Half-bad Is Not Good

Research Shows Significant Shelf-life Variability at Leading Grocery Stores and the Impact on Customer Experience and Satisfaction

Freshness of Strawberries, Romaine Lettuce and Salad Mix Varies Dramatically from Store-to-Store and Within Stores

Executive Summary

The primary reason consumers choose a grocery store is because it offers, fresh, high quality produce. However, Zest Labs research documents that grocery stores are not providing their customers with consistently fresh produce.

Zest Labs™ performed a research study measuring and comparing the shelf-life (or freshness) of produce being sold at major grocery chain stores across the United States. The research found that the freshness of produce – specifically strawberries, romaine lettuce and packaged salad mixes – varied significantly from store to store as well as within each individual store. This shelf-life variability causes early spoilage, which can disappoint consumers and result in costly retail waste. By offering produce with consistent freshness and quality, grocers can create competitive differentiation in the market.

Key findings from the research included:

- **Roughly half of the sampled produce spoiled prematurely**, based on target shelf-life of the produce, and could lead to customer dissatisfaction.
- **The Shelf-life variability of produce within individual stores varied dramatically** by as much as 21 days for romaine, 12 days for strawberries and nine days for salad mixes. This provides an inconsistent shopping experience that can frustrate customers and cause them to take their business elsewhere.
- **Several stores sold some produce that had expired or spoiled at the time of purchase**. This would cause customers to have to return to the store or simply waste the produce, leading to customer dissatisfaction.

While not a primary focus of the study, the research also found that, for strawberries, there was no correlation between the price of strawberries and their freshness, that there was significant variability in freshness across strawberries supplied by one brand, and that the "Use By" dates, where published, were inaccurate and misleading.
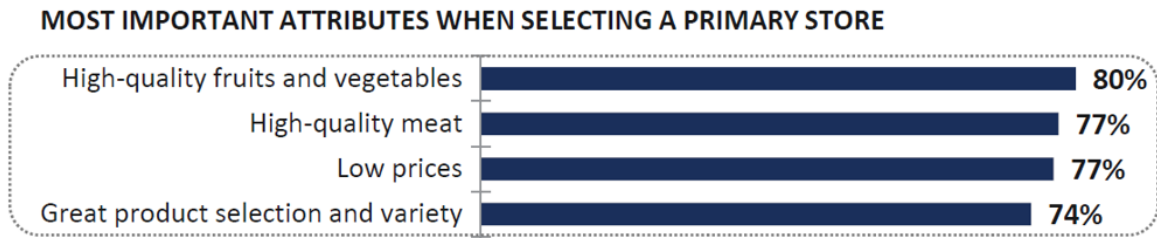
Most grocery stores assume that the produce they are receiving has uniform freshness or shelf-life, but the data shows there are *significant* variations. These shelf-life variations lead to in-store waste and to dissatisfied customers who purchase produce that spoils before they can consume it. As a result, customers may take their business elsewhere in search of fresher, more consistent quality produce.

Disparities in shelf-life generally occur due to variations in harvest conditions and post-harvest handling and processing. When not properly managed, this variability leads to premature spoilage of produce, either at the store or with the consumer. However, by measuring and managing the impacts of shelf-life variation beginning at harvest, growers, suppliers, processors and grocers can ensure that each pallet of produce is delivered to the retailer with sufficient freshness for sale, and customer use and satisfaction, building customer loyalty for their preferred grocer.

About the Research Study

The research study, performed from February to May of 2019, was based on random sampling of strawberry clamshells, packaged hearts of romaine lettuce and packaged salad mixes purchased throughout the research period from eight major grocery store chains in the U.S. For strawberries, two of the chains included stores in two locations, creating a sample base of ten stores for strawberries. Nine stores were sampled for romaine (including two stores from the same chain) and five stores were sampled for packaged salad mixes.

MOST IMPORTANT ATTRIBUTES WHEN SELECTING A PRIMARY STORE

High-quality fruits and vegetables	80%
High-quality meat	77%
Low prices	77%
Great product selection and variety	74%

Source: FMI Grocery Shopper Trends 2018

According to the Food Marketing Institute, high-quality fruits and vegetables are the most important attribute for consumers when selecting a primary grocery store, with 80 percent citing it as the top factor.

However, many consumers have had the disappointing experience of purchasing produce that looks good on the store shelf only to have it "go bad" at home shortly after purchase. This problem occurs because the produce is spoiling prematurely, before the expected expiration date. This leads to waste and customer dissatisfaction and may lead to consumers changing their primary grocery store, resulting in negative revenue impact on the store. A recent survey by customer engagement consultancy Vision Critical found that 42 percent of shoppers will abandon a store they shop at after two bad experiences.

42%

of shoppers will abandon a store they shop at after two bad experiences

Certainly, growers, suppliers and grocers strive to sell the freshest produce but, due to variability in harvest conditions and post-harvest processing, the shelf-life of fresh produce can vary significantly. Pallets of produce harvested in the same field on the same day can have dramatically different shelf-lives due to harvest conditions, time spent in the field, cut-to-cool times, pre-cooling efficiency and effectiveness, and variations in shipping and handling. For example, pallet A may have 12 days of shelf-life and an adjacent pallet harvested from the same field on the same day may have only seven days of shelf-life. Despite this, both pallets may look the same until spoilage begins.

This is also why "Harvested On" and "Best By" dates can be extremely misleading as consumers may falsely expect produce to last to a certain date only to have it spoil earlier or toss it thinking it has gone bad even if it is still actually fresh. Both situations lead to unnecessary waste.

Research Study Methodology

Zest Labs staff shopped at a defined set of grocery stores in multiple locations across the U.S. over the study period, from February to May 2019. Staff would randomly select from the available inventory without any visual inspection of the produce prior to purchase.

The display and temperature conditions of grocery store samples were recorded, along with the purchase price and brand. The samples were then transferred to specialized refrigerators and held under optimal storage conditions of temperature and humidity. Each day, using the Zest Fresh shelf-life and freshness management solution, every produce sample was evaluated for discolorations, rot, mold and abrasions, among other factors, to determine remaining shelf-life and, ultimately, the end-of life for the produce.
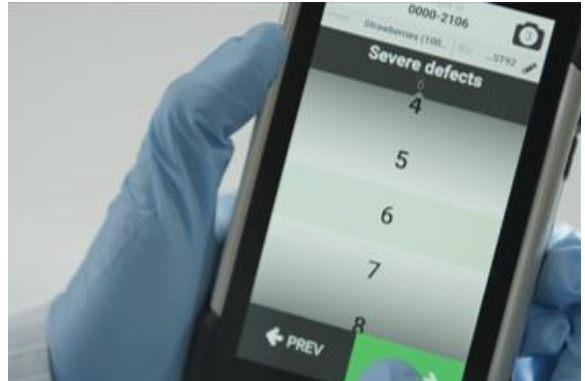
The Zest Fresh Handheld Application

The end of the shelf-life (or end-of-life) is defined as the time when the produce is no longer considered fresh or consumable. While it may still edible, it is no longer marketable due to the visible signs of deterioration and the average customer would not purchase or consume the item. The number of elapsed days from purchase to end of life is then documented in the Zest Fresh solution. The data was then evaluated by a Ph.D. agronomist with specific expertise in evaluating produce freshness to verify the accuracy of the findings.

This approach to shelf-life modeling has been validated by leading academic experts. "Zest Labs' methodology for determining shelf-life is based on years of university research on agronomic science," said Dr. Cecilia Nunes, Ph.D., Associate Professor at the University of South Florida, Department of Cell Biology, Microbiology and Molecular Biology. "Major universities including University of Florida and University of South Florida have confirmed that this approach is scientifically validated and accurate."
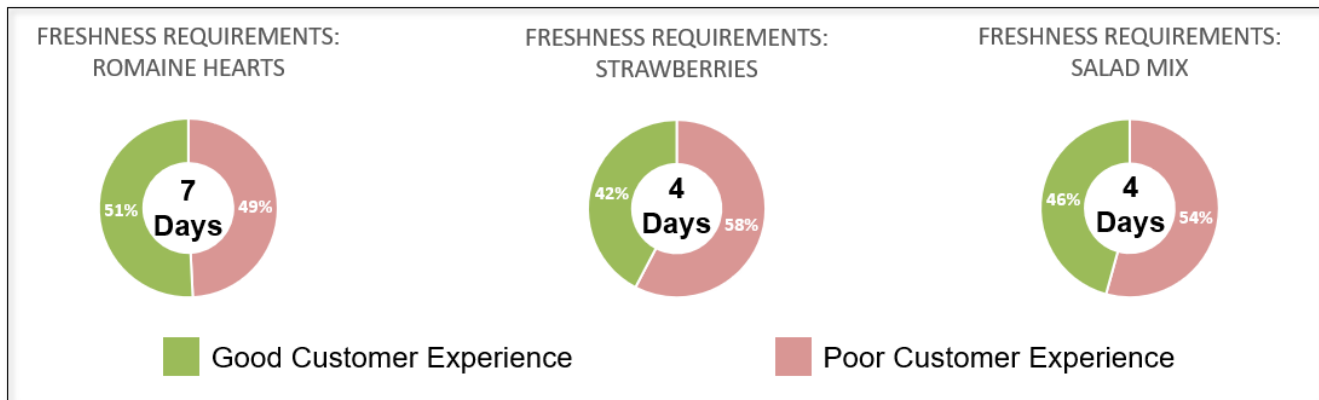
Key Research Findings

- Roughly half of the samples across all stores would provide an unsatisfactory customer experience by spoiling before the consumer would have time to consume and enjoy them. In fact, multiple samples were found to have spoiled at the time of purchase, having a remaining shelf-life of zero days.
- There was significant instore variation for strawberries, romaine hearts and salad mixes. This inconsistent experience would mean, for example, a customer could buy a clamshell of strawberries on one shopping trip and it could last eight days and, on another trip, buy another clamshell to find it had already spoiled.

Poor Customer Experiences – Half Bad is Not Good!

As shown in the diagram below, 49 percent of romaine hearts, 58 percent of strawberries and 54 percent of packaged salad mixes purchased will result in a poor customer experience. Essentially, about half – or more – of the produce purchased by consumers could spoil with the consumer before the expected or desired consumption time.

Based on academic studies and input from grocers, customers should conservatively expect to receive:

- Seven days of shelf-life from romaine hearts once they purchase and take them home. The data showed that 49 percent of the total samples did not meet this requirement.
- Four days of shelf-life from strawberries once they purchase and take them home. The data showed that 58 percent of the total samples did not meet this requirement.
- Four days of shelf-life from salad mixes once they purchase and take them home. The data showed that 54 percent of the total samples did not meet this requirement.

FRESHNESS REQUIREMENTS: ROMAINE HEARTS — 7 Days — 51% / 49%

FRESHNESS REQUIREMENTS: STRAWBERRIES — 4 Days — 42% / 58%

FRESHNESS REQUIREMENTS: SALAD MIX — 4 Days — 46% / 54%

Good Customer Experience   Poor Customer Experience

In-store Shelf-life Variation

The study documented that the shelf-life of each type of produce *within a single store* varied dramatically by as much as 12 days for strawberries, 21 days for romaine, and nine days for packaged salads. This means that customers purchasing produce from the same stores may experience extreme variations in produce freshness each time they purchase a product. In the charts on the following pages:

- The Maximum Shelf-life represents the shelf-life of at least one sample from a particular store that lasted the longest amount of time before its end-of-life. For romaine lettuce, the study was capped at 21 days.
- The Minimum Shelf-life represents the shelf-life of at least one sample from a particular store that lasted the shortest amount of time before its end-of-life. A zero in the third column indicates that there was at least one sample that was spoiled (end-of-life) at the time of purchase.
- The Average Shelf-life represents the aggregate average of the shelf-life of all samples at that store before their respective end of lives. Average shelf-life does not represent any individual sample but can be interpreted for a general level of freshness at a particular store.

Strawberry Shelf-life Analysis

Strawberry Shelf-life Distribution

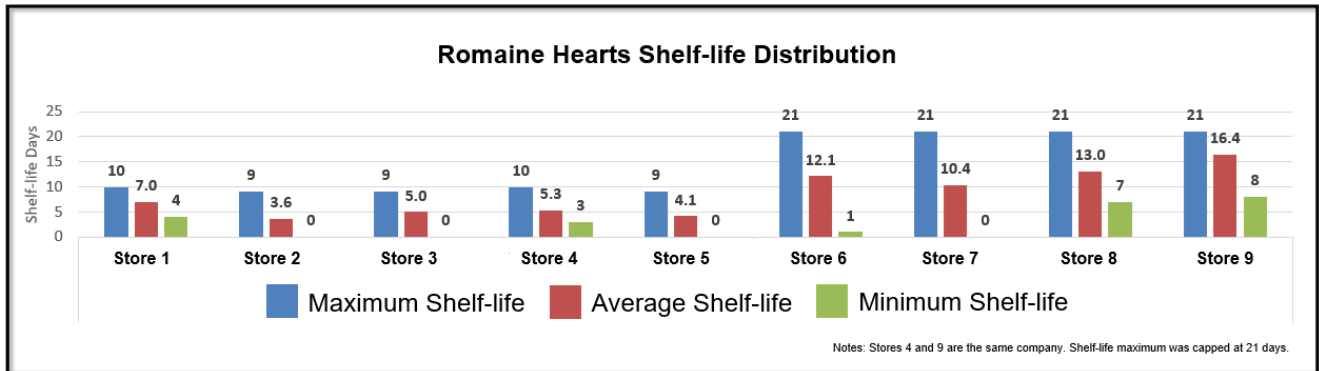Note: Stores 4 and 9 and stores 5 and 10 are the same company.
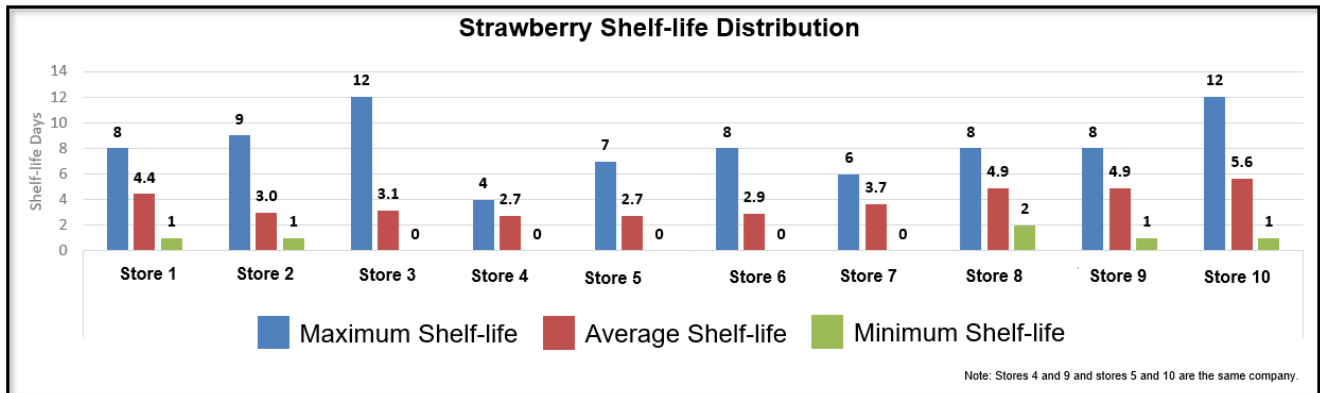
For strawberries, samples were selected across ten stores. As can be seen in Shelf-life Distribution above, variation within a single store was as much as 12 days at Store 3 (12 day maximum minus 0 day minimum). At least one sample had 12 days of freshness while another sample was spoiled at purchase. At that store, the average shelf-life of the samples was 3.1 days, below the four days of desired freshness at purchase. Five stores sold some strawberries that were spoiled at the time of purchase. All but one store (Store 8) sold product that had only one day of shelf-life.

The desired goal was set at four days of shelf-life after purchase. While every store but Store 4 had some product that exceeded the target freshness of four days, all of them sold produce that was below the target shelf-life goal. Some stores were better, on average, than others with store 10 having the highest average shelf-life.
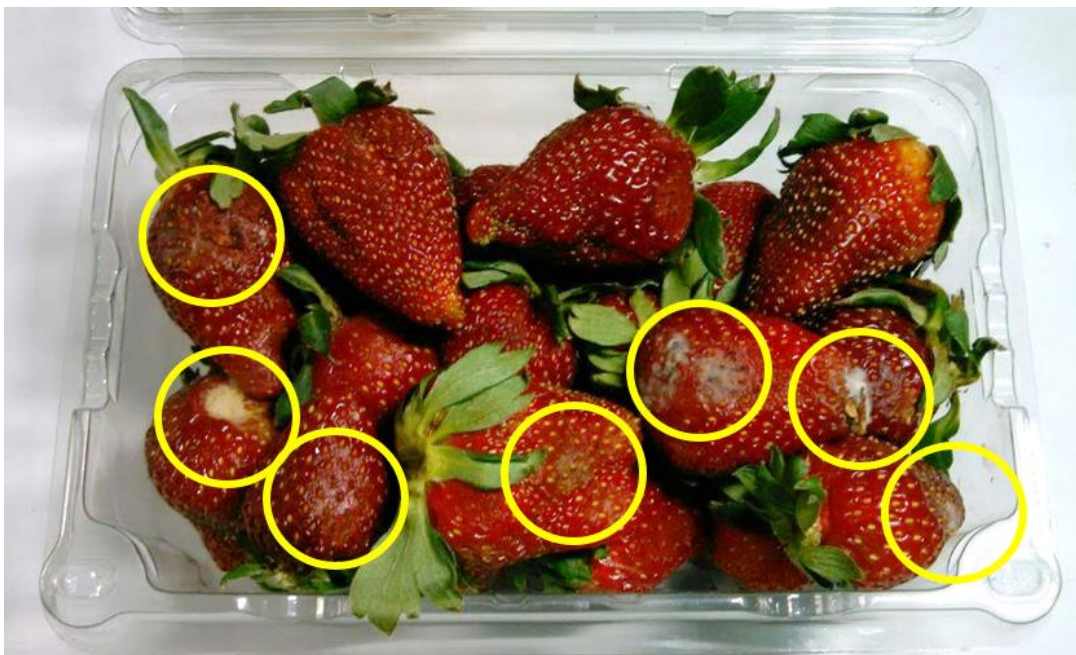
The photo above was taken from a sample one day after it was purchased. The berries were stored in optimal conditions for temperature and humidity. Note in the yellow circles examples of rot and mold. A customer purchasing this clamshell would likely have to throw it away the day after it was purchased, leading to waste and customer dissatisfaction.

Romaine Lettuce Shelf-life Analysis

Romaine Hearts Shelf-life Distribution

Notes: Stores 4 and 9 are the same company. Shelf-life maximum was capped at 21 days.
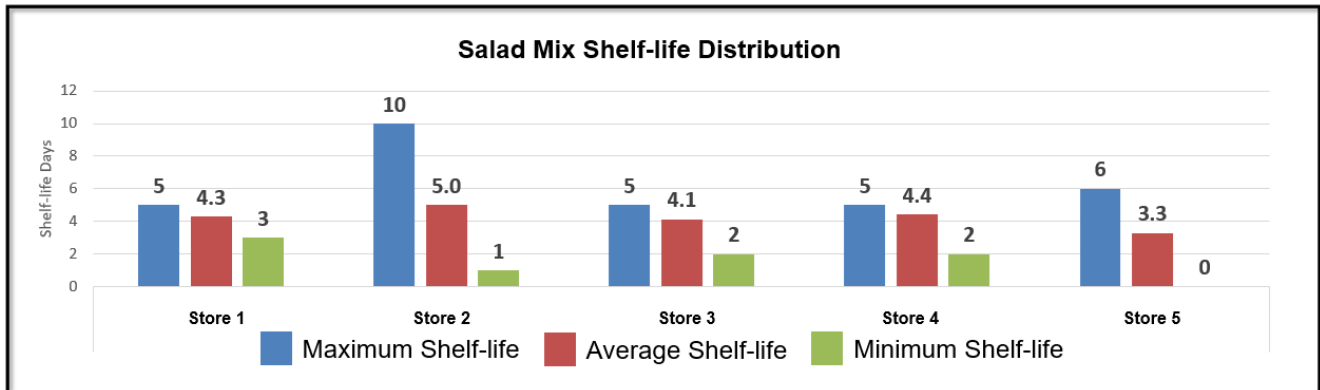
For romaine hearts, samples were selected across nine stores. As can be seen in the Shelf-life Distribution above, variation within a single store was as much as 20 days at Store 7 (21 day maximum minus 0 days (spoiled at purchase) minimum). Four stores had samples that were spoiled at the time of purchase (stores 2, 3, 5 and 7). In evaluating the romaine samples, the shelf life was capped at 21 days and evaluations stopped at that point in the interest of managing the evaluation time. Additionally, going beyond 21 days is not very relevant as consumers will not purchase lettuce to store it for a month.

The desired goal was set at seven days of shelf-life after purchase. While every store had some product that exceeded the target freshness goal of seven days, all but Store 9 sold produce that was below the target shelf-life goal. Some stores were better, on average than others with Store 9 having the highest average shelf-life.

The above photos are from samples that had zero days of shelf-life and had spoiled at the grocery store by the time of purchase. The circles show areas of rot, wilting, browning, decay, slime and other damage.

Salad Mix Shelf-life Analysis

Salad Mix Shelf-life Distribution

For salad mixes, samples were selected across five stores. As shown in the Shelf-life Distribution above, variation within a single store was as much as nine days at Store 2 (10 day maximum minus 1 day minimum). At least one sample had 10 days of freshness while one store (store 5) had at least one sample that was spoiled at the time of purchase.

The desired goal was set at four days of shelf-life after purchase. While every store had some product that exceeded the target freshness, all of the stores sold produce that was below the target shelf-life goal. Some stores were better, on average, than others with Store 2 having the highest average shelf-life.

In the photo on the left, note the spoilage and slime (decay). This photo was taken on the day of purchase and the sample had zero days of shelf-life. The photo on the right shows examples of spoilage for a sample two days after purchase where it was termed "end of life."

Correlation Between Price and Freshness

This study also included some evaluation of the prices of clamshells of strawberries relative to their shelf-life. This was only possible on strawberries as they have uniform packaging of one pound clamshells. (For example, romaine hearts packages range from two to five heads, depending on the supplier.)

The research showed that there was no correlation between the price of a one pound clamshell of strawberries and its shelf-life at the time of purchase. As noted in the table, Store H averaged 5.5 days of shelf-life at an average cost of $3.49 per pound whereas Store D averaged 3.44 days of shelf-life at an average of $5.32 per pound. Or, roughly speaking, you could spend about $2 *more* per pound and get two *fewer* days of shelf-life.

Store	Average of Shelf-life days	Average Price $/Lb.
A	3	$3.08
B	3	$1.89
C	3.17	$3.33
D	3.44	$5.32
E	3.83	$3.74
F	4	$4.02
G	5	$4.99
H	5.5	$3.49

Correlation Between Supplier Brand and Freshness

The brands of the produce (the suppliers) were noted for each product. However, due to the differing number of suppliers, it was generally not possible to state that one supplier was superior to another because of sample sizes. However, it was apparent that even individual suppliers had a significant variation in freshness.

The research found that there were significant samples from one strawberry supplier to compare the freshness of their strawberries which ranged from zero to 12 days of shelf-life from the time of purchase. 56 percent of this supplier's strawberries did not meet the four day freshness requirement. This is not to denigrate any suppliers or the freshness of their product when shipped from their packing houses or facilities. It should be noted that there are many variables that impact freshness of the produce that occur after it is shipped by the supplier to the retailer.
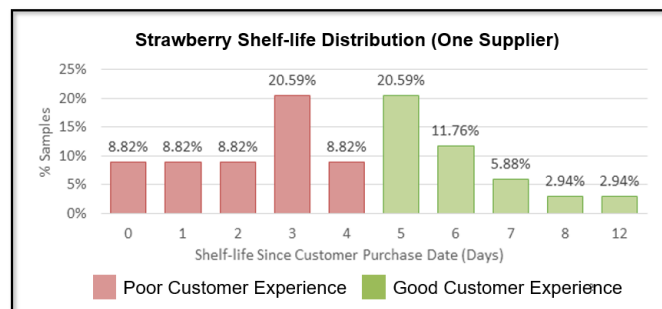
Accuracy of "Use By" Dates

Most produce does not include a "Best By" or "Use By" date. As such, there was only a very limited sample size of produce that did. It is, however, interesting to note that in six cases where a "Use By" date was printed on the packaging, it was incorrect 100 percent of the time, and often quite significantly.

40% percent, (samples A and C below) lasted longer than the published "Use By" date. For example, sample A lasted seven days longer than the "Use By" date indicated. In this case, the consumer may throw away perfectly consumable produce because the label told them it had expired, leading to unnecessary waste.

60% of the samples (B, D, E, F) spoiled before the printed "Use By" date. For example, sample D spoiled seven days before the date label indicated it would. This leads to customer dissatisfaction and waste.

In the end, estimating produce shelf-life by adding a "best guess" number of days to the harvest date isn't accurate due to variabilities in harvest conditions, post-harvest processing and handling and the produce itself. This approach leads to waste, customer dissatisfaction and further confuses customers about the value of date labeling.
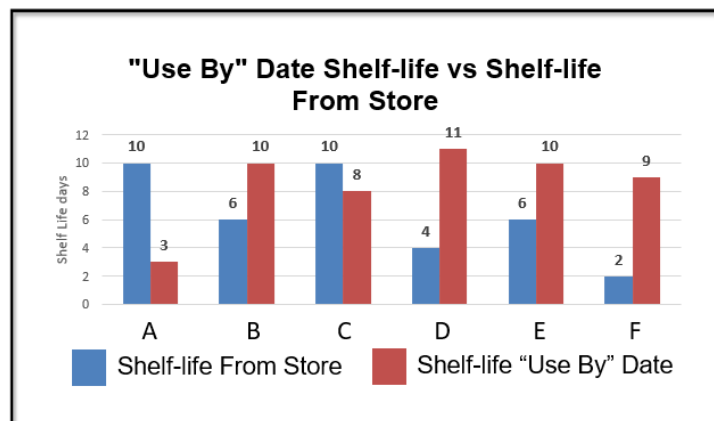
Causes of Shelf-life Variation and Premature Spoilage

The best way to prevent premature spoilage is to understand its cause. Zest Labs data shows that the primary causes of food waste occur in the first 24-48 hours after harvest, due to harvest conditions and post-harvest processing.

For example, if pallets of strawberries were harvested at 75° F and one waited five hours for precooling and another waited two hours, there would be a difference of three days of shelf-life between the two pallets due to the time spent in heat.

Zest Fresh provides growers, shippers and processors with autonomous, post-harvest quality and process visibility for proactive decision making. This helps to optimize operational efficiencies, reduce costs and improve delivered freshness. By monitoring and evaluating the condition of the produce from the time it's harvested, Zest Fresh identifies the issues impacting freshness and dynamically calculates a freshness metric making it simple and easy for the grower or supplier to provide better consistency and more uniform deliveries by shipping the retailer only produce that meets the retailer's requirements.

Zest Fresh enables suppliers and retailers to:

- Build customer loyalty because the grocer offers consistently fresh produce that meets or exceeds consumer expectations.
- Prevent food waste due to premature spoilage.
- Save money by reducing waste and time spent culling for spoiled produce on the shelf.

Zest Fresh helps suppliers ensure they're delivering the consistently freshest produce to the retailer, reducing food waste and making it easy for grocers to ensure that their customers keep coming back for more – instead of shopping at another store down the street. Please visit our website to learn more about Zest Fresh.

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