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Improving Quality and Profitability for Retail Grocers

The Benefits of Pallet-level Monitoring for the
Fresh and Perishable Food Cold Chain

Introduction

Retail grocers face a tough competitive environment. Increasing imports, entrants of new competitors, traceability requirements and complex supply chains make providing customers with fresh produce, meats, seafood and dairy a challenge. New regulations will change how products are tracked and monitored. Margins are thin and customers are fickle. Retailers are looking at new ways to optimize cold chain operations, manage suppliers, reduce shrink and improve profitability. New pallet-level temperature monitoring solutions can provide the ability to proactively manage the cold chain, reduce waste and improve retail grocers' bottom line.

The Cost: \$53 Billion in Cold Chain Shrink

One-third of shipped produce is wasted annually, amounting to a loss of \$160 billion each year¹. Post-harvest losses of horticultural crops are estimated to be more than 50% of the production due to poor post-harvest handling techniques such as bad temperature management. This equates to roughly \$53 billion of cold chain shrink per year for produce. Waste and quality issues aren't limited to produce alone. Mishandling and mismanagement of any temperature sensitive product – including meats, seafood, poultry and dairy – represent a potential loss of revenues and brand loyalty, as well as food safety risks. Successfully reducing this shrink can have an immediate and direct benefit to the bottom line. Using strawberries as an example, one grocery chain estimated that reducing shrink in strawberries by just 1% would add more than \$1.173 million of profit to their bottom line annually. A 6% reduction would generate an estimated \$7.739 million each year. That's for just *one* produce item for *one* retail grocery chain. Imagine the costs when factoring in the myriad of fresh fruits, vegetables and other perishable items stocked by each retailer.

Proper temperature monitoring and management throughout the cold chain is no longer a luxury but a necessity for improving operations and addressing food safety and traceability issues. Even relatively small variations in temperature can significantly impact the shelf life of fresh product – and its value.

Specific Example: Impact to Bottom Line for a Commodity (Strawberries):

1% reduction in Shrink

Increase in profit of \$1,173,555

6% reduction in Shrink

Increase in profit of \$7,378,830

Once again referencing strawberries, the diagram below, produced by the University of Florida, shows how strawberries should be shipped at a consistent temperature of 34° Fahrenheit. A temperature drop of 2° will freeze and destroy the berries resulting in a complete loss of product. Shipping at a temperature of just 42° (an increase of only 8°), shaves seven days off the shelf life, significantly impacting quality and potential revenues. Temperature monitoring throughout the cold chain – enabling the ability to proactively address changes in temperature in real-time – provides improved delivered freshness, documented quality and increased customer satisfaction.



Cold Chain: Strawberries	
Transport time to a distribution center	2.5 days
If maintained at a consistent 34°	10 day shelf life
↓ If 2°	freeze damage, complete loss
↑ If 4°	Lose about 3 days of shelf life
↑ If 8°	lose about 7 days of shelf life

The path between grower or manufacturer and retailer for perishable products involves many steps and handoffs, especially with the increasing amount of food that is imported into North America including 50% of fruits and 20% of vegetables². To maximize quality, value, shelf life and food safety, it's essential that temperature is monitored and managed at every step throughout the cold chain because, at each point along the way, there's potential for trouble. Produce could wait in the field, wait for precool, sit in the sun on a loading dock, or be stored in a truck with faulty refrigeration that places the product's quality and safety at risk.

Each handoff in the cold chain also creates the opportunity to break the chain of responsibility. Without pallet-level temperature monitoring and logging, the producer can claim that the product was fine when it left their dock, for example, leaving the distributor wondering about the quality and remaining shelf life when they receive the product. Ultimately, the retail grocer is left making a determination on the quality and can accept or reject a shipment – or re-estimate its value – with limited or inaccurate information based solely on visual inspection and incomplete paperwork. Simply put, product freshness and shelf live cannot be ascertained by visual inspection.

The Need for Pallet-Level Temperature Monitoring

Well over one billion pallets of produce are shipped annually to retail grocers in North America and Europe – but how can you examine a billion pallets of produce cost-effectively? The cold chain has tried to address this problem by implementing temperature monitoring solutions at various points along the way, such as environmental monitoring of the tractor trailer or the cold storage facility. However, this only monitors refrigeration conditions and does not accurately track the condition of each pallet of product. This leads to inaccurate

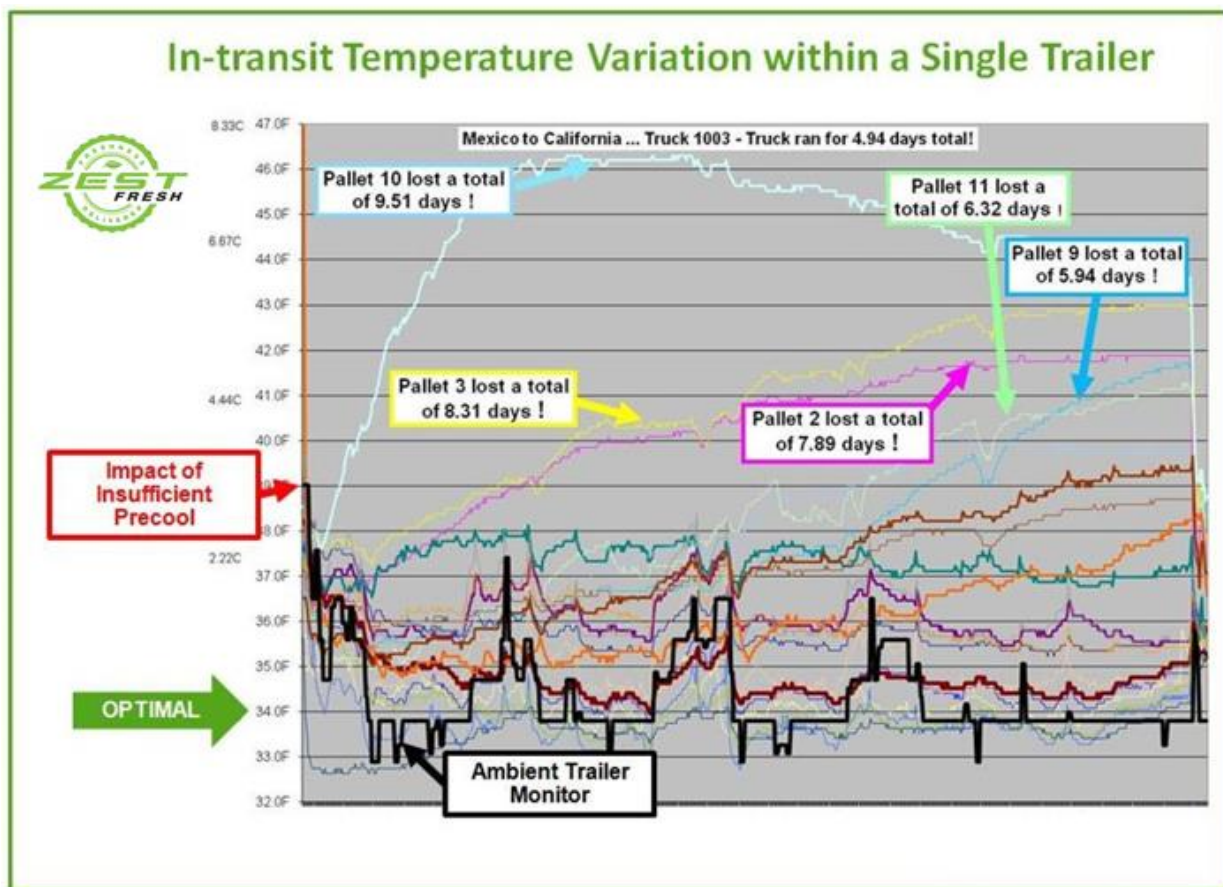


assumptions that group the condition of an entire shipment when it has been proven that the cooling (and quality) is not uniform from pallet to pallet.

The result is the aforementioned \$53 billion problem and grocers can be stuck with at risk product with unknown shelf life. This can lead to:

- Unhappy customers who take product home only to have it spoil the next day
- Out-of-stocks if shipments are rejected
- Costly overstocks to prevent running out of products
- Potential food safety issues
- Increased costs and lost profits

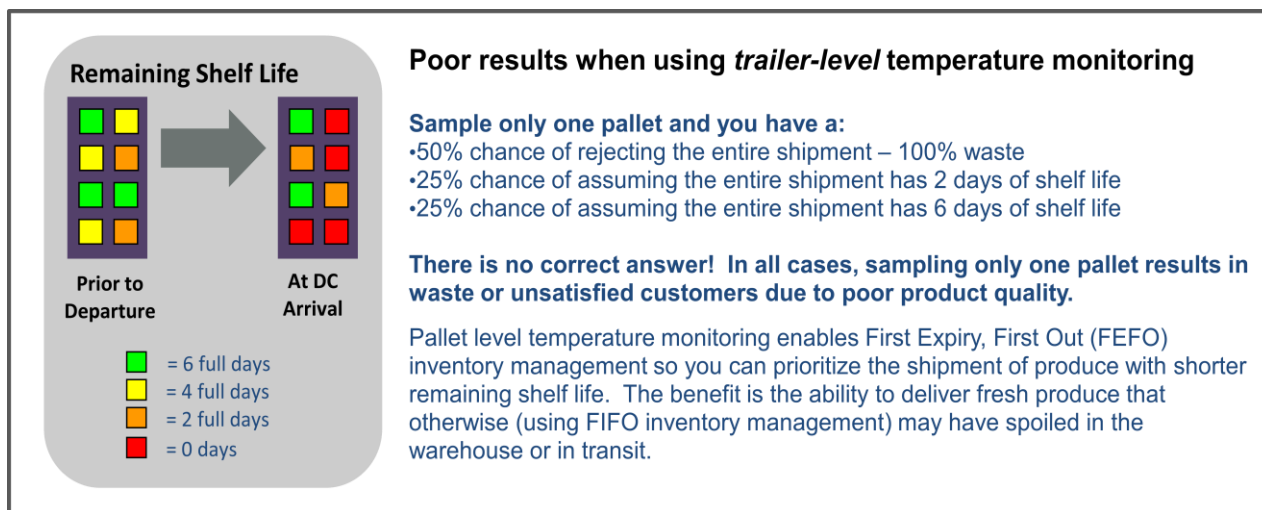
Here's a case study example of the inadequacy of implementing temperature monitoring solutions at the "truck level" using one or two temperature monitors in the refrigerated trailer. One or two temperature monitors cannot address the pallet-level temperature variation within the trailers that vary significantly due to variations in production, precooling, warehousing and even load placement in the trailer. What's needed is pallet-level temperature monitoring from harvest or manufacturing through to retail delivery.



The chart above represents the pallet-by-pallet temperature variation for a shipment of one trailer of blackberries from Mexico to California. Of the 26 pallets in this one trailer, five (19%) experienced significant temperature variations, with one pallet (pallet 10) aging *ten days* over the five-day trip – twice what the trailer-level monitor would have indicated. Visual inspection and random sample/pulping of product would not identify these significant variations in pallet-

level temperatures and relative remaining shelf life. Pallet-level monitoring helps to improve receiving operations and streamline quality control by taking the guesswork out of visual inspections and incomplete shipping information.

The diagram below illuminates the benefits of pallet-level monitoring and how it enables a FEFO (First Expiry, First Out) model over the more traditional FIFO (First In, First Out) approach by factoring in the variation of pallet-level temperatures within a refrigerated trailer and its impact on the remaining shelf life of produce. FEFO-based inventory management means you ship out the product with the first expiry date first, regardless of when it was received in the warehouse.



The color codes indicate the remaining available shelf life of pallets in a trailer in a shipment from a grower to a retail distribution center. In the diagram on the left (prior to shipment), it indicates that two pallets (in orange) have only two remaining days of shelf life prior to departure, three (in yellow) have four days of remaining shelf life and three (in green) have six days of remaining shelf life. With this information, the distributor can choose to ship those with six days of shelf life (green) to more distant retailers and those with only two days of remaining shelf life to a closer location for rapid consumption. With pallet-level temperature monitoring, these FEFO-based decisions can be made at the warehouse – or other steps in the cold chain – at a pallet-by-pallet level and result in maximizing shelf life and improving cold chain yield.



Zest Labs Temperature Monitoring Tags in pallets of broccoli

If the temperature is monitored only at the trailer level, the potential exists for poor decision making that can have very expensive consequences. As discussed in the example above, when the trailer arrives at the distribution center, only one pallet may be selected and sampled for quality. If a red pallet were chosen, the entire load may be rejected and wasted when, in fact, only half of the load should be wasted. Conversely, if a green pallet were chosen for the sample, the entire load may be accepted meaning that four pallets of poor

quality produce will be delivered to stores or customers. In this example, in each case, trailer-level monitoring produces incorrect – and costly – results.

As a result, by implementing pallet-level temperature monitoring and FEFO inventory management, product revenues can be improved by maximizing the available shelf life based on the dynamic state of the product by knowing its temperature throughout the distribution process. What's important for maximizing the delivered value of the product is knowing the current relative remaining shelf life and freshness from the field or manufacturer to the retailer. This level of knowledge is what drives effective real-time decision making, shrink reduction and quality improvement. In other words, by removing the guesswork, you can more effectively ensure that every pallet of product is delivered to the retailer with adequate freshness and safety for sale.

Proven in the Field

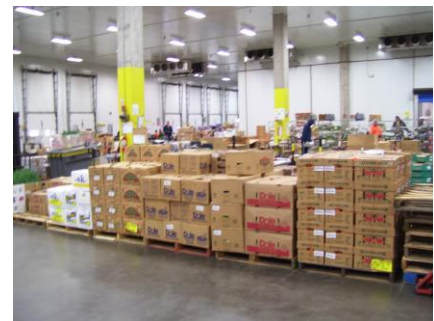
A number of growers, grocers and food service companies are working to provide a more complete method of tracking the temperature of produce in-pallet throughout the cold chain. They're utilizing Zest Fresh™ and reusable Zest Labs temperature monitoring tags *within the packed product at the pallet level* to monitor its temperature from throughout the cold chain with little or no change to existing processes. The tags can be wirelessly read while packed in the pallet of produce (or bin of meat, seafood or poultry, or frozen or processed food) making this solution easy to implement.



Zest Labs
Tag

Growers, manufacturers, shippers and retailers have verified the value of this approach to improve their supply chain operations, product quality and traceability and the results have exceeded expectations.

In one case study done in Hawaii, a produce supplier worked with the Hawaii Department of Agriculture to optimize the cold chain from the warehouse to the retailers. Hawaii is heavily dependent on agriculture – both locally grown as well as imported. However, due to the tropical Hawaiian climate, spoilage due to temperature exposure is a significant problem, especially when shipping produce from island to island, or receiving produce from the mainland or Asia. Once the produce leaves the supplier's warehouse, it can be subject to damaging temperatures inside a truck or sitting on the hot tarmac at the airport waiting for the air carrier to load it and transport it. Temperatures inside the produce can quickly reach the ambient air temperature or higher – drastically reducing the shelf life.



Pallets of Produce in Hawaii

Working with Zest Labs and other companies, the Hawaii Department of Agriculture monitored and logged the pallet-level temperature data from the warehouse, on board the trucks, at the airports and through to the distribution centers on other islands – providing accountability and control throughout the entire process.

Other retail grocers and food service companies are utilizing Zest Fresh to monitor and manage the condition of fresh produce as it moves through the supply chain to provide documented quality of delivery as well as a complete traceability record through to the retail store or restaurant.

These projects demonstrate the benefits of monitoring the temperature throughout the cold supply chain. Zest Fresh temperature monitoring tags can be placed with the product at the time of harvest and accessed throughout the distribution process through to the retailer provide invaluable temperature and traceability data. As a result, the grocer can make more informed decisions and better manage their inventory to maximize the product shelf life and quality. They can also look at the historical temperature data to determine if systematic breaks in the cold chain exist and how best to correct them. This helps manage the quality and shelf life of the product and helps optimize the cold chain and drive down costs.

Addressing Traceability Regulations

Zest Fresh can assist growers, packers, shippers and retailers address the requirements of the Food Safety Modernization Act and Produce Traceability Initiative by providing electronic records of a food's origin and movement throughout the supply chain.

Traditionally, information and records about a product's origin, shipment and delivery have been paper-based which slows track-and-trace and recall efforts. Zest Fresh tags include information about the product's origin and its condition between the field and the retail grocer that can be securely stored directly on the tag and in the system. The system also records the product's waypoint information to the tag every time it is read by a Zest Labs reader – at the pack house, distribution center and other transit points – creating an electronic data log for track-and-trace capability. This data and these transactions can also be recorded in the blockchain. This data record can be utilized to more rapidly help identify origins of products and thereby help dramatically speed recalls and improve track and trace requirements by utilizing electronic, rather than paper-based record keeping. This data is extremely helpful in optimizing cold chain operations and addressing food safety and traceability requirements, such as those mandated in the Food Safety Modernization Act because each tag provides a traceability record for the complete history of the product including production information as well as a complete shipping and way point information.

Data is easily captured and shared in the cloud using Zest Fresh. This provides the ability to securely and selectively share information between offices, distribution centers and supply chain partners for improved decision making and quality control.

The Bottom Line on Quality and Profitability

Utilizing Zest Fresh and temperature monitoring at the pallet-level drives improvements in the cold chain that enables retail grocers to better manage the myriad of complexities as fresh, frozen and processed foods are moved through the supply chain. With Zest Fresh, retail grocers can:

- Maximize product quality and document delivered freshness
- Reduce shrink due to temperature management issues
- Ensure food safety and traceability requirements
- Automate receiving and operations
- Streamline quality control and merchandising

Zest Fresh is affordable with a rapid ROI with less than a dollar per use. Zest Fresh temperature monitoring tags can be wirelessly read without unpacking the pallets or containers making pallet-level monitoring possible. Because the tags can be read when placed within the product on the pallets, no changes to product handling are necessary, eliminating the need for staff to scan multiple bar codes. With on-board memory, tags can store thousands of temperature data measurements – as well as waypoint and other production data – that can quickly be accessed and used as the basis for real-time acceptance criteria, shipping prioritization based on FEFO inventory management and addressing traceability requirements.

The result is the ability to proactively manage and monitor your cold chain with real-time decision making to maximize shelf life, improve quality and value and increase revenues for retail grocers.

For more information on Zest Fresh and how it can improve your business please contact us at:

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¹ <https://www.theguardian.com/environment/2016/jul/13/us-food-waste-ugly-fruit-vegetables-perfect>

² <https://www.foodsafety.gov/news/fsma.html>