Consumer Acceptance of CRISPR: Evidence from Incentive-Aligned Online Experiments

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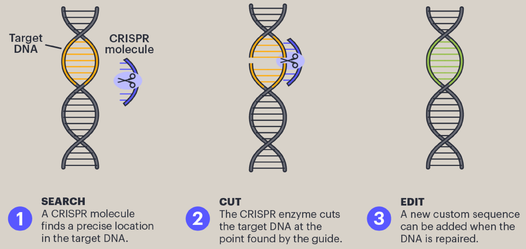
What is CRISPR?



Source: *Innovative Genomics Institute*

Summary of CRISPR:

- Also referred to as gene editing
- Adapted from the natural defense mechanisms of bacteria
- Precisely edit DNA within a product without adding genetic material from other organisms

Benefits and Risks of CRISPR:

- The process is faster, cheaper, and more accurate compared to other genome editing tools
- Potential to increase food productivity and quality
- The risks of CRISPR are comparable to those of accepted, past, and current breeding methods

BACKGROUND & MOTIVATION

Prior Literature

- Most studies on CRISPR are hypothetical
- No literature explores the acceptance of CRISPR products in an online shopping environment
- Studies comparing CRISPR and GMO products find mixed results
- Most studies find that providing information about CRISPR technology positively affects the acceptance of CRISPR

Main Question and Contribution

- Adapt an incentive-aligned conjoint experiment with salad greens and tomatoes as the focal products
- Consider the acceptance of CRISPR products in the context of online shopping
- Compare the participants' preference between CRISPR and GMO products
- Examine how different information about CRISPR technology affect participants' acceptance and willingness to pay for CRISPR food products

METHODOLOGY

- Mixed Logit model (MXL) to analyze the choice experiment data
- The model is estimated by Hierarchical Bayesian (HB) Markov Chain Monte Carlo (MCMC) algorithm
  - a simulation-based procedure that can handle models with unknown or variable numbers of parameters
- The HB CBC estimation method allows us to estimate both **individual** and **aggregate** WTP and utility for attributes.
- The choice utility can be expressed as

$$U_{ijt} = \sum_{k=1}^{k} \beta_{ki} l_{jkt} + \eta p_{ijt} + \epsilon_{ijt} \quad (1)$$

- Consumer i's WTP estimates for each attribute k as

$$WTP_{ik} = \frac{\beta_{ik}}{-\eta} \quad (2)$$

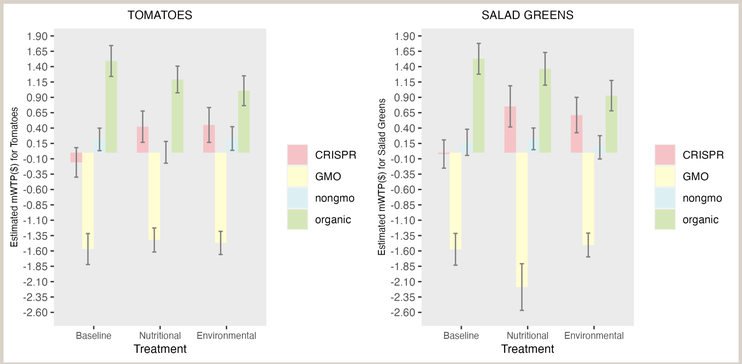
RESULTS — Benefit-Focused Information Treatments Effects

Marginal WTP for Production Methods of Tomatoes

Variables	Basic 95%CI	Nutri 95%CI	Envi 95%CI
Organic	0.90 [0.76, 1.04]	0.77 [0.63, 0.91]	0.63 [0.49, 0.78]
GMO	-0.95 [-1.09, -0.8]	-0.92 [-1.05, -0.8]	-0.93 [-1.05, -0.81]
CRISPR	-0.10 [-0.24, 0.05]	0.28 [0.11, 0.44]	0.28 [0.11, 0.46]
Non-GMO	0.13 [0.02, 0.24]	0.00 [-0.11, 0.12]	0.15 [0.02, 0.27]

Marginal WTP for Production Methods of Salad Greens

Variables	Basic 95%CI	Nutri 95%CI	Envi 95%CI
Organic	0.94 [0.8, 1.08]	0.74 [0.6, 0.87]	0.61 [0.45, 0.76]
GMO	-0.97 [-1.12, -0.83]	-1.18 [-1.37, -0.99]	-0.99 [-1.14, -0.83]
CRISPR	-0.014 [-0.16, 0.13]	0.41 [0.23, 0.59]	0.4 [0.21, 0.6]
Non-GMO	0.10 [-0.03, 0.23]	0.12 [0.03, 0.22]	0.06 [-0.07, 0.18]



Effect of Information Treatments on WTP for Different Production Methods

RESULTS — Interaction Effects

MWTP of Interaction Effects on CRISPR Tomatoes and Salad Greens Over All Treatments

Variables	Tomato SD 95%CI	Salad SD 95%CI
c age25+	-0.8 0.28 [-1.35, -0.25]	-1.49 0.28 [-2.03, -0.94]
c age35+	-0.21 0.21 [-0.62, 0.2]	-0.44 0.19 [-0.82, -0.06]
c age45+	-0.37 0.21 [-0.79, 0.05]	-0.61 0.20 [-1.0, -0.22]
c age55+	-1.17 0.23 [-1.62, -0.72]	-1.49 0.22 [-1.92, -1.06]
c age65+	-0.94 0.24 [-1.41, -0.47]	-1.19 0.22 [-1.63, -0.76]
c health	-0.08 0.09 [-0.26, 0.1]	-0.05 0.09 [-0.23, 0.14]
c male	0.36 0.09 [0.18, 0.55]	0.34 0.09 [0.16, 0.52]
c vegan	-0.42 0.18 [-0.77, -0.07]	-0.49 0.18 [-0.84, -0.13]
c online	0.15 0.1 [-0.05, 0.34]	0.44 0.1 [0.24, 0.63]
c q1	0.16 0.09 [-0.02, 0.34]	0.28 0.09 [0.09, 0.46]
c q2	0.10 0.09 [-0.09, 0.28]	0.14 0.10 [-0.05, 0.33]

CONCLUSION

Information Treatments Effects

- Providing information about CRISPR technology is generally effective for increasing consumer acceptance and WTP for CRISPR-based food products
- Information treatments that highlight the specific benefits of the product are more effective than those that only offer basic information about CRISPR, resulting in a higher WTP for CRISPR products
- CRISPR is preferred over GMO for all treatments, even in the basic information treatment

Correlation and Interaction Effects

- Impact of demographic factors and participants' knowledge of CRISPR
  - Males are more likely to choose CRISPR
  - Older individuals, those who self-identify as following a healthy diet, those who identify as vegan, and those with more knowledge of CRISPR technology are less likely to select CRISPR products
- Positive correlation between the online purchasing method and the CRISPR production method
- Positive interaction effects between online shopping experience and CRISPR salad greens

POLICY IMPLICATIONS

Agricultural biotechnology regulations

- Differentiate between CRISPR and GMO technologies and avoid labeling them in the same category
- Provide benefit-focused information to consumers in achieving better outcomes in terms of the acceptance of new technologies such as CRISPR

Accessibility of fresh produce

- Utilizing the online marketing space to provide detailed information on the benefits of CRISPR products can be an effective strategy for enhancing the adoption of CRISPR produce and promoting the online purchase of fresh produce
- Distribute CRISPR fresh produce via online channels, especially for areas with limited access to physical grocery stores, and areas considered as food deserts

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