



STRAWBERRY CASE STUDY

STRAWBERRY TEST WITH BLUEZONE®
TECHNOLOGY FOR MOLD
CONTROL/FRESH PRESERVATION



FRESH THINKING, KOOLER RESULTS: THERMO-KOOL + BLUEZONE®

Revolutionizing Food Preservation for the Modern Kitchen

When peak performance meets breakthrough technology, freshness becomes more than a promise, it becomes a guarantee. That's the story behind the partnership between Thermo-Kool and Bluezone® by Middleby, where world-class walk-in refrigeration meets air purification science.

Thermo-Kool's commitment to superior insulation, flexible design, and lasting durability is now enhanced by Bluezone's patented air purification system—engineered to destroy contaminants like mold, bacteria, and ethylene gas. This collaboration empowers operators to extend the shelf life of fresh produce, like strawberries, reduce spoilage, and exceed safety standards with ease.

Together, Thermo-Kool and Bluezone are redefining what it means to seal in freshness, offering a smarter, cleaner, and longer-lasting solution for commercial kitchens that refuse to compromise.



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OVERVIEW

Strawberries stored for 10 Days under Bluezone® Control exhibited less mold, less ripening, and less undesirable odor than strawberries from the same original pallet stored in an identical refrigerated chamber without the Bluezone® Unit.

OBJECTIVE

To evaluate the effectiveness of Bluezone® Technology in reducing mold growth, controlling ripening, and maintaining freshness in stored strawberries over a 10-day period.

SOLUTIONS

By utilizing Bluezone Technology in a refrigerated storage environment, the test demonstrated a significant reduction in mold growth, volatile organic compounds (VOCs), and undesirable odors, resulting in extended strawberry freshness and improved quality compared to conventional storage methods.



TESTING THE IMPACT OF BLUEZONE ON PERISHABLE PRODUCE



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Tests were conducted with two pallets of California, Driscoll strawberries, packed with 1 pound, vented, plastic clamshells, 8 clamshells to a cardboard flat, six flats per layer, 40" X 48" wood pallet base, total of 18 layers of strawberries per pallet. These two pallets were a minimum of 10 days old when we initiated the test. (The previous 10 days included five days in transport from California to Chelsea AM in Tectrol Pallet Cover, followed by 5 days of storage at the distribution center in Chelsea MA). The two pallets and all flats in each pallet were labeled as Pallet A and Pallet B. On receipt, Pallet B already showed significant signs of mold and decay. Berries in Pallet A exhibited far less mold from the start.



Typical Flat from Pallet A

Flats from Pallet A were marked and a total of 18 flats were identified, numbered, and photographed for detailed analysis at the end of the test. Each refrigerated container was filled with 9 marked, numbered, and photographed flats from Pallet A along with all the other flats from both Pallet A and B. Flats from Pallet B were distributed evenly between the two refrigerated containers, but were not used in subsequent evaluations because they were already exhibiting mold growth.



Typical Flat from Pallet B

Photographs of typical flats from Pallet A and B are shown to the right. Pallet B was clearly older or had more decay from the other.



RECAP OF TEST SETUP

- Two identical refrigerated storage environments (one with Bluezone, one without)
- Strawberries stored for 10 days under identical conditions
- Data collected on mold growth, ripeness, odor, and air quality

BACKGROUND ON METHODS & ALTERNATIVE PRESERVATION SYSTEMS



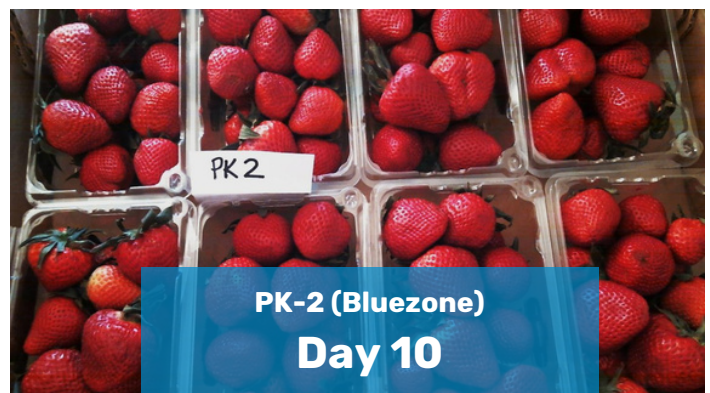
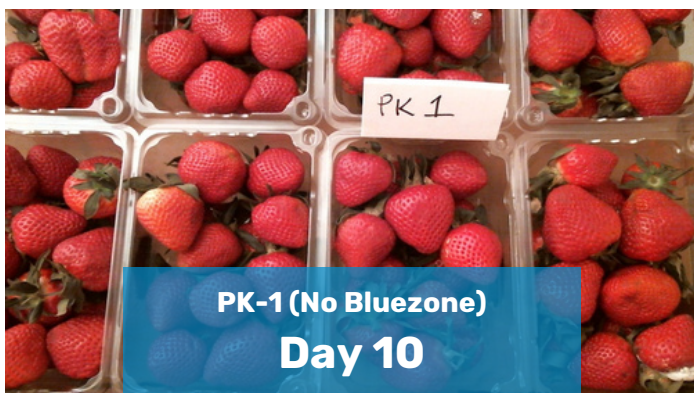
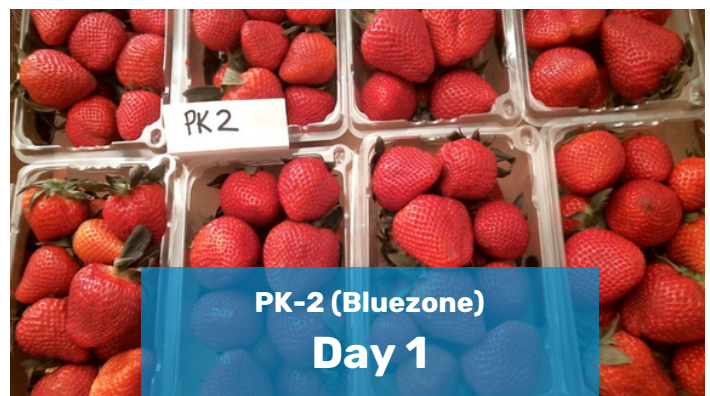
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Source of Method

Sampling and measurement methods were adapted from strawberry test methods documented in a paper written by researchers at UC Davis Department of Plant Sciences and University of Florida Horticultural Sciences Department. Comparison of Pallet Cover Systems to Maintain Strawberry Fruit Quality During Transport by Andrew Macnish, Malkeet Padda, Francine Pupin, Pavlos Tsouvaltzis, Angelos Deltisidis, Charles Sims, Jeffrey Brecht, and Elizabeth Mitcham, **Hortechonology**, 22(4) August 2012 describes test methods and evaluation methods in detail. The paper defined the value of testing after removal from the refrigerated container and after two days at room temperature storage.

Standard of Comparison for Bluezone® Technology for Strawberry Preservation

MacNish describes the value of strawberry pallet cover systems that create a high CO₂ concentration environment in order to reduce mold growth/decay. There was not significant impact of these systems on maintenance of fruit firmness and weight loss. Impact of the CO₂ systems on decay incidence is shown below. After 2 – 4 days in refrigerated transport, there was insignificant impact of any of the CO₂ pallet cover technologies. After 2 additional days at room temperature (shelf life), however, the Tectrol system reduced the incidence of decay from over 40% to approximately 36%. This controlled atmosphere method is considered state of the art for fresh preservation of berries.



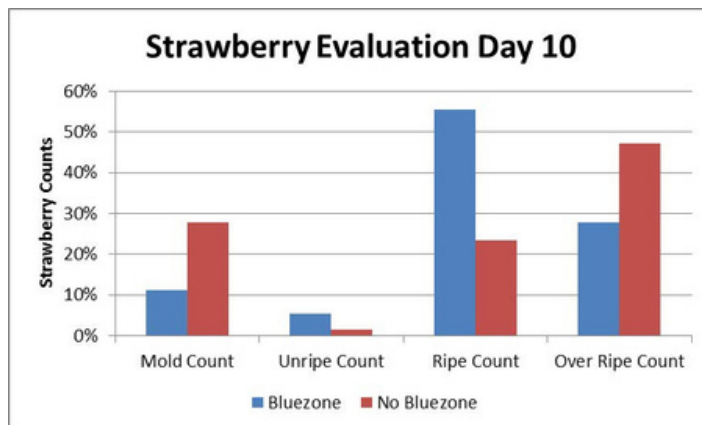
THE VALUE OF BLUEZONE FOR COLD STORAGE



STRAWBERRY CASE STUDY

BETTER PRESERVATION, LESS WASTE, MORE SAVINGS

Six strawberry flats from each container (identified on Day 1 for evaluation) were removed from both refrigerated containers. Two flats from each set were set aside for evaluation after a day at room temperature. Each strawberry in each clamshell of each flat (four flats from each container) was examined for mold and ripeness, using the scale shown below. The results showed significant benefit of the Bluezone unit for both mold reduction and control of ripening.

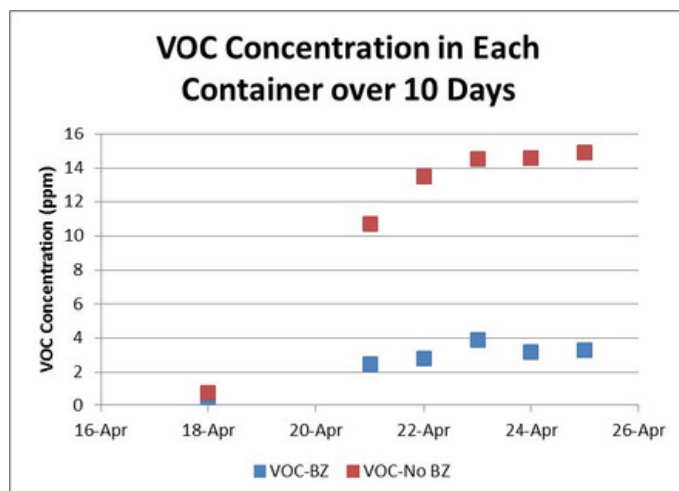
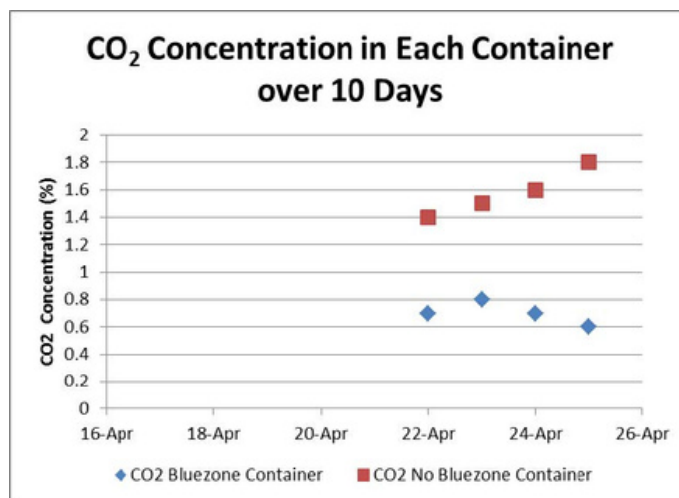


Strawberry counts after removal from refrigerated storage, Day 10 (20 days total berry life)

GAS MEASUREMENTS/ODOR

Over by the 5th day of the tests, Volatile Organic Compound concentration in the container with the Bluezone® unit were held to than 25% of the VOC levels in the container without the Bluezone® unit. Carbon dioxide levels in the Bluezone container were roughly half that of the other container. By Day 5 in the tests, a strong odor of alcohol/aldehydes were emanating from the container without the Bluezone® Unit. When the strawberries were removed from the container on Day 10, the odor in the non-Bluezone® container was quite foul, while the smell in the Bluezone container was less intense and consistent with "strawberry" odor.

Note: Temperature and humidity levels in each container were continuously logged. Each container held the temperature to 34 – 36 °F. Relative humidity cycled between 85 – 92% in each container.



HOW BLUEZONE PRESERVES FRESHNESS

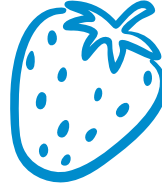


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Mold Reduction

Bluezone-treated strawberries showed no visible mold after 10 days, compared to significant mold growth in the untreated batch.



Slower Ripening

Bluezone preserved fruit firmness and reduced premature softening.



Odor Control

The untreated strawberries developed a strong, unpleasant odor, while the Bluezone batch retained a fresh strawberry scent.



Lower VOC Levels

Bluezone maintained significantly lower volatile organic compound (VOC) levels, reducing spoilage indicators.



COMMERCIAL WALK-INS

Sealing in Freshness



STRAWBERRY CASE STUDY

Benefits Come Standard

Running a commercial kitchen is a year-round commitment. With Thermo-Kool, operators can rely on walk-in coolers and freezers built to last, backed by quality construction and a 10-year warranty. Customizable, interchangeable panels ensure a perfect fit for any concept or space, down to the inch.



Flexibility

Walk-ins where you want them



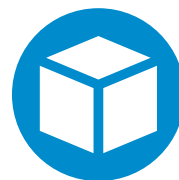
Doors

Stands up to day-to-day use



Flooring

Where durability meets safety



Panels

Custom configurations



Preservation Made Easy

Refrigeration controls can be cumbersome and hard to operate. In a foodservice landscape of labor challenges, it's important to make processes as easy as possible for staff, and that's exactly what Thermo-Kool's new state-of-the-art controllers will do. Manage your cold food storage at the press of a button.

