Understanding the Chemistry of American and Hybrid Hazelnut Flavor

Upper Midwest Hazelnut Development Conference

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Importance of Hazelnut Flavor to Consumers

Flavor is the most important purchase driver for nuts

	Importance Rank
Flavor	2.7
Price	2.9
Quality	3.0
Availability	4
Local	4.5
Environmental Benefits	4.7

Table 1. Average ranking of factors considered when purchasing nuts. 1 = most important, 7 = least important. N = 597[1].

1. Fischbach, Carlson, & Dempsey. 2023 Midwest Consumer Survey.

What is Flavor?

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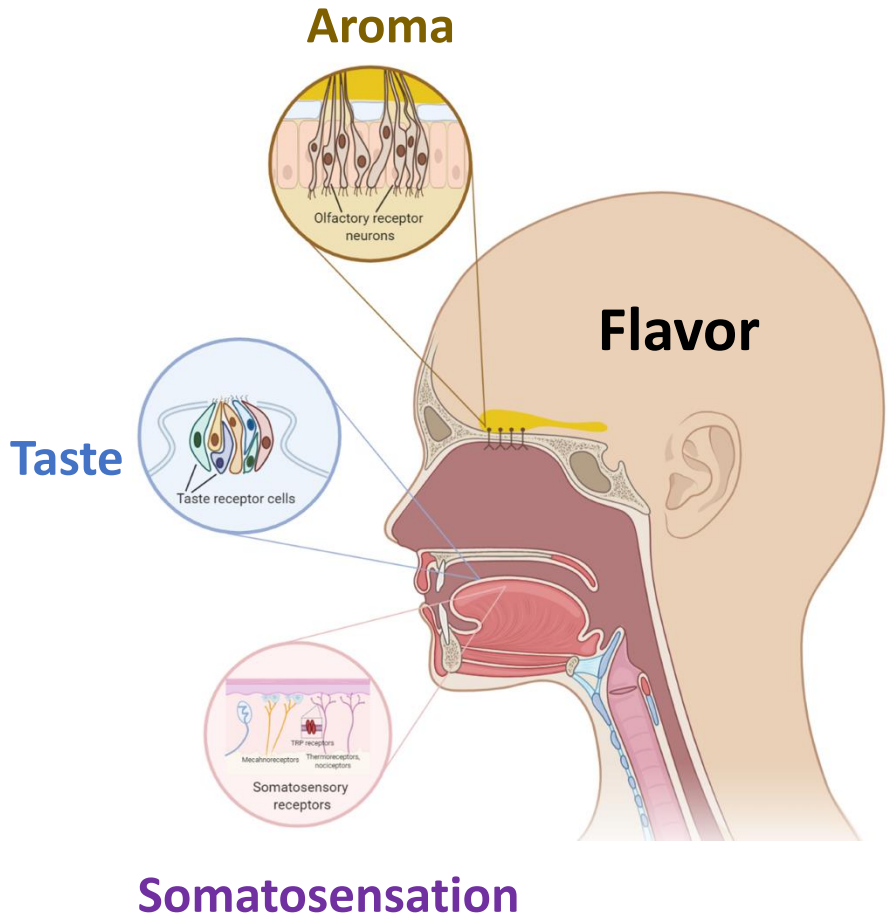
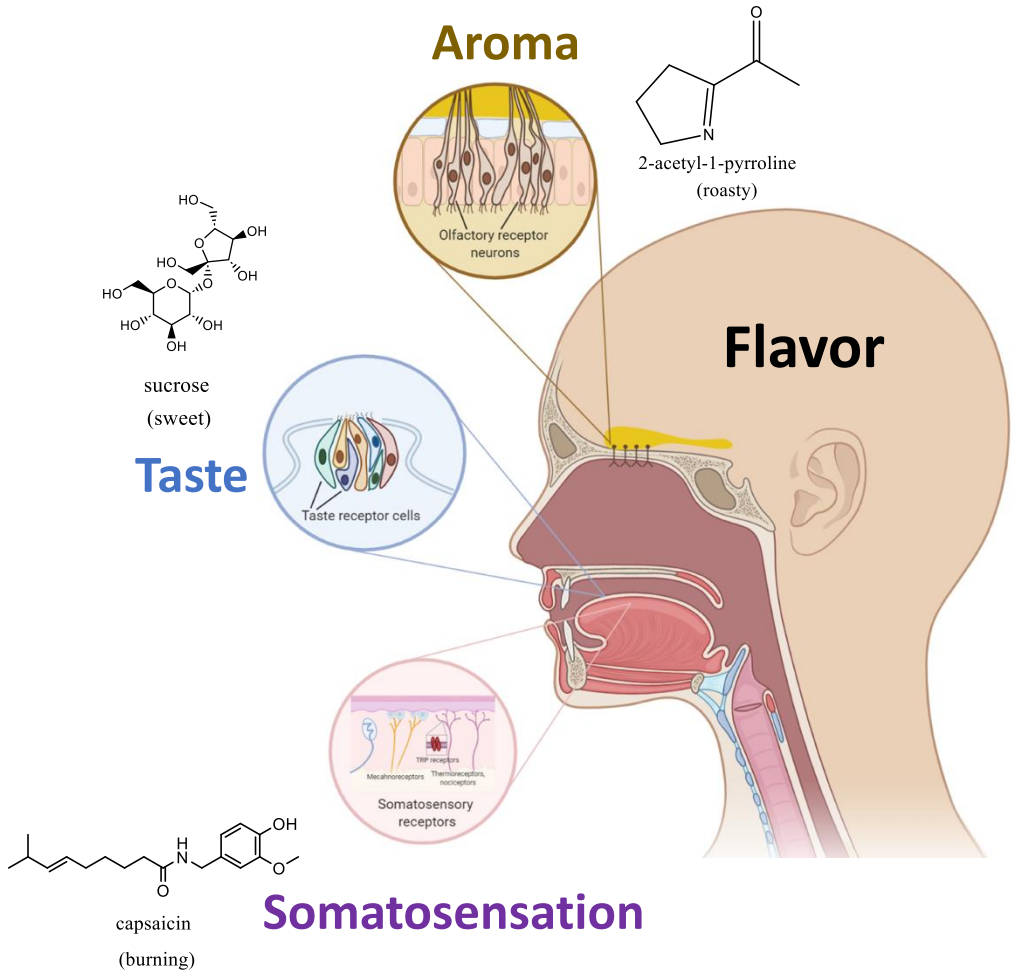


1. Fischbach, Carlson, & Dempsey. 2023 Midwest Consumer Survey.

Flavor Compounds in Food

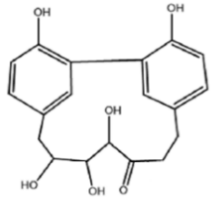
- **Aroma:** involves the interaction of **volatile** compounds with receptors in the nose
  - Perceive by smelling food and when eating
- **Taste:** involves the interaction of **non-volatile** compounds with receptors on the tongue
  - Sweet, salty, sour, bitter, umami
- **Somatosensation:** chemical interactions with receptors in the mouth
  - Tactile sensations (e.g., astringent drying), thermal (e.g., burning, cooling)



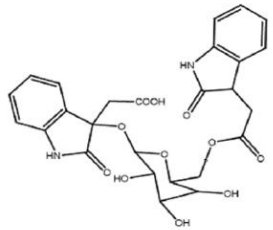
American Hazelnut Flavor

- Bitterness reported as defect in several American hazelnut selections[2]
- Main bitter compounds in raw American hazelnuts were identified by Dr. Xue Wang in Ph.D. work at Ohio State[3]

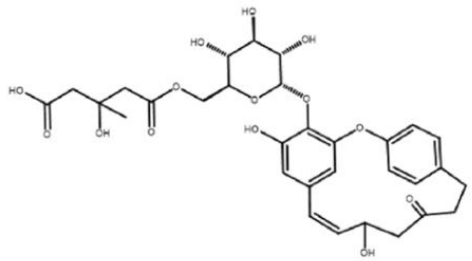
Compound 1



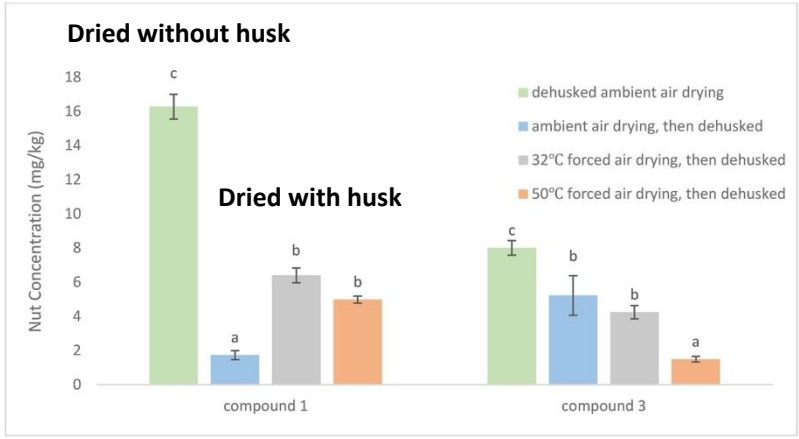
Compound 2



Compound 3



Husk acts as a protective barrier to minimize formation of the compounds



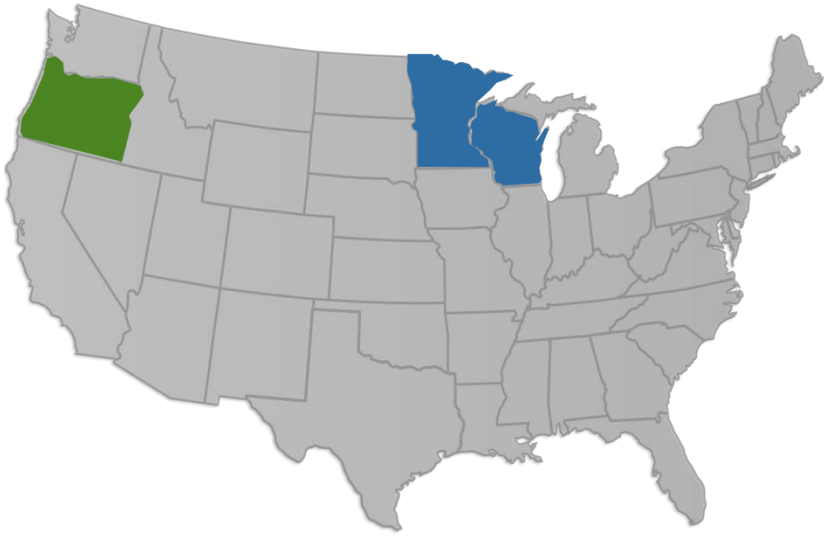
2. Demchik MC, Fischbach J, Yates MD (2016) Agroforest Syst 90:919–926.
3. Wang X, Tello E, Peterson DG (2021) Food Chemistry 363:130311.

Hybrid American-European Hazelnut Flavor

- Current research focus at Ohio State
- Focus on roasted nuts (highly flavored and popular)
- Dr. Menying Fu: taste compounds that impact consumer liking
- My work: aroma compounds that impact consumer liking

Hazelnuts Evaluated

Code	Variety Name	Hazelnut Species
H-1	GibsGrimoS15	*C. americana* x *C. avellana* hybrids
H-2	SpC-2D5	
H-3	Arb7-1	
H-4	Gibs4-20	
H-5	Gibs2-30	
H-6	SpC-2C7	
H-7	Rose11-12	
H-8	Eric5-13	
H-9	Rose11-8 and Rose17-4	
H-10	Gibs6-23	
H-11	GibsGrimoN16	
H-12	Millie	
E-1	Ennis	*C. avellana* (from Oregon)
E-2	Barcelona	



All from 2020 harvest year

Sample Preparation and Consumer Testing

- Each hazelnut variety was roasted at 275 ^{o}F for 30 min
- Roasted nuts were blended to make homogenous pastes of each variety
- Regular nut consumers rated each sample for flavor liking and attributes

N = 98 consumers

N = 14 roasted hazelnut pastes

Liking Score on a 9-point Scale

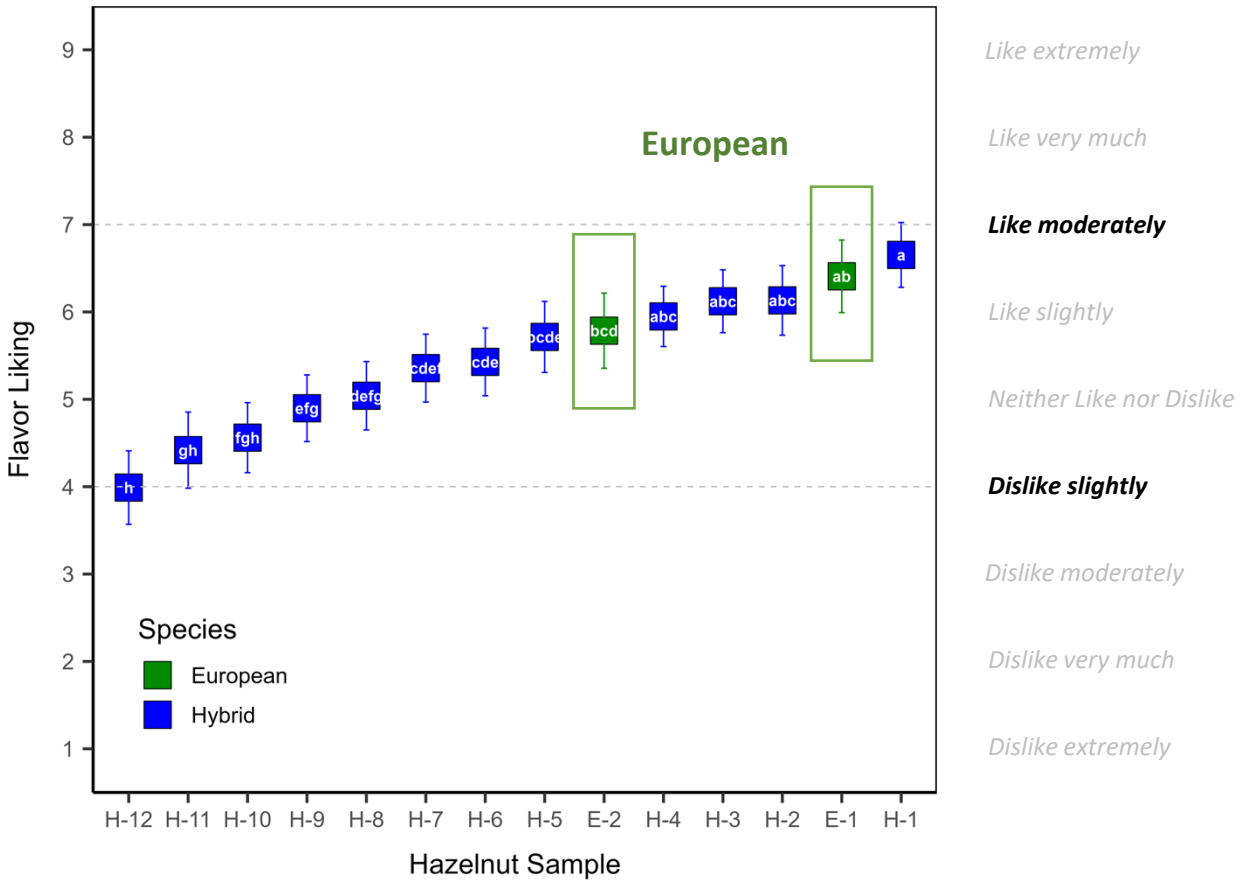
Grade	Score
Like extremely	9
Like very much	8
Like moderately	7
Like slightly	6
Neither like nor dislike	5
Dislike slightly	4
Dislike moderately	3
Dislike very much	2
Dislike extremely	1

Check-All-That-Apply (CATA) For Flavor Attributes

Hybrids vs. European Samples

Flavor Liking

Mean Score: 4.0 – 6.7



Like extremely

Like very much

Like moderately

Like slightly

Neither Like nor Dislike

Dislike slightly

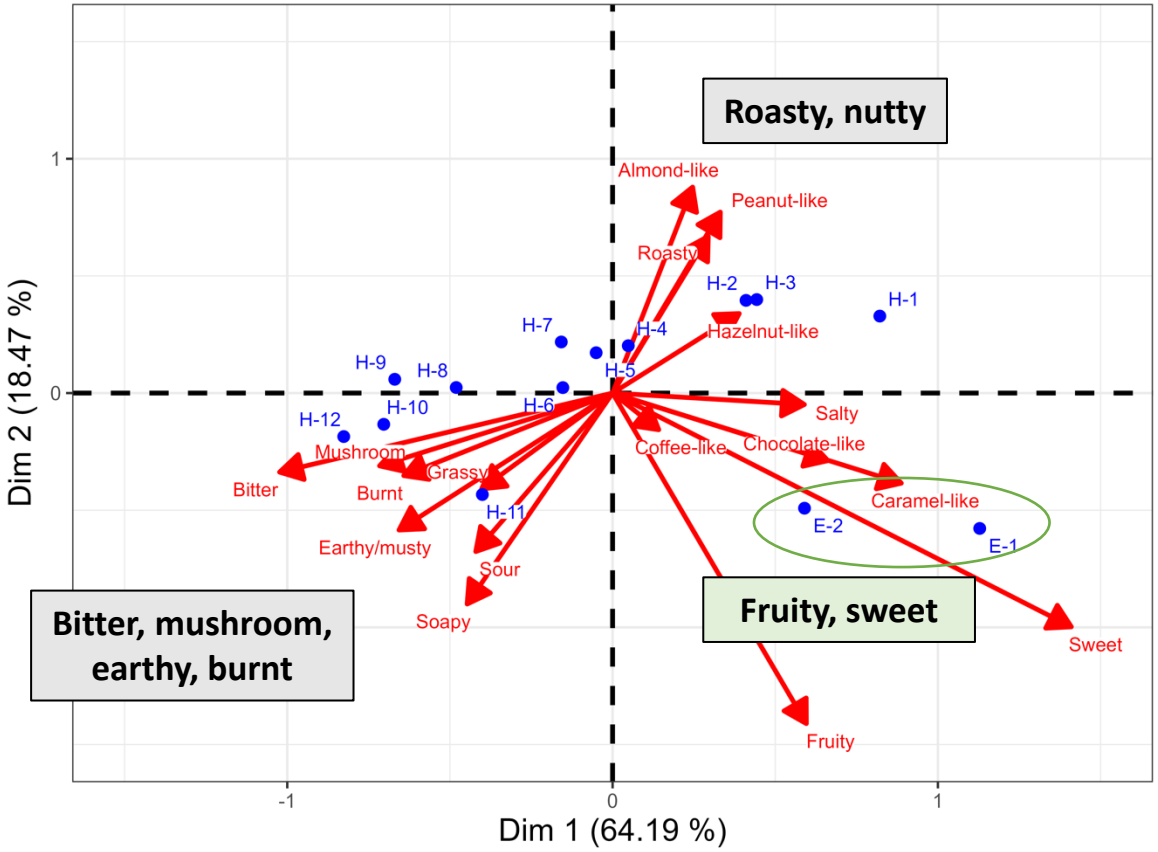
Dislike moderately

Dislike very much

Dislike extremely

Mean and 95% confidence intervals (n = 98) with post-hoc Tukey's HSD (α = 0.05)

Diversity of flavor profiles



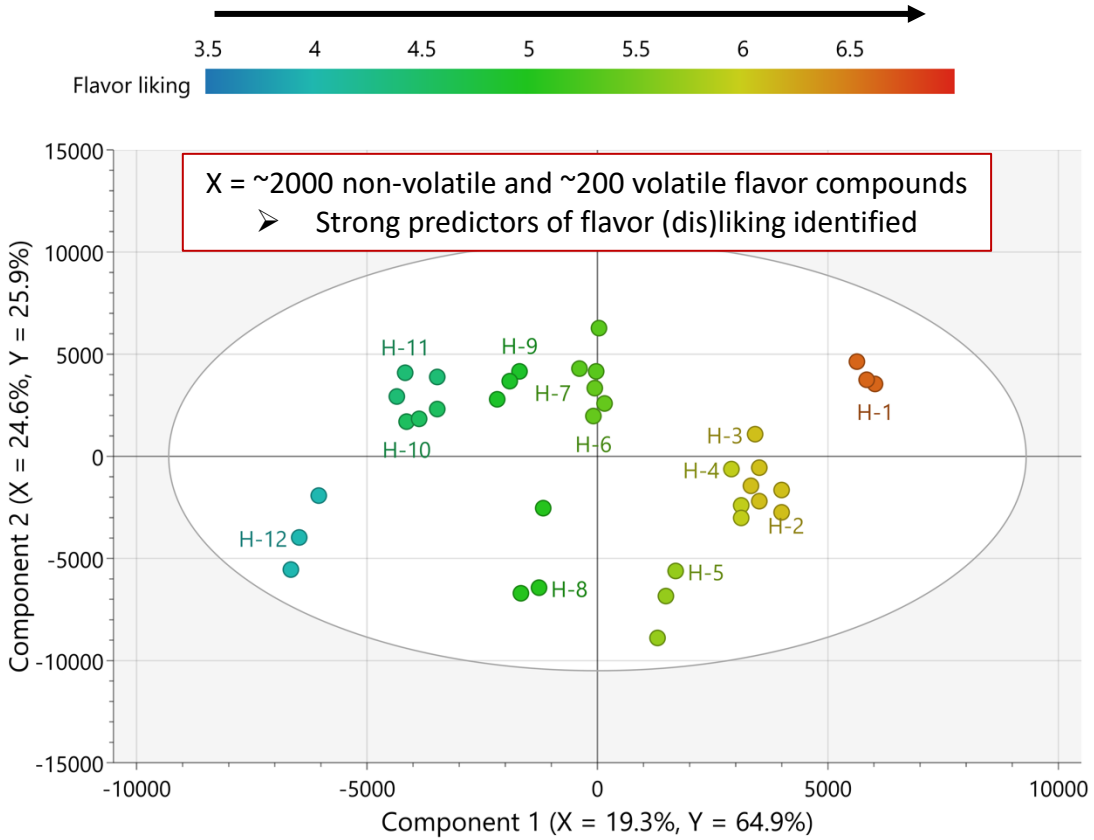
Biplot from multiple-response correspondence analysis of CATA responses

Taste Test!

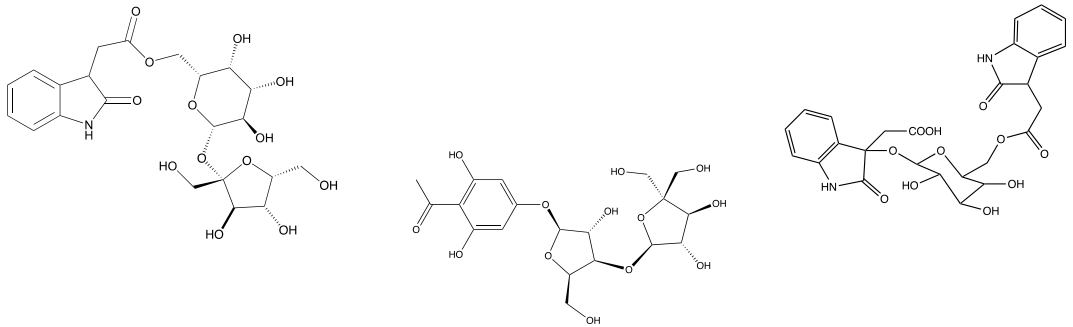
- We will evaluate the roasted nuts of 6 different hybrids
- Please use scan the QR code below to access the ballot

Findings from Hybrid Hazelnut Flavor Analysis

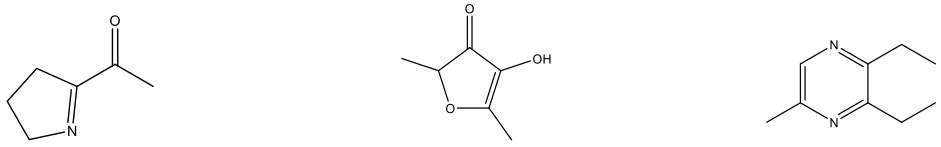
Predictive multivariate regression models: connect flavor compositions to liking



Bitter-tasting compounds



Roasty, nutty, sweet-smelling aroma compounds



Roasty

Caramel, sweet

Nutty, cocoa

Overall Summary

- Unique flavors that impacted liking were found in roasted hybrid American hazelnuts
- Aroma and taste compounds that have positive and negative impacts on liking were identified
- Further investigation on the formation pathways of these compounds may support breeding strategies for flavor advancement