DryGair SOLUTION CASE STUDY

Cannabis Greenhouses

The data presented in this case study was collected from measured user experiences in cannabis greenhouses, utilizing the DryGair system. These greenhouses span diverse climates around the world.

Intro

The innovative DryGair solution targets one of the biggest issues in greenhouse climate control: **humidity**.

Plant transpiration occurring within the greenhouse produces moisture in the air. If not regulated properly, humidity condenses on plant surfaces and greenhouse equipment, creating the necessary conditions for the development of detrimental cannabis diseases including **bud rot**, **powdery mildew**, and **hemp canker** (**white mold**) which harm the plants and significantly reduce yields.

DryGair offers an innovative solution to humidity management, that's effective, energy efficient, and economical.

Advantages

Effective Dehumidification
Extracts 12 G (45 L) of water/hr* using 10kW of electricity. This is the highest output available on the market!

*At designed conditions of 18˚C, 80% RH

Prevents Diseases
Humidity diseases such as botrytis, powdery mildew, and hemp canker lead to lower quality products and yield loss.
Prevention is key in managing cannabis diseases and molds. By preventing the conditions necessary for disease development, DryGair provides a solution to the problem, before it can develop.

Fewer Fungicides
Lower outbreak rates mean less fungicide use. Avoiding sprays is critical in cannabis cultivation, to uphold health regulations, save on resources, and contribute to a greener environment.

Energy Savings & CO_2 Emission Reduction
Growing cannabis has one of the highest carbon footprints in horticulture, due to high energy requirements. In fact, indoor growing accounts for 1% of all total electricity consumption in the United States (New Frontier

Financial Group, 2016). Using large-scale heating and HVAC systems to control climate conditions contributes to very high energy usage, and is a massive part of the total growing costs.
Governments often subsidize energy-saving technologies in order to promote a greener environment and reduce CO_2 emissions.
DryGair allows growers to save energy and enjoy a significant financial advantage.

Easy Integration

DryGair's integration is simple and easy to use. The unit is an automated plug and play solution that reduces the need for complicated infrastructure. The unit does not require any adaptation in the existing greenhouse, only minor rearranging of a few plants to make space.

Higher Quality & Larger Yields

DryGair's humidity reduction capacity means less diseases in the growing facility, which translates to higher quality and larger yields. The climate uniformity DryGair creates produces a more uniform product, which is highly important in cannabis production. Growers report a 30-40% increase in yields in greenhouses utilizing the DryGair solution.

Fast ROI

Increased yields (30-40%) translate to greater profits for the grower. The reduction in heating expenses (average savings of 50%) and humidity diseases lead to a return on investment of 1-3 years. This measurement is conservative and does not include additional advantages such as reduced fungicide use, CO_2 retention, decrease in working hours, etc.

Conclusion

DryGair was able to maintain ideal humidity levels, while creating homogeneous climate conditions in all areas of the greenhouse. These results make DryGair an important growing tool, holding several advantages compared to alternative methods, including high-capacity water extraction, patented air circulation, and very high energy efficiency.
It is easily integrated into any growing facility, and provides a preventative solution for humidity diseases that is effective, economical, and environmental.
DryGair allows growers to be competitive by preventing yield loss, maintaining high quality products, and reducing costs.

Ventilation

Not Always Possible

Traditionally, greenhouse humidity is controlled through ventilation, releasing humid air from the greenhouse to the environment. While this may lower humidity, it also affects temperatures inside, by introducing untreated air. This is especially problematic at night, as the air outside is colder than inside. To combat this, growers must invest more energy to reheat the greenhouse back to ideal levels.
In cannabis production, ventilation isn't always possible. Cannabis production is based on a strict light regimen, extending day length with grow lights, or shortening day length by using blackout screens. Certain regional regulations even make blackout screens mandatory, in order to prevent light pollution. Once blackout screens are in use, ventilating becomes much more complex, or no longer possible, leading to uncontrolled humidity increase with no treatment options.

RESULTS

How Does DryGair Work?

DryGair's concept offers an alternative to ventilation: it works in a closed greenhouse, isolated from the outside air, and reduces humidity from within. The patented technology takes the humid indoor air, extracts moisture at a rate of 12 G (45 L) water/hr*, and recirculates the dehumidified air uniformly throughout the greenhouse, minimizing humid microclimates that can lead to disease development.
DryGair's target operation times are during lights-off periods, or when blackout screens are deployed. Closed greenhouses benefit from dehumidification, allowing heat to be retained inside, while maintaining ideal humidity levels. Constant plant transpiration raises humidity. DryGair operates to negate this, and control humidity in order to guarantee dry plants.

*At designed conditions of 18˚C, 80% RH

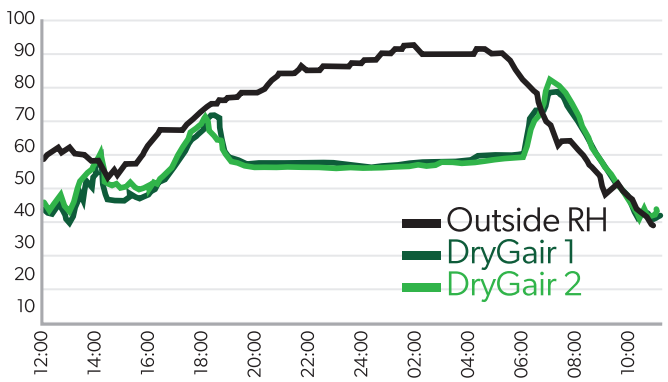
Experiments

The following was gathered from data sensors measuring temperature, relative humidity, and water outputs in trials conducted in medical cannabis greenhouses.

Relative Humidity

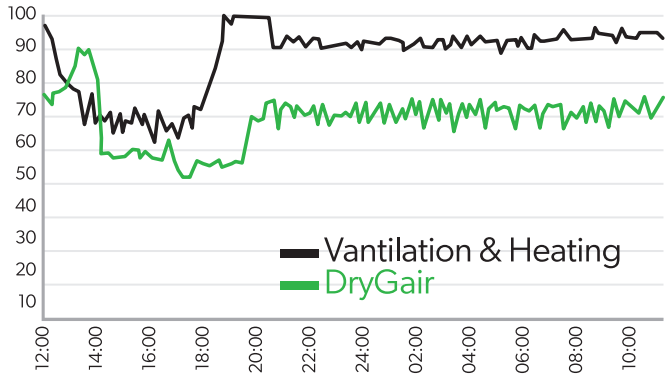
1. DryGair was operated within a cannabis greenhouse during nighttime hours and relative humidity levels were recorded by 2 sensors located at different distances from the unit, as well as different heights in the greenhouse. Within these greenhouses, the DryGair unit maintained a steady relative humidity level of 57% during operation hours, compared to fluctuating high outdoor humidity levels. The alternative, ventilation, relies on outdoor air and so is subject to fluctuation and can often be ineffective when outdoor humidity levels are high. Additionally, during times when the blackout screens are deployed, ventilation isn't possible, leaving no solution for humidity control. Growers therefore get suboptimal conditions, leading to high rates of disease outbreaks. (Figure A).

Relative Humidity (%) / Time of Day (Figure A)



2. Nighttime relative humidity levels were measured in a greenhouse using DryGair and a control greenhouse utilizing a ventilation system.

Relative Humidity (%) / Time of Day (Figure B)

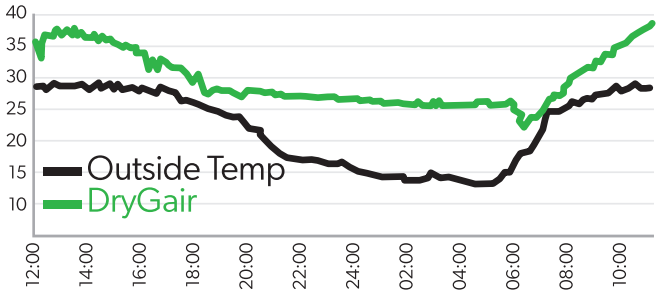


In the greenhouse with DryGair, relative humidity levels of under 70% were maintained during operating hours, whereas the greenhouse utilizing the traditional ventilation and heating technique had relative humidity levels around 93% (Figure B).

Temperature

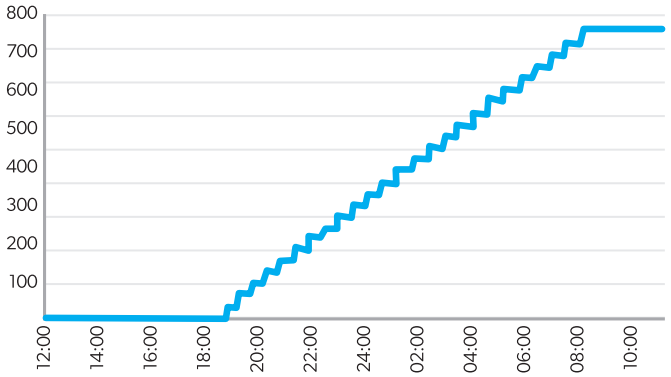
Temperature was measured outdoors and within a closed greenhouse using DryGair (without additional heating).
During the nighttime, outdoor temperatures dropped to 13˚C. In contrast, temperatures within the greenhouse remained 26.5˚C consistently during DryGair's operation, due

Temperature (˚C) / Time of Day (Figure C)



to DryGair's conversion of electric energy to heat energy and the isolation of the greenhouse from outside conditions. The DryGair concept reuses all of the energy invested in the operation of the unit and the energy released from the water condensed in the process. This energy can increase the temperature inside the greenhouse by 1-8˚C, depending on the greenhouse structure and needs (Figure C).

Water Removed (L) / Time of Day (Figure D)



Humidity Extraction

Water output volumes extracted by the DryGair unit were measured during nighttime operating hours.

During operation, DryGair extracted a total of 740 L of water from the greenhouse air. This is a dehumidification rate of 54 L/hr (Figure D). DryGair has the highest dehumidification rate on the market, with the capacity to extract 12 G (45 L) water/hr*.

Homogeneous Climate Conditions

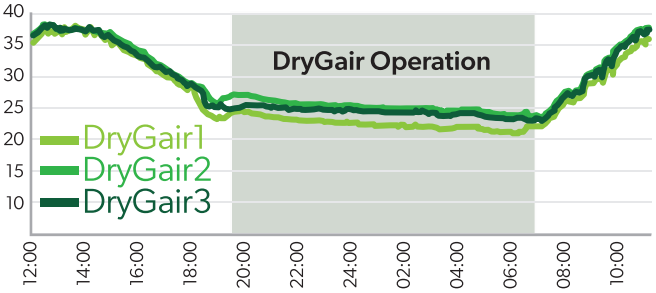
Temperature and humidity sensors were placed at different heights and different distances from the DryGair unit within the greenhouse.

Uniform relative humidity (57% RH) (Figure F) and temperature levels (27˚C) were found throughout the greenhouse, at all sensor locations (Figure E).

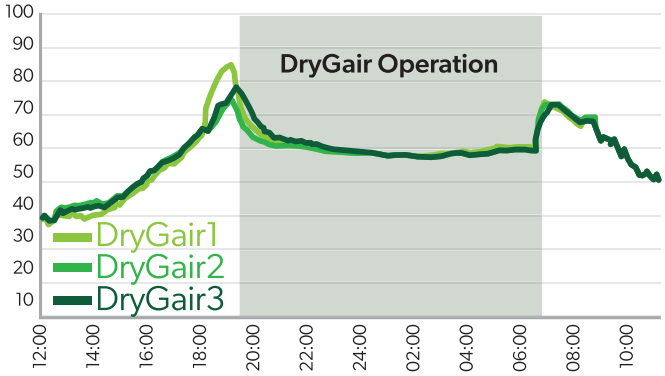
Uniform growing conditions produce a uniform

crop, critical for the high standards required by the medical cannabis industry. DryGair is able to provide uniformity of indoor temperature, leaf temperature, and relative humidity, helping to produce high quality, uniform growth. Additionally, the uniform conditions DryGair produces prevent humid microclimates in the greenhouse, where diseases and molds can develop. Cannabis flowers have a dense structure which makes them especially prone to dangerous surface moisture. Moldy flowers are unmarketable and can have a heavy economic price for growers, so maintaining uniform optimal conditions is critical.

Temperature (˚C) / Time of Day (Figure E)



Relative Humidity (%) / Time of Day (Figure F)



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DryGair Horticulture Dehumidifiers
a new way to grow.