

Brand New Precision Ethylene Treatment (PET) Technology

A major step change for ethylene, protecting the quality of potatoes.



August 2024

LET'S UNPACK THE TECHNOLOGY IN MORE DETAIL...



Understanding Ethylene

WHAT IS ETHYLENE?

Ethylene is a natural plant hormone, found in every living plant. It is a harmless but potent colourless gas that acts as a signaling molecule in plants, influencing various physiological processes, including ripening, senescence, petal fall and responses to stress.



ROLE OF ETHYLENE IN STORAGE SOLUTIONS

**Relevant to potatoes and other crops*



Sprouting:

Ethylene accelerates the ripening process in many fruits and vegetables. In the case of potatoes ethylene works by altering the signaling pathways of gibberellins in the tuber, responsible for potato sprouting.

Ethylene also promotes the production of abscisic acid (ABA) that opposes gibberellin actions leading to significantly reduced sprouting.



Quality Maintenance:

Maintaining appropriate ethylene levels in storage environments is essential for preserving potato quality and preventing the conversion of starches into reducing sugars, which can negatively impact fry colour.

Using ethylene carefully and in controlled amounts helps prevent sprouting without adversely affecting potatoes intended for commercial use, such as those for french fries.

For 20 years,

Restrain has been pioneering the way in potato storage with its state-of-the-art ethylene technology, keeping your potatoes sprout-free, quality-stable and ready for market.



Seamless ethylene integration

We have refined our systems to create a stable ethylene environment in commercial bulk, box, ambient and refrigerated storage setups, integrating seamlessly into existing facilities without costly modifications.



Innovation and enhanced control

In 2017, Restrain began designing and manufacturing its own catalytic generators, enhancing safety, reducing costs, and fostering innovation. Using advanced micro computer technology, we offer advanced control and future internet connectivity for unparalleled monitoring.



Leading the Future of Potato Storage

By 2023, we integrated iCloud for real-time remote monitoring and adaptive storage control. Our ongoing research and new patent system ensure groundbreaking advancements, solidifying our leadership in ethylene management for potato storage. Restrain makes long-term potato storage possible.



Adapting to industry challenges

With the European CIPC ban in 2020, **Restrain** became a solution for major French fry manufacturers and table potato suppliers in key varieties. Our natural, cost-effective sprout suppression system ensures minimal weight loss and optimal fry colour without a required harvest interval. Whilst sprout prevention was the initial priority, fry colours and weight loss became increasingly important following the growth after 2020.

For Autumn 2024, comes the biggest revolution...



Restrain's new pioneering Precision Ethylene Treatment (PET) technology:

An improved method for introducing and maintaining the correct ethylene levels in potato stores - preventing sprouting, protecting fry colour and minimising weight loss.



Key Benefits of New Precision Ethylene Treatment (PET) Technology



1

Accurate Ethylene Control

Leverage the latest in software and sensor innovations for precise control of ethylene levels, preventing overexposure ensuring top-quality potato storage.

2

Protection of Fry Colour

Maintain the fry colour by precisely controlling ethylene levels.

3

Reduction in Fuel Consumption

Reduce operational costs and environmental impact with lower fuel consumption.

4

Gentle Treatment for Potatoes

Treats your potatoes more gently, preserving their quality from storage to market reducing weight loss.

5

Patent-pending Technology

Trust in our new, innovative technology that sets the industry standard for sprout suppression and potato preservation, ensuring you receive the best results.

What is the new Precision Ethylene Treatment (PET) technology?

3 REVOLUTIONARY STEPS:

1

THE SENSOR

The introduction of a new, exclusively designed ethylene sensor improves accuracy, response time, and blocks out other molecules, creating the most accurate continuous ethylene sensing system in potato storage.

Other parameters measured:
Carbon dioxide, temperature and relative humidity.

2

THE PULSE

The development of a new ultra-low dosing pulse system that prepares potatoes for higher levels of ethylene to suppress sprouting.

This system delivers controlled ethylene below sensor detection levels in parts per billion, minimizing respiration to protect fry colour and reduce weight loss.

3

THE CONTROL

A new state-of-the-art ethylene control management system uses algorithms to establish and precisely control ethylene levels in commercial storage facilities, gradually increasing ethylene levels.

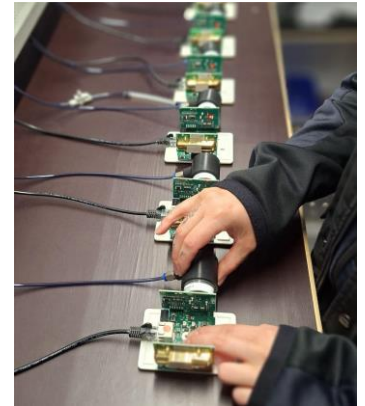
With cutting-edge ethylene **sensors**, an ultra-low dosing **pulse** system, and precise **control** algorithms, our technology ensures superior and reliable potato storage conditions.

The 3 Steps, Unpacked...

1

THE SENSOR

The sensor is fully compatible with on-farm potato storage conditions. In testing, the new sensors are expected to last the entire farm storage period without replacement, providing accuracy and continuous Ethylene monitoring - unmatched by any other system.



The 3 Steps, Unpacked...

2

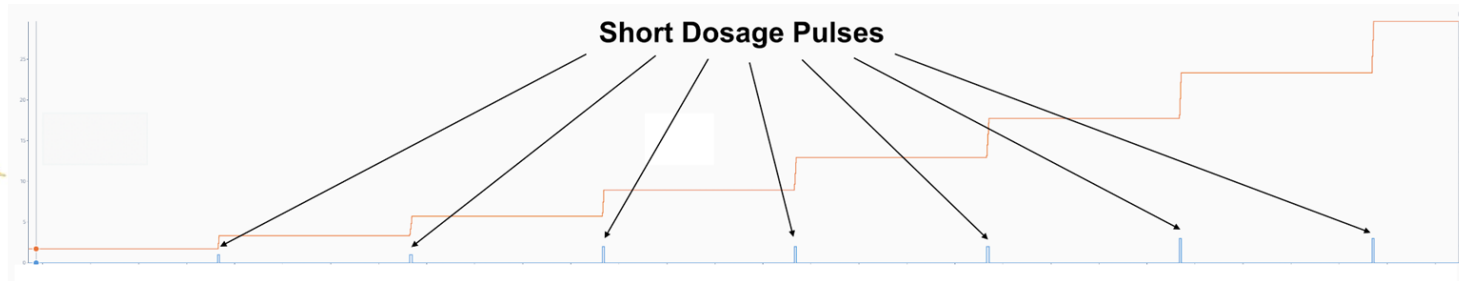
THE PULSE



Through research Restrain has developed a process to accurately pulse, at specific intervals, Restrain Fuel to the catalytic generator to deliver ethylene in controlled micro amounts.

These ultra low doses of ethylene are only detected by the potatoes. The potato reacts to this gentle introduction of ethylene preparing biochemical pathways without stress.

This has the effect of conditioning the potato to ethylene. As the potato is not stressed, respiration rate remains low as higher ethylene is introduced achieving sprout control while fry colours are maintained.

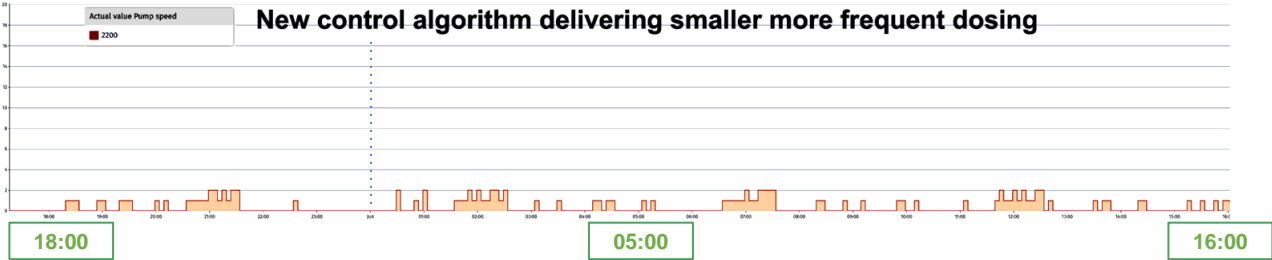


The 3 Steps, Unpacked...

3 THE CONTROL

Restrain software has a new algorithm control that enables smaller, more frequent dosing. This is only possible because of Restrain's unique, continuous ethylene monitoring.

The overall impact is a very consistent and a gentle ethylene atmosphere establishment in the store.

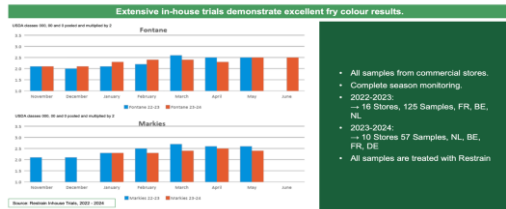




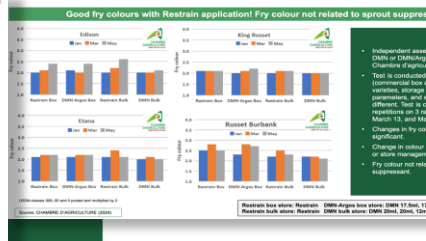
IMPACT ON QUALITY & FUEL CONSUMPTION

Even without PET-Technology trial results show very good quality....

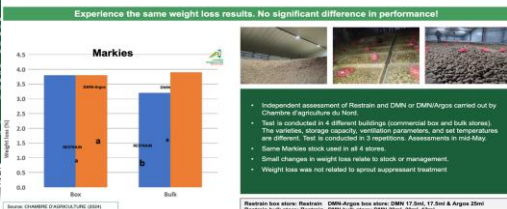
Fry Colour Tests 2023-2024 (1) – RESTRAIN (Netherlands)



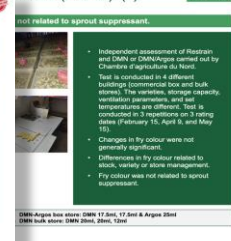
Fry Colour Tests 2023-2024 – Chambre d'agriculture (France) (2)



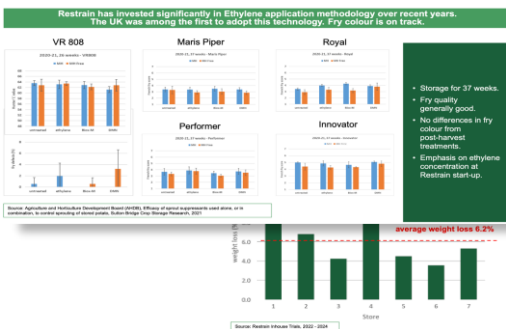
Weight Loss Tests 2023-2024 – Chambre d'agriculture (France) (2)



...culture (France) (1)



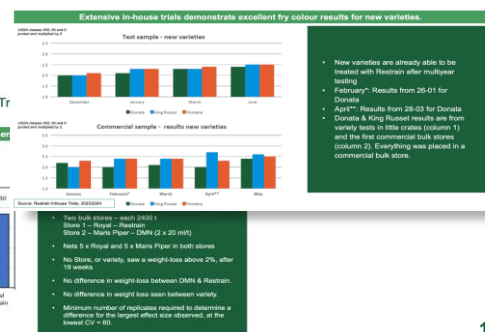
Fry Colour Tests 2021-2022 – AHDB (United Kingdom)



Weight Loss Tests 2023-2024 – Chambre d'agriculture (France) (1)



Fry Colour Tests 2023-2024 (4) – RESTRAIN (Netherlands)



...but with PET-technology we achieve Premium Quality on crisps level! - see next slide

2024 Crisping Update: A step change for the snacking sector

PET Technology delivers robust colour management within standard crisping varieties.



Variety SHC1010
Treatment:- Restrained PET
60 days after treatment
Processed 26/1/24

During the storage period from October to July.

No other controls required like 1-MCP.

Step change in managing Hunter Value (L value) within processing contract parameters.

Next steps:

- Arrange 2024 trials across a broad range of varieties with full seed to pack traceability to give confidence to ensure impartiality and consistency.
- View to roll out large scale implementation for crop 2025 saving both cost and carbon dioxide.

More Efficient Fuel Consumption

The New Sensor-Technology as part of the PET System significantly reduces fuel consumption up to 40 %.



Fixed dose rate
0.5 l/day

Old Sensor
Technology

New PET Sensor
Technology incl. fan

New PET Sensor
Technology without fan

Discover how our cutting-edge sensors detect even the smallest concentrations of ethylene, drastically reducing ethanol consumption.

Our latest generators, equipped with advanced fans, ensure optimal ethylene distribution, enhancing efficiency and further lowering ethanol usage.

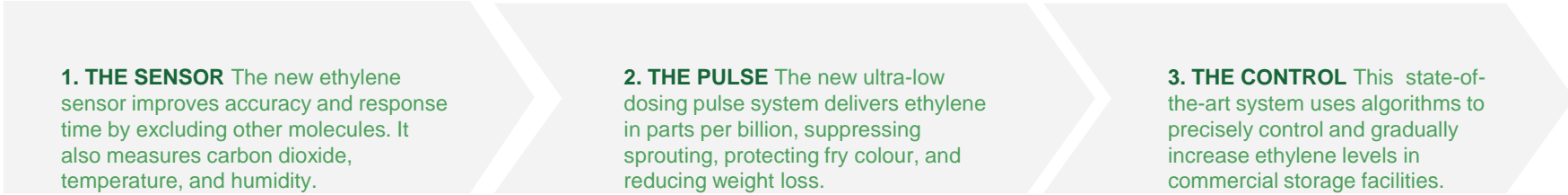
Save money and drive down carbon dioxide to even lower levels with our innovative technology.

Summary

ROLE OF ETHYLENE

Ethylene accelerates ripening and affects sprouting in potatoes. Proper ethylene levels prevent starch conversion to sugars and preserve fry colour. Controlled use prevents sprouting without harming commercial potatoes.

3 Steps:



1. THE SENSOR The new ethylene sensor improves accuracy and response time by excluding other molecules. It also measures carbon dioxide, temperature, and humidity.

2. THE PULSE The new ultra-low dosing pulse system delivers ethylene in parts per billion, suppressing sprouting, protecting fry colour, and reducing weight loss.

3. THE CONTROL This state-of-the-art system uses algorithms to precisely control and gradually increase ethylene levels in commercial storage facilities.

5 KEY BENEFITS

Accurate Ethylene Control

Protection of Fry Colour

Reduction in Fuel Consumption

Gentle Treatment

Patent-pending Technology

PET Technology is not just for potatoes...



Apply product **carefully**. Follow recommendations.
Always read manual and watch training materials **before using**.
Pay attention to warning notices and symbols.



THANK YOU