

Seeding Knowledge

Cannabis Drying Rooms:

The Importance of Uniformity
in the Cannabis Drying Process

About the host:

Eric Sandy is the digital editor of *Cannabis Business Times (CBT)*. Eric Sandy joined CBT as digital editor in January 2018. Previously, he worked as managing editor and staff writer of Cleveland Scene, where he covered criminal justice and environmental issues. Sandy is a graduate of Ohio University's E.W. Scripps School of Journalism. CBT's mission is to help accelerate the success of legal cannabis cultivators by providing actionable intelligence in all aspects of the business, from legislation, regulation and compliance news to analysis of industry trends, as well as expert advice on cultivation, marketing, financial topics, legal issues and more.

About the topic:

The drying process is one of the most critical stages of cannabis production, yet is sometimes overlooked. With the right solution, producers can preserve their terpenes, prevent microbial formation, and achieve their quality and production goals.

About the experts:

Tim Nolan is the *Director of Operations* at AtlantiCann Medical. Tim oversees and directs the cannabis production facilities including cultivation, quality control, packaging, and distribution. Located in Halifax, Canada, AtlantiCann has a state-of-the-art indoor cultivation facility and decades of combined experience in the cannabis cultivation space.

Marc Paynter is the *Western Business Development Rep* for Argus Controls and has been with Argus since 2017. Marc has been working in the horticultural industry since 2014. Prior to Argus, Marc worked in the cannabis field as a sales professional in the cannabis trimming machinery industry.

Calvin Birdsall is an *Account Manager* for cannabis production with Conviron, and has been with them since 2017. With a background in BioSystems Engineering from the University of Manitoba, Calvin specializes in helping clients develop the right cannabis grow room for their cultivation facility.

Why is the drying process so key to cannabis production?

Marc: The profit you make is determined by how good your product is. Drying is the last step before your product gets into your customer's hands, so if that process isn't dialed in and accurate, there's a lot more opportunity for failure, such as botrytis and other molds and fungus. To lose it at the end would be really detrimental to the business.

To be able to replicate and have an automated process takes the guesswork out of everything; things have come a long way. Having a repeatable process with data that shows what's being done right and wrong gives more uniformity to the product leaving your doors.

Calvin: You create a great product in the flower room, then harvest and reach the point of drying and curing, which brings out the terpenes and cannabinoids of the product and really showcases it. This is one of the steps you want to do in your drying/curing process. If you don't dry or cure adequately, you'll harm the product in a way that really degrades the solution and the product. You differentiate yourself in the market by having a quality product and showcasing it.

Tim: I've had the opportunity to dry cannabis a number of different ways with different technology at play. When you're creating a high-end product, terpene preservation and a uniform moisture content are very important. We can deliver on our promise to retailers that our product will land between 12% and 14% moisture content because of the dry rooms.

When people reach for your brand, they're expecting uniformity. Terpene and THC preservation keeps the product high-end and consistent. I think of moisture content in cannabis as similar to the temperature in wine; if cannabis is great, but it's at 6% moisture content, then it's not going to be a great product. I believe that most cannabis consumers have experienced this, and our consistency allows us to deliver that kind of uniform moisture content every time.



Is drying overlooked in the industry?

Marc: It seems to be one of the last things that many people go to, putting more emphasis on growing the plant – which is also important, as you need the plant matter to be able to dry and cure. However, if your drying process and room isn't dialed in, you're going to lose out. To me, that's the most important room in the entire facility, so being able to automate it is crucial.

What are the key considerations of the drying process?

Calvin: I think one of the biggest misconceptions about drying is that it's just a room with dehumidification. One of the main aspects to drive home in the drying/curing process is adequate airflow uniformity and

dehumidification. We want to make sure that we have the capacity to adequately dry the product quick enough that it reduces any chance of botrytis, bringing that available water down in the room below 0.8 and mitigate pathogens and mold growth.

Once it's past that point, you'll want to even out the curve and slow the drying process to make sure the product isn't losing terpenes and cannabinoids. That's where uniformity and precision controls come in as key, because controlling the product allows it to dry adequately and become a fantastic product.

Could you elaborate on the idea of uniformity, particularly relating to moisture content?

Tim: You can look at it through two lenses: Uniformity between batches, and uniformity of your workflow.

Regarding batches, you want uniformity within batches. If I were to look at the wet weight that I'm putting into a dry room (for example, 700 kg), it's going to dry somewhere in the 140 kg range when it comes out.

It's important that all of the product in the dry room is at the same moisture content when it's time to go into a receptacle and begin the curing process, which I believe is an integral step for creating high-end cannabis.

If I'm removing samples from the dry room that are on day eight, for example, and I'd like to increase my fan speed and drop humidity, I need the product to be drying uniformly. In the past, I've had problems with parts of the room sitting at different moisture content (i.e. 14% and 18%). From a workflow perspective, the product needs to be removed from the dry room on the same day, begin the curing process in the receptacles, and you need to be able to sanitize the dry rooms.

In this case, we're pulling harvest every 10 days, so we need consistency between lots, and we need the entire 700 kg of wet weight to dry down at the same, which we're able to do. I believe we have approximately 67 harvests through these dry rooms, and at this point, I'm able to review my spreadsheet and note that the range of moisture content is quite high.

Could you elaborate on the sampling process?

Tim: There's a number of ways it can be approached.

We use a destructive process that involves putting a product onto a specially-designed scale, and as the product heats, monitoring the moisture content in order to see a uniform sample. We send our product in for our CFAs to clear microbial tests and get our potency and terpene analysis, and we'll validate the sample once we get it back. It's important to have a reliable instrument that you can use to validate the product's moisture content.

The other part of it is having the ability to control it to a degree. If I were to have an extra day to dry because I pushed a harvest out, that means I've got 11 days, and I might be able to slow the fans down a little, bringing up the relative humidity and dropping the air temperature. With that, I might consider a slower process if that's available. If I have to push product because I need the dry room back a day early (e.g. if I'm on a 9-day rotation), then I need to be able to gently move the product along.

”

Drying is the last step before your product gets into your customer's hands, so if that process isn't dialed in and accurate, there's a lot more opportunity for failure.

What are some dry room equipment considerations?

Marc: With Conviron, we have specifically engineered rooms that include their own HVAC built in on the roof, and we take care of the equipment inside there. If somebody has built a room themselves, it's important to have a proper HVAC, know your latent loads, and have a supplemental dehumidification unit (if it's needed). The main part that many people miss is to have something that can reintroduce humidity back into the room; it's incredibly important to have this and proper airflow and dehumidification. If you don't, it can be detrimental.

What are some of the alternatives for airflow and humidity control?

Calvin: There's many different drying solutions on the market right now, such as microwave drying, freezer drying, and dehumidification drying. It's heavily dependant upon the product that you want to promote.

If you're promoting a flower, then you want to provide a good dry and cure, because that's where you really want to showcase your flower.

If you're extracting materials after the product is dry, an immediate dry might be a quick solution to pump it out as quick as possible.

When we're specifically talking about solutions where you want to promote the integrity of the bud, cannabinoids, and terpenes, the most ideal practice is reducing any possibilities of microclimates in that space as it will provide you with uniformity and ensure the product is drying adequately and consistently.

Another aspect is the ability to sanitize the surface after each harvest, which gives you a safety factor of reducing any chance of pathogens passing along to the next batch brought into the room. For certain certifications, this is also a requirement. Whether you use isopropyl alcohol, vinegar, or just handwash the space, sanitizing is typically required for all processes. Aside from that, providing adequate filtration for fresh air is all the processes you typically require. You can also add some sort of positive pressure to reduce pathogens from entering the room; when the door opens, almost no contaminants can enter the room if the positive pressure is pushing out anything in the room.

What are some common misconceptions about the drying process?

Tim: Often times it seems that this gets pushed to the end of people's priority lists. A misconception is that you can just use a 'touch and feel' approach if you're producing high-end cannabis at a smaller scale. It's not to say that you can't work your way through it when growing small amounts of cannabis, however when you scale up, something unique in the dry rooms is that you're able to use high-end technology at the same time as some old-school techniques such as drying racks, hand trimming, and hand drying.

The other important thing is that it can be difficult to identify where things went wrong in flawed cannabis. You need to have a good upstream processes; garbage in, garbage out. It's possible to ruin cannabis in a dry room, and it's not possible to save it, so being able to refine processes is important.

”

It's important to have a proper HVAC, know your latent loads, have a supplemental dehumidification unit, and be able to reintroduce humidity back into the room.

What are important considerations when it comes to scale with drying?

Tim: We had some historical, baseline data in terms of grams per square foot that we were able to work with, so we knew roughly what our outcomes would be in that sense. We wanted to be a little oversized to prepare for those bumper crops when everything goes perfectly and you exceed your normal grams per square foot, and work closely with Argus to go through our needs and expectations of what's going into the dry room and what we're trying to accomplish.

For us, we have two different sized flower rooms and 12 flower rooms total. We were able to work with Argus to figure out the perfect-sized dry room, which worked out really well. We are able to house our bumper crop in the dry rooms; however, floor space is a premium that you don't want to use too much of, so we have a sweet spot where we're able to fit our rooms into the appropriate space, but it doesn't have a huge footprint in the facility.

What should growers consider when they plan their drying solution?

Marc: One of the most important questions is how much weight we are taking down per harvest. The Conviron solution is engineered for a room's needs – such as the one Tim mentioned that was built for 700 kg to go in, and 140 to come out (roughly). We need to know exactly how much is being taken down.

One of the mistakes I see often is how much is going into the rooms; if new products are being reintroduced, this can throw everything from humidity levels to cure rates off, and the room is no longer an engineered solution.

What are the potential problems that improper drying can cause?

Marc: One of the great things about legal cannabis is the testing, and ensuring that a sub-par or poor product isn't going to market. Ensuring pesticides, molds, mildews, etc. are non-existent is extremely important in this industry. Petridis grows at .8 AW and above, and where Conviron is great is that it just rides the .8 line, giving uniformity every single time.

The other thing is to have an engineered solution, upstream processes, and using data to understand what went right and what went wrong.

How does humidity control and airflow interact with microbials?

Calvin: Once the product is put into the room, the plants are still transpiring and releasing moisture, so the dehumidification is what's needed most. We've seen growers set their rooms to immediate dry or lowest relative humidity set point, pulling as much moisture out of the product as quick as possible. We typically see a removal of about 50% of the moisture within the first 24-48 hours, which is typically ideal, as it mitigates any chance of microbials forming around the buds.

When you're able to control the humidity temperature and maintain adequate airflow, you're not agitating the bud either. The two of these together are the full package. With Conviron and Argus, you get precision at plus or minus 1 degree Celsius, and plus or minus 3% humidity. Having the ability to control the space with such precision will give you uniformity and the ability to mitigate potential petridis, etc., as well as get the finished product that you want.

”

Having 50% of moisture removed within the first 24-48 hours is typically ideal, and being able to control humidity temperature and maintain adequate airflow means you're not agitating the bud.

Adding sanitization, air filtration, and positive pressure are just added redundancies that will ensure you're not integrating new outside pathogens into that space when you're drying your product.

Why is airflow important?

Calvin: When it comes to airflow, you want to make sure that air passes through the product. If it's packed too densely, the airflow can get stuck behind certain product, leaving it unable to return and wick away moisture from the space. Airflow is providing dry air across your product so it dries uniformly at the same rate.

What about the importance of other factors such as microbial prevention?

Tim: Anyone in the cannabis industry is aware of just how perilous it can be to navigate microbial standards, and balance the needs of a safe product with a desirable product. At AtlantiCann, we produced over 6000 kg of product and never failed a microbial test, which is something that we're incredibly proud of.

In addition to our drying rooms, most people understand that once the plant is harvested, it doesn't have any natural defences, so it's in its most vulnerable state. At that point, the plant needs to be cared for delicately. When it's alive, it still has its natural defences, but once it's chopped the plant is no longer alive and is highly susceptible to yeast, mold, and bacteria. Having the control to remove the moisture means we can pull 50% of the moisture out in the first 24-36 hours, which we believe is critical. When we're at a point that we're happy with, we can also slow the fans and everything else down.

How does terpene preservation and development play into the drying process?

Calvin: One of the aspects we see goes back to airflow; you're maintaining the integrity of the bud. For example, you're trying to crystalize those trichomes on the edge of the bud via a very soft airflow that pulls moisture away, but isn't strong enough to agitate the bud.

One thing I've seen in the industry that if there's dehumidification, you should just force as much circulation airflow as possible. This pulls away any residual moisture we're not getting from the dehumidification. However, where you're hurting the bud more is by pushing more air against it and agitating it more, diminishing the quality of your product. This is one of the things you're combining with adequate airflow to ensure you're maintaining those essential cannabinoids without irritating them. There's a happy medium of gently pulling away moisture, but not pulling away any valuable aspects of the bud.

Is there a point where too much drying can negatively impact terpenes?

Calvin: Yes. You don't want to over-dry the product. You can get to a point where the product crumbles in your hand, and it's not even smokable, enjoyable, or consumable. If it isn't consumable, it's not going to show off those beautiful terpenes and cannabinoids. It's a fine line that most growers deal with where they want to do an immediate dry, but this can make it very difficult to determine the ideal time to stop drying. When you elongate your drying and curing process, you're able to pinpoint the perfect time to remove the product for when it's ready for consumers.

”

You need to combine adequate airflow with dehumidification to gently pull away moisture without also pulling away any valuable aspects of the bud.

What is important to consider with terpenes and cannabinoids?

Tim: It's important to be able to remove that moisture initially, and just as important to be able to slow it down towards the end. One thing we've found, as cannabis moves into packaged goods and you're dealing with national distribution, you're putting it on the shelves of hundreds of stores at the same time, and people are looking for consistent uniformity. No matter where in Canada somebody is, they want to open the jar and experience being hit with terpenes.

We've seen levels in excess of 3.5% total terpenes consistently, and that has allowed us to capture the market; we're in the higher end of it, and a lot of that has to do with the terpene preservation and our slow, gentle drying process.

You see a lot of people using moisture packs – not to take anything away from those – but, while you can reintroduce moisture back into the flower after it's been harvested, you can't put the terpenes back. If the moisture that the flower had when it was in the dry room is gone and you reintroduce it, the terpenes are gone and not coming back. You can make it feel like it did prior, but it's not the same, and most experienced cannabis consumers are aware of that.

How do you balance different cultivars coming in/out of the drying process?

Tim: Not only is the size of the flower important to look at, but density is critical. When we got our dry rooms, we worked with Argus, paid attention, took a lot of notes, watched for the outcomes, and put some work in at the beginning. I would put something dense with large flowers in a high-risk category for microbials, and it's also a lower risk that you're going to dry it down and over-dry it quickly.

We classify cultivars into four or five different classes, then look at the proper drying techniques for each one. You don't necessarily need to be that specific, but for us it's really important that we don't over-dry our product. If you go online and read reviews of cannabis, one of the biggest critiques of legal cannabis is the moisture content, so it's definitely in the hierarchy for consumers and seems to be in the top three or four attributes.

”

Your 'before' process is important: you need to be growing quality product that will go into the dry rooms.

How do you ensure uniform results?

Marc: As Tim mentioned earlier, your 'before' process is important. You need to be growing quality product that will go into the dry rooms. You also need to monitor little things, such as proper air movement. An oscillating fan is not proper air movement because you can't control exactly where the air is going. Whether in your grow rooms or dry rooms, you need to have proper air flow that's mapped out so you can figure out if you have microclimates, and eliminating those to make things as uniform as possible.

At the end of the day, this is still farming. You can mitigate a lot of risks if you have proper equipment and proper processes in place. To make sure you're drying correctly, know exactly how much is coming down, and what your target is, whether that be 10 days, 14 days, or something else.

It's also important to give people like Calvin and I the proper information to make decisions with, so we can give you the proper solution and help you achieve your goals.

How many days should drying take?

Calvin: The timeline for drying is usually scheduled based on their harvest schedule. If they're harvesting their room every four days – unless they have multiple dry rooms – they'll need to figure out a way to ensure they're not harvesting product when all of their drying spaces are full. This will likely dictate some of their schedule. We typically see a fan favourite of being around a 10-14-day cure time, as this seems to produce a very good product.

We've had some clients try drying and curing in a 5-6-day span, and some that dry in a span of 28 days; there's a huge range of different people. It's all preference and expertise of how you grow. However, the 10-14-day timeline seems to be adequate to fill a room, dry it, cure it, remove it, and sanitize the space, then put the new product in. At the end of the day, it's all based on the grower's preference based on their harvest schedules, how they want to bring out their product, and what product they're providing.

Presentation Images



Tim: These are drying chambers here at AtlantiCann. They're two separate dry rooms, but we're on a 10-day harvest interval so we fill them every 10 days and reload them. There are seals on the outside, and the middle panel allows you to view the room without going inside. Once we have our rooms loaded, nobody goes in; we've seen how they behave and are comfortable with the process, so we can just view through the window.



Tim: This is that combination of high-end technology with old-school techniques, as I mentioned earlier. Stainless steel hangers are a way to create a lot of linear feet and give you flexibility. If we have a bumper crop, we can hang those onto linear feet, which gives us a lot of control. I think we can hang them on the interior racking.



This is day-of-hanging. Once the product is hung in the dry rooms, we monitor from the outside. There's a number of ways you can configure them, which is something I like about these dry rooms. We chose to hang dry, which is more labour-intensive, but we're looking to create a high-end product and we've been successful in that so far. However, if we wanted to run our product through a wet trimmer and roll a rack in there, it'd be just as viable.

What should a grower keep in mind for spacing and density?



Tim: We always want to have some space on every side, so we have 360 degrees around the flower where you're able to get airflow through. That being said, we fill these rooms pretty tight, so when you walk into the drying chambers they're quite full. It's a little confusing because you have spacing on the hanger, then you have spacing in between hangers.

Basically, we took the Unistrut to figure out the proper spacing. In the front end, it's important to understand that it is a bit of work to figure out what's going to be perfect for you. Like any powerful tool, you need to put a little time in on your end to figure out the best way to use it for your purposes.



Calvin: With respect to loading the room, it'll dictate a couple different ways, as wet trim on trays is a form compared to hang drying as you see in this image. With wet trimming, you're removing the stems, which is a substantial amount of biomass you're not including in the room. We've actually found that hang drying takes about 2/3 more space than we trim on trays, so you're able to fit more product in the room via wet trim on trays, but you're getting a substantial amount of additional biomass in the room with the stems, so it'll dictate how you're sizing the room when putting product in.

That's one of the aspects we would at least recommend: we're taking into consideration the finished, dry product, and understanding what the wet product is going in. If you're strictly going off dry product, the application of how you're drying via wet trim on trays or hang dry will dictate the amount of drying capacity and physical space you'll need.

How important is control and monitoring humidity levels, temperature, airflow, and fan speeds?

Calvin: Ideally, we don't want any range at all. We know that's very difficult to achieve in any solution, so try to be as close as possible to maintaining that set point. If your room is at 40% relative humidity at 21 degrees Celsius, that's what you want at all times. If you have sensors in the room, that's what you want to be reading, so as little fluctuation as possible from that is ideal.

With our solutions, we're able to provide a ± 1 degree Celsius, as well as a $\pm 3\%$ humidity, and that's rare to see in the industry. Fluctuations and curves we've seen on other sites or solutions flip-flop between much higher temperatures and lower humidities, just based on being able to maintain a set point. That's one aspect we try to drive with uniformity; maintaining that precision set point without fluctuations, because it could really deteriorate your final product.

When drying, are materials then sent to the packaging stage at the high side of the moisture level?

Tim: Being that we're in Nova Scotia, we have that level of control with this dry room. We account for the seasonal fluctuations in the packaging and trim because we do hand-trim, so the process is slower than machine trimming, and the product is exposed.

We count on the product losing 1-2% moisture in the winter when the heat is running and it's dry inside the building in the post-production area. In the summer, the cooling isn't always running and the space tends to be more humid, so we come out of the dry room a little bit dryer because it tends to pick up a little bit of moisture on that back-end process.

Being able to nail it down that precisely is helpful. In the summer, perhaps I want to come out at 12% because I may end up at 13% putting the product into the jar because of the humidity, and in the winter when the heat is running and the building is dry, we know we're going to lose that point.

Are there any concerns about terpene volatility?

Calvin: One of the aspects that we understand is that removing the moisture is dehumidifying the space. You'll be setting your temperature to your desired set point, but if that comes down to affecting the product or the terpene contents before you're testing the product, then I'm not entirely sure on the degradation of that product during those higher temperatures.

I am aware that it can affect it definitely, but that's just at the initial point of your drying – having those lower temperatures and as much dehumidification capacity as you could achieve with the limited dew

point. That's where you're really working with the understanding that you might affect your initial terpene content, but keeping that in mind for when you're doing that initial dry. You're setting your room to a low temperature, but you're also providing a low heat relative humidity as well.

Marc: In my own experience, I haven't seen a dry room get to 70 degrees. Most of the time it's between 55-65 degrees Fahrenheit, and around 50-55% humidity depending on what part of the drying cycle you're in.

Tim: That's what we see here on the ground in operations, too. We're typically around 16-17 degrees Celsius for drying, so we keep our temperatures quite low and are able to pull that moisture out. One limitation I've seen is that it's often a challenge to achieve a lower relative humidity with lower air temperature with HVAC equipment. We find we're able to dry consistently at that 16-17 degrees Celsius mark.

Marc: The psychrometric chart really comes in handy here to make sure you stay within your levels, and the environment is where it needs to be. For trimming and packaging environments, I'd argue that they need to be the same – if not, very similar – to the drying environment so you don't have a reintroduction or removal of moisture. Those are controlled environments that need to be considered, ensuring that the whole processing plant is the same temperature. We're talking about the bud here, and making sure that it's as correct as possible.

Does flooring material or finish have an impact?

Marc: Antimicrobial flooring is preferred as it's easier to clean and keeps a lot of pathogens out of these rooms. Kingspan walls are a really good idea as they're also easier to clean. You don't want a porous material; you're not building a dry room out of 2x4s and Sheetrock. You want to make sure that it's sealed so that mold and mildew can't form.



How does wet trimming versus dry trimming impact the drying room?

Tim: You can remove that stem and it dries quicker, so I think you can get more into the dry room if you're removing it from the stem prior to drying. I like the flexibility that these dry rooms afford. From what I've seen, a lot of people in Canada were just hyper-focused on efficiencies 18 months ago. That's a great thing to focus on, but you also need to worry about creating demand for your product.

It's great to produce a cheap product that there's a niche for, but for us to preserve the shape and integrity of the product, we choose to hand-trim it. The minute you put your product into that tumbler, it impacts the aesthetic of the product.

Is there a relationship between moisture content and THC concentration?

Tim: The relationship isn't linear. At one point, there was an assumption that when products are dried down, the potency increases. I personally struggle with the degree of variance within the test itself because even with fixed variables, the test seems to move around a couple points.

We're able to stay within 2% cannabinoids on average, but it's not perfect. My own anecdotal evidence is that I've seen really high potency scores with product that's got moisture over 14%, and I've seen low potency scores with the same cultivars when the product is as low as 6-7%. It seems like a complex relationship to me.

Marc: I'd say nutrients play a huge role in that too. Depending on what you're dosing your plants with, that dictates your outcome very much.

What are considerations when trying to reduce dry time?

Tim: When we've had to accelerate it by a day or two, we usually drop the relative humidity and we're able to maintain quite low relative humidity once initial load has been removed, without raising air temperature and without compromising quality.

One consideration is that the faster you're drying, the harder it is to get it perfect because it's moving really fast. If we're to squeeze a 12-day drying cycle into 6 days, it's moving twice as fast and has to be kept up with and paid attention to, but it does seem with these drying chambers, you have the ability to move things up or slow them down depending on the needs of the operation.

Anybody that's spent a lot of time on the ground in operations knows that there's the plan, and then there's the reality. It's important for people to think about that, especially in the age of COVID. Your harvest may take a day longer because you have an inordinate amount of people missing from your facility. It's hard to predict every variable before it happens.



GROUP OF COMPANIES

Founded in 1964, the CEL Group of Companies (CEL) comprises Conviron Canada, Conviron USA, Conviron Europe and Conviron Australia together forming the world's leading designer and supplier of controlled environments for plant growth. The CEL Group also includes Argus Controls, the leading supplier of plant-centric environmental controls and automation systems used in greenhouse and indoor growing facilities. Together, Conviron and Argus provide technologies to our clients in the plant science research, commercial horticulture, and plant-derived pharmaceutical industries in over 90 countries around the world.



CONVIRON[®]

conviron.com

ARGUS[®]
CONTROLS

arguscontrols.com