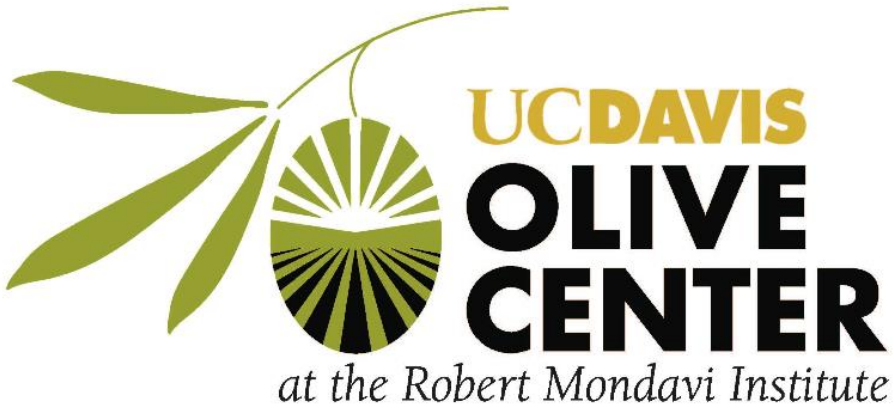
OOCC Research Review

March 19th, 2018

Selina C. Wang PhD



- Work with growers and processors to address the research needs
- Identify important research areas/topics and recommend them to the industry

2016/2017 season

#	Project Name
1	Survey on California commercial olive oil off-the-shelf in the marketplace
2	Evaluation of Mandatory Testing for California Olive Oil 2016/2017
3	Evaluation of Fatty Acid and Sterol Profiles for California Olive Oils
4	Literature Review on Best Before Date Predictors for olive oil

2016/2017 season

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Survey on California commercial olive oil off-the-shelf in the marketplace

2016/2017

Evaluation of 50 California Olive Oil at Marketplaces 2016

Submitted to the
Olive Oil Commission of California

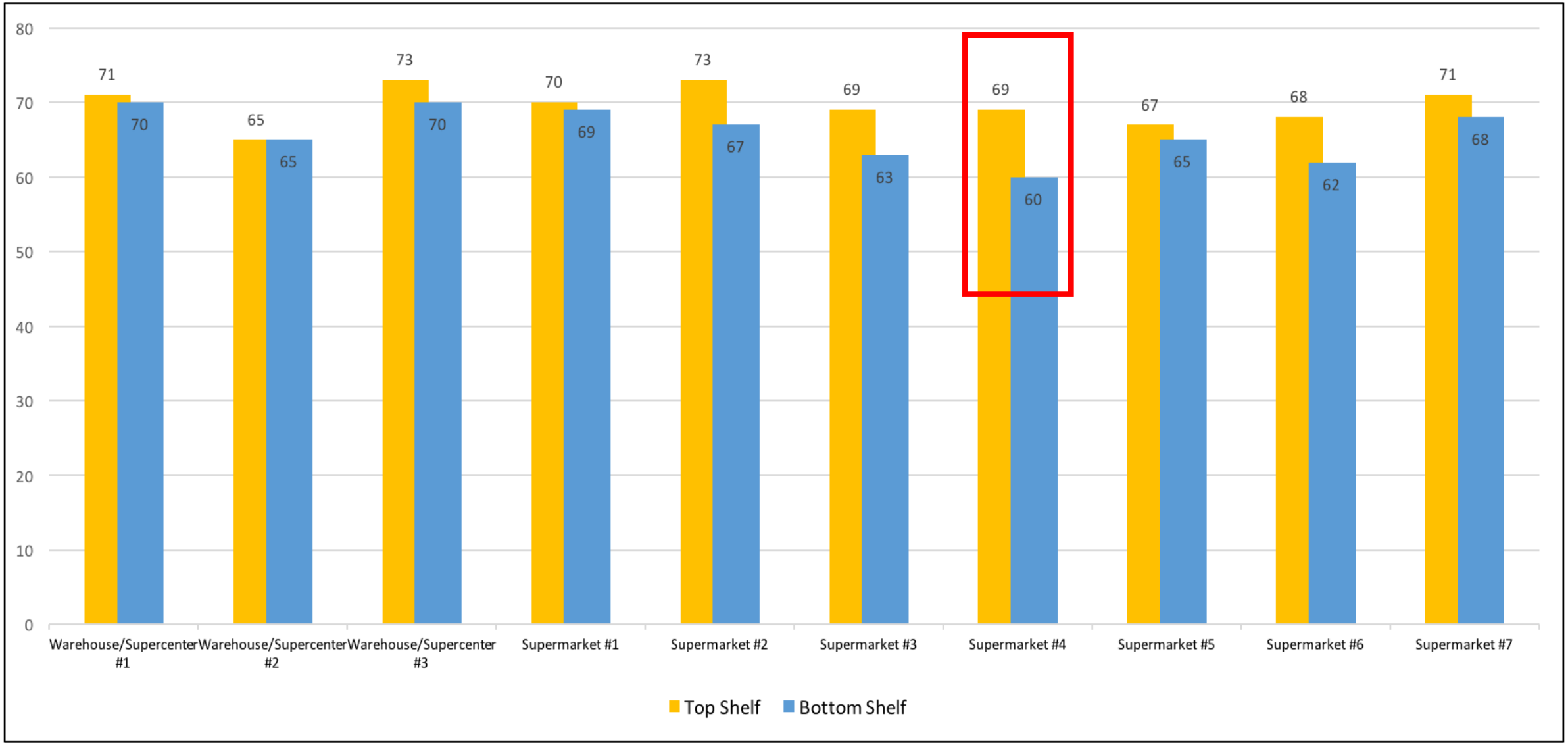
July 2017

- Sampling methodology
- Store information
- Discussion on chemistry and sensory results
- Best before date correlations
- Conclusions
- Recommendations

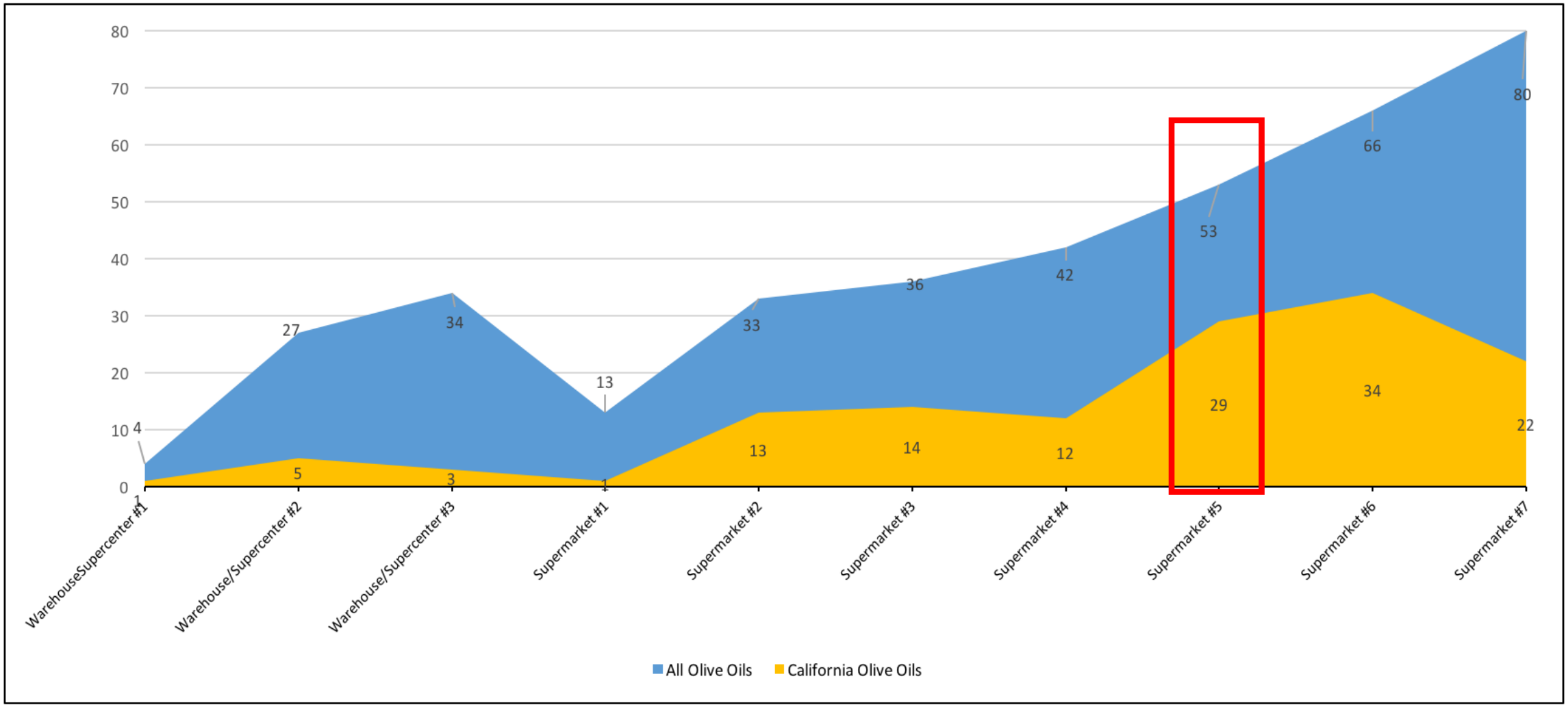
Samples

- 50 California olive oil samples purchased in Sacramento in Nov. 2016
- 7 traditional food stores (80%), 3 warehouse clubs/supercenters (12%), Amazon (6%), tasting room of an olive oil producer (2%)
- 62% OOCC members
- 96% from 2015 harvest

Temperature at shelf (°F)



Number of olive oils at each store



Quality tests in California olive oil standards

PARAMETER	DETERMINATION	INDICATOR	CA EXTRA VIRGIN STANDARD
Free Fatty Acids (FFA)	Free fatty acids are formed by the hydrolysis of the triacylglycerols during extraction, processing and storage.	An elevated level of free fatty acid indicates hydrolyzed fruits and/or poor quality oil made from unsound fruit, improperly processed or stored oil.	≤ 0.5 % as oleic acid
Peroxide Value (PV)	Peroxides are primary oxidation products that are formed when oils are exposed to oxygen, producing undesirable flavors and odors.	An elevated level of peroxides indicates oxidized and/or poor quality oil.	≤ 15 meq. O_2/kg oil
Ultraviolet absorbance (UV)	Conjugated double bonds are formed from natural nonconjugated unsaturation in oils upon oxidation. The K_{232} measures primary oxidation products and K_{270} measures secondary oxidation products.	An elevated level of UV absorbance indicates oxidized and/or poor quality oil.	K_{232}: ≤ 2.40 $K^{1\%}_{1cm}$; K_{270} ≤ 0.22 $K^{1\%}_{1cm}$; ΔK: ≤ 0.01 $K^{1\%}_{1\ cm}$
Moisture and Volatile Matter %m/m	Olive oil retains water and volatile compounds during processing. Moisture and volatile matter are determined by the loss in mass of olive oil in an air oven at 130±2°C or in a vacuum oven at the temperature range of 20°C to 25°C under specific test conditions.	An elevated level of moisture and volatile matter could be caused by improper extraction methods, leading to poor olive oil quality, organoleptic defects, and reduced shelf life.	≤ 0.2 %
Insoluble Impurities %m/m	Insoluble impurities (meal, dirt, and other foreign matter) are determined when the impurities are insoluble in petroleum ether under specific experimental conditions.	Elevated insoluble impurities can be caused by substandard manufacturing practices, leading to poor olive oil quality, organoleptic defects and reduced shelf life.	≤ 0.1 %
1,2-Diacylglycerols (DAGs)	Fresh extra virgin olive oil contains a high proportion of 1,2-diacylglycerols to 1,2- and 1,3-diacylglycerols, while olive oil from poor quality fruits and refined olive oils have higher level of 1,3-DAGs than fresh extra virgin olive oils.	The ratio of 1,2-diacylglycerols to 1,2- and 1,3-diacylglycerols is an indicator for oil that is hydrolyzed, oxidized, and/or of poor quality.	≥ 35%
Pyropheophytins (PPP)	Chlorophyll pigments break down to pheophytins and then pyropheophytins upon thermal degradation of olive oil.	An elevated level of pyropheophytins is an indicator for oil that is oxidized and/or adulterated with refined oil.	≤ 17%
Sensory	Sensory refers to taste, odor and mouthfeel	Sensory assessment can help identify oils that are of poor quality, oxidized, and/or adulterated with other oils.	Median of defects=0.0; median of the fruity>0.0

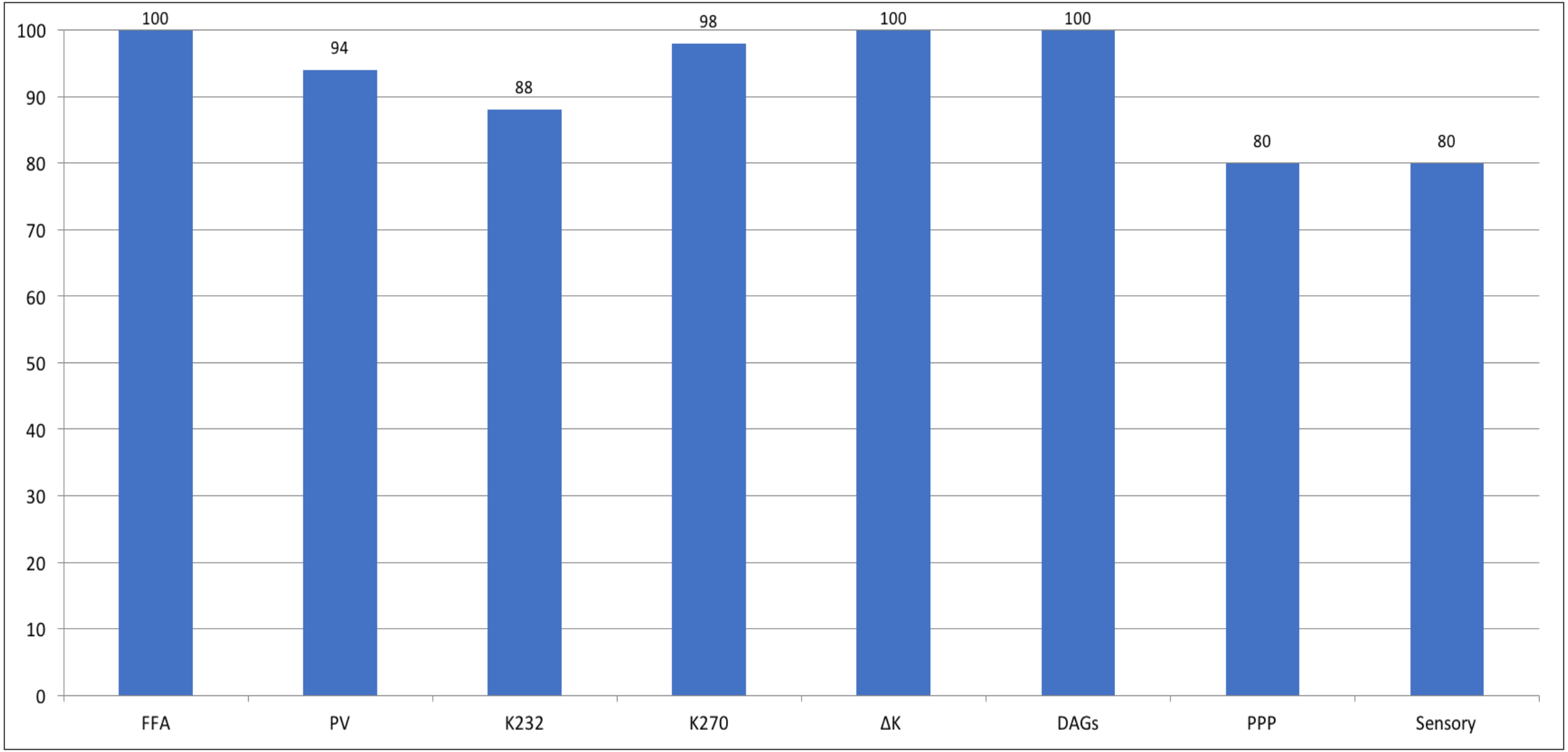
Quality tests and standards for California olive oil grades

Test	Extra Virgin	Virgin	Crude
Free Fatty Acidity (FFA) %m/m expressed as oleic acid	≤0.5	≤1.0	>1.0
Peroxide Value (PV) meq. O_2/kg oil	≤15.0	≤20.0	>20.0
K_{232} Ultraviolet Absorbance (UV) $K^{1\%}_{1cm}$	≤2.40	≤2.60	>2.60
K_{270} Ultraviolet Absorbance (UV) $K^{1\%}_{1cm}$	≤0.22	≤0.25	>0.25
ΔK Ultraviolet Absorbance (UV) $K^{1\%}_{1cm}$	≤/0.01/	≤/0.01/	≤/0.01/
Moisture and Volatile Matter %m/m	≤0.2	≤0.2	≤0.3
Insoluble Impurities %m/m	≤0.1	≤0.1	≤0.2
Pyropheophytin a (PPP) %	≤17	N/A	N/A
1,2–Diacylglycerols (DAGs) %	≥35	N/A	N/A
Organoleptic Median of Defects (MeD) **Organoleptic Median of Fruity (MeF)**	0.0 >0.0	≤2.5 >0.0	>2.5 N/A

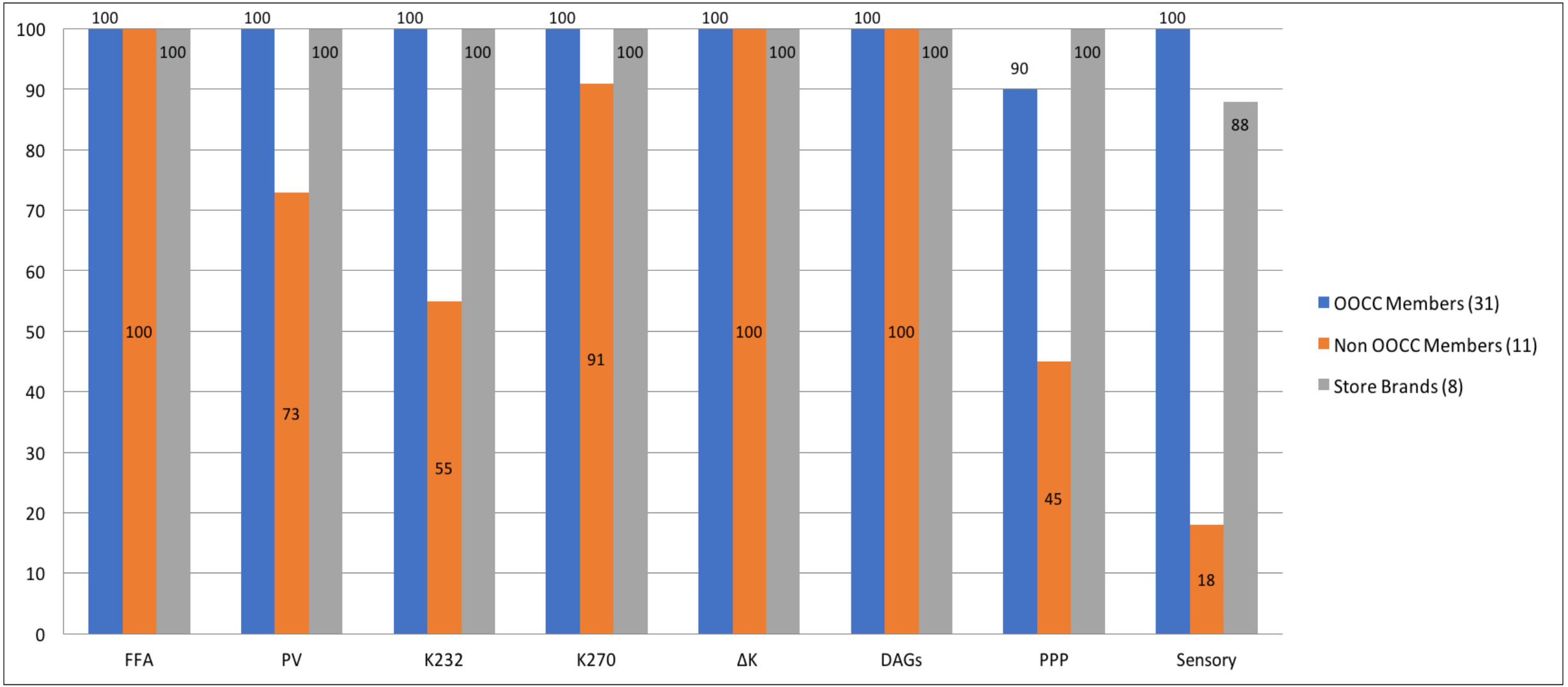
SAMPLE #	HARVEST YEAR	FFA	PV	K_{232}	K_{270}	Δ K	DAGs	PPP	INDUCTION TIME*	SENSORY DEFECTS	GRADE
		≤0.5 ≤1.0 >1.0	≤15 ≤20 >20	≤2.40 ≤2.60 >2.60	≤0.22 ≤0.25 >0.25	≤0.01 ≤0.01 ≤0.01	≥35 N/A N/A	≤17 N/A N/A		MeD=0.0 0.0<MeD≤2.5 MeD>2.5	Extra Virgin Virgin Crude
1	2015	0.16	20.0	2.80	0.16	0.00	55	12	4.4	Rancid: 1.1, 0.4	Crude
2	2015	0.20	4.5	1.60	0.13	0.00	50	18	11.6		Virgin
3	2015	0.20	5.5	1.62	0.13	0.00	49	19	11.2		Virgin
4	2015	0.15	6.6	1.73	0.12	0.00	54	18	9.2		Virgin
5	2015	0.25	11.1	2.50	0.17	0.00	40	22	9.2	Rancid: 1.7, 0.7	Virgin
6	2015	0.17	7.1	1.61	0.13	0.00	58	14	8.8		Extra Virgin
7	2015	0.25	6.7	1.61	0.12	0.00	48	16	10		Extra Virgin
8	2015	0.18	7.4	1.66	0.10	0.00	54	14	8.6		Extra Virgin
9	2015	0.20	5.5	1.59	0.12	0.00	53	15	12.4		Extra Virgin
10	2015	0.18	6.5	1.63	0.12	0.00	53	14	12.1		Extra Virgin
11	2015	0.27	11.1	2.60	0.21	0.00	39	39	9.3	Rancid: 2.7, 2.6; Fusty: 1.6, 1.0	Crude
12	2015	0.21	11.1	1.33	0.10	0.00	56	11	6.7		Extra Virgin
13	2015	0.17	10.5	1.71	0.13	0.00	59	14	11.1		Extra Virgin
14	2015	0.27	5.7	1.73	0.20	0.00	39	46	10.8	Rancid: 2.7, 2.7; Fusty: 1.6, 1.0	Crude
15	2015	0.19	5.5	1.60	0.12	0.00	55	14	10.4		Extra Virgin
16	2015	0.25	7.6	1.55	0.13	0.00	49	10	10.8		Extra Virgin
17	2015	0.18	4.9	1.59	0.11	0.00	53	14	10.4		Extra Virgin
18	2015	0.19	5.0	1.55	0.11	0.00	51	14	10.4		Extra Virgin
19	2015	0.27	7.0	1.79	0.13	0.00	39	22	9.1	Rancid: 1.1, 1.9	Virgin
20	2014	0.24	19.2	2.88	0.27	0.00	36	42	4.7	Rancid: 2.6, 1.9; Fusty: 0.7, 0.8	Crude
21	2015	0.14	10.4	2.20	0.15	0.00	74	7	9.9		Extra Virgin
22	2015	0.18	7.0	1.82	0.15	0.00	52	17	12.4		Extra Virgin
23	2015	0.29	5.6	1.64	0.09	0.00	44	14	9.7		Extra Virgin

22	2015	0.18	7.0	1.82	0.15	0.00	52	17	12.4		Extra Virgin
23	2015	0.29	5.6	1.64	0.09	0.00	44	14	9.7		Extra Virgin
24	2015	0.18	5.5	1.66	0.07	0.00	53	15	11.6		Extra Virgin
25	2015	0.13	12.5	2.34	0.08	0.00	66	9	8.5		Extra Virgin
26	2015	0.31	6.3	2.25	0.19	0.00	45	12	15.5		Extra Virgin
27	2015	0.31	4.7	1.62	0.07	0.00	43	15	13		Extra Virgin
28	2015	0.29	4.5	1.54	0.08	0.00	45	16	9.9		Extra Virgin
29	2015	0.22	8.1	1.85	0.07	0.00	53	13	6.8		Extra Virgin
30	2015	0.26	12.4	2.69	0.20	0.00	37	39	8.2	Rancid: 2.6, 2.9; Fusty: 0.4, 0.5	Crude
31	2015	0.21	3.9	1.66	0.17	0.00	58	10	11.3		Extra Virgin
32	2015	0.19	4.5	1.68	0.15	0.00	59	11	12.2		Extra Virgin
33	2015	0.19	4.7	1.58	0.12	0.00	60	11	11.9		Extra Virgin
34	2015	0.18	8.9	1.11	0.14	0.00	62	6	10.9		Extra Virgin
35	2015	0.16	5.4	1.71	0.13	0.00	61	12	8.7		Extra Virgin
36	2015	0.16	6.9	1.76	0.16	0.00	59	12	7.8		Extra Virgin
37	2015	0.20	5.3	1.59	0.10	0.00	61	9	10.7		Extra Virgin
38	2015	0.19	9.3	2.14	0.15	0.00	56	15	11.6		Extra Virgin
39	2015	0.19	9.6	2.11	0.10	0.00	59	12	5	Rancid: 0.4, 0.2	Virgin
40	2015	0.15	6.2	1.83	0.12	0.00	67	10	10.3	Rancid: 0.3, 0.2	Virgin
41	2015	0.31	5.5	1.59	0.12	0.00	44	15	9.2		Extra Virgin
42	2015	0.20	6.7	1.55	0.12	0.00	53	12	10		Extra Virgin
43	2015	0.30	7.7	1.70	0.17	0.00	44	14	11.3		Extra Virgin
44	2015	0.20	8.5	1.61	0.13	0.00	52	15	10.1		Extra Virgin
45	2015	0.18	6.5	1.48	0.10	0.00	58	12	10.8		Extra Virgin
46	2014	0.34	18.1	2.56	0.17	0.00	36	22	5.9	Rancid: 2.1, 2.6; Fusty: 1.1, 0.7	Virgin
47	2015	0.20	7.1	1.70	0.10	0.00	58	12	11.2		Extra Virgin
48	2015	0.22	5.9	1.49	0.11	0.00	52	15	11.2		Extra Virgin
49	2015	0.18	4.2	1.49	0.10	0.00	60	10	12.1		Extra Virgin
50	2015	0.21	5.7	1.56	0.13	0.00	52	13	11.4		Extra Virgin

Overall passage rate



Passage rate for OOCC members and non-members



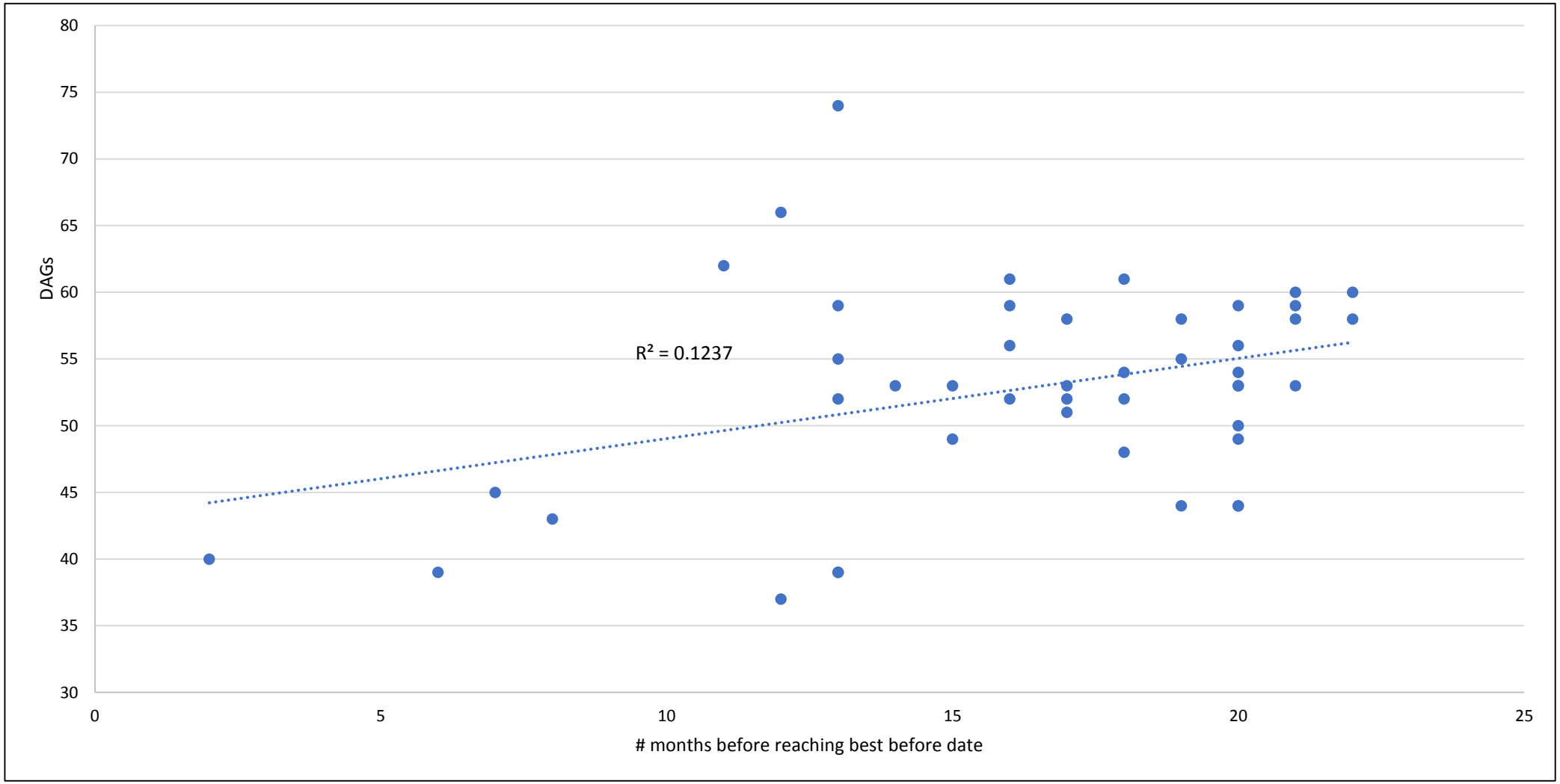
Range of values for samples graded as Extra Virgin

TEST	EVOO SAMPLE RANGE	CA LIMIT
FFA	0.14 - 0.31	≤ 0.5
PV	3.9 - 12.5	≤ 15
K_{232}	1.11 - 2.34	≤ 2.40
K_{270}	0.07 - 0.19	≤ 0.22
ΔK	0.00 - 0.00	≤ 0.03
DAGs	43 - 74	≥ 35
PPP	6 - 17	≤ 17

Averages by grade

	# OF SAMPLES	FFA	PV	K_{232}	K_{270}	DAGs	PPP	INDUCTION TIME
EVOO	37	0.22	6.7	1.67	0.12	54.4	12.8	10.6
VIRGIN	8	0.24	8.6	1.97	0.13	49.3	17.9	8.9
CRUDE	5	0.26	13.7	2.54	0.21	41.2	35.6	7.5

Correlations between number of months before reaching best before date and DAGs in 46 samples



Conclusions (1)

- Passage rate: 90% for OOCC member; 88% for store brands; 18% for non-members.

- The results suggest that the OOCC and its assessed growers and handlers are advancing a reputable level of Extra Virgin quality.

Conclusions (2)

- Five samples had fusty defects, all were from producers outside of the OOCC. These samples were defective because of substandard fruit, processing or storage and should not have been packaged as Extra Virgin grade.

- Five samples were graded as Crude, all were from producers outside of the OOCC. These handlers would benefit from education on best practices as well as careful monitoring of their product shelf life.

Mandatory testing

2016/2017

- Assesses the Standard and California oils
- Samples from the Handlers and CDFA were subjected to quality/purity testing
- Olive Center analyzed data from OOCC
- Since 2014 harvest season

Evaluation of Mandatory Testing
California Olive Oil
2016/17 Season

Submitted to the
Olive Oil Commission of California

July 2017

- 147 samples (57 by OOCC, 90 by 12 Handlers).
- 51 of the 57 OOCC samples were from the same lots tested by the Handlers.
- 139 samples (95%) were designated as EVOO, 2 samples (1%) as lower grade, 6 samples (4%) unidentified prior to testing.

- All samples were analyzed based on the quality tests specified in the standards
- 25 of the OOCC samples were also analyzed for the purity tests specified in the standards
- Four Handlers did not complete all of the tests required in California standards for 23 of 90 Handler samples (26 percent).

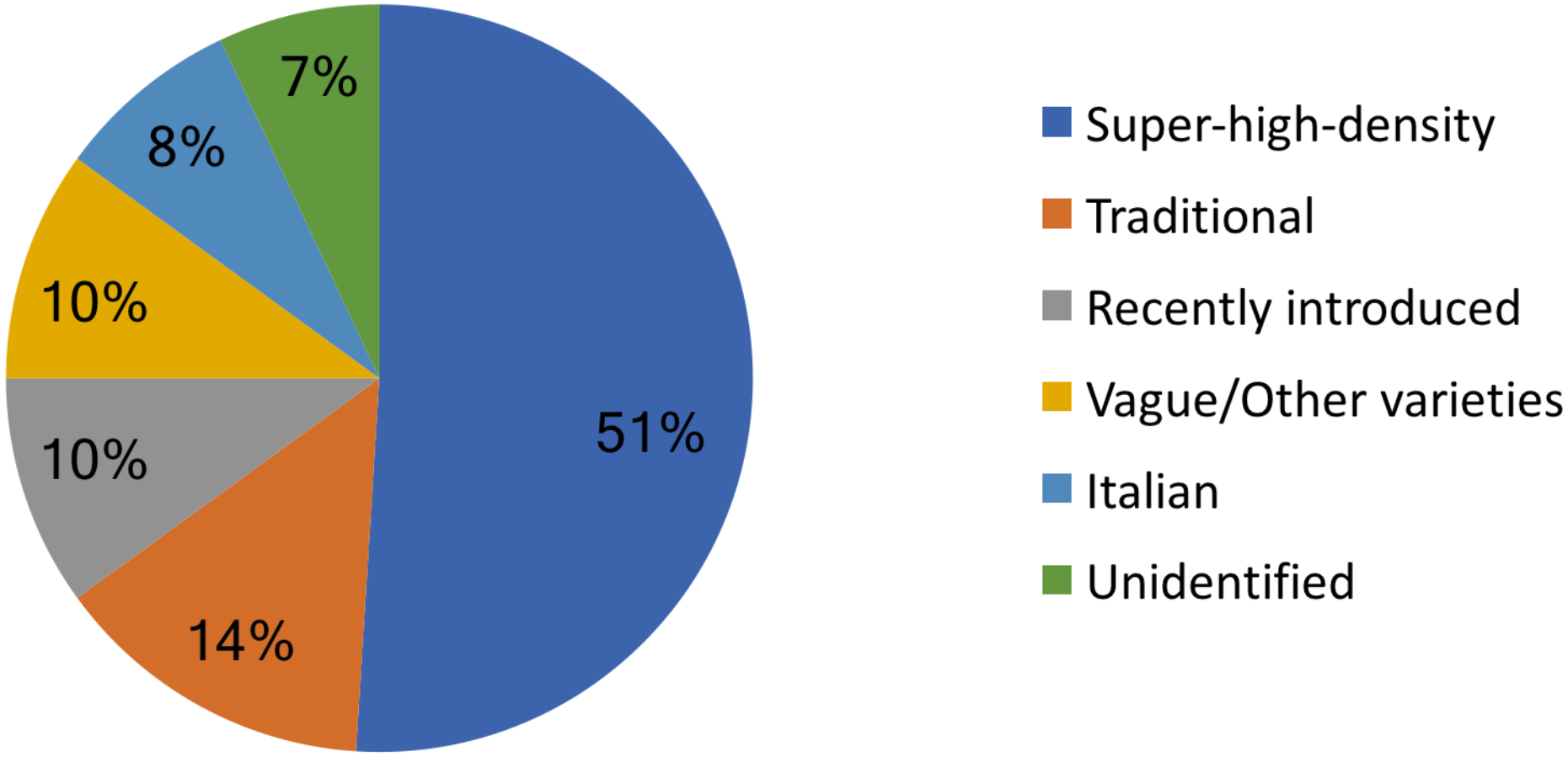
Quality tests in California olive oil standards

PARAMETER	DETERMINATION	INDICATOR	CA EXTRA VIRGIN STANDARD
Free Fatty Acids (FFA)	Free fatty acids are formed by the hydrolysis of the triacylglycerols during extraction, processing and storage.	An elevated level of free fatty acid indicates hydrolyzed fruits and/or poor quality oil made from unsound fruit, improperly processed or stored oil.	≤ 0.5 % as oleic acid
Peroxide Value (PV)	Peroxides are primary oxidation products that are formed when oils are exposed to oxygen, producing undesirable flavors and odors.	An elevated level of peroxides indicates oxidized and/or poor quality oil.	≤ 15 meq. O_2/kg oil
Ultraviolet absorbance (UV)	Conjugated double bonds are formed from natural nonconjugated unsaturation in oils upon oxidation. The K_{232} measures primary oxidation products and K_{270} measures secondary oxidation products.	An elevated level of UV absorbance indicates oxidized and/or poor quality oil.	K_{232}: ≤ 2.40 $K^{1\%}_{1cm}$; K_{270} ≤ 0.22 $K^{1\%}_{1cm}$; ΔK: ≤ 0.01 $K^{1\%}_{1\ cm}$
Moisture and Volatile Matter %m/m	Olive oil retains water and volatile compounds during processing. Moisture and volatile matter are determined by the loss in mass of olive oil in an air oven at 130±2°C or in a vacuum oven at the temperature range of 20°C to 25°C under specific test conditions.	An elevated level of moisture and volatile matter could be caused by improper extraction methods, leading to poor olive oil quality, organoleptic defects, and reduced shelf life.	≤ 0.2 %
Insoluble Impurities %m/m	Insoluble impurities (meal, dirt, and other foreign matter) are determined when the impurities are insoluble in petroleum ether under specific experimental conditions.	Elevated insoluble impurities can be caused by substandard manufacturing practices, leading to poor olive oil quality, organoleptic defects and reduced shelf life.	≤ 0.1 %
1,2-Diacylglycerols (DAGs)	Fresh extra virgin olive oil contains a high proportion of 1,2-diacylglycerols to 1,2- and 1,3-diacylglycerols, while olive oil from poor quality fruits and refined olive oils have higher level of 1,3-DAGs than fresh extra virgin olive oils.	The ratio of 1,2-diacylglycerols to 1,2- and 1,3-diacylglycerols is an indicator for oil that is hydrolyzed, oxidized, and/or of poor quality.	≥ 35%
Pyropheophytins (PPP)	Chlorophyll pigments break down to pheophytins and then pyropheophytins upon thermal degradation of olive oil.	An elevated level of pyropheophytins is an indicator for oil that is oxidized and/or adulterated with refined oil.	≤ 17%
Sensory	Sensory refers to taste, odor and mouthfeel	Sensory assessment can help identify oils that are of poor quality, oxidized, and/or adulterated with other oils.	Median of defects=0.0; median of the fruity>0.0

Samples by variety or blend (147 samples)

Variety	OOCC	Handler	Total # (%) Samples
Arbequina	13	23	36 (24.5)
Arbosana	10	14	24 (16.3)
Ascolano	0	1	1 (0.7)
Barnea	1	1	2 (1.4)
Coratina	1	2	3 (2)
Empeltre	0	1	1 (0.7)
Favolosa	0	1	1 (0.7)
Frantoio	2	3	5 (3.4)
Hojiblanca	1	1	2 (1.4)
Italian Blend	1	1	2 (1.4)
Koroneiki	6	9	15 (10.2)
Leccino	0	2	2 (1.4)
Lunigiana	0	1	1 (0.7)
Manzanillo	1	4	5 (3.4)
Mission	2	3	5 (3.4)
Morailolo	0	1	1 (0.7)
Oliana	1	1	2 (1.4)
Pendolino	0	1	1 (0.7)
Picual	1	3	4 (2.7)
Sevillano	2	4	6 (4.1)
Spanish Blend	0	1	1 (0.7)
Taggiasca	0	1	1 (0.7)
12% Arbequina, 12% Arbosana, 5% Ascolano, 27% Frantoio, 24% Koroneiki, 8% Manzanillo, 7% Mission, 5% Picual	1	1	2 (1.4)
24% Frantoio, 19% San Felica, 15% Itrana, 15% Leccino, 13% Pendalino, 8% Kalamata, 6% Grapollo	1	1	2 (1.4)
3% Mission, 61% Arbequina, 36% Arbosana	2	1	3 (2)
3% Picual, 28% Ascolano, 27% Manzanillo, 17% Mission, 25% Sevillano	1	1	2 (1.4)
45% Frantoio, 45% Leccino, 10% Pendalino	0	1	1 (0.7)
50% Leccino, 50% Frantoio	0	1	1 (0.7)
50% Mission, 50% Manzanillo	2	2	4 (2.7)
55% Frantoio, 25% Leccino, 10% Pendolino, 10% Mission	0	1	1 (0.7)
Unidentified	8	2	10 (6.8)
Total	57	90	147 (100)

Categories of olive varieties tested



Summary of quality testing results for Extra Virgin samples (145 of 147 sample)

Test (CA Extra Virgin Standard)	Average Value	Standard Deviation
Free Fatty Acidity (≤0.5)	0.2	0.1
Peroxide Value (≤15.0)	5.5	2.5
UV K_{232} (≤2.40)	1.78	0.22
UV K_{270} (≤0.22)	0.13	0.03
UV ΔK (≤/0.01/)	0.00	0.00
Moisture and Volatile Matter (≤0.2)	0.1	0.0
Insoluble Impurities (≤0.1)	0.0	0.0
Pyropheophytins (≤17)	2	1
1,2-Diacylglycerols (≥35)	89	7
Organoleptic (MeF>0)	4.6	0.8

Summary of quality testing results for non-Extra Virgin samples (2 of 147 samples)

	Sample	
Test (CA Extra Virgin Standard)	1	2
Free Fatty Acidity (≤0.5)	0.6	2.1
Peroxide Value (≤15.0)	4.8	8.4
UV K_{232} (≤2.40)	1.65	2.02
UV K_{270} (≤0.22)	0.13	0.22
UV ΔK (≤/0.01/)	0.00	<0.001
Moisture and Volatile Matter (≤0.2)	0.2	0.2
Insoluble Impurities (≤0.1)	<0.01	<0.01
Pyropheophytins (≤17)	<1.0	1
1,2-Diacylglycerols (≥35)	83	62
Organoleptic (MeD=0)	0	Rancid 1.9, Fusty 1.4
Organoleptic (MeF>0)	2.8	1.9
Handler Assumed Grade	VOO	Crude
Tested Grade	VOO	Crude

Olive oil grading consistency for same lots from 2014/15 to 2016/17 harvest seasons

	2014/15	2015/16	2016/17
Number of lots tested by both Handlers and the OOCC	26	41	51
Number of samples in agreement	22	39	51
Percentage of grading agreement	85	95	100

Summary of quality testing results for Extra Virgin samples from 2014/15 to 2016/17 harvest seasons

	2014/15		2015/16		2016/17	
Test (CA Extra Virgin Standard)	Average Value	Standard Deviation	Average Value	Standard Deviation	Average Value	Standard Deviation
Free Fatty Acidity (≤0.5)	0.2	0.1	0.2	0.1	0.2	0.1
Peroxide Value (≤15.0)	7.3	2.8	5.9	2.9	5.5	2.5
UV K_{232} (≤2.40)	1.69	0.25	1.77	0.21	1.78	0.22
UV K_{270} (≤0.22)	0.12	0.03	0.12	0.03	0.13	0.03
UV ΔK (≤/0.01/)	<0.003	0.00	<0.003	0.00	0.00	0.00
Moisture and Volatile Matter (≤0.2)	0.1	0.0	0.1	0.0	0.1	0.0
Insoluble Impurities (≤0.1)	0.0	0.0	0.0	0.0	0.0	0.0
Pyropheophytins (≤17)	2	1	2	1	2	1
1,2-Diacylglycerols (≥35)	82	10	88	6	89	7
Organoleptic (MeF>0)	4.2	0.7	4.4	0.7	4.6	0.8

Conclusions and recommendations

- All samples that were designated by Handlers as Extra Virgin prior to testing were ultimately graded as Extra Virgin after testing. A caveat is that a total of 23 samples did not provide data for all of the quality tests required in California standards.
- The third-party sampling agency did not record the grade of the lot designated by the Handler prior to testing, nor did the sampling agency record the olive varieties for each lot. The OOCC may wish to require the third-party sampling agency to report the grade, variety or varieties of olives that the Handler has designated for each lot prior to testing.

California olive oils have little trouble passing the California extra virgin standards when the oils are tested early in the season.

Fatty acids and sterols Profiles

2016/2017

Report

Fatty acid and sterol profiles of olive oil produced in the United States

Dan Flynn, Xueqi Li, and Selina Wang, PhD

June 2014

UCDAVIS OLIVE CENTER
at the Robert Mondavi Institute

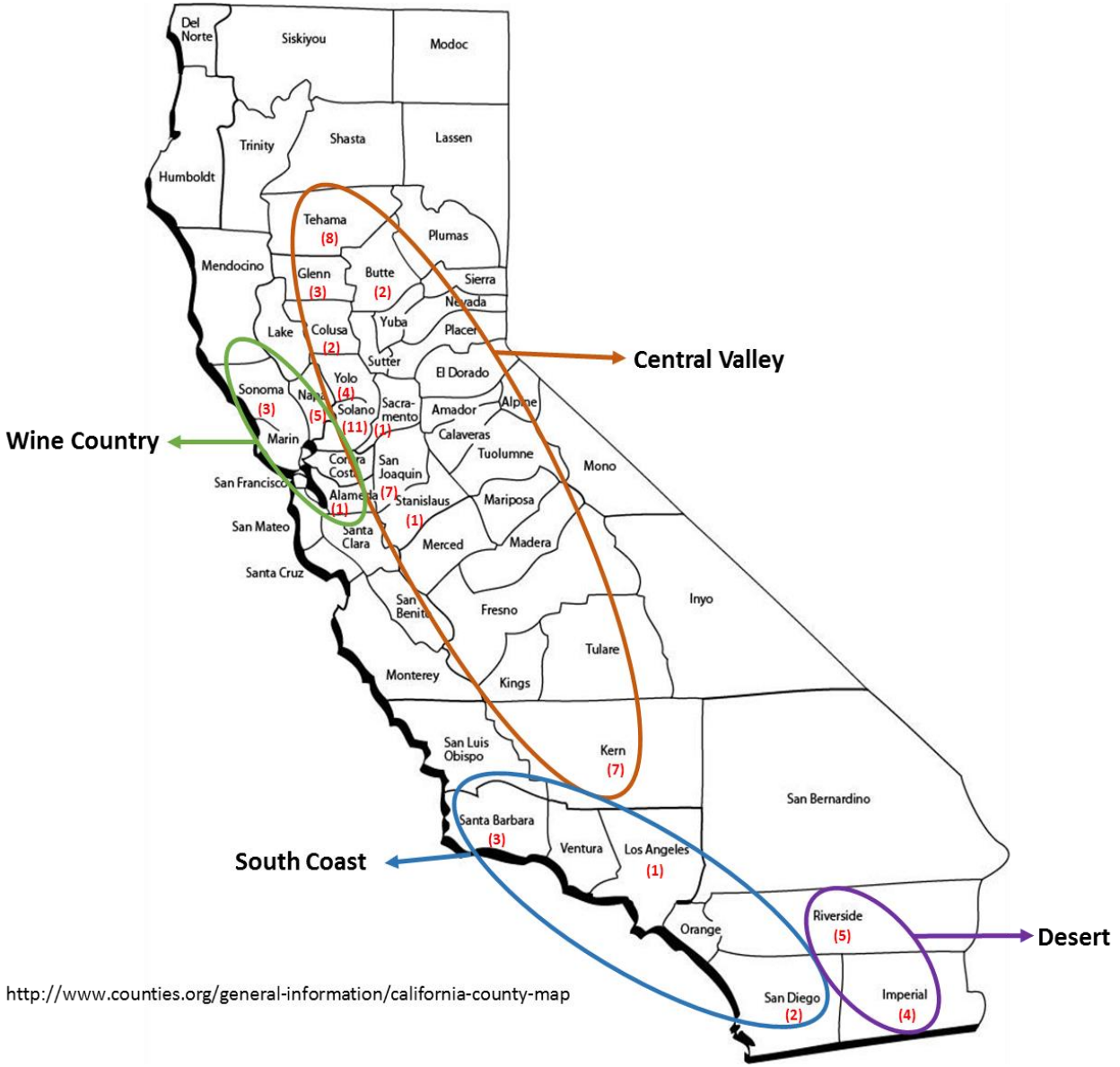
Evaluation of Fatty Acid and Sterol Profiles
California Olive Oil
2016/17 Season

Submitted to the
Olive Oil Commission of California

June 2017

- 70 single-variety samples of olive oil from California commercial producers.
- 61 of 70 samples (87 percent) were within the fatty acid and sterol parameters required in California. Nine samples (13 percent) were outside at least one fatty acid or sterol parameter.

Sample distribution by California counties and regions



http://www.counties.org/general-information/california-county-map

Fatty acid profile by variety

Varity	Region	Palmitic Acid (C16:0)	Palmitoleic Acid (C16:1)	Stearic Acid (C18:0)	Oleic Acid (C18:1)	Linoleic Acid (C18:2)	Linolenic Acid (C18:3)
USDA Standard		7.5-20.0	0.3-3.5	0.5-5.0	55.0-83.0	3.5-21.0	≤1.5
Aglandau	Central Valley	16.4	1.3	2.5	69.9	8.1	0.5
Arbequina	Central Valley	16.7±1.3	1.4±0.2	2.1±0.1	68.4±3.1	9.7±1.7	0.5±0.1
	Wine Country	15.7	1.5	2.2	71.8	7.2	0.7
	Desert	21.2	2.1	2.1	49.3	23.0	0.9
Arbosana	Central Valley	15.1±1.1	1.4±0.3	2±0.1	72.7±2.7	7±1.3	0.6±0.1
Ascolano	Central Valley	17.3±3.0	1.6±0.5	1.9±0.1	67.5±4.3	9.7±0.4	0.8±0.2
Chemlali	Desert	18.3	1.8	2.5	64.0	11.8	0.7
Coratina	Central Valley	14.8	0.5	2.4	70.7	9.6	0.9
	Wine Country	10.7	0.4	2.3	79.3	5.7	0.7
Dolce di Morocco	Desert	14.8	1.3	1.9	67.5	13.0	0.7
Frantoio	Central Valley	16.2±1.9	1.3±0.1	2.1±0.1	67.1±5.6	11.7±3.4	0.7±0.3
	Wine Country	11.9±0.5	0.7±0.1	2.2±0.4	75.8±2.8	8±1.7	0.6±0.1
Grapolo	South Coast	14.6	1.1	2.8	73.7	6.1	0.6
Grignon	Desert	14.8	1.1	2.4	70.3	9.8	0.7
Koroneiki	Central Valley	14.1±0.5	1±0.1	2.5±0.3	74.4±1.7	6.4±1.2	0.5±0.1
	Wine Country	13.1	0.8	2.5	76.3	5.7	0.6
	Desert	16.1±1.3	1.1±0.2	2.6±0.0	69.1±2.8	9±1.2	0.9±0.1
Leccino	Central Valley	15.2±0.3	1.4±0.0	2.2±0.1	72±0.9	8±1.3	0.5±0.0
Manzanillo	Central Valley	14.9±0.3	1.2±0.2	3.9±0.0	71.9±1.1	6.2±0.7	0.6±0.0
	South Coast	14.8	1.2	2.9	72.2	7.4	0.5
	Wine Country	14.6	1.1	2.8	72.7	6.9	0.6
Maurino	Central Valley	18.7	1.5	1.8	60.1	16.0	1.1
	South Coast	15.7	1.2	2.1	69.1	10.4	0.7
	Desert	16.4	1.3	2.1	65.5	13.0	0.9
Mission	Central Valley	12.5±1.1	0.8±0.2	2.5±0.7	75.1±1.6	7.3±0.6	0.9±0.2
Moraiolo	Central Valley	16.5	1.0	2.1	70.5	8.4	0.6
	Wine Country	12.8	0.6	1.8	76.2	7.2	0.6
Nocellara del Belice	Central Valley	16.8	1.3	2.3	66.3	11.1	1.2
	South Coast	9.7	0.3	3.4	75.5	9.3	0.6
Pendolino	Central Valley	16.9±2.7	1.3±0.2	1.9±0.1	66.7±6.5	11.2±2.9	1.1±0.8
Picholine	South Coast	14.0	0.9	2.1	70.2	11.3	0.7
Picual	Central Valley	15±0.5	1.3±0.2	2.4±0.2	75.4±1.4	4.3±0.5	0.8±0.1
	South Coast	13.7	0.9	3.2	73.9	6.7	0.7
Sevillano	Central Valley	15.7	0.9	2.1	69.6	9.2	1.2
	Wine Country	13.0	0.7	2.7	73.7	7.7	0.8
Taggiasca	Central Valley	15.0	1.4	2.0	70.9	9.4	0.5
	Wine Country	13.2	0.8	2.8	73.1	8.6	0.6

Sterol profile by variety

Varity	Region	Cholesterol	Brassicasterol	Campesterol	Stigmasterol	Delta-7-stigmastenol	Apparent B-sitosterol	Total Sterols
USDA Standard		≤0.5	≤0.1	≤4.5	≤ campesterol	≤0.5	≥93.0	≥1000
Aglandau	Central Valley	0.1	0.0	2.6	0.5	0.3	95.5	1310
Arbequina	Central Valley	0.0±0.0	0.0±0.0	3.9±0.3	0.8±0.1	0.2±0.0	94.3±0.3	1440±247
	Wine Country	0.0	0.0	4.1	0.8	0.2	93.8	2329
	Desert	0.1	0.1	5.0	1.4	0.3	92.7	2130
Arbosana	Central Valley	0.0±0.0	0.0±0.0	3.9±0.2	0.8±0.1	0.1±0.0	94.6±0.2	1745±195
Ascolano	Central Valley	0.0±0.0	0.0±0.0	3.2±0.1	1.2±0	0.2±0.1	94.9±0	2101±634
Chemlali	Desert	0.0	0.0	3.5	0.6	0.3	94.9	1768
Coratina	Central Valley	0.1	0.0	3.7	0.8	0.3	94.7	1608
	Wine Country	0.0	0.0	3.7	0.5	0.1	95.1	1209
Dolce di Morocco	Desert	0.0	0.0	3.2	1.0	0.2	95.0	1609
Frantoio	Central Valley	0.1±0.0	0.1±0.1	3.4±0.6	0.6±0.1	0.4±0.1	94.7±0.5	1656±465
	Wine Country	0.0±0.0	0.0±0.0	3.2±0.3	0.5±0.1	0.2±0.0	95.4±0.1	1472±216
Grapolo	South Coast	0.0	0.0	3.0	0.7	0.2	95.2	1179
Grignon	Desert	0.0	0.0	3.4	1.3	0.3	94.3	1362
Koroneiki	Central Valley	0.1±0.1	0.1±0.0	4.2±0.2	0.7±0.1	0.3±0.1	93.6±0.7	1305±515
	Wine Country	0.1	0.1	4.0	0.7	0.2	93.6	918
	Desert	0.1±0.0	0.1±0.0	4.7±0.6	1.5±0.5	0.4±0.1	92.7±1.2	1447±140
Leccino	Central Valley	0.0±0.0	0.0±0.0	2.7±0.0	0.8±0.1	0.4±0.1	95.1±0.5	1234±74
Manzanillo	Central Valley	0.0±0.0	0.0±0.0	2.7±0.1	1.2±0.5	0.2±0.1	95.3±0.6	1124±14
	South Coast	0.1	0.0	3.1	0.9	0.5	94.6	1218
	Wine Country	0.0	0.0	3.0	0.8	0.2	95.3	1283
Maurino	Central Valley	0.0	0.0	3.2	0.4	0.4	95.1	2506
	South Coast	0.0	0.0	3.1	0.3	0.2	95.1	1467
	Desert	0.0	0.0	3.1	0.7	0.4	94.8	1897
Mission	Central Valley	0.0±0.0	0.0±0.0	2.8±0.3	0.7±0.1	0.2±0.1	95.7±0.1	1992±521
Moraiolo	Central Valley	0.1	0.0	2.8	0.4	0.3	95.3	1072
	Wine Country	0.0	0.0	3.1	0.7	0.2	95.3	1054
Nocellara del Belice	Central Valley	0.1	0.1	4.7	2.2	0.3	91.9	1142
	South Coast	0.0	0.0	3.4	0.4	0.2	95.1	1532
Pendolino	Central Valley	0.0±0.0	0.0±0.0	3.0±0.3	0.4±0.2	0.3±0.2	95.2±0.4	1735±653
Picholine	South Coast	0.0	0.0	2.9	0.5	0.2	95.7	1691
Picual	Central Valley	0.0±0.0	0.0±0.0	3.0±0.1	0.9±0.2	0.3±0.1	95.2±0.2	1395±256
	South Coast	0.1	0.0	3.2	0.7	0.3	95.1	1477
Sevillano	Central Valley	0.0	0.0	2.6	1.2	0.2	95.5	1779
	Wine Country	0.0	0.0	3.3	0.7	0.2	95.1	1605
Taggiasca	Central Valley	0.0	0.0	2.7	0.5	0.3	95.4	1306
	Wine Country	0.0	0.0	2.8	0.6	0.4	94.8	1448

- An Arbequina oil from Imperial County, was outside the parameters for palmitic acid, oleic acid, linoleic acid, campesterol, and apparent B-sitosterol.
- A Pendolino oil from Kern County, was outside the parameters of palmitic acid and linolenic acid.
- Hot climates are associated with lower levels of oleic acid while cooler climates are associated with higher levels of oleic acid.
- Hot climates also tend to correlate with elevated palmitic acid and polyunsaturated linoleic acid

Consistent with desert samples in the Center's previous studies as well as research in Australia and Argentina.

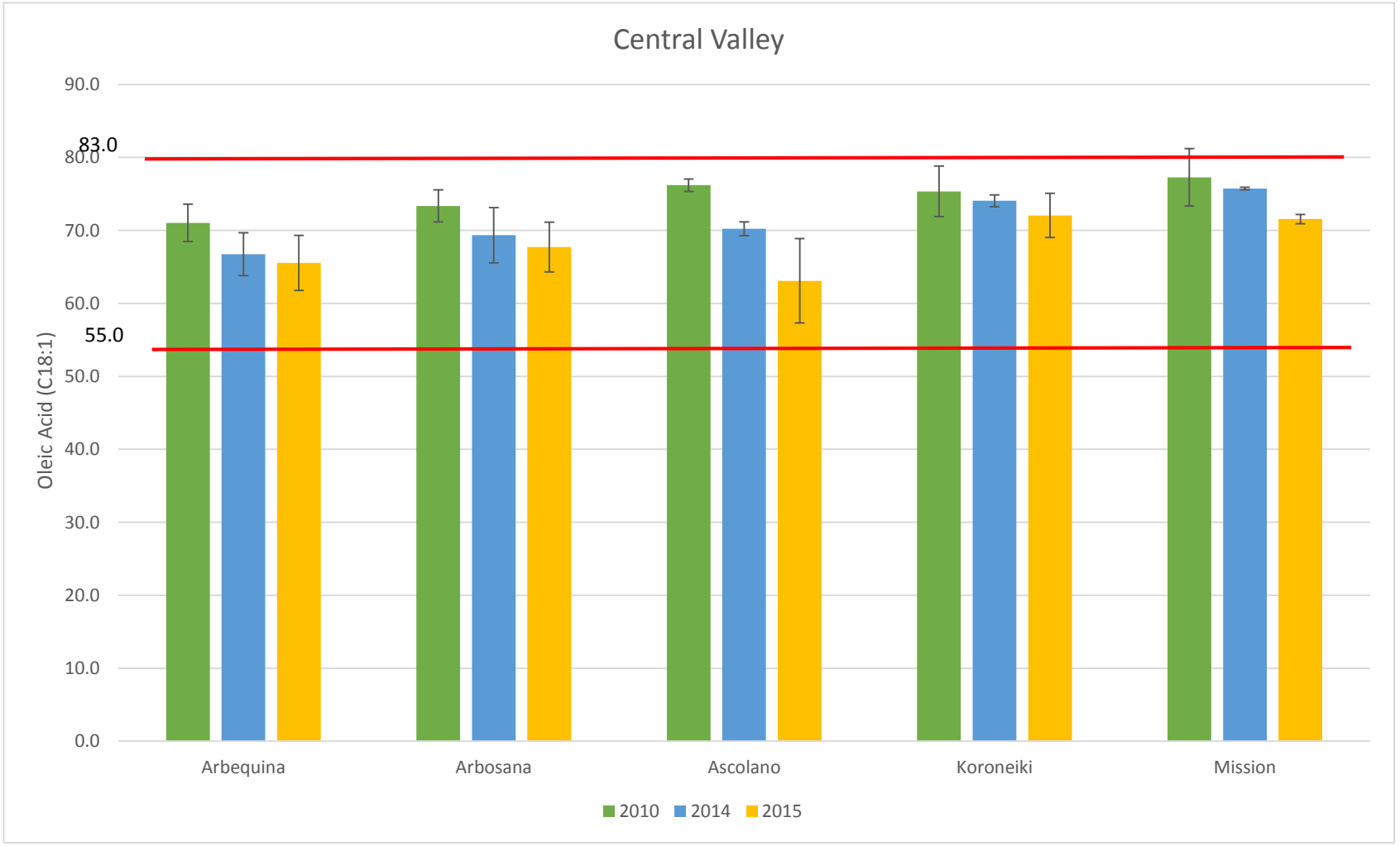
- Three Koroneiki samples from the same desert area were outside the parameters for campesterol and apparent B-sitosterol.
- Two Koroneiki samples from Tehama County were outside the parameter for total sterols.
- One Koroneiki sample from Napa County was outside the parameter for total sterols.

Consistent with desert samples in the Center's previous studies as well as research in Australia and Argentina.

Conclusions and recommendations

- Our finding that some legitimate olive oil is outside fatty acid or sterol profile standards is consistent with California data from previous seasons, as well as similar research in Australia, Chile, Argentina, New Zealand, Italy, Spain and Tunisia.
- The fatty acid and sterol profile of SHD oil varieties from Imperial Valley (desert region) have been consistently outside the current California olive oil standards. The commission may wish to recommend modifications to California olive oil standards so that fatty acid and sterol profile standards accommodate all olive oil produced in California.

Yearly Variations



Stay tuned for results for 2017/2018 season

#	Project Name
1	Survey on California commercial olive oil off-the-shelf in the marketplace
2	Evaluation of Mandatory Testing for California Olive Oil 2017/2018
3	Evaluation of Fatty Acid and Sterol Profiles for California Olive Oils
4	Literature Review on C17:1 Heptadecenoic Acid in Olive Oil
5	Protocol Development for measuring induction time for olive oil and analysis of the OOCC samples for best before date
6	Protocol Development for measuring fat and moisture content of olives using near-infrared (NIR) spectroscopy or Soxhlet