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**Food waste: The role of date labels, package size, and product category**

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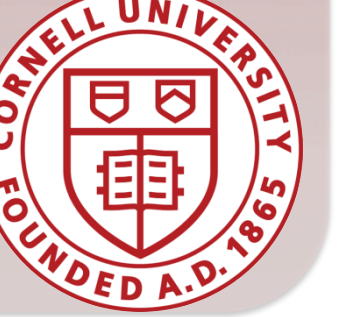




# Food waste: The role of date labels, package size, and product category

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## Introduction

- In the U.S., 31% of all food is wasted, with 21% from consumers.
- Annual food waste costs in the U.S. are ~\$160 B, representing squandered natural resources and symbolizing a lost opportunity to feed the 17.5 million food insecure U.S. households.
- The UK’s Waste & Resources Action Programme found **confusion over date labels may be responsible for up to 20% of household food waste.**

## Motivation

- U.S. open date labeling laws differ by state, but overall they are widely unregulated. Vague phrases including “Sell by,” “Use before,” “Best by” and Enjoy before” are determined by the manufacturer and can be used interchangeably.
- Inconsistencies in terminology send mixed signals to consumers regarding a product’s safety and quality, contributing to food waste.
- **Little empirical work exists that provides primary data to quantify food waste resulting from consumer confusion over date labels.**

## Summary of Open Date Labels

- The following are general USDA recommended guidelines for open date labels, but are not fixed standards:
  - “Sell By” conveys to the retailer how long the product can be displayed for sale. It is not an indication of a product’s safety or quality.
  - “Best if Use By,” “Best Before,” or “Best By” are used to suggest the date after which the food’s quality or flavor may deteriorate.
  - “Use By” recommends the last date by which the product should be consumed, but does not necessarily convey safety information.
  - “Fresh By” or “Enjoy By” indicate when a product is of peak quality.

## Key References

Buzby, J. C., Wells, H., F., & Hyman, J. (2014). The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States. In E. R. Service. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service.

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Newsome, R., Balestrini, C. G., Baum, M. D., Corby, J., Fisher, W., Goodburn, K., et al. (2014). Applications and Perceptions of Date Labeling of Food. *Comprehensive Reviews in Food Science and Food Safety*, 13(4), 745-769.

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## Research Questions

**Objective: Assess how consumers respond to different date labels, and how this response varies across package size and product categories.**

• We expect consumers intentionally waste food and have a baseline Willingness to Waste (WTW) regardless of the intent or purpose of the date label wording.

**Willingness to Waste (WTW) = WTP \* (100-% expected to consume)**

- H1: Date labels differentially affect WTW.
- H2a: The “Sell by” relative to the other treatments yields the lowest WTW.
- H2b: The “Use by” relative to the other treatments yields the highest WTW.
- H3: WTW varies by the perishability of products, date, and product size.

## Experimental Design

- Using the incentive compatible Becker-DeGroot-Marschak auction, we asked 200 non-student subjects to indicate a WTP and percentage of the food product they expected their household to consume.
- For 6 products total, including a small and large version of cereal, salad greens and yogurt, subjects stated their WTP and expected percentage of consumption for three dates (near, middle, and far).
- Subjects saw only one date label (Best by, Fresh by, Sell by or Use by), which was repeated throughout their session.

## Results & Discussion

- There is much speculation on the efficacy of various mechanisms and policies that might be used to reduce food waste, but there is little economic research examining the alternatives carefully.
- Our experiment showed subjects responded differently to the four date labels jointly and on a pairwise basis over all products, dates, and sizes, indicating on average a higher WTW under “Use by” and a lower WTW under “Sell by” treatments relative to the other treatments.

Maximum Willingness to Waste Mean Values for Each Treatment with One Standard Error

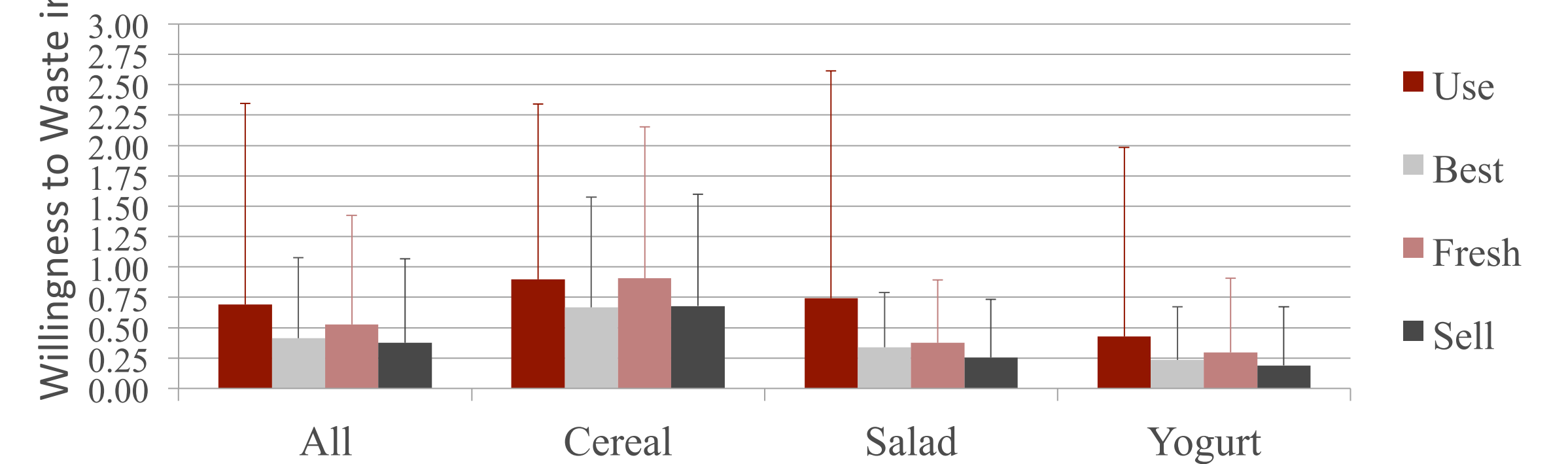


Table 1. Nonparametric Comparisons of Date Labels

Treatments	Rank Sum z-value (p-value)			
	All	Cereal	Salad	Yogurt
Best v. Fresh	-2.269* (0.0233)	-2.437* (0.0148)	-0.383 (0.702)	-0.991 (0.322)
Best vs. Sell	0.026 (0.079)	1.316 (0.188)	3.371*** (0.0007)	2.206* (0.0274)
Best vs. Use	3.153*** (0.0016)	0.331 (0.741)	2.372* (0.0177)	-0.980 (0.327)
Fresh vs. Sell	5.022*** (0.000)	2.586** (0.0097)	3.399*** (0.0007)	3.008** (0.0026)
Fresh vs. Use	-1.606 (0.1084)	-2.702** (0.0069)	1.828 (0.0676)	-1.803 (0.0714)
Sell vs. Use	3.053*** (0.0023)	-0.242 (0.809)	4.982*** (0.000)	0.942 (0.355)

$p<0.001=***$ ,  $p<0.01=**$ ,  $p<0.05=*$

Table 2. Nonparametric Pairwise Comparisons of Date Labels

Treatments	Rank Sum z-value (p-value)				
	Dates			Sizes	
	Far	Middle	Near	Small	Large
Best v. Fresh	-1.37 (0.17)	-0.88 (0.38)	-1.63 (0.10)	-1.74 (0.082)	-1.60 (0.110)
Best vs. Sell	2.342* (0.019)	1.162 (0.25)	2.15* (0.032)	2.47* (0.014)	2.15* (0.032)
Best vs. Use	-0.259 (0.80)	0.110 (0.91)	0.95 (0.34)	0.366 (0.71)	0.30 (0.77)
Fresh vs. Sell	3.34*** (0.00)	1.885 (0.059)	3.60*** (0.00)	3.90*** (0.00)	3.444*** (0.00)
Fresh vs. Use	-1.41 (0.16)	-0.67 (0.50)	-0.553 (0.58)	-1.18 (0.24)	-1.15 (0.25)
Sell vs. Use	1.83 (0.067)	1.03 (0.30)	2.66*** (0.008)	2.45* (0.014)	2.027* (0.043)

$p<0.001=***$ ,  $p<0.01=**$ ,  $p<0.05=*$

- This suggests consumer food waste can be mitigated by **harmonizing date labels away from phrases that have inherent food safety connotations.**
- Furthermore, we found the “Sell by” date label may serve as a lower bound for WTW such that customers have a predetermined value of product that they expect to waste regardless of the date label.
- Therefore, **concealing “Sell by” date labels from consumers** could also reduce the amount of premature food waste due to misinterpretation.

The working paper can be accessed at: <http://dyson.cornell.edu/research/researchpdf/wp/2015/Cornell-Dyson-wp1507.pdf>