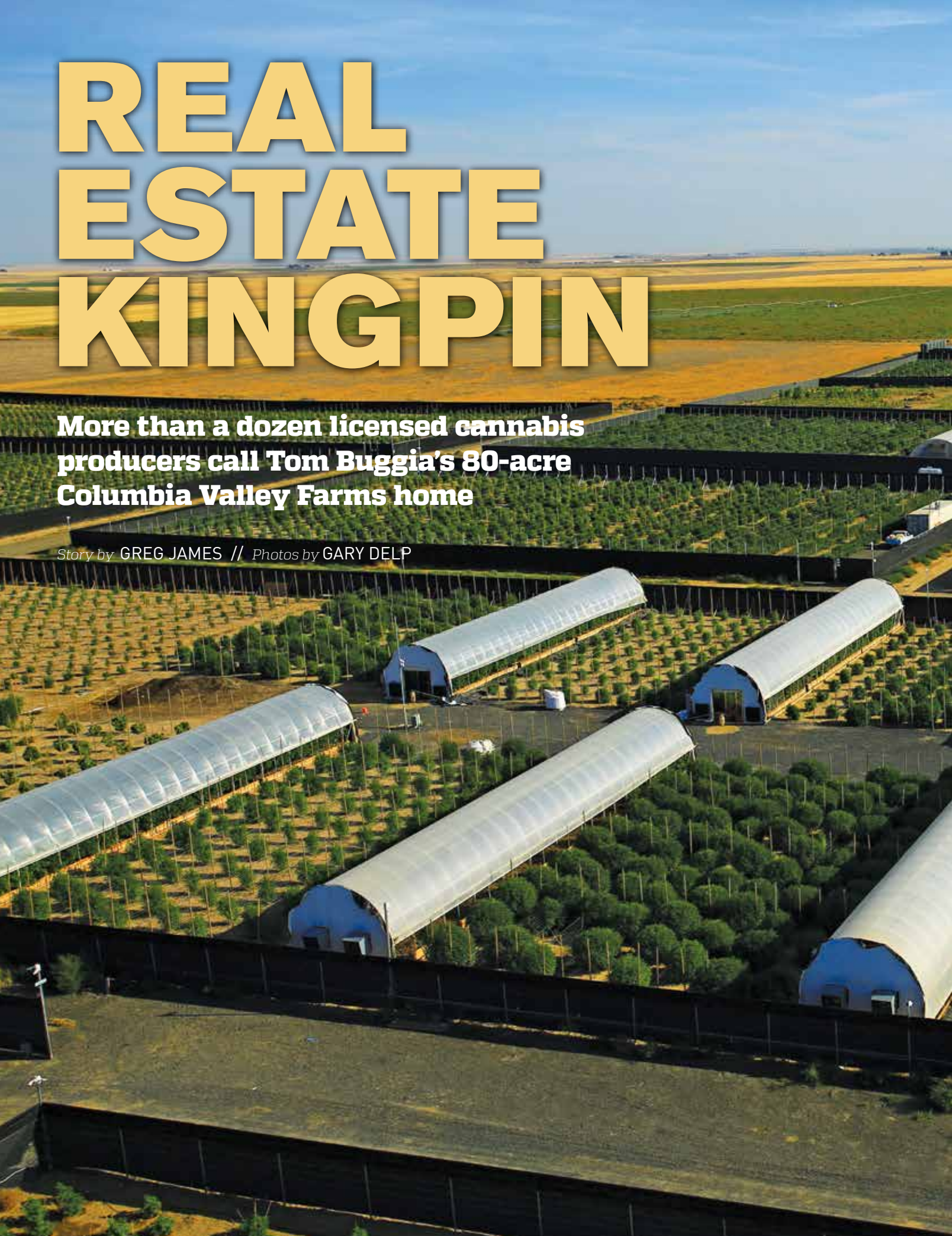
"A lot of folks come up here for fishing, hunting, canoeing," Leif says. "This would pair so well with that. We think it'll be great for tourists." ■

Arthur Abel (left) and his brother Leif have been builders and farmers in Alaska for years, which has instilled the ability to be adaptable to the challenging environment.

REAL ESTATE KINGPIN

More than a dozen licensed cannabis producers call Tom Buggia's 80-acre Columbia Valley Farms home

Story by GREG JAMES // *Photos by* GARY DELP



With 15 licensed businesses currently leasing plots at Columbia Valley Farms, Othello could be considered the marijuana capital of Washington.

Flor Carmon laughs while hand-rolling joints at Columbia Valley Farms.

Tom Buggia thinks big. When it was announced that Washington and Colorado were going to legalize recreational marijuana, Buggia immediately started thinking about how he could find his niche in the new market. Prior experience in business and farming told him that scale would play a decisive role in a business that could go in any number of directions.

After seeking advice from experienced agriculture professionals, Buggia started looking for a location that would work for an industrial-sized grow campus, where he could lease plots to licensed producers.

He surveyed many localities and weighed a number of important factors as he sought the ideal location: What was the local political climate like? How did the soil measure up? What other crops were grown nearby? What were the weather conditions? Would he be able to find experienced ag workers? What — if any — logistical problems were present? How far was the drive to major retail customers? In the end, after a lot of searching, Buggia purchased an 80-acre plot of agricultural land in the Columbia Basin, near the town of Othello, Washington.

Othello, which is also home to many ag businesses, is well-known for highly productive growing conditions. The soil is rich in minerals due to thousands of years of volcanic eruptions from the Cascade Mountains 100 miles to the west. While the area has particularly fertile soil, the arid conditions (averaging about nine inches of rain per year) prevented ag development until the completion of the Grand Coulee Dam in the 1940s, and a gigantic irrigation project paid for by the federal government in the '40s and '50s. Once the Columbia Basin was irrigated, it quickly turned into the second-most productive farmland in the U.S., behind California's Central Valley. Grapes, apples, onions, wheat, potatoes and peaches are just some of the local crops.

Tom Buggia sees being a landlord as a lucrative business plan within the cannabis industry.

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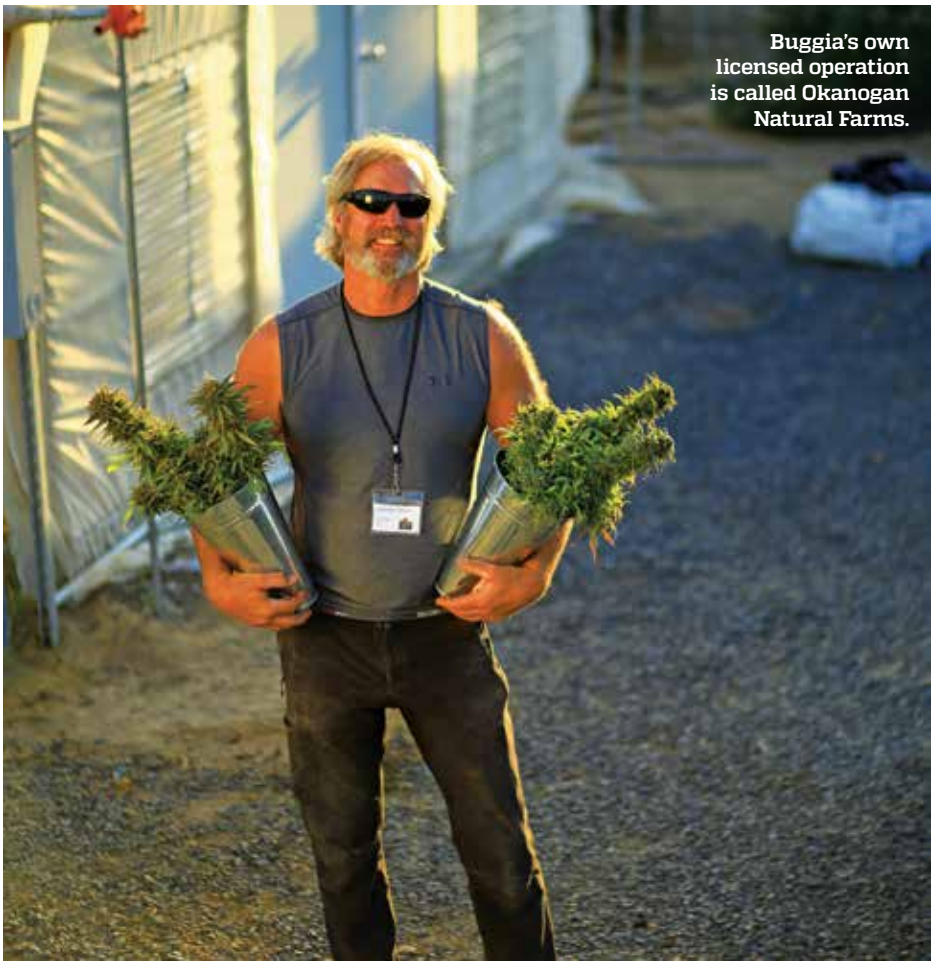
Buggia reckoned that Othello had it all: a largely welcoming attitude toward cannabis, good soil and water, plenty of sun and a great local labor force that was familiar with ag.

Buggia's parcel was in a prime location. His next move was to recruit growers who were interested in his vision and the relative safety and isolation offered by the proposed complex. That part of the plan proved to be fairly simple as many friends and associates looking to enter the business were also seeking a secure location to cultivate cannabis. Within a few weeks, Buggia had commitments from nearly a dozen growers, and Columbia Valley Farms rapidly filled up.

"I had no problem attracting growers because there were a lot of people looking for good locations, and not a lot of land that was well-suited for cannabis production or landlords willing to take the risk," Buggia says. "Furthermore, I discovered that a lot of people who wanted to grow cannabis also wanted to locate in a safe area with other farms nearby."

Columbia Valley Farms will soon feature 16 licensed producers with nearly half a million square feet of canopy.



Buggia's own licensed operation is called Okanogan Natural Farms.

The campus model with Buggia on-site providing security proved to be attractive for his tenants. He then hired several full-time experienced ag workers. In addition, he took on two real estate partners, Terry Lien and Marty Nelson, to expand the Othello complex. Lien and Nelson are experienced apartment and condo developers, and they recognized the potential for Buggia's business model. Their end-game was to provide a safe, secure plot of land for cannabis entrepreneurs who wanted to be close to like-minded business owners.

The complex began filling up in the spring of 2015, but it was a short year for the project. Buggia received his own grow license from the Washington Liquor and Cannabis Board late in the season, so his crop only achieved a fraction of its potential. Nevertheless, he was satisfied to have his grow up and running and a campus full of tenants who were thrilled to be in a great location and optimistic about the 2016 grow season.

With everything in place, Buggia and his enthusiastic real estate partners were able to get an early start in 2016.

The Columbia Valley Farms complex was full, with 13 Tier-3 licenses and a pair of Tier-2s. One more Tier-3 license is pending, which would bring the total available canopy to almost half a million square feet between the 16 businesses. Early estimates put total production at between 20,000 and 30,000 pounds.

In addition to the regular farm amenities like fences, racks and irrigation, the Columbia Valley Farms complex has eight greenhouses, 10 light-deprivation hoop houses and a dozen more planned. Buggia is a big proponent of greenhouses.

"With the addition of the eight full greenhouses, we will be able to produce quality flower all winter long, and for a very competitive price," he says.

While the greenhouses will be utilized for bud production, Buggia and his partners are even more thrilled about the potential they offer when it comes to planning and preparing for next year's spring planting.

"Greenhouses are great for winter production, but they also allow you to get a big jump on the spring planting season, because

Early forecasts indicate the entire grow complex could produce upwards of 30,000 pounds of cannabis.

you can have much larger and more robust starts ready to go in the ground in May or June," Nelson says. "We can start the spring cannabis plants as early as March, and have them three feet high by the time we're sure the last frost has passed."

Most of the tenants at Columbia Valley Farms are growing in native soil. Buggia's own farm, Okanogan Natural Farms, is no exception. However, as he explains, working with native soil is not without its challenges.

"The soil in Othello is rich, and well-suited for Cannabis. However, we've had to deal with a number of challenges, including gophers, voles and verticillium, just to name a few," he says.

The upside is that most of the locals have been dealing with pests for years, and they know how to combat the rodents and pests effectively.

"Because it's a center of ag production, we have a lot of resources and local knowledge at our disposal," Buggia says.

While most of the strains planted have done well, several have been standouts, including White Buffalo, Romulan and Snow Leopard. Buggia's personal favorite is White Buffalo, which has proven to be well-adapted to the local growing conditions. Other local favorites include Juicy Fruit, Girl Scout Cookies and Blue Dream.

When it comes to nutrients, the farm uses a line of JNS fertilizers that are priced for commercial application.

"We like JNS," Buggia says. "They are good people to work with, and have developed their line so that it's priced right for big producers who need commercial quantities."

Columbia Valley Farms, with its large number of tenants, is positioned to be a major producer in Washington's recreational marijuana market. With a relatively fluid business plan, low cost ag land and its location in Central Washington, the complex and its tenants are poised to produce thousands of pounds of top-quality flower, which would be just fine for a guy like Tom Buggia, who likes to think big. ■

AT A GLANCE: COLUMBIA VALLEY FARMS

Number of grow operations:
16 total.
Estimated total production in 2016:
In excess of 30,000 lbs
Number of employees:
7 full time, 80 seasonal.
Location:
Othello WA.
Number of retail partners:
30+

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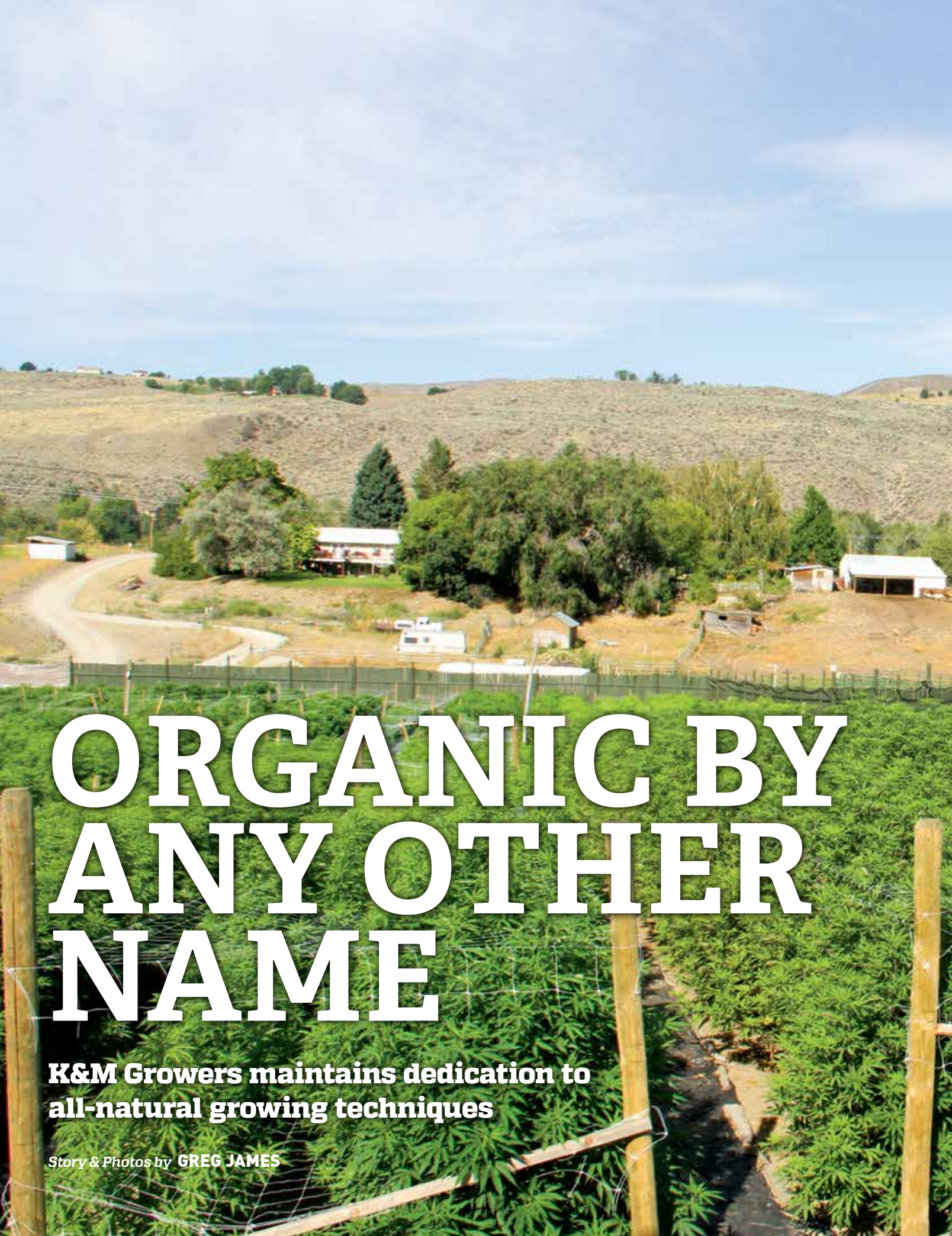
Greg Garza (right) uses a crank-handle to close the curtains on a light-dep hoop house, while Israel Rebuilta looks out from under the tarp.

Each producer on the campus is using a different combination of greenhouses, hoop houses and pure outdoor cultivation to grow their crops.



ORGANIC BY ANY OTHER NAME

K&M Growers maintains dedication to all-natural growing techniques

Story & Photos by **GREG JAMES**

K&M Growers uses an all-natural growing style not just for profitability, but also for the environmental impact.

Kim Harriman is the type of guy who quickly disarms you with his easy-going demeanor, big smile and willingness to talk about his passion. In Harriman's case, that passion is growing top-quality cannabis with a no-compromise commitment to being both profitable and environmentally friendly.

Ironically, the most profitable way to grow marijuana is also the most environmentally responsible method, he says. While this seems to be at odds with the way marijuana growers operated in the past, Harriman and his head grower, Andrew Wolf, aren't at a loss for words to explain why.

"When marijuana was illegal, it forced growers to cultivate indoors," Harriman says. "This, in turn, led to some pretty cool advances in CEA (controlled-environment agriculture) as it applied to cannabis.

"However, as is so often the case, advances in one area can lead to unforeseen challenges in another. A perfect example of this would be the proliferation of pests in a typical indoor grow. In other words, if you want to create the ideal environment for the production of marijuana and mites, a constant 70- to 80-degree indoor space with 18 hours of light a day would be it."

Harriman and his business partner Mike Wolf decided from the start that K&M Growers would mostly reject the prevailing trends in marijuana cultivation. Instead, they decided on a style of farming that mimics the way family farms have operated for decades. Their method is unabashedly good-old-fashioned, organic-oriented farming. In keeping with a family farming style, all major decisions are made by both partners and their family members. Visits to the farm in August and September revealed cannabis plants that were healthy, robust and obviously not lacking for care or attention.

So what exactly is the K&M secret?

Andrew Wolf is quick to deny a secret formula. He says cannabis is actually a fairly simple plant to grow.

"Give it good sun, good soil, good water and a well-balanced nutrient regimen, and cannabis will practically explode right in front of your eyes," Wolf explains.

Of course, he hides a good bit of humility in his statement, but it's easy to realize that Wolf is talking about basic farming knowledge, not the overly complicated techniques that are pushed by people trying to sell novice growers products and services that amount to overkill.

ORGANIC-STYLE FARMING

When asked why the emphasis on an organic, natural grow style was important, Wolf's matter-of-fact explanations make a lot of sense.

"From firsthand experience, we noticed a significant difference in taste and aroma from marijuana grown organically," he says. "Synthetically grown cannabis imparted a harsher smoke with a flavor not unlike the smell of the chemicals used to grow it. Organic marijuana tasted and smelled more floral, as you would expect from a flowering plant."

When pressed further, Wolf's passion for natural growing and his knowledge of plant science became obvious.

"There is a real beauty to organic growing and how it differs from industrial methods," he says. "Organic agriculture relies on a complex symbiotic relationship between plants and microorganisms in the soil. Plants cannot utilize nutrients in their organic form. Instead, bacteria, fungi and

Kim Harriman says prohibition forced marijuana growers indoors, but legalization has allowed farmers to grow cannabis like any other crop.

> “GIVE IT GOOD SUN, GOOD SOIL, GOOD WATER AND A WELL-BALANCED NUTRIENT REGIMEN, AND CANNABIS WILL PRACTICALLY EXPLODE RIGHT IN FRONT OF YOUR EYES.”

AT A GLANCE: K&M FARMS

Number of plants:
1,500
Number of strains:
15
Anticipated production:
1,200 to 1,500 pounds
Year-round employees:
10
Harvest season employees:
30
Top strains:
God Bud, OG Ringo, ATF

other microbes convert these unavailable nutrients into a form that can be used by the plant. The plant, in return, provides carbon to the microorganisms.”

Harriman and Wolf like the idea of farming in a style that benefits the very soil in which the plants grow.

“Plants and microbes have evolved over millions of years relying on interdependence,” Wolf says. “Chemical amendments — both fertilizers and pesticides — negate the relationship, and can sterilize the soil the plants are utilizing.”

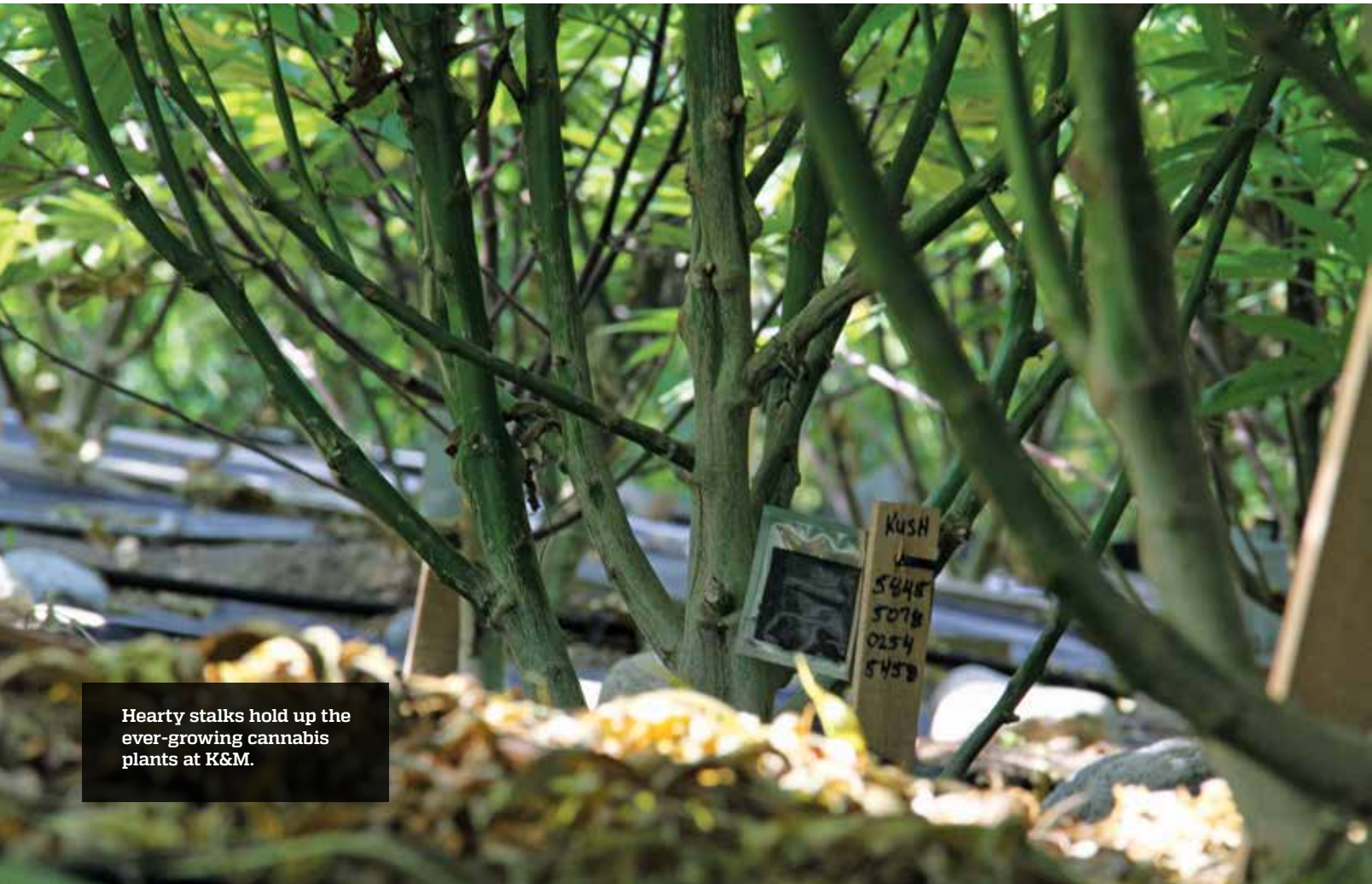
Wolf believes that growing cannabis with chemicals and synthetic fertilizers can have detrimental long-term effects on the plants themselves. He likens it to the way humans need probiotics for proper intestinal health. In Wolf’s view, chemical amendments are the antibiotics of agriculture. When used too liberally, they can have the same effect as antibiotics on mammals, leading to the creation of “super bugs” and increasingly dangerous pathogens.

NUTRIENT TEA

All plants require proper nutrients for healthy growth. At K&M, the belief is that the native soil has been around for thousands of years, and is well-suited for cannabis.

However, like all commercial farms, there is the desire to accelerate growth and help Mother Nature. To Harriman and Wolf, the best solution was to create an actively aerated compost tea (AACT) at the farm. While the term AACT might be relatively unknown in the emerging legal

Business partners Kim Harriman (left) and Mike Wolf talk shop on a hot August day at their Eastern Washington farm.



Hearty stalks hold up the ever-growing cannabis plants at K&M.

K&M's nutrient tea helps plants grow large and healthy.

A wasp searches for prey among the cannabis leaves and branches.

Simplicity by design, and a wasp at work

If high-tech indoor facilities brimming with the latest advances in CEA represent one end of the cultivation spectrum, then K&M surely represents the other.

Lacking features like light-deprivation hoop houses or even a basic greenhouse, K&M looks and feels like a facility that emphasizes growing a crop in a simple, natural environment.

As my August visit was winding down, a movement on one of the plants caught my eye: A closer look revealed a wasp busily working its way up and down a healthy OG Ringo plant. Wasps, which can elicit fear in some people, are voracious predators of caterpillars and many other plant pests. It was fascinating to watch the wasp as it worked its way around the plants. Its hunting technique was not unlike that of many land-based predators as it searched the surface area of exposed leaves and stems. In the end, it left empty-handed, and moved on to search for prey on other plants.

Kim Harriman and I watched the wasp for several fascinating minutes. To Harriman, it was just another day at the office. And the wasp was a perfect example of why the natural world can often provide the best helpers for a farmer.

— Greg James, publisher of SunGrower & Greenhouse

marijuana industry, the practice itself has been well-understood for many years in traditional organic farming. The same fairly simple principles and procedures apply.

Wolf explains how K&M creates its nutrient tea: "The process involves a basin of water that is constantly aerated by a pump. Various organic nutrients are placed within the basin along with the addition of compost. Compost, a by-product of decomposition, is rich in microorganisms that feed on nutrients placed in the basin. The microbes multiply over the course of a few days. This process creates a type of inoculant that can be spread into the soil. This brings both microorganisms and nutrients into the root zone, allowing the plants to thrive."

Wolf believes that a system using natural nutrients created by the AACT method is the best all-around way to cultivate marijuana while staying true to a less impactful farming style.

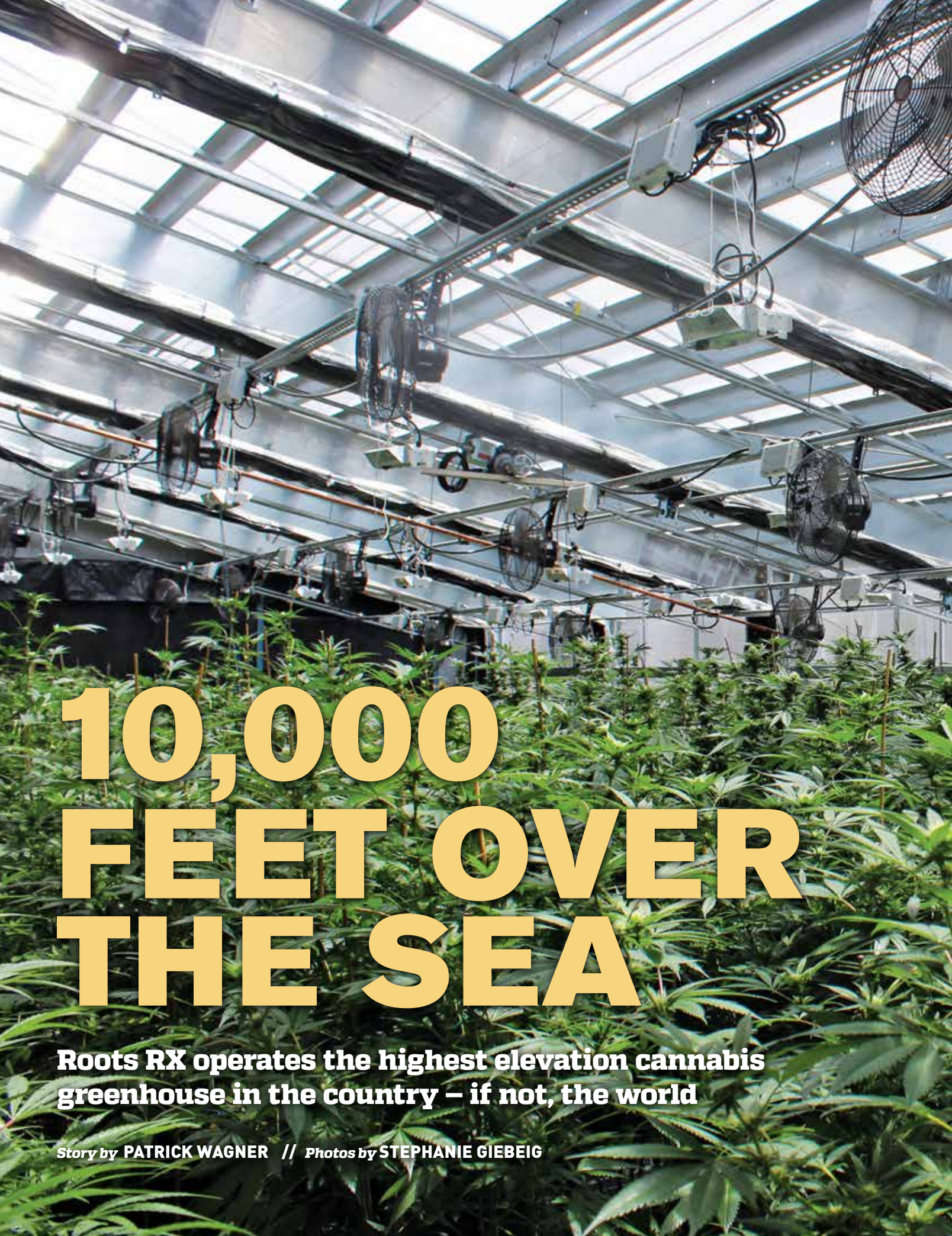
PROFIT POTENTIAL

With any new industry — think back to the early days of the Internet — many different models and business ideas will naturally emerge. Cannabis production is no exception.

Anyone who regularly visits many grow operations (as staff members of Marijuana Venture and SunGrower & Greenhouse do) will quickly note that there is no shortage of cultivation techniques. While one would expect plenty of variations at this early stage, it's staggering how many different ways marijuana is currently grown commercially. They range from state-of-the-art indoor hydroponic facilities that cost millions of dollars to simple outdoor plots fueled by little more than good soil and sunlight.

However, at this point, it's safe to say there is no clear path to profits. Most growers are learning as they go. When asked if he thought that growing organic could lead to higher prices and more profit, Wolf pauses and thinks for a minute.

"Perhaps organic marijuana will be more profitable when a uniform registration system is put into practice, like the USDA or OMRI," he says. "As of now, it's difficult to say with so many market forces involved. Advertising, marketing, packaging and consumer demand will all play a role. Regardless, we would still grow using organic methods just because we believe in it ourselves and think it's best for the planet." ■

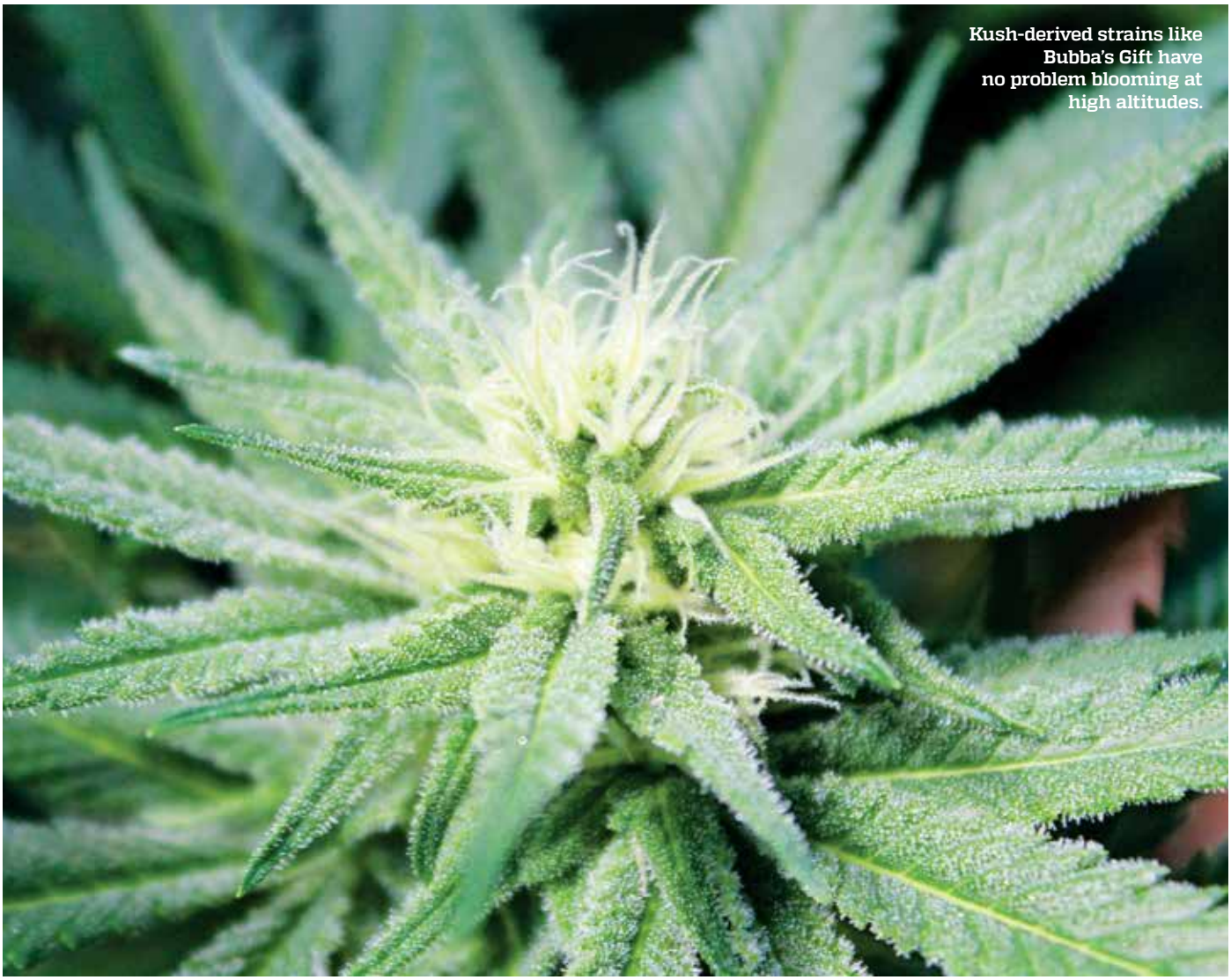


10,000 FEET OVER THE SEA

Roots RX operates the highest elevation cannabis greenhouse in the country – if not, the world

Story by PATRICK WAGNER // *Photos by* STEPHANIE GIEBEIG

Ironically, Roots Rx co-owner Pete Tramm says preventing the greenhouse from overheating has been a bigger challenge than keeping it warm.



Kush-derived strains like Bubba's Gift have no problem blooming at high altitudes.

At an elevation of 10,200 feet, Leadville, Colorado has been nicknamed "The Two-Mile-High City." It's the highest incorporated city in the United States, and quite possibly the last place one would expect to find sun-grown cannabis.

But with its innovative Ceres greenhouse, Roots Rx successfully supplies its five retail stores with cannabis grown high atop the Rocky Mountains.

Pete Tramm, co-owner of Roots Rx, believes the high-altitude environment provides the ideal proving grounds for his prototype greenhouse and somewhat radical agricultural theory.

"Much like the Kenyan long-distance runner we saw at the Olympics, training at 9,000 or 10,000 feet makes you a stronger runner," Tramm says. "We believe the same thing for plants, and from what we're seeing — and we've only been up here since March — that is true."

BENEFITS OF ELEVATION

Tramm hails from a long line of Eastern Washington ranchers dating back to the mid-1800s. His knowledge of commercial agriculture was one of the reasons he got involved in the cannabis industry when he moved to Colorado. Friends and neighbors who were aware of his farming experience began to regularly seeking his advice about growing cannabis.

When Amendment 64 legalized recreational marijuana in 2012, there were a lot of clueless growers because they didn't have commercial cultivation experience, Tramm says.

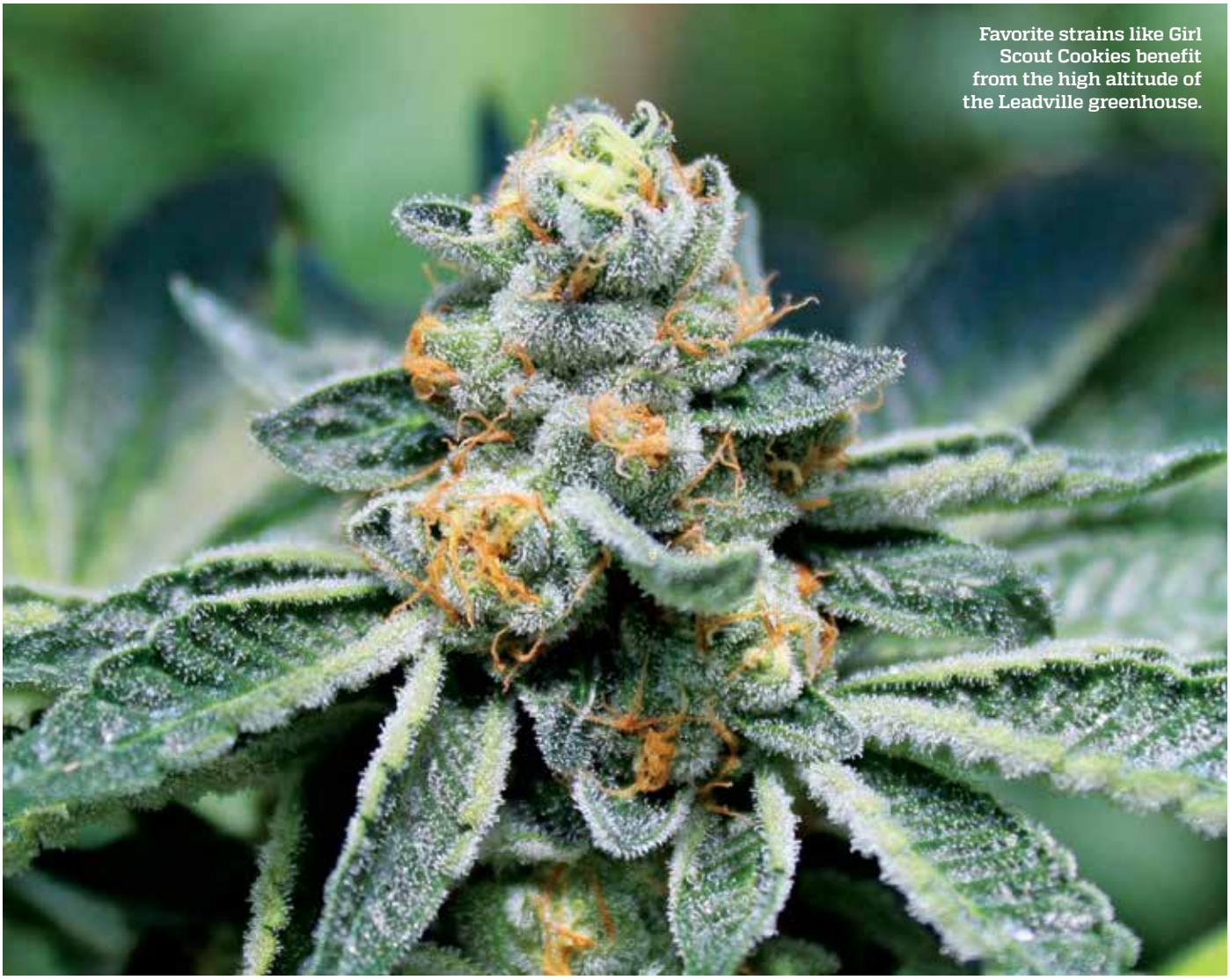
"So they're out there breaking their backs with a hoe to tend to eight plants," he says. "It made me ask myself, 'If these guys are making so much money, why aren't I?'"

Banking on his knowledge of commercial agriculture, RootsRx wanted to go a step beyond standard application for its grow operation. Firmly believing that there are both good and bad stresses for plants, the company built its greenhouse with the intention of pushing the plants to their limits. At 10,000 feet, the environment is certainly challenging.

The intensity of the sunlight increases exponentially, which can lead to serious hazards like snow blindness (photokeratitis). UV radiation increases by 4% for every 1,000 feet of elevation.

The oxygen gets so thin it's difficult to breath. The ambient CO_2

Tramm's knowledge of commercial agriculture gave him an advantage in Colorado's recreational cannabis market.



Favorite strains like Girl Scout Cookies benefit from the high altitude of the Leadville greenhouse.

rises with the elevation. For people, the environment can be dangerous if they're not careful.

"But if you think about it from a plant's point of view — those are things you want," Tramm says.

The thin air, intense sunlight, long winters and minimal vegetation have the added benefit of keeping pests at bay.

"We don't even have cockroaches, and they can survive a nuclear holocaust," Tramm jokes. "Do we still have pests? Sure we do. I'm pretty sure spider mites would survive on Mars. But do we encounter those things here? Not typically."

Not taking any chances, Roots Rx utilizes beneficial insects for pest control — "a full regime of predators," Tramm says — along with a Puradigm system to eliminate mold from the air.

HIGH-EFFICIENCY

Tramm says the primary reason for Roots Rx locating its 3,000-square-foot greenhouse in Leadville was the malleable foundation which allowed them to incorporate a geo-thermal air-conditioning system beneath the facility. The Ceres greenhouse employs an innovative ground-to-air heat transfer (GAHT) system that drastically reduces heating and cooling costs by utilizing the sun and soil.

Heat gathers at the northernmost tip of the greenhouse roof and is collected through an intake valve that funnels the hot air downward. The heated air travels eight feet below the greenhouse into an 18-inch perforated pipe where gravel siphons the heat and humidity from the air.

The ambient temperature of the ground beneath the greenhouse holds steady at a warm 55 degrees, warming cool air in the winter and cooling the hotter air in the summer. Air traveling below, through the spider web of crushed rocks surrounding the pipe, returns at or around the ideal temperature for the grow. Tramm says the system regularly mitigates differences up to 35 degrees from start to finish.

To accommodate the system, the north side of the greenhouse stands at 26 feet, more than three times the height of the southern end of the greenhouse. Only the roof and southern wall are translucent.

Tramm says Leadville's intense climate, geographic advantages and uniquely formed foundation provide the perfect testing lab for the greenhouse. The summer in Leadville is the only three-month period in the year where temperatures rise above freezing to an average of 75 degrees. During the first summer of operating the Roots Rx greenhouse, Tramm says there were a few problems with overheating.

From the Editors of *Marijuana Business Daily*™

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The increased light intensity and CO2 in the air at 10,200 feet elevation contribute to the vigorous growth of cannabis plants.

One of the growers at Roots Rx peers over the plants at the greenhouse.

Roots Rx has five retail stores, including one in Eagle-Vail (pictured above), and is in the process of building a sixth.

But during the harsh winter, he says the store of warm air beneath the greenhouse keeps the grow at a perfect temperature.

"At night we're not even using our heaters," he says. "If we do, they are literally on for 10-15 minutes at the most. So we didn't have any heating challenges at all, and again, we're in a subarctic environment."

Tramm's next plan is to build a larger greenhouse at the same location. At 12,000 square feet, the second greenhouse will be about four times the size of the current facility, and it will incorporate numerous revisions to the company's prototype. GAHT-powered greenhouses could prove to be an economical alternative to facilities that use traditional air conditioning. The energy-efficient facilities allow Roots Rx to produce cannabis at a fraction of the price other producers, particularly those growing in warehouses and paying a small fortune for lighting and HVAC.

The second greenhouse is slated to break ground during the summer of 2017.

Tramm says he wants to be sure all the quirks of the system are completely understood before he moves forward with the next build, because retrofitting the system isn't a viable option.

> "AT NIGHT WE ARE NOT EVEN USING OUR HEATERS, IF WE DO THEY ARE LITERALLY ON FOR 10-15 MINUTES AT THE MOST. SO WE DIDN'T HAVE ANY HEATING CHALLENGES AT ALL, AND AGAIN, WE'RE IN A SUB-ARCTIC ENVIRONMENT."

"I would suggest to people who're interested in doing this to be very mindful of trying to retrofit something eight feet under a concrete slab," he says.

SUPPLY CHAIN

Tramm hopes in the future the design can be implemented outside of the industry to produce food in extreme environments across the globe.

"You're going to be able to grow tomatoes in the Saudi desert," he says. "We will probably be able to share this for cannabis in the next year, year and a half. And across the board for food? I'd say in about four, five years."

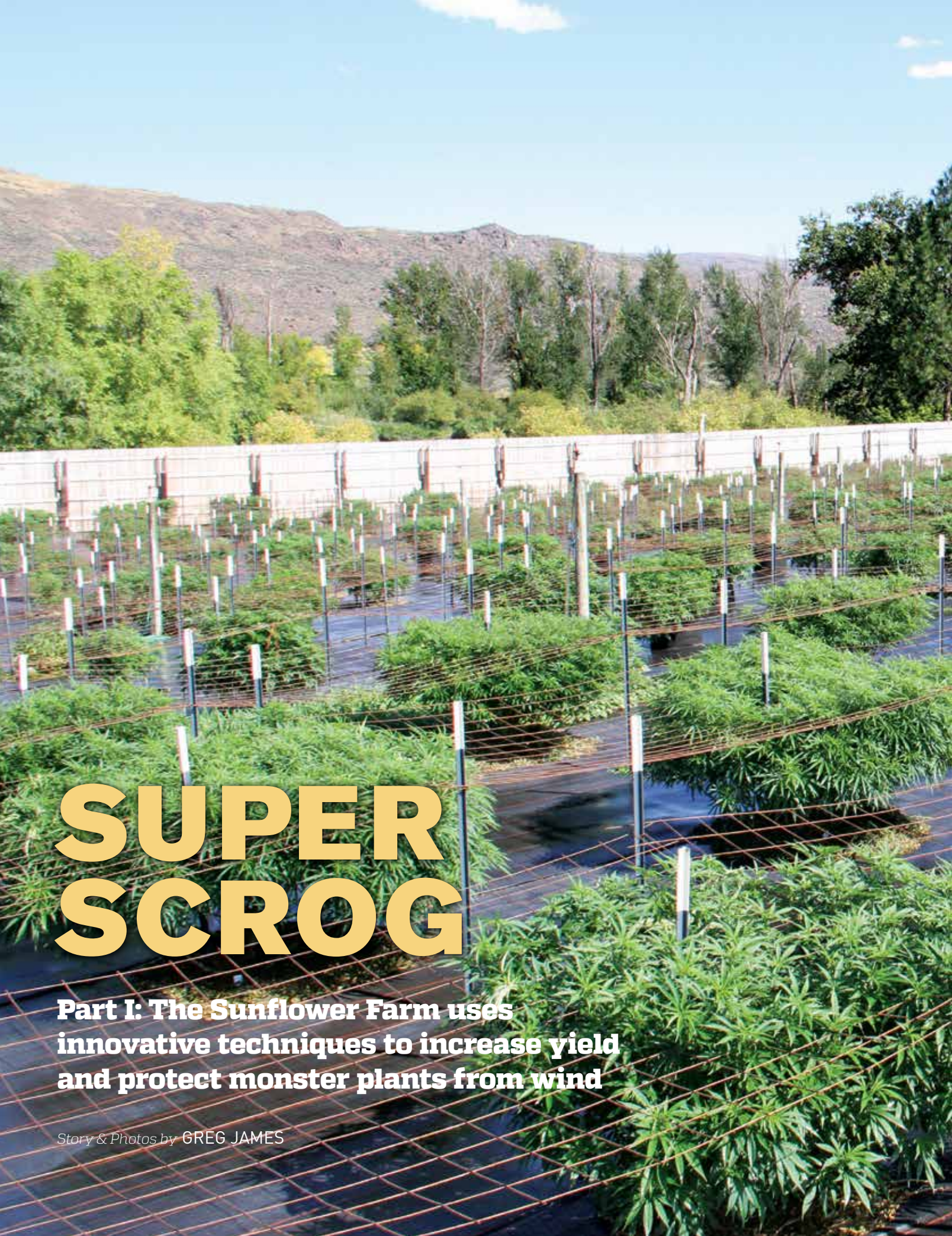
For now, the smaller greenhouse will keep the Roots Rx stores in Leadville, Eagle-Vail, Basalt, Aspen and Gunnison fully stocked with high-altitude cannabis. A sixth store is under construction in Edwards. Brittany Centifanto, a manager for the Basalt location, says about two-thirds of the flower available at the store comes from the Leadville greenhouse.

"At the Basalt location we get orders almost weekly," Centifanto says. "I would say that is pretty average for most of the locations, except for Leadville. They have the farm-to-table convenience."

Because the greenhouse sits so high in the Rocky Mountains, Tramm feels the best strains to cultivate are those that historically have been successful on other mountain ranges across the globe.

"People have been growing cannabis in the areas of Pashtun and Cashmere and Afghanistan for thousands of years, and they know that certain strains grow better at altitudes than others," he says. "We're finding that out as we go. Would we think to bring some of the more tropical strains to this altitude? We might, just to see, but our intuition tells us to stick with the Kushes and the Afghanis that we know translate to higher altitudes." ■

The prototype greenhouse serves as both a proof of concept and as a loose blueprint for the company's future grow facilities.



SUPER SCROG

Part I: The Sunflower Farm uses innovative techniques to increase yield and protect monster plants from wind

Story & Photos by GREG JAMES

The Sunflower Farm uses hard metal screens to create short wide plants, rather than the tall, bushy trees of most outdoor farms.

Terry Taylor would probably tell you he lives as close to paradise as you can get. His 30-acre farm and legal marijuana operation are located on the banks of the Okanogan River, 20 miles south of the county seat in north central Washington.

The river meanders down one of the longest glacial-carved valleys in North America, winding its way along fertile bottomland for more than a hundred miles from central British Columbia's Okanagan Lake to Washington state. It finishes its journey as a tributary of the mighty Columbia, the USA's second largest river by volume, six miles south of Terry's farm in the small community of Brewster, Washington.

Being a glacial-carved valley means the alluvial soils found along the river's bottomlands and flood plains are rich and perennially fertile. The nutrients have been continuously building up since the last ice age. Terry's acreage, which he named The Sunflower Farm, has one more valuable asset along with the rich soils: water rights.

Dating back almost a century, Terry's farmland has deeded water rights that are a priceless asset in the arid West. And being able to legally pump water directly from the Okanogan River is an asset Terry has used to great advantage when negotiating with other licensed growers who approach him about leasing land.

"I love it here, and to me this piece of property is about as good as it gets," he says. "However, the ace up my sleeve is the deeded water rights that guarantee me thousands of gallons of irrigation water a day. It's a really big plus to own them, and they ensure there is no way the government can cut me off."

In addition to the incredible natural beauty of the farm, which abuts some of the largest apple orchards in North America, the micro-climate along the river bottom is ideal for a sun-loving, short-day annual like cannabis. Before getting his Washington recreational grow license, Terry produced several crops of medical marijuana for dispensaries.

"With the combination of the deep rich soils, 300 days of sun and the warm river-bottom micro-clime, I was able to grow some really big cannabis plants that produced five to eight pounds of bud each," he says. "There are people who don't believe you can grow plants that big this far north, but we did it, and then did it again a year later."

DEVELOPING THE SCROG METHOD

If there is a downside to the Okanogan River Valley, it's the occasional wind. In 2012, one summer storm blew over many of Terry's eight-foot plants, causing a fair amount of crop damage.

"Even with stakes and supports, the fierce winds played havoc with my girls and forced me to rethink how I cultivate cannabis," Terry says.

Sometimes a setback can lead to improvements and innovation, and in this case, it caused something of a "eureka" moment for Terry.

"I was quite familiar with trellis netting and the benefits of stakes and various other support systems," he says. "I also knew that many plants, like grapes and tomatoes, thrive with a solid support structure. This got me thinking about a grow method I call SCROG (screen of green), which basically

The Okanogan Gold team, from left to right: Jason Norbut, Terry Taylor, Zachary Taylor and Chris Smith.

> WITH THE COMBINATION OF THE DEEP RICH SOILS, 300 DAYS OF SUN AND THE WARM RIVER-BOTTOM MICRO-CLIME, I WAS ABLE TO GROW SOME REALLY BIG CANNABIS PLANTS THAT PRODUCED FIVE TO EIGHT POUNDS OF BUD EACH.

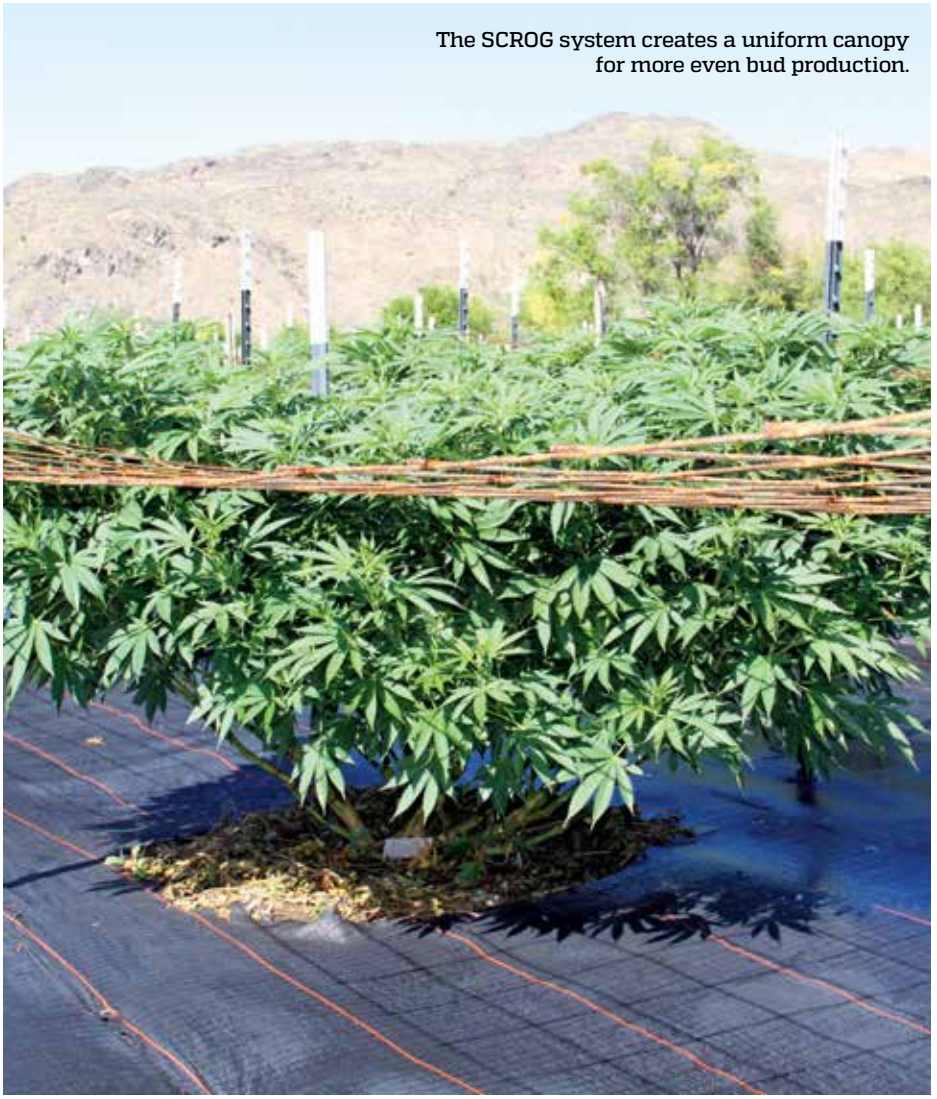
uses a horizontal metal screen about three feet above the plants.

"The basic idea is that we spread out the plant horizontally and fairly close to the ground. This decreases the wind's impact on the plant, gives it plenty of structural support, and also, most importantly, exposes a lot more area to direct sunlight."

According to Terry, the SCROG method can increase productivity by up to 30%. It leads to bigger, more uniform buds with less possibility of wind damage, he says.

Terry's 2016 crop was almost entirely com-

Sprinkler systems are set up on posts throughout the garden to make watering easy.



The SCROG system creates a uniform canopy for more even bud production.

posed of plants that were grown using the SCROG cultivation method. By early July, many of the hardy cannabis plants were already more than six feet wide, with base stems nearly as thick as a man's wrist. As the summer progressed, the plants filled out and eventually extended to 70 square feet of surface area each.

"SCROG is a fairly simple concept that trains the plants to spread out horizontally," Terry explains. "This, in turn, causes them to continuously grow from an ever-widening horizontal surface of roughly uniform height."

The end result is a carpet of choice colas that rise up from the screen in a visually impressive layer of easily cut and harvested bud. Following traditional agricultural thinking, the method becomes a smart way to create a crop that is uniform, easy to harvest and very manageable for a commercial cannabis operation.

OPTIMUM SOLAR ENERGY

Cannabis is classified as a short-day annual, meaning it grows during the long days of the spring and summer, and is triggered to flower by the lengthening of the night in the fall. What some readers may not realize is just how pronounced the difference in day length can be depending on latitude.

For example, on the longest day of the year — the summer solstice — at the latitude of Seattle, the day is 16 hours (Seattle and Brewster are at roughly the same latitude). In San Francisco, the day is 14 hours, 45 minutes, and further south in Los Angeles, the longest day is only 14 hours. In practical terms, this means plants receive two hours more sun at latitude 47 degrees north (Seattle) than they do at latitude 34 degrees north (LA). In addition, the more northern latitudes get a sharper reduction in day length as the long days of summer shorten and move toward fall.

Terry Taylor learned farming techniques from his grandparents, giving him the knowledge to grow without chemical fertilizers.

Taylor sees consolidation coming to Washington's cannabis industry.

Five questions with Terry Taylor:

1. Who was the biggest influence on you as a grower?

My grandparents on both sides of the family grew up farming, and always had large, beautiful gardens. I learned how to use marigolds and sunflowers instead of pesticides for bug protection. They also taught me about manure as fertilizer.

2. How much bud do you believe is theoretically possible from a cannabis plant in a northern state like Washington?

I believe that we will be producing plants with 10-12 pounds of bud per plant in good years.

3. Where do you see the industry going in the next few years?

In Washington, I see consolidation coming. Bigger players will absorb the smaller ones. We will follow the same path as the wine industry. Tourism will also become a huge part of the business.

4. Do you believe outdoor-grown marijuana can rival indoor in terms of quality?

There is good indoor and good outdoor. It's all about how it's grown, cured and marketed.

5. What is your least favorite element of the marijuana industry?

There still seems to be a lot of shady characters. Hopefully, in time, they will be 'weeded out,' and the whole industry will be better for it.

From a cultivator's standpoint, the longer days of the northern latitudes would seem to favor a short-day annual like cannabis. However, there are other factors that potentially offset this advantage, such as the angle of the sun. As the sun moves north toward the summer solstice, the angle at which it hits the earth decreases until it's directly overhead (90 degrees) at the Tropic of Cancer. In North America, this position lies just north of Cabo San Lucas in the Mexican state of Baja Sur on the West Coast. While the day is two hours shorter in LA on the summer solstice than it is in Seattle, the angle of the sun is more direct, and therefore contains more energy.

The second — and more important — factor that potentially offsets the advantages of longer days in northern latitudes is the length of time between potential frosts. On the U.S. Department of Agriculture website, this is referred to as the number of "frost-free days," which can vary greatly from location to location. For Brewster, there are about 140 days of frost-free days per year between mid-May and the end of October.

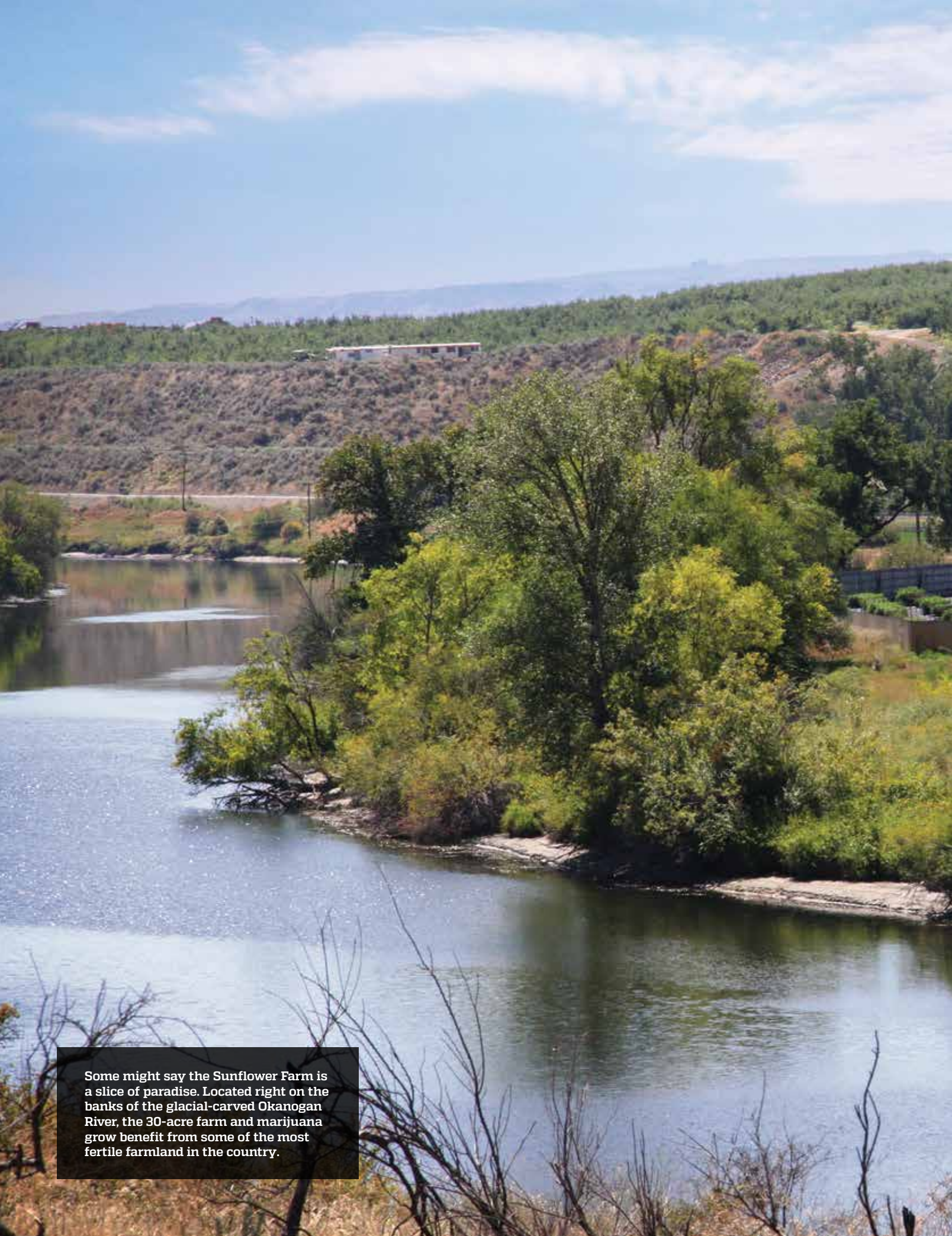
However, further south and lower in elevation is Redding, California, which has a 255-day frost-free season from mid-March to late November. In practical terms, this means that the worry-free growing season for an annual plant that's susceptible to frost is more than 100 days longer in Redding than Eastern Washington. Therefore, much bigger plants can be grown outdoors in northern California than Washington because of the longer growing season.

SCROG IN PRACTICE

All of the above may not mean much to casual growers, but to a serious commercial marijuana cultivator, it can be summed up thus: To maximize yield, minimize potential problems and create an easy-to-harvest crop — something all commercial growers should strive for — constant experimentation and refinement are the orders of the day.

SCROG is an innovative method in which the cultivator utilizes metal wire screens to expose the plants to more sun, which accelerates growth, while at the same time, mitigating the potentially negative effects of wind. ■

This is the first part of Super SCROG. Part two, which will look at the results of the SCROG method and Sunflower's 2016 harvest, will be featured in the Winter issue of SunGrower & Greenhouse.



Some might say the Sunflower Farm is a slice of paradise. Located right on the banks of the glacial-carved Okanogan River, the 30-acre farm and marijuana grow benefit from some of the most fertile farmland in the country.

by RICHARD FREEMAN

Container grow media can be risky business

A primer on commercial media for cannabis production

For a greenhouse operation, buying container media in bulk is a large investment that involves many risks, including media-borne pest infestations, unbalanced formulations, poorly mixed media, unstable compost and other factors that can lead to toxic root environments. Formulating and mixing a container media for cannabis plants involves several considerations, because the vigorous growth of cannabis demands significant resources and management.

Poorly-built container media can cause serious losses. Because high-value agronomy involves higher risks, growers must focus on minimizing losses from a variety of potential problems that a poor medium could introduce. Fast-growing plants require a high-quality medium to sustain growth and enable disease- and insect-resistance over a sustained period of eight to 14 weeks.

High-quality container media support vigorous plant growth while promoting plant health, increasing product quality and reducing opportunities for pests. In the case of a "super soil," the goal is to carry a plant through a production cycle without supplemental nutrients, while providing a healthy environment for seedlings early in the cycle — a difficult balance that is oftentimes not achievable.

Furthermore, a well-balanced medium will conserve water and nutrients, saving significantly on long-term labor and nutrient costs. A container media vendor should be able to prove the company's quality with verifiable testing and certifications.

BASIC FUNCTIONS

The container medium provides several support functions for the growing plant: (a) one of the main functions is structure — a good medium provides physical structures for root fixation, allowing the plant

to stand and grow vertically; (b) a container medium must provide large pores to allow for air-filled spaces (aeration) to avoid the development of anoxic and anaerobic conditions; (c) water-holding capacity is a key attribute of container media, which must provide enough small pores to hold water between container capacity and wilting point; (d) the medium must provide nutrients or surfaces with adsorption properties suitable to nutrient sorption; and (e) a high-quality container media provides a vigorous (though ephemeral) soil food web with active nutrient cycling and adequate resources to complete plant growth and function — including insect and disease resistance.

THE CONTAINER ENVIRONMENT

The container environment is a drastically simplified version of a natural soil ecosystem. Natural buffering systems are absent or highly constrained. Thus, the container environment is dynamic and fast-changing, and farmers must be aware of the environmental and nutritional indicators to avoid problems. Quality is crucial.

The container environment in which a medium functions is much more constrained and less buffered than a common field soil environment (unless the soil has been badly abused) in several ways, including:

- A key characteristic of container media is that it usually functions with a much lower pH level (acidity) than field soil. A container medium will operate at a pH level of 5 to 6.5, significantly lower on the pH scale than a typical field soil, which is between 6.5 and 7; this acidity is caused by inputs (for example sphagnum peat) and from the soil dynamics (several potential acidifying cycles). During the growing cycle, pH tends to plunge, often to dangerous levels. Low pH makes several metals available at toxic levels (including aluminum, manganese and iron).
- Plastic containers provide a much wetter environment, usually with a perched water table at the bottom of the container. (Cloth containers are less susceptible.) Thus, the danger of anoxic or anaerobic conditions is constant.
- Container environments lack the natural buffering systems (especially pH buffering) found in healthy field soils.
- Container soils are vulnerable to root disease contamination due to incomplete or absent soil food webs.

MATERIALS CONCERNS

As a rule, nutrient release, pH and other important characteristics vary drastically between sources, and sometimes even between batches from the same source. Variation is especially common in popular bulk media like coconut coir, sphagnum peat moss and compost.

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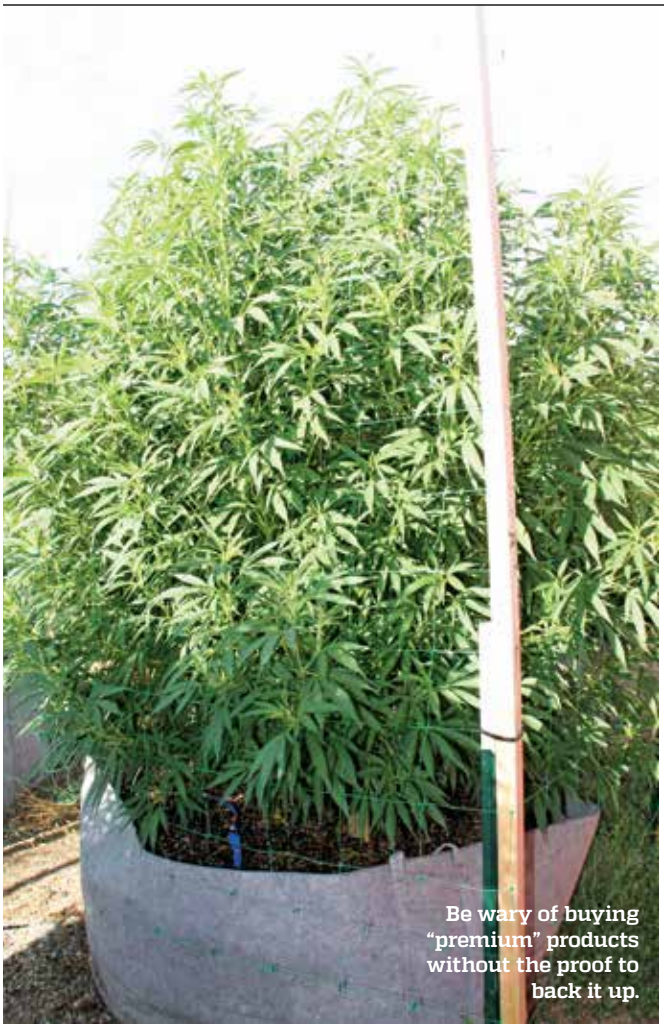

Be wary of buying "premium" products without the proof to back it up.

PHOTO BY GREG JAMES

High-quality, vegetation-based, mature compost is key to a good container medium. Poor-quality compost — which is common in commercial media — can cause serious problems ranging from nutritional lock-ups and overdoses, to adverse biological conditions and disease and arthropod infestation. Generally, commercial compost varies in almost every important detail: pH, carbon-to-nitrogen ratio, ammonium-to-nitrate ratio, nutrient content, micronutrient content, biological content and other parameters pertaining to maturity (stability) and available nutrient content. However, good compost is available, and a proficient composter can minimize these ranges with careful attention to detail.

Due to scarcity and lack of oversight, the majority of commercial compost is not suitable for container media. Farmers should be very careful about sourcing compost. When buying commercial media, farmers should ask for product specifications on the compost and ensure that these specifications are actually represented in the product. Vendors of high-quality compost will always provide lab tests for their product, and mixers or vendors of container media should be able to provide these tests with little effort.

FORMULATING CONTAINER MEDIA

When formulating container media, the formulator must select, balance and test materials in a number of ways. Balancing requires knowing the nutritional contributions, release rates, loss rates and reserve rates of all components. It's a complex interaction.

> WHEN BUYING COMMERCIAL MEDIA, FARMERS SHOULD ASK FOR PRODUCT SPECIFICATIONS ON THE COMPOST AND ENSURE THAT THESE SPECIFICATIONS ARE ACTUALLY REPRESENTED IN THE PRODUCT.

If the goal is to carry a plant through a production cycle without supplemental nutrients, the formulation must supply adequate nutrients at the end of the cycle without damaging plants early in the cycle. Depending upon the strain, that goal is elusive and in some cases unrealistic.

However, it does provide a conceptual target. Having formulated a mix, farmers should send samples to a laboratory for testing. Container media vendors have a responsibility to test copiously — including conducting and documenting plant growth and survival tests, in addition to systematic sampling and lab testing.

CONCLUSION

Container media buyers must be careful about their choices in order to avoid problems.

A vendor's poor quality-control protocol can yield serious disasters and surprises as quality fluctuates. This type of problem usually points to other problems as well.

Furthermore, buyers should be wary of products that claim to be "premium" without substantiating that claim with certification and/or lab testing and plant vigor testing — especially given the prices for these products.

No vendor should cut these corners, but some do. Inconsistency in quality and performance can present large-scale risks. Without verifiable assurances, "premium" only guarantees a premium in price. ■

Richard Freeman designs ecological cannabis agriculture systems, including soil-building, integrated pest management and waste-reduction/reuse programs. His prior experience includes research and development of residential permaculture food and composting systems and ecological forest planning and management. He has a Ph.D. in forest management, a master's degree in environmental studies and certifications in permaculture and food forest design. A more in-depth version of this article and information about his company, Eco Paradigm, can be found at growecology.com.

by CLIFF TOMASINI

Regulate humidity, reduce the need for pesticides

It's not a cure-all, but proper environmental controls increase the chance of success

Consumer demand, regulatory compliance, avoiding recalls and building a market advantage are four pretty good reasons to eliminate the need for pesticides in cannabis production. These are big reasons why industry members, government officials and consumers constantly debate pesticide usage by cannabis growers.

But more often than not, I hear people discussing the problem, not actual solutions.

One option — and I realize it's easier in theory than in practice — is to solve the problem before it occurs.

That's where controlling humidity levels in a clean growing environment comes into play. Humidity is a critical factor to consider when attempting to prevent plant diseases that could require a chemical treatment.

MOISTURE

Here's the simple fact: Too much moisture creates the perfect environment for mold, mildew and fungus to take hold. Numerous agricultural studies from top-tier research hubs, including Purdue University, have proven this for other types of plants.

Once mold and mildew appear, growers have little choice but to spray or harvest early. Even then, they can't always solve the problem. The worst case scenario is total crop loss.

After visiting numerous grow operations, including many that have successfully tackled powdery mildew and various molds without pesticides, it's fairly clear that these plant killers were thriving because of the abundance of water in the air.

Think about this: If you have 100 plants and they need 50 gallons of water a day, the plants are releasing about 97% of that water back into the air. It has to go somewhere and the best option is to pull it out via dehumidifiers that can reclaim the water.

Therefore, if we control humidity, we significantly reduce the risk of mold spores and mildew taking hold because they simply cannot grow. No mold or mildew means no need for related herbicides and fungicides.

While relative humidity levels vary based on plant maturity, it's generally ideal to keep levels at or below 50% to prevent mold and mildew growth, most experts say.

Many experts say maintaining a humidity of about 50% is ideal for grow rooms. The facility pictured has digital temperature and humidity gauges on each post for accurate measurements.

PHOTO BY GARRETT RUDOLPH

BUGGING OUT

Controlling moisture can help prevent mold and mildew, but it can also act as a deterrent for unwanted insects.

Many insects and mites are attracted to mold and mildew, so eliminating their growth can reduce the chance of pest infestation, thus reducing the need for pesticides. It's not the entire solution, but it can help significantly.

Of course, if you don't start with a clean grow facility and aren't careful about what you bring into it, there's a higher likelihood that pests will still attack your plants. That's why when I help growers eliminate such issues, I examine their entire process, not just dehumidification, to ensure a truly clean environment.

We need to conduct more research, but the evidence is in the grow rooms. Great growers with truly clean cultivation facilities are seeing amazing success producing pesticide-free marijuana without reducing yield or quality. One common theme among these growers is strict control of humidity levels and a focus on prevention. ■

Cliff Tomasini is the product manager for Quest Dehumidifiers (questhydro.com), which manufactures some of the most energy-efficient dehumidifiers in the world. Quest has supported the cannabis industry for more than a decade, working with growers to improve the quality of their plants through clean growing processes.

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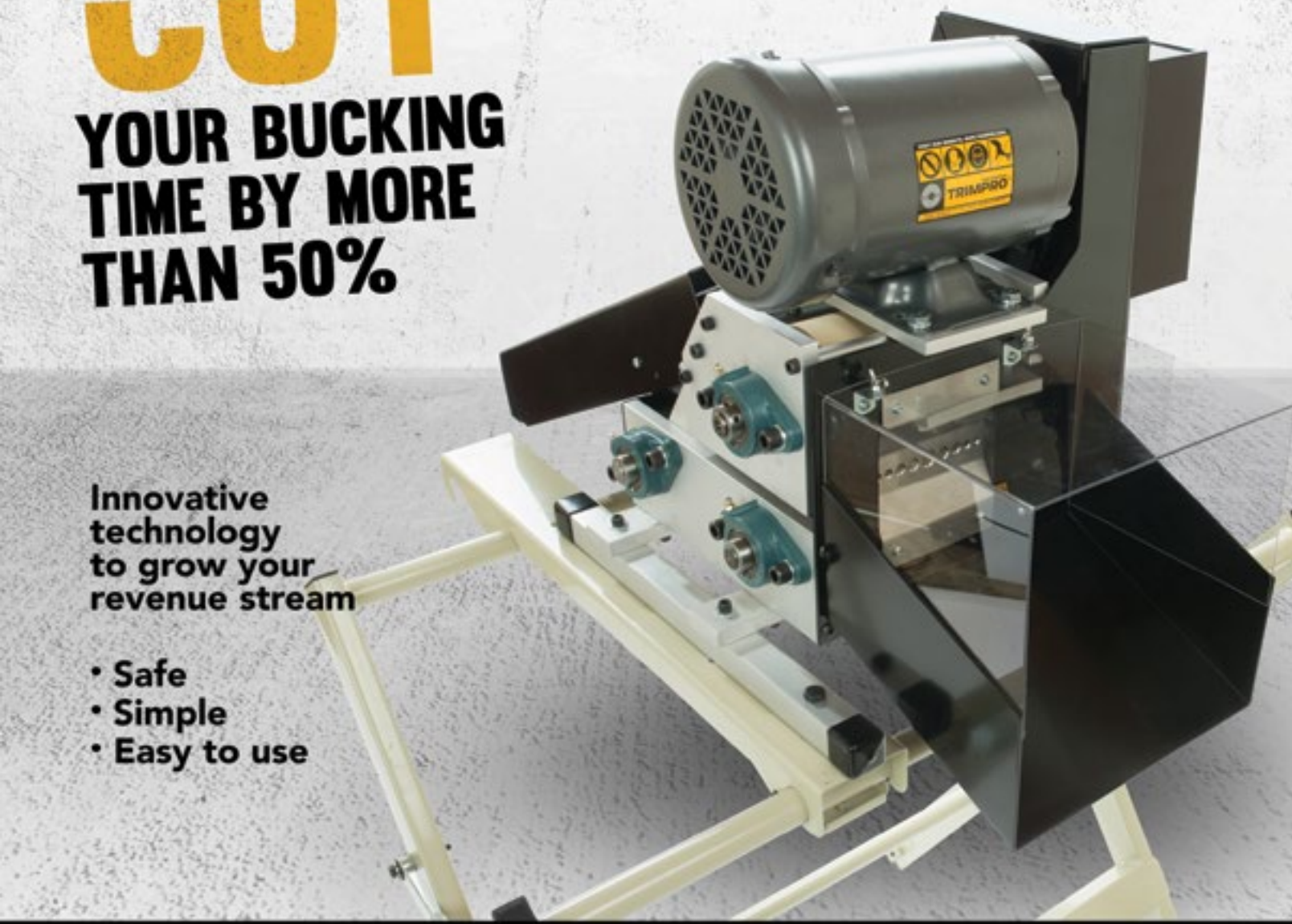

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