



# Extra Virgin Olive Oils – A Case Study

*Society of Sensory Professionals – Industry Transforming Research*

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# Extra Virgin Olive Oil is a Global Business

Over 750 million olive trees are cultivated worldwide, 95% of which are in the Mediterranean. Spain is the worlds top producer of olive oil.

With Italian EVOO in high demand, adulterated olive oil has become the biggest source of agricultural fraud in the European Union.

The International Olive Oil Council (IOOC) is an intergovernmental organization that tracks production, defining quality standards, and monitors authenticity.

IOOC governs 95% of production. IOOC terminology is precise, but there is confusion between words that describe production and words used on labels.

# **A New Business for California**

**Olive oil may do for California what wine did during the 1980's and 90's.**

**In 2008, U.S. olive oil production was 3.8 million pounds (~400,000 gallons) whereas consumption was 454 million pounds (~50,000,000 gallons)**

**California has a tremendous opportunity to increase market share, especially with Extra Virgin Olive Oil.**

**Product sensory information should be a part of this opportunity to be sure that consumer expectations are realized.**

**There are many varieties of olive trees and not all may be suitable for oil production**

**Yields and the sensory experience will differ**

**Like other crops that undergo limited processing, e.g., grapes into wine, opportunities are driven by one's business strategy**

**There is much to be learned from the market experiences of the wine business ..... Wine lakes, limited brand allegiance, etc.**

# Research Objectives

**Determine whether there are preference differences among consumers**

**Determine if there are preference segments**

**Measure sensory similarities and differences**

**Determine which sensory differences have strong correlation with preferences**

**Determine the influence of packaging on consumer attitudes**

**Some results follow**

## How was this done ?

**We used Tragon QDA® to measure sensory similarities and differences of EVOO's. These data were correlated with preferences and related consumer attitudinal judgments.**

**The methodology relies on a panel of qualified consumers (12) to describe an array of products and record the strengths of the product characteristics.**

## Why is this important ?

**If there are preference differences, we need to inform requesters as to the nature of the differences and recommendations based on the business strategy.**

**If the market is segmented, we can identify the sensory attributes that explain the segments.**

**Added value is obtained when the sensory differences are related to consumer preferences and attitudinal measures such as brand, price/value, etc.**

**The sensory information becomes an integral part of the market strategy.**

# Products Tested

**A subset of products was selected from an array of over 50 EVOOs readily available in the marketplace.**

Country of Origin	Product Description
California-1	Certified Organic Estate Grown Extra Virgin Olive Oil
California-2	Extra Virgin Olive Oil Unrefined
California-3	Mission Extra Virgin Olive Oil
California-4	Ascolano
Italy-1	Extra Virgin Olive Oil
Italy-2	Extra Virgin Olive Oil
Italy-3	Extra Virgin Olive Oil
Italy-4	Extra Virgin Olive Oil
Spain-1	First Cold Press Extra Virgin Olive Oil
Spain-2	Extra Virgin Olive Oil
Spain-3	100% Spanish Extra Virgin Olive Oil
Greece-1	FirstCold Pressed Organic Extra Virgin Olive Oil
Greece-2	Extra Virgin Olive Oil
Turkey-1	Delightfully Turkish Extra Virgin Olive Oil





# Quantitative Descriptive Analysis

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# Descriptive Analysis Methodology

**Qualified consumers evaluated 15 commercially available EVOOs using a list of attributes/words they developed.**

**There were 40 sensory words**

**4 Appearance**

**12 Aroma**

**8 Flavor**

**5 Mouthfeel**

**11 Aftertaste/Aftereffect**

**Products were evaluated 3 times to provide sufficient data for analysis.**

# Scorecard & Definitions of Terms (1<sup>st</sup> Page Example)

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ CODE: \_\_\_\_\_

## OLIVE OIL APPEARANCE

R  
P  
S

**- Judge Instructions:**

YELLOW COLOR		
	light	dark
GREEN TINT		
	light	dark
CLEAR		
	slightly	very
COATING		
	thin	thick

## AROMA

**- Judge Instructions: Remove lid and smell, then rate:**

OVERALL AROMA		
	weak	strong
OLIVE		
	weak	strong
HERB		
	weak	strong
GRASS		
	weak	strong
OIL		
	weak	strong
UNRIPE		
	weak	strong
SWEET		
	weak	strong
NUTTY		
	weak	strong
FRUITY		
	weak	strong
RANCID		
	weak	strong
ARTIFICIAL		
	weak	strong
MUSKY		
	weak	strong

## OLIVE OIL

### APPEARANCE

**- Judge instructions: Hold up to eye level and then rate:**

YELLOW (light-dark)	Intensity of yellow color from light yellow, like lemons, to dark or golden yellow, like melted butter.
GREEN TINT (light-dark)	Intensity of a green tint from light green, like olive, to dark green tint like chartreuse.
CLEAR (slightly-very)	Measure of the clarity of the product from slightly to very. A slightly clear product might be somewhat cloudy or foggy.
COATING (thin-thick)	Measure of a coating appearance on the cup, as it runs down the side of the container, from thin like water to thicker like corn syrup.

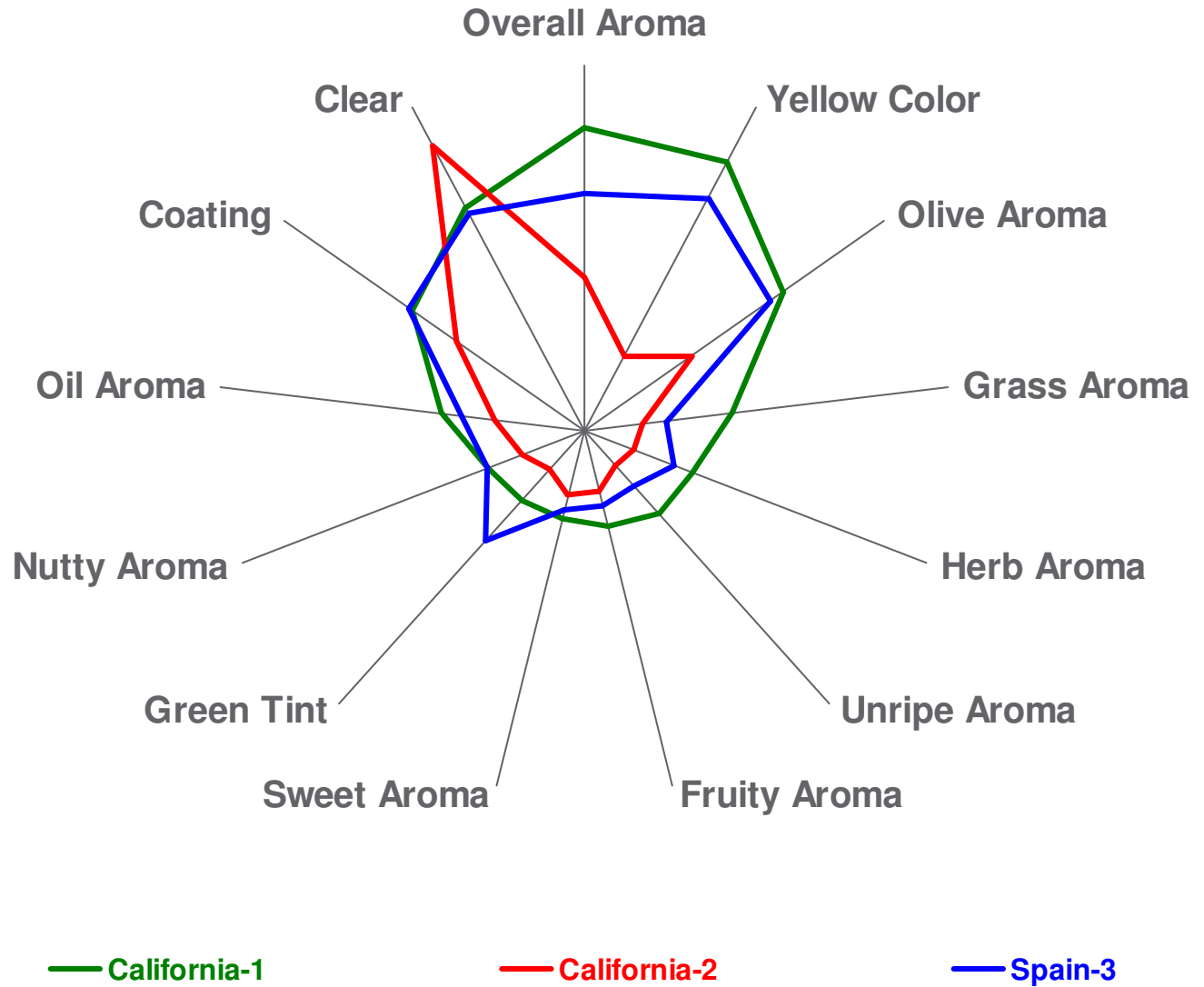
### AROMA

**- Judge instructions: Remove lid and smell, then rate:**

OVERALL AROMA (weak-strong)	Measure of the overall aroma from weak to strong.
OLIVE (weak-strong)	Intensity of an olive aroma like that of green olives, from weak to strong.
HERB (weak-strong)	Intensity of an herb aroma like that of oregano or rosemary, from weak to strong.
GRASS (weak-strong)	Intensity of a grassy aroma like that of fresh-cut green grass or crushed leaves, from weak to strong.
OIL (weak-strong)	Intensity of a cooking oil aroma like that of vegetable or safflower oil, from weak to strong
UNRIPE (weak-strong)	Intensity an unripe flavor like that from unripe green grapes or green banana peel, from weak to strong.
SWEET (weak-strong)	Intensity of a sweet flavor like that of sugar from weak to strong.
NUTTY (weak-strong)	Intensity of a nutty flavor like that of peanuts from weak to strong.
FRUITY (weak-strong)	Intensity of a fruity flavor like that of peach or lemon, from weak to strong.
RANCID (weak-strong)	Intensity of a rancid oil or old oil aroma from weak to strong.
ARTIFICIAL (weak-strong)	Intensity of an artificial or chemical aroma like that of paint thinner or car oil.
MUSKY (weak-strong)	Intensity of a musky aroma similar to that of dampness, mold, wet rocks – granite.

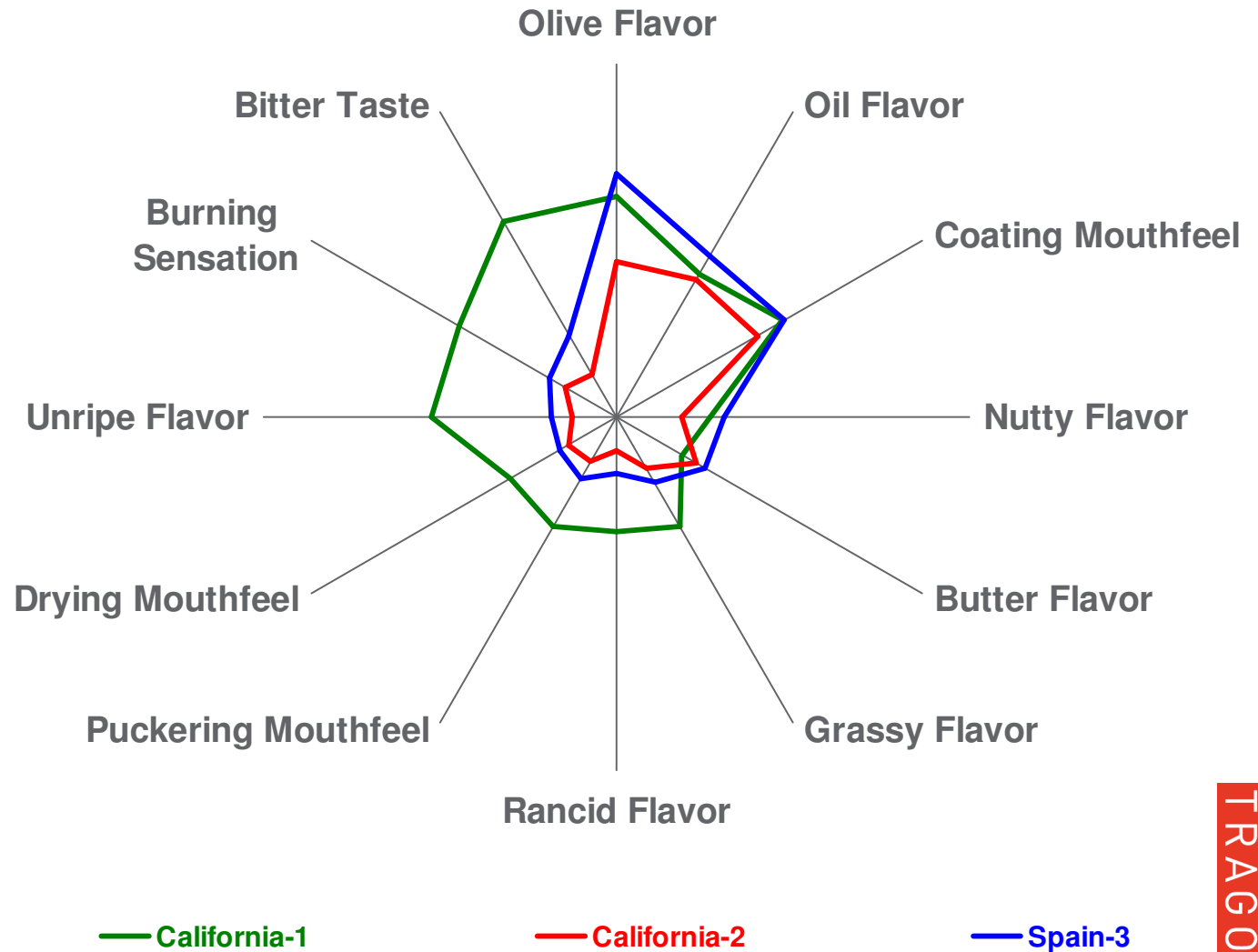
# Appearance & Aroma Attributes for Selected Products

**California-1 was the most clear-light yellow in appearance with mild overall aroma.**



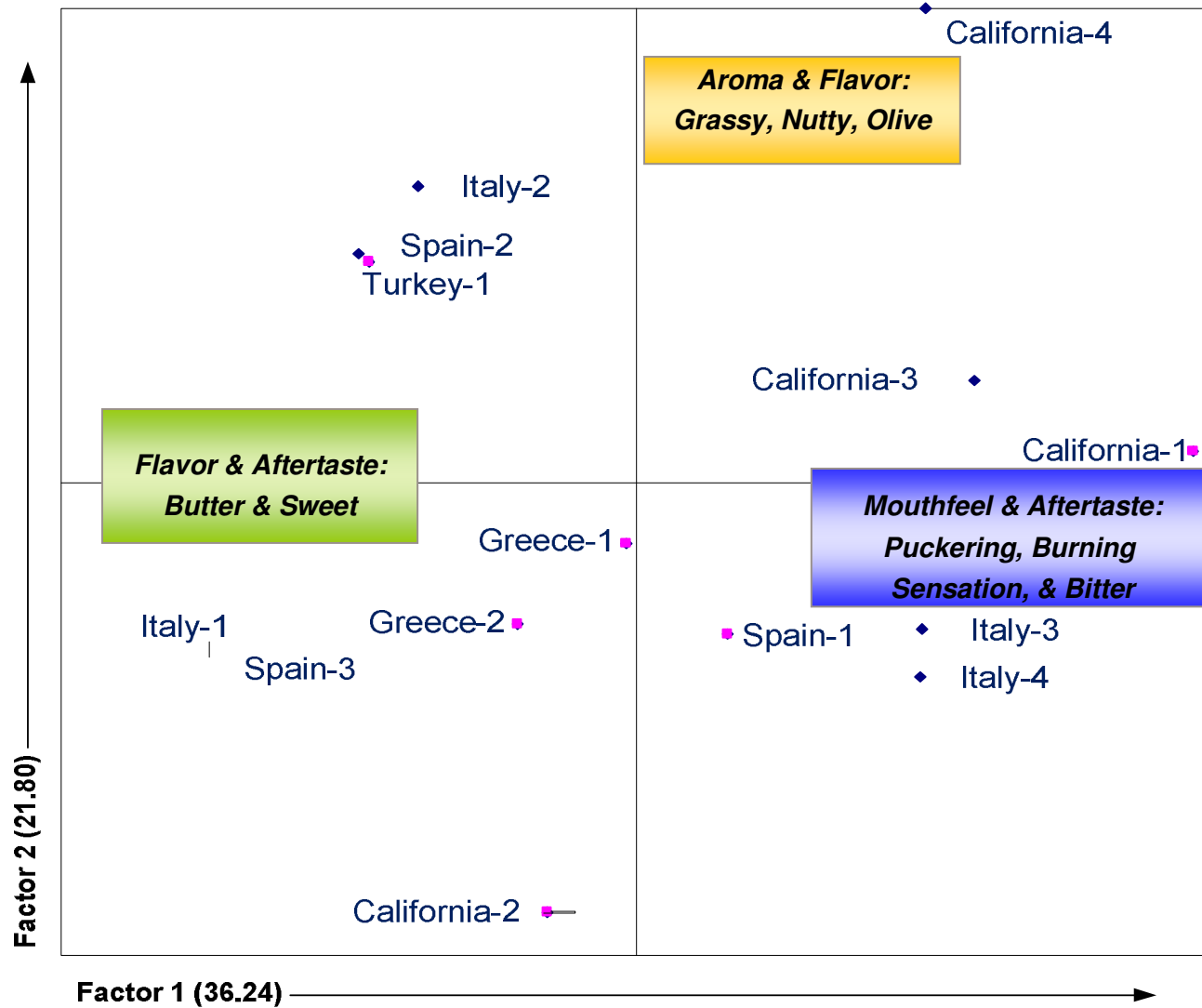
# Flavor & Mouthfeel Attributes for Selected Products

**California-1 had an intense bitter taste, along with grassy and unripe flavors. It also had a high burning sensation along with a dry and puckery mouthfeel.**



# PCA Sensory Map: Attribute Factors 1 & 2

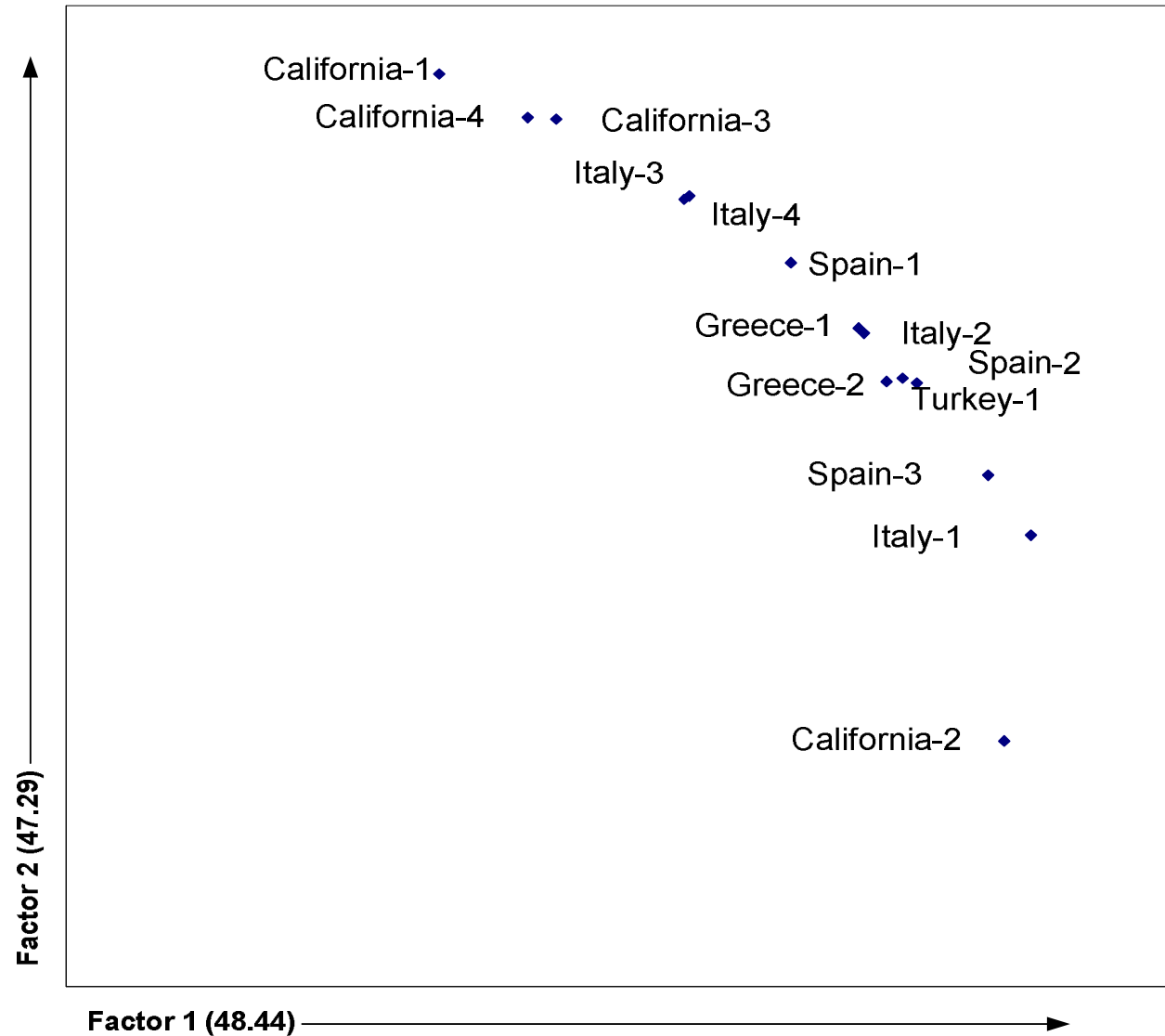
There are large sensory differences independent of stated country of origin.



# Principal Component Analysis Product Map

**This map shows the product differences across all sensory attributes.**

**Proximity defines degree of similarity.**





# Consumer Assessment

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# Consumer Qualification Criteria

**163 consumers from San Francisco and Chicago metropolitan areas qualified for this research according to the following criteria:**

**Gender: 30% males, 70% females;**

**Ages 25-64;**

**Attended or graduated from college;**

**Primary grocery shopper (>50%);**

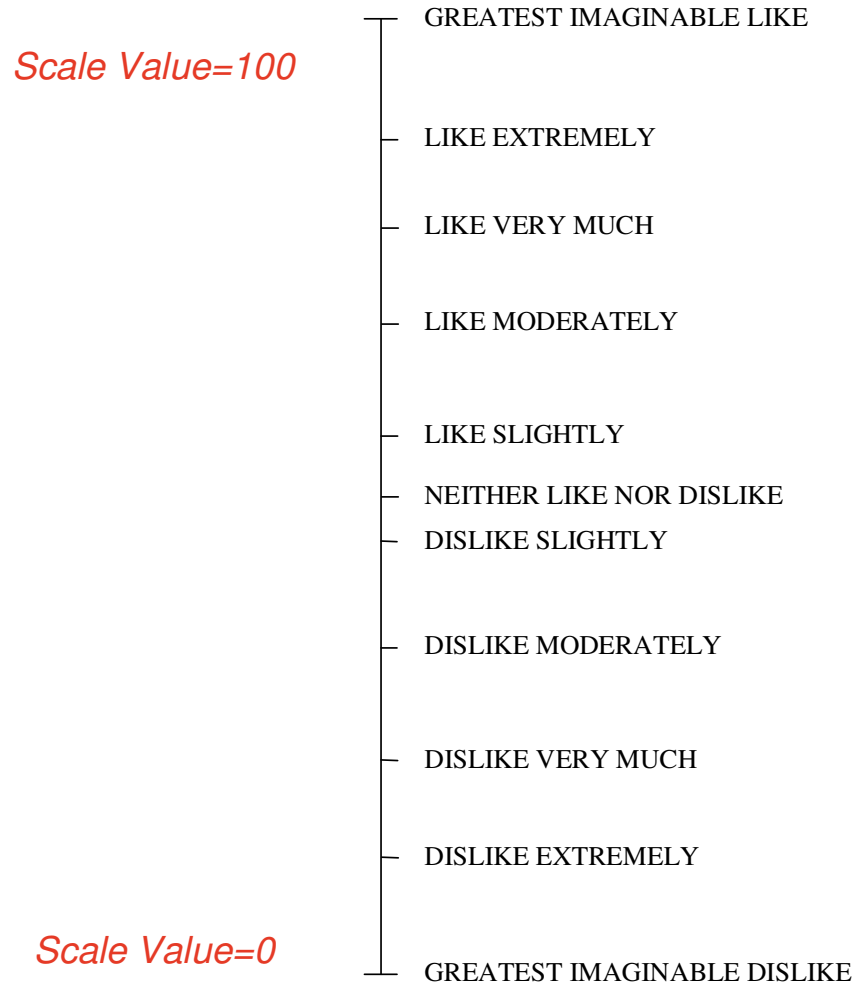
**Purchased and eaten Extra Virgin Olive Oil in past month;**

**Use Extra Virgin Olive Oils in cooking, in salads, and for dipping;**

**Standard employment, allergies, and past participation screen.**

# Scorecard - Labeled Affective Magnitude Scale

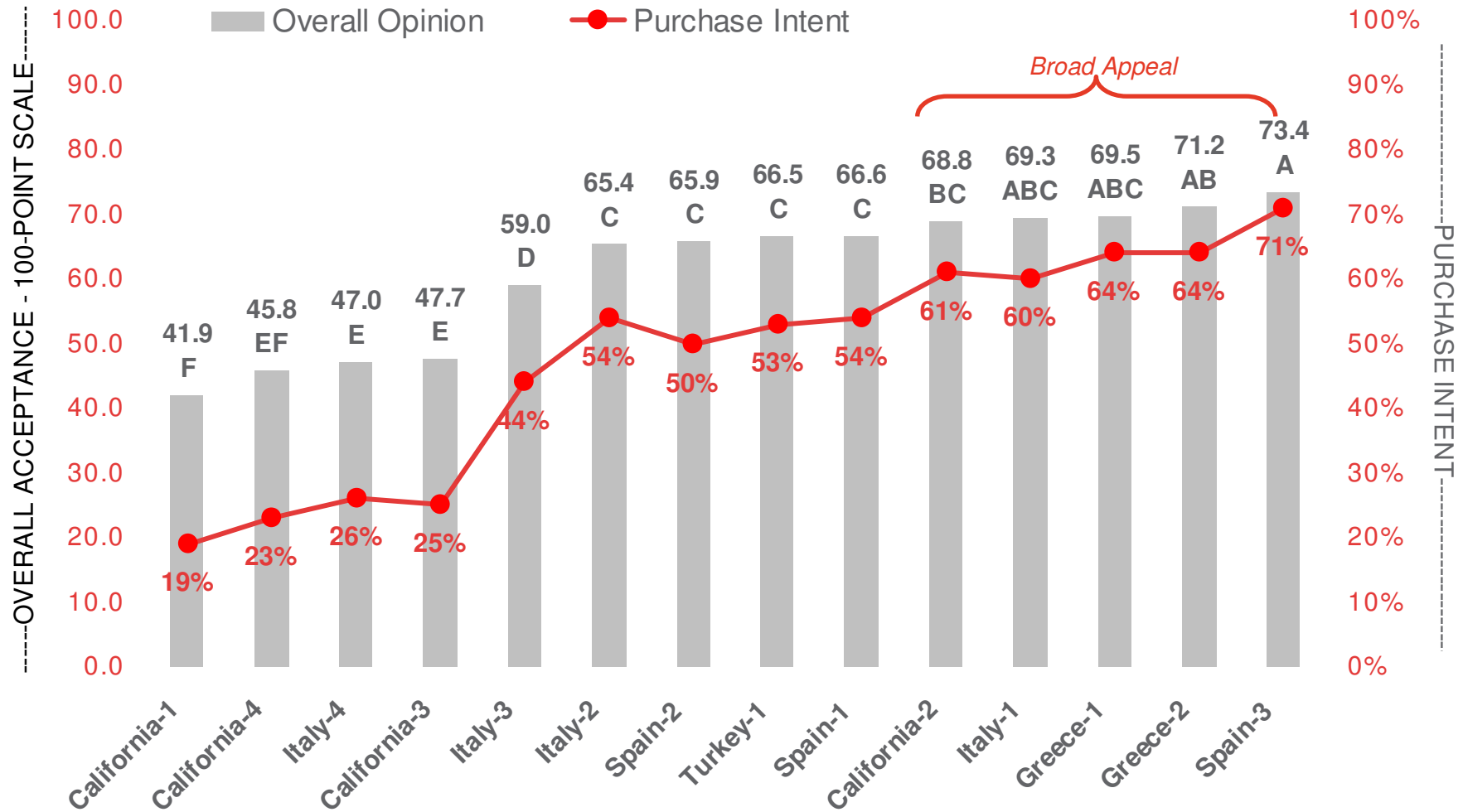
1. Please look at, smell and taste the olive oil. How much do you like or dislike this olive oil? Please place a slash mark (/) somewhere on the line below.



2. How likely would you be to purchase this olive oil if it were available for a reasonable price where you normally shop?

Definitely Would Not Purchase	Probably Would Not Purchase	Might or Might Not Purchase	Probably Would Purchase	Definitely Would Purchase
@	@	@	@	@

# Overall Liking and Purchase Interest for the Total Population



a. N=163

b. Consumers rated products using 100-pt LAM scale; 0=Greatest Imaginable Dislike, 100=Greatest Imaginable Like

c. Entries are mean values. Significance at the 95% confidence level.



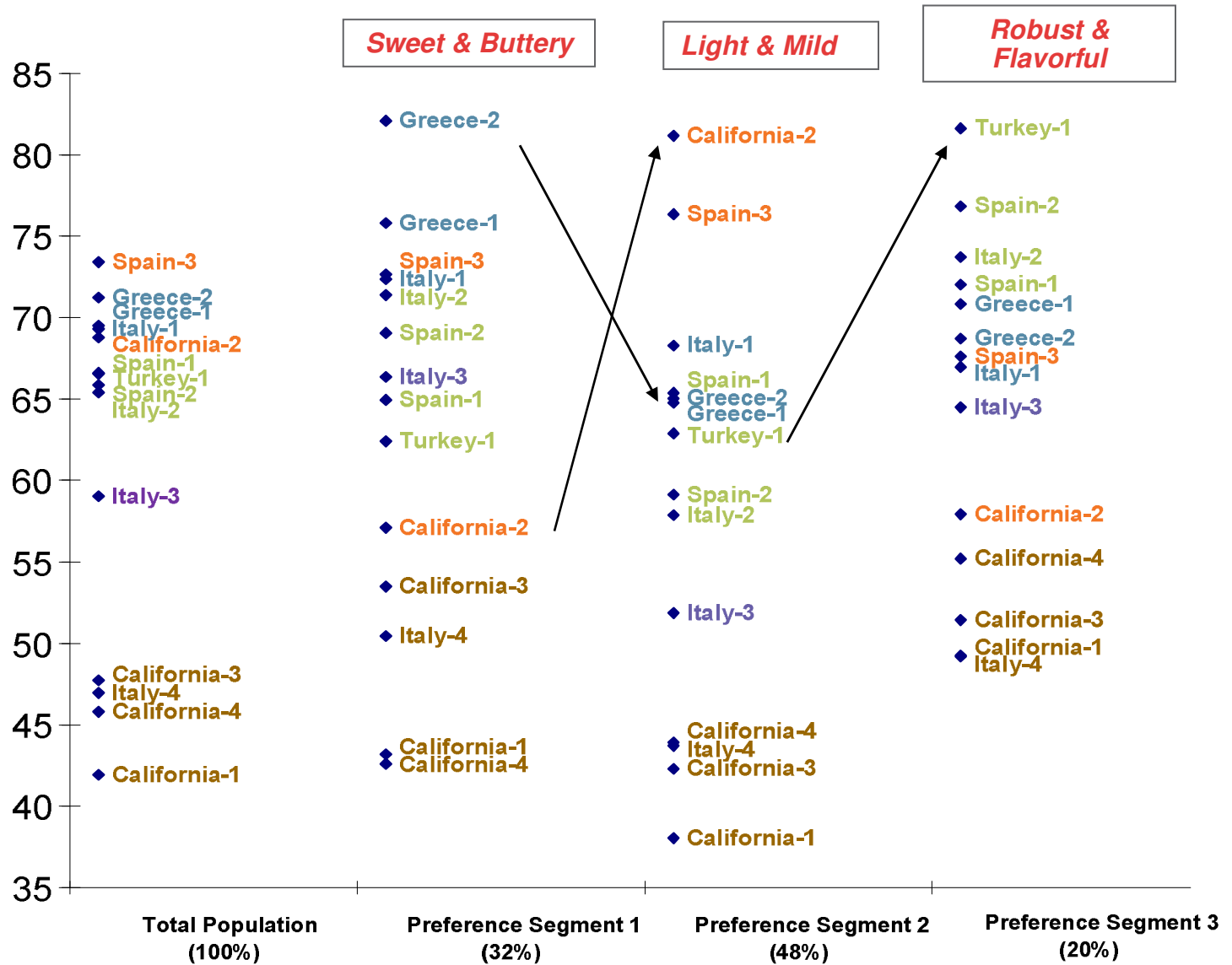
# Preference Segmentation

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# 3 Preference Segments Identified



## **The segments are defined by specific sensory attributes**

**Sweet & Buttery (32%)\* - preferred Greece-1 and -2 with a green tint, cloudy, with butter flavors and some sweetness.**

**Light & Mild (48%) – represented the largest opportunity, preferred California-2 & Spain-3 with lighter golden colors and weaker flavors.**

**Robust & Flavorful (20%) - preferred Turkey-1 and Spain-2 with more grassy, nutty, and olive aromas, and flavors with some bitterness.**

**\*Segment names assigned based on experimenter judgment; % - designates population**



# Understanding the ‘Why’ in Consumer Preferences

## Relating Tragon QDA® & Consumer responses

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## Correlation of Sensory Attributes with Total and Segment Populations

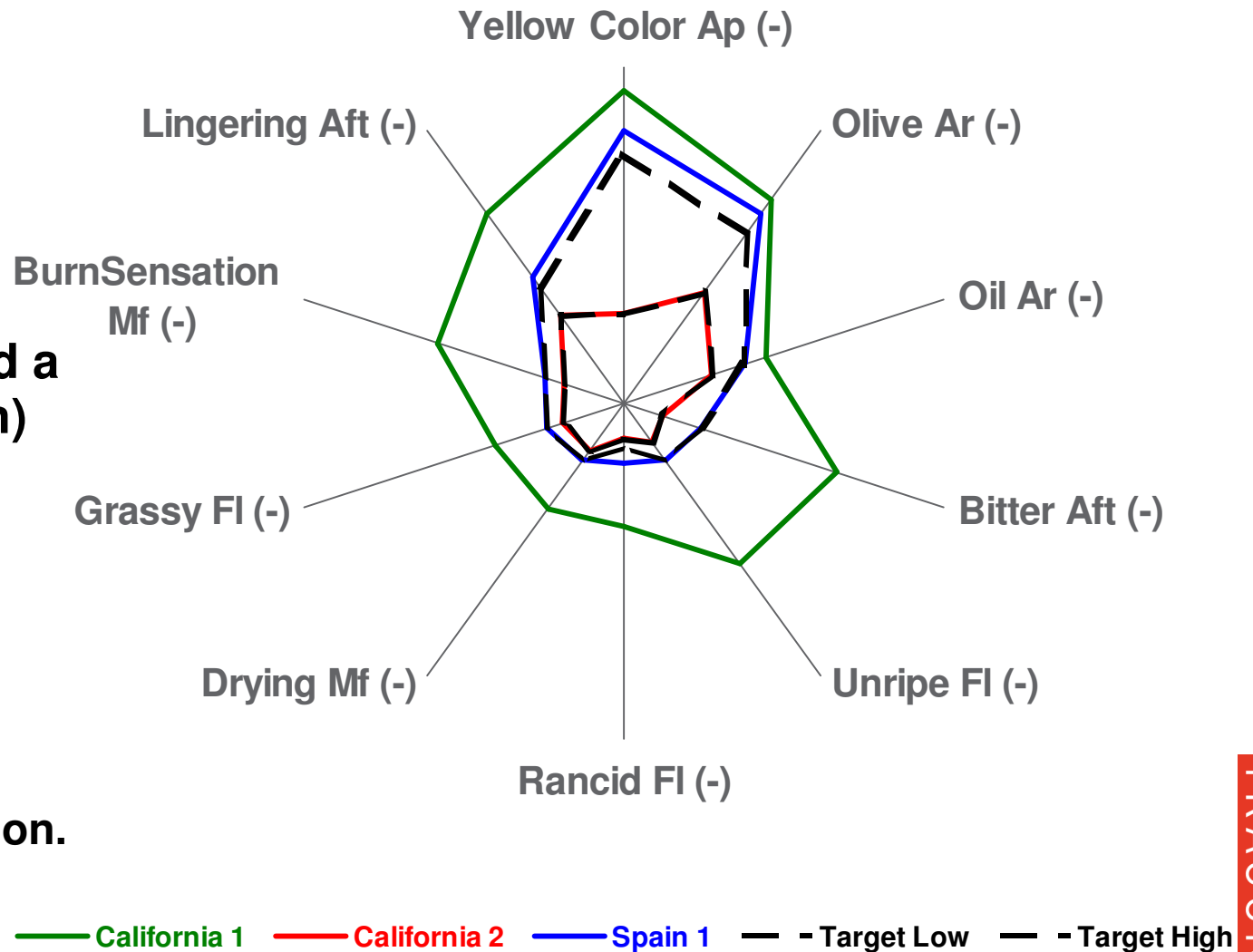
Total Population (n=163)		Preference Segment 1 (n=52)		Preference Segment 2 (n=78)		Preference Segment 3 (n=33)	
Sweet Aft	0.68	Green Tint Ap	0.74	Artificial Ar	0.67	Grass Ar	0.78
Coating Aft	-0.51	Coating Ap	0.73	Cooling Mf	0.55	Oil Ar	0.76
Grassy Fl	-0.51	Yellow Color Ap	0.67	Sweet Aft	0.53	Nutty Ar	0.74
Overall Aft	-0.59	Olive Fl	0.55	Coating Aft	-0.54	Overall Ar	0.74
Lingering Aft	-0.60	Herb Ar	0.55	Puckering Aft	-0.54	Nutty Aft	0.72
Drying Mf	-0.62	Nutty Fl	0.51	Artificial Aft	-0.55	Unripe Ar	0.67
Unripe Ar	-0.62	Clear Ap	-0.80	Nutty Fl	-0.55	Olive Ar	0.67
Bitter Fl	-0.64			Rancid Ar	-0.56	Grassy Fl	0.66
Bitter Aft	-0.65			Coating Mf	-0.57	Herb Ar	0.64
Puckering Mf	-0.65			Rancid Fl	-0.57	Olive Fl	0.59
Unripe Fl	-0.68			Nutty Aft	-0.59	Olive Aft	0.57
BurnSensation Aft	-0.72			Nutty Ar	-0.60	Musky Ar	0.57
BurnSensation Mf	-0.74			Drying Mf	-0.69	Yellow Color Ap	0.52
				Grass Ar	-0.70	Artificial Ar	-0.56
				Yellow Color Ap	-0.70		
				Olive Aft	-0.71		
				Lingering Aft	-0.73		
				Olive Fl	-0.73		
				Herb Ar	-0.75		
				BurnSensation Mf	-0.75		
				Puckering Mf	-0.78		
				BurnSensation Aft	-0.79		
				Bitter Fl	-0.79		
				Bitter Aft	-0.81		
				Overall Aft	-0.82		
				Grassy Fl	-0.83		
				Unripe Ar	-0.83		
				Olive Ar	-0.84		
				Oil Ar	-0.87		
				Unripe Fl	-0.88		
				Overall Ar	-0.90		

Pearson Correlations Without Disliked Products



# Using MR/C\* to Identify Attributes Most important to Preferences – Segment 2

Segment 2 wanted a mild (low strength) olive oil.

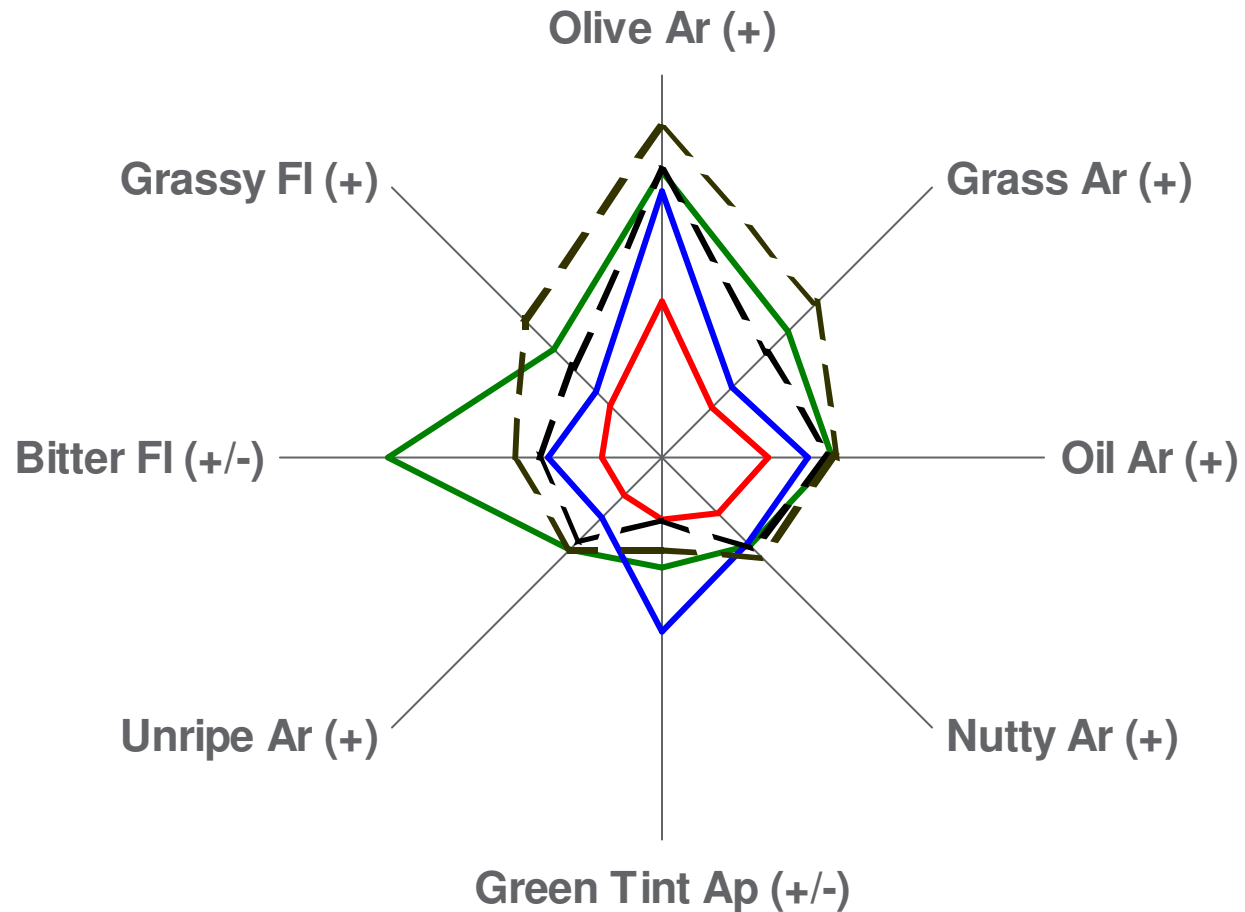


\* MR/C is multiple regression/correlation.

# Segment 3

Wanted an oil that had olive, grassy, nutty, and unripe aromas and flavors along with some bitterness and greenish tint.

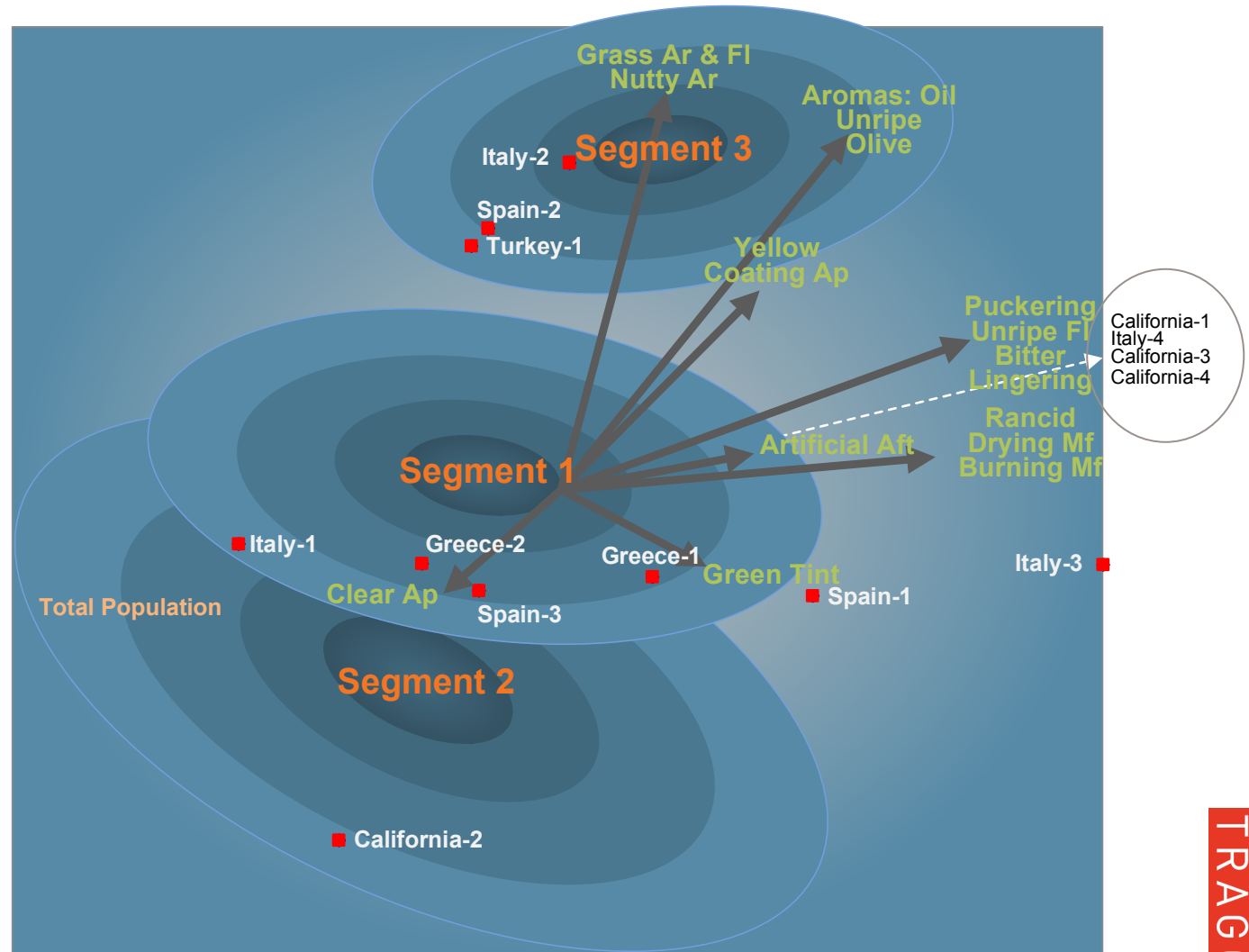
+/- designates curvilinearity (too little and too much decrease preferences).



— California 1 — California 2 — Spain 1 — - Target Low — - Target High

# Product Dimensions Landscape

Products within and closest to each acceptance sphere best meet segment acceptance and sensory profiles.



# Key Findings

**Consumers developed 40 words/attributes to describe commercially available EVOOs.**

**Sensory differences did not define country of origin.**

**A wide range of preferences for EVOOs were obtained.**

**Preference segments were defined by specific sensory properties.**



# Packaging Research

**What information does the package convey?**

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# Package Research

**Using a type of choice behavior/conjoint, consumers rated expected price, quality, country of origin and type of olive oil based on observing four packages widely available in the marketplace.**

# Results

180



343



286



269



	180	343	286	269
<b>Type</b>	Pure	Pure/EVOO	EVOO	EVOO
<b>Price</b>	Less than \$10 to \$15	\$10 to \$20	\$10 to \$20	\$15 to \$25
<b>Country of Origin</b>	California/Italy	Italy	Italy	Italy
<b>Quality Level</b>	Value/Mainstream	Mainstream/Premium	Premium	Premium/Specialty

# Conclusions

**There was a wide range of sensory differences and preferences among the EVOOs tested.**

**Differences were independent of country of origin.**

**Three preference segments identified – the sensory differences explained the preferences.**

**Packaging also conveyed information with regard to expectations as to: value, type of oil, country of origin, and usage occasion.**

**Market opportunities can be identified relative to specific market strategies**



# Managing the Information

**The value of this information is significantly enhanced when associated with a market strategy.**

**A few words of caution --- the product set was limited relative to all the products currently in the market as was the consumer population.**

**Testing at UC Davis yielded similar results.**

**Taken together, results demonstrate the face validity of the information and its potential value for the EVOO business.**

**Physical and chemical analyses needed to add potential health benefits.**



## Extra Virgin Olive Oil Grading by USDA

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# USDA Olive Oil Grading Standards

The **United States** is not an IOOC member and the USDA does not recognize its classifications (i.e., extra-virgin olive oil). USDA, until 2010, used a system defined in 1948.

**USDA** had four grades, based on acidity, absence of defects, odor and flavor:

**Grade A or U.S. Fancy free fatty acid < 1.4% and "free from defects";**

**Grade B or U.S. Choice free fatty acid <2.5% and "reasonably free from defects";**

**Grade C or U.S. Standard free fatty acid < 3.0% and "fairly free from defects";**

**Grade D or U.S. Substandard free fatty acid > 3.0% and "fails to meet the requirements of U.S. Grade C".**

## USDA Revises Olive Oil Grade Standards -- April 27, 2010

**The California Olive Oil Council petitioned USDA to revise the current U.S. grade standards to conform to current industry standards. These revised standards provide a common language for trade and provide consumers more assurance of the quality of olive oil that they purchase.**

**The revised standards include objective criteria for extra virgin olive oil.**

**This revision affects importers and ~ 500 domestic producers and growers.**

**This leads us to a discussion about grading and the EVOO business.**

**THANK YOU**

**Any Questions ?**