# DryGair SOLUTION CASE STUDY

## Vegetable Greenhouses

Based on measured user experience, the data presented in this case study was collected from tomato, pepper and cucumber greenhouses, utilizing the DryGair system. These greenhouses span diverse climates around the world.

## Intro

Humidity is a critical factor that impacts the growth, health and quality of vegetables. The DryGair solution provides innovative, effective and energy efficient humidity control for greenhouses and closed growing facilities.

## The Problem

Vegetable crops are especially susceptible to a number of humidity-related diseases. Their dense and tall foliage produces high amounts of transpiration, while also making it difficult to generate the air circulation necessary for humidity control.

High humidity in vegetable greenhouses causes:

- Damaging diseases such botrytis, downy mildew, powdery mildew and more...
- Lower pollination rates
- Internal water pressure imbalances that suppress plant activity and lead to conditions like fruit split
- Lower yields and lower quality

## The DryGair Solution

DryGair, in partnership with the Israeli Agricultural Research Organization, the Volcani Center, has designed a solution to control humidity inside greenhouses and closed growing facilities.

### How It Works

Close the greenhouse, spread thermal screens (if applicable) and operate the DryGair unit to remove excess moisture.

Extracts 45 L/hr (12 G/hr)* of water using 10kW of electricity

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

Treats 22,000 $m^3$ (13,000 CFM) of air

Circulates the air to create uniform conditions

Saves ~50% energy on average

DryGair CONTACT drygair.com

DryGair Horticulture Dehumidifiers
a new way to grow.

# RESULTS

## Traditional greenhouse humidity control – ventilating and heating

Ventilating causes energy loss, as heat escapes to the outdoors, especially at night, when it's cold outside. This energy must be reinvested as heating, at a great expense.
Ventilation also leads to constant fluctuations to the greenhouse climate, creating non-uniform growing conditions, leading to yield loss and lower produce quality.
Under certain weather conditions, such as rain or clouds, this method may not be capable of reducing humidity at all, leaving growers with no solution.

These issues contribute to high operational and energy costs.

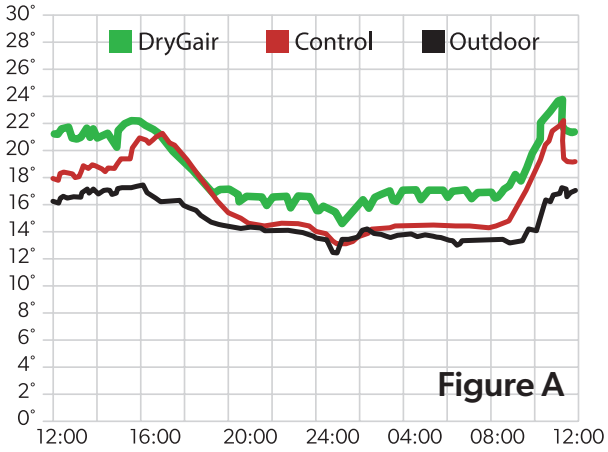


**Figure A**

## Benefits in Heated Greenhouses

### Cherry Tomatoes – UK

DryGair vs. Control (Heating & Ventilation)

| | |
|---|---|
| Energy Savings | **~50% Average**<br>**~38% Winter & Spring** |

Average energy savings in DryGair greenhouses reaches 50% and higher, resulting from optimal closed greenhouse operation. Over the course of winter and spring, energy savings were 38% in this greenhouse.

| | |
|---|---|
| Yield | **~5.5% Increase** |

Yield increase results from reduced rates of disease, and creating active climate conditions that stimulate growth.
DryGair's dehumidification, combined with its patented air circulation, allows for denser crop placement as well.

## Benefits in Unheated Greenhouses

### Cherry Tomatoes – Spain

DryGair vs. Control (Ventilation)
**Figure A** – Temperature/Time (hr)

| | |
|---|---|
| Additional Heat | **~8°C (14.5°F) Increase** |

Additional heat is a byproduct of DryGair's operation. The energy used in operation is converted to heat in a closed environment. DryGair units can provide up to 8°C (14.5°F) increase, depending on the greenhouse.

| | |
|---|---|
| Yield | **~25% Increase** |

The temperature increase, provided by DryGair, significantly improves growing conditions in non-heated greenhouses. These conditions stimulate growth and fruit production. Combining dehumidification with a temperature increase leads to optimal growing conditions and significant yield improvement.

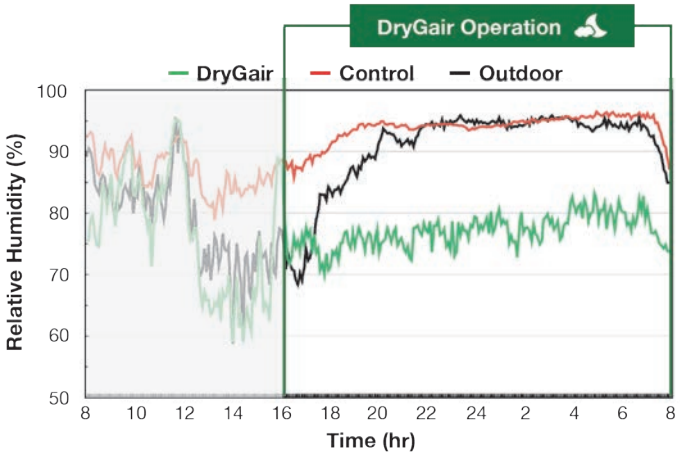
# Humidity & Temperature Control

## Unheated Pepper Greenhouse for Seed Production – Israel

DryGair vs. Control (Ventilation)

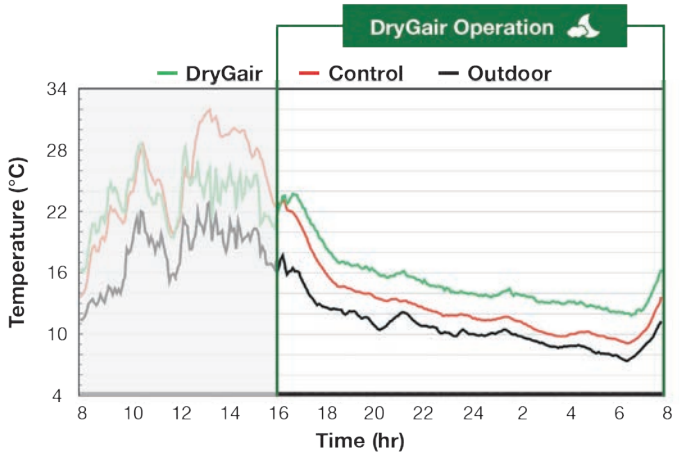
### Relative Humidity

DryGair provided optimal conditions at a steady rate of ~78% RH throughout the night, in conditions where the alternative (ventilation) was completely ineffective.




### Temperature

DryGair provided a 3˚C temperature increase during its operation, creating both optimal nighttime temperatures and relative humidity levels.




### Water Extraction

- 1000L (264 gallons) per night measured in tomato greenhouse in the Netherlands
- 470L (124 gallons) per night measured in tomato greenhouse in Israel.

Water extraction is influenced by various factors, including relative humidity, temperature, unit operation hours, plant density (leaf area index), etc.

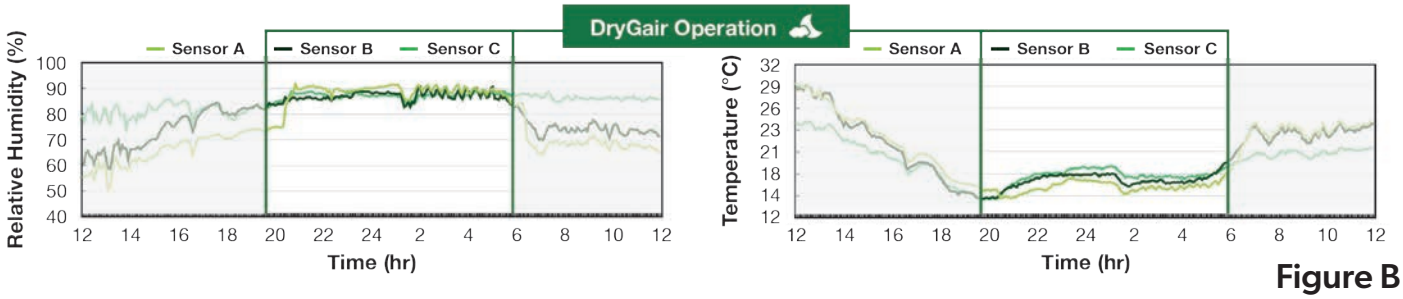
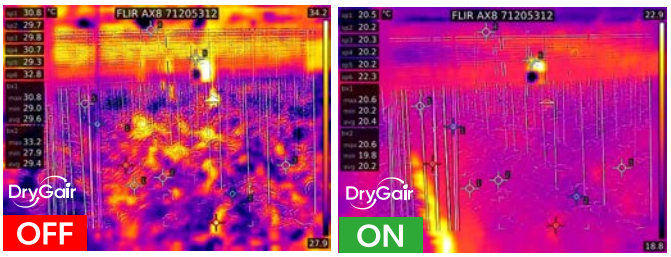



Figure B

## Climate Uniformity Through Air Circulation

Thermal camera images show temperature fluctuations in 4-meter-tall pepper crops in the Netherlands. When the DryGair fans are on (right), temperatures remain relatively uniform throughout the greenhouse.




Three sensors capture relative humidity & temperature in different locations and height in a tomato greenhouse in Israel. During DryGair's operation, variability in conditions is significantly minimized **(Figure B)**.

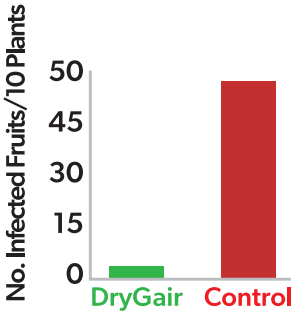
DryGair's air circulation provides homogeneous desired conditions for the plants throughout the entire greenhouse. The uniformity prevents the formation of humid microclimates within the foliage, preventing the development of damaging diseases.

**No Humid Microclimates = Disease Reduction**
**Uniform Conditions = Uniform Crops**

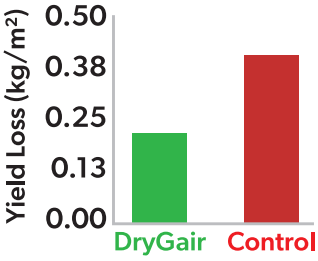
## Improved Yield Quality

DryGair prevents disease outbreaks and reduces spray use, by preventing the conditions necessary for disease development.

### 98% reduction in botrytis infections in peppers (Israel)




### 50% reduction in yield loss due to cracked tomatoes (Spain)




DryGair reduces the presence and development of diseases, such as downy mildew, powdery mildew, and gray mold. Growers report higher and more consistent Brix index in tomatoes throughout the growing season.

DryGair Horticulture Dehumidifiers
a new way to grow.