Paul Vossen

Background:

UC – Extension – 36 years

- **Founded first certified tasting panel**
- **Leading expert in quality olive oil**
- **Founder of the UCD Olive Center**
- **Research on Olive Cultivation & Processing**
- **Taught Production, Processing, & Sensory Evaluation**

- **Founder of California Olive Oil Council**
- **World Consulting "Paul Vossen Ag Consulting"**
- **Source Olive Oils for MillPress Imports**
- **Olive Oil Judge**

Retired after 36 years (6-2016)

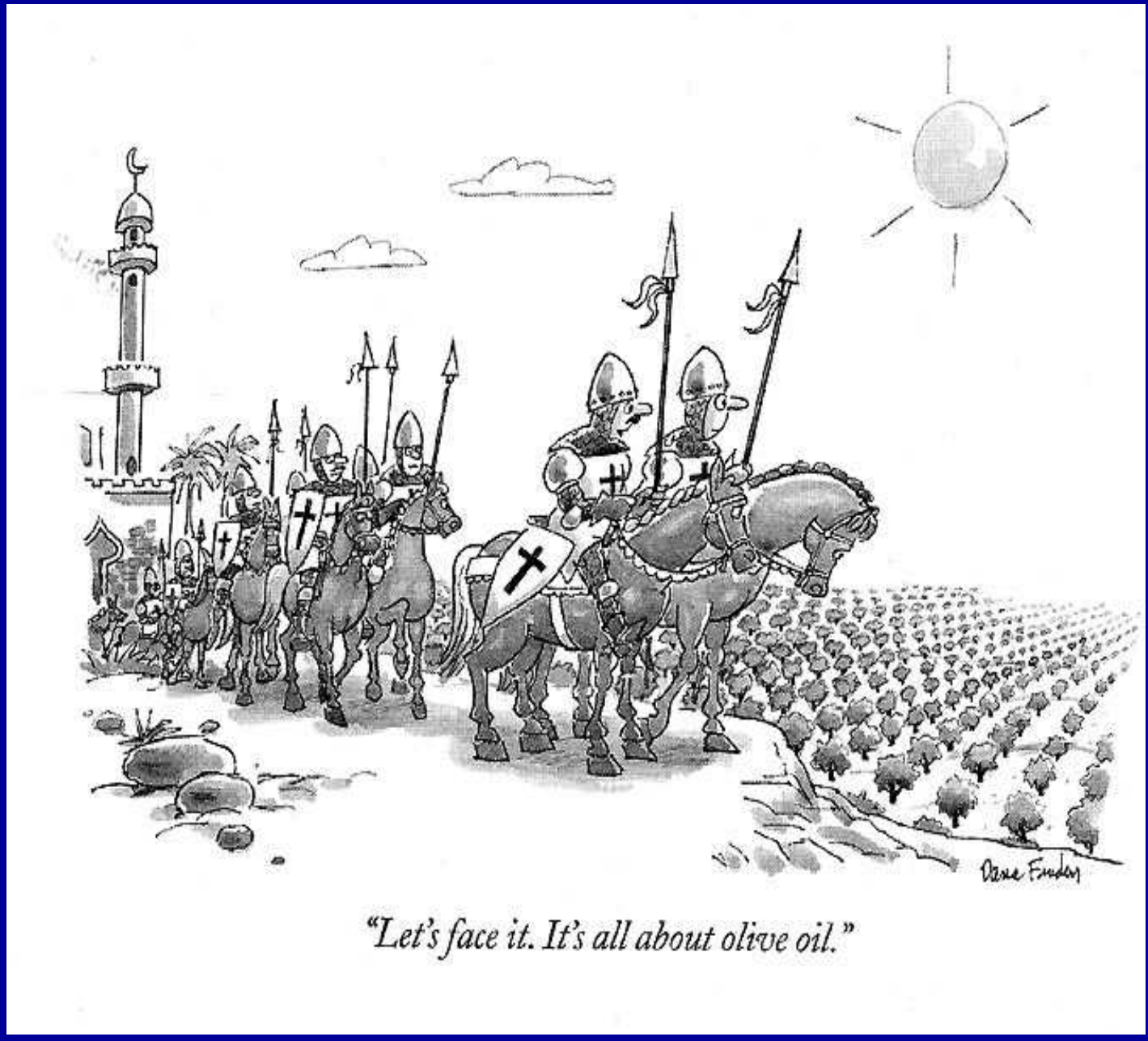
Intro to Olive Oil Production

- World Situation (California is Tiny)
- Production Costs
- Establish and Orchard
- Producing Oil
- The Market
- Challenges & Opportunities

USA imports ~ 97.0% of consumption

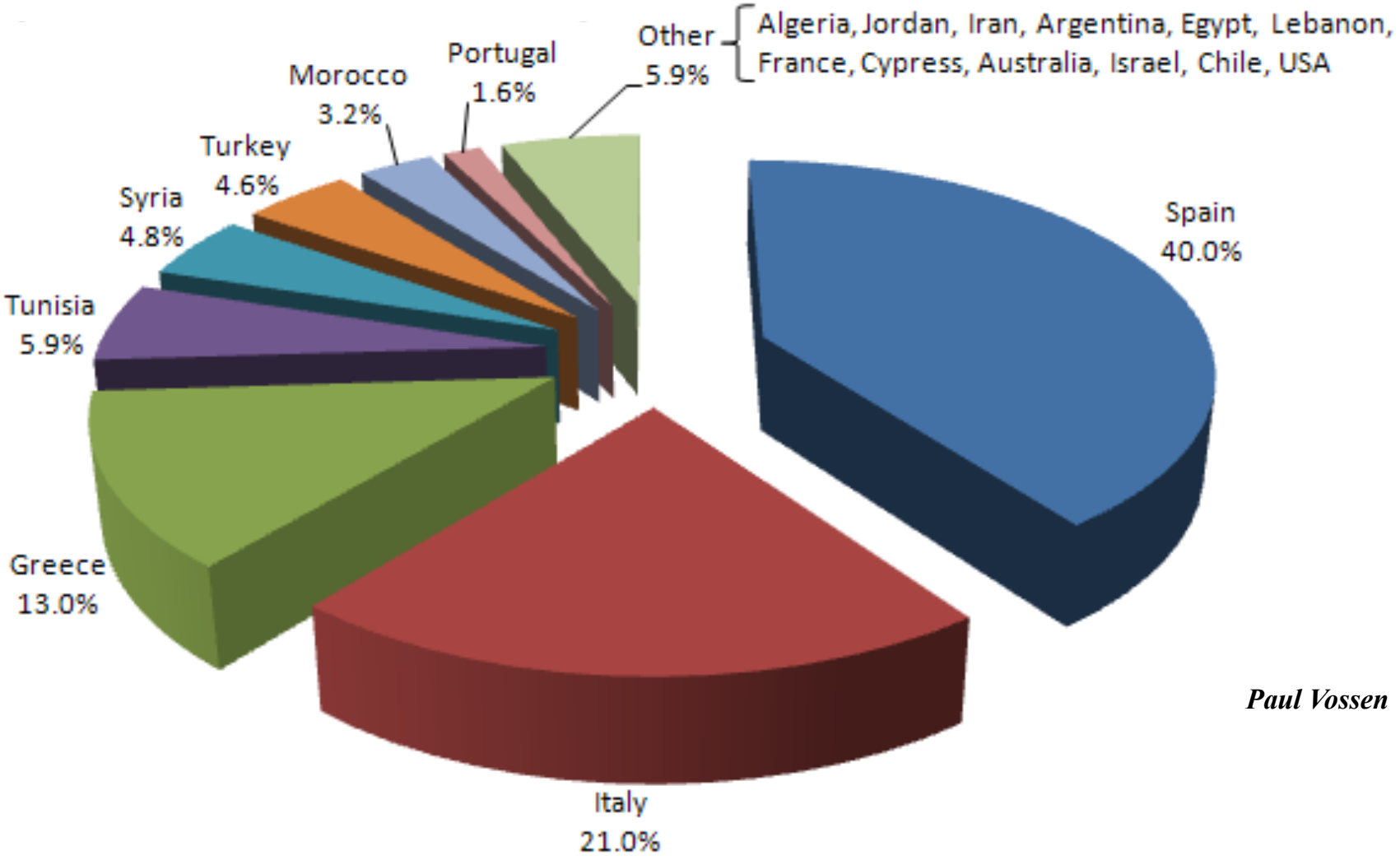
6,000 years

How important is Olive Oil?



"Let's face it. It's all about olive oil."

World Production 3 million tons (EU= 75% - Other 24%) USA ~ 1%



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WORLD OLIVE ACREAGE

- Spain ~ 6 million *25%*
- Tunisia ~ 3.8 million *16%*
- Italy ~ 3.5 million *15%*
- Greece 2.5 million *11%*
- Portugal 1.3 million *6%*
- Turkey 1.2 million *5%*
- Morocco 1.1 million *5%*
- Syria 1.0 million *5%*
- Algeria, Jordan, Iran, Egypt, Lebanon, Israel, France, Palestine *11%*

- Argentina 200,000 *0.85%*
- Australia ~ 80,000 *0.33%*
- Chile ~ 50,000 *0.22%*
- USA ~ 22,000 table *0.09%*
  ~ 30,000 oil *0.125%*

- World ~ 24 million

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Spain – 6 million acres

Andalucía Spain

Traditionally Spaced Trees

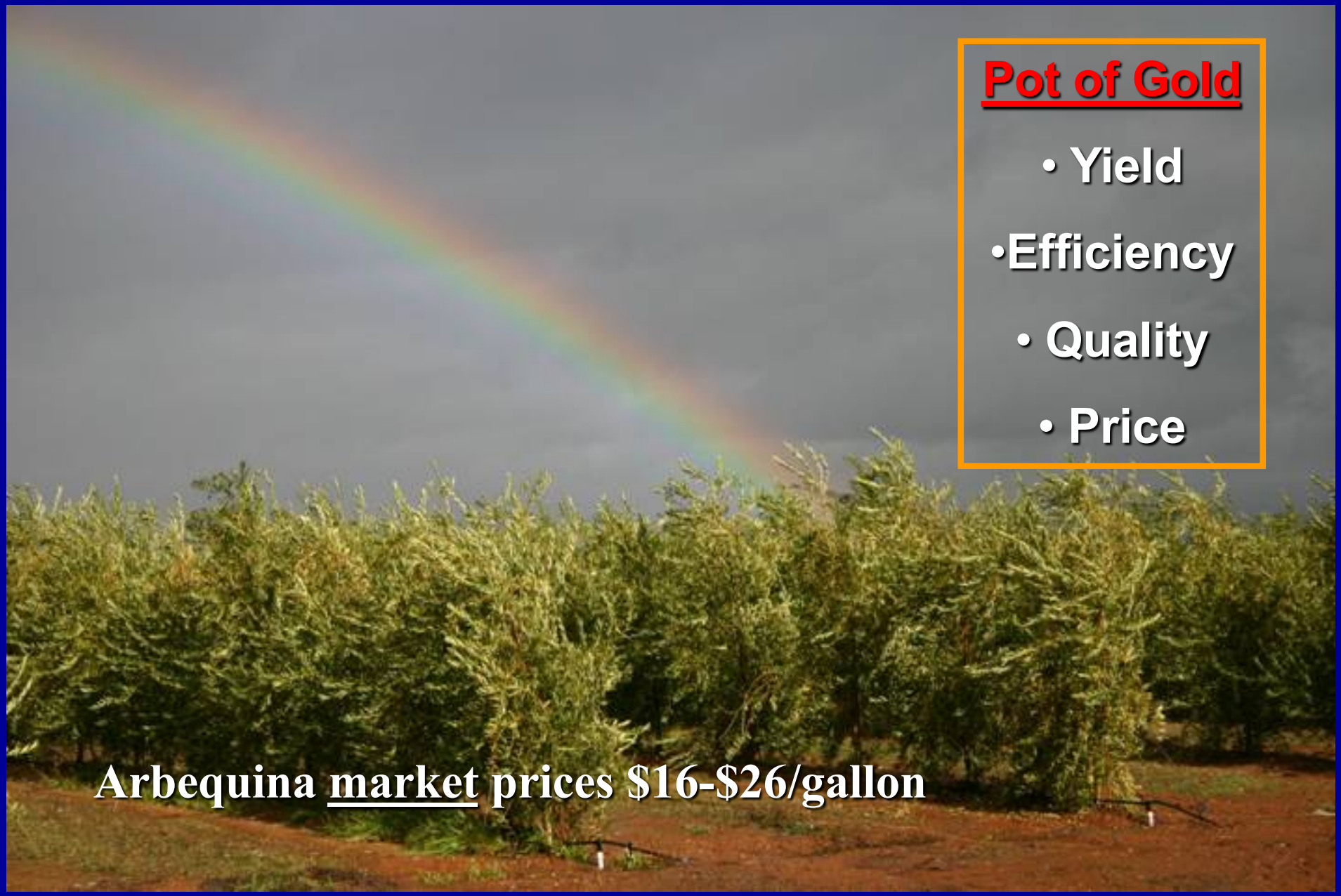
High-Density System

Italy = 3.5 million acres

Greece – 2.5 million acres


North Africa &
Middle East 9.6
million acres

Super-High-Density in California



SUPER-HIGH DENSITY PRODUCTION

5 x 13 = 670 trees/ acre 4 x 12 = 907 trees/acre

- **Arbequina – Arbosana – Koroneiki**

Over-the-row harvest

Wine grape Harvesters 6x10 ft.

Costs to Establish and Produce Olives for Bulk Oil

Super-high-density (SHD) orchard

- Sacramento Valley, - $5,000-$10,000/acre
- Over-the-row mechanical harvest $50/ton)
- Arbequina, Arbosana, or Koroneiki varieties
- 5’ X 13' spacing, 670 trees per acre
- 80 contiguous acres
- Drip irrigation
- Growers paid by gallons produced - $15-$26

Lower Cost Production in Europe, South America, & Australia

Learning by Tasting

Taste Oil # 1

UC Cooperative Extension 10-point Olive Oil Profile

1. Aroma intensity	0	1	2	3	4	5	6	7	8	9	10
2. Bitterness	0	1	2	3	4	5	6	7	8	9	10
3. Pungency	0	1	2	3	4	5	6	7	8	9	10
4. Fruit intensity	0	1	2	3	4	5	6	7	8	9	10
5. Total flavor intensity	0	1	2	3	4	5	6	7	8	9	10
6. Sweetness	0	1	2	3	4	5	6	7	8	9	10
7. Astringency	0	1	2	3	4	5	6	7	8	9	10
8. Texture: thin to thick	0	1	2	3	4	5	6	7	8	9	10
9. Greasiness	0	1	2	3	4	5	6	7	8	9	10

Taster:

Date:

Sample:

10. Defects

rancid

fusty, muddy sediment

musty

winey

frozen

other

specify: _____

11. Positives

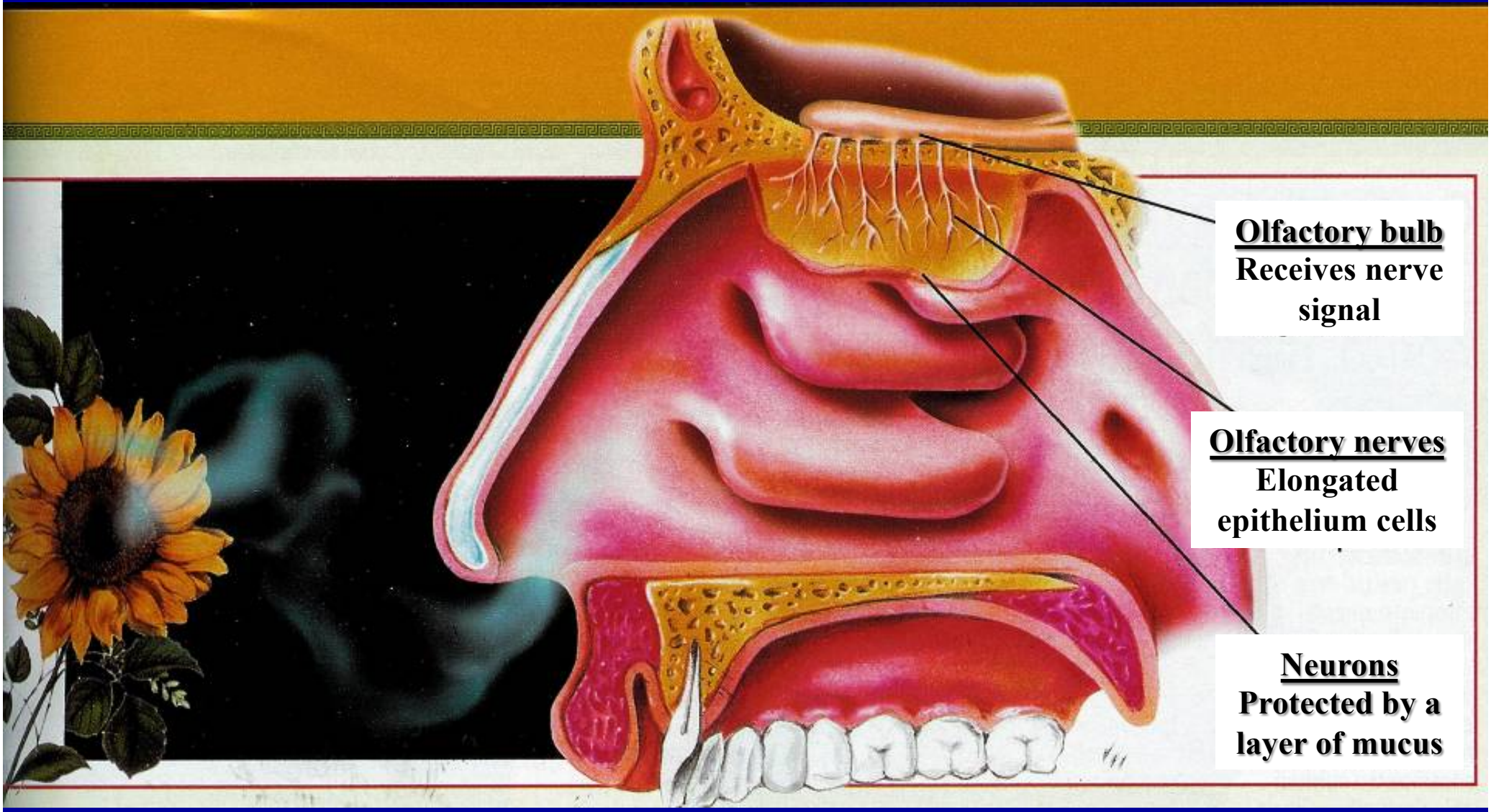
Point by Point

1. **Aroma Intensity**: Positive or Negative (#)
2. **Bitterness:** Dull sensation – back of tongue
3. **Pungency:** Harsh sensation – throat
4. **Fruit Intensity:** Fruity – green or ripe
5. **Total Flavor:** Overall B-P-F
6. **Ripe Characteristics:** tropical, berry, apple, etc.
7. **Green Characteristics:** Herbal, spicy, etc.
8. **Complexity:** Number of different flavors
9. **Balance:** Harmony of Fruity – Bitter – Pungent
10. **Freshness:** Zing, crispness, flat, tiredness

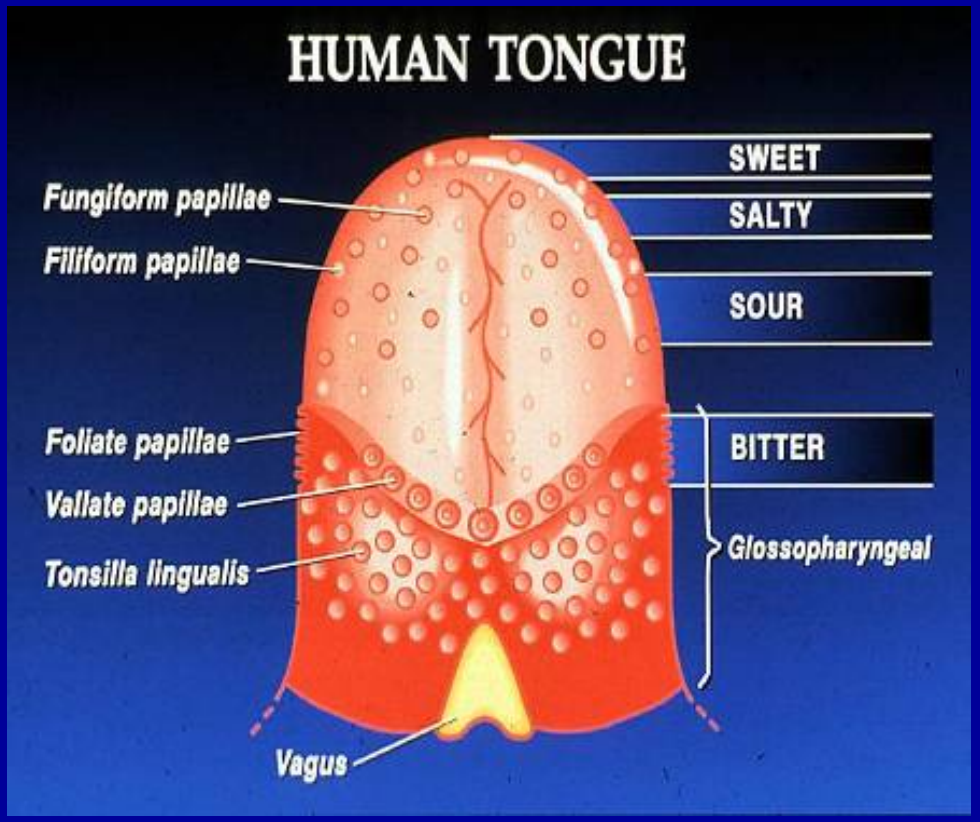
Aroma - Smell *(nose test)*

(ID some of the complex flavors)

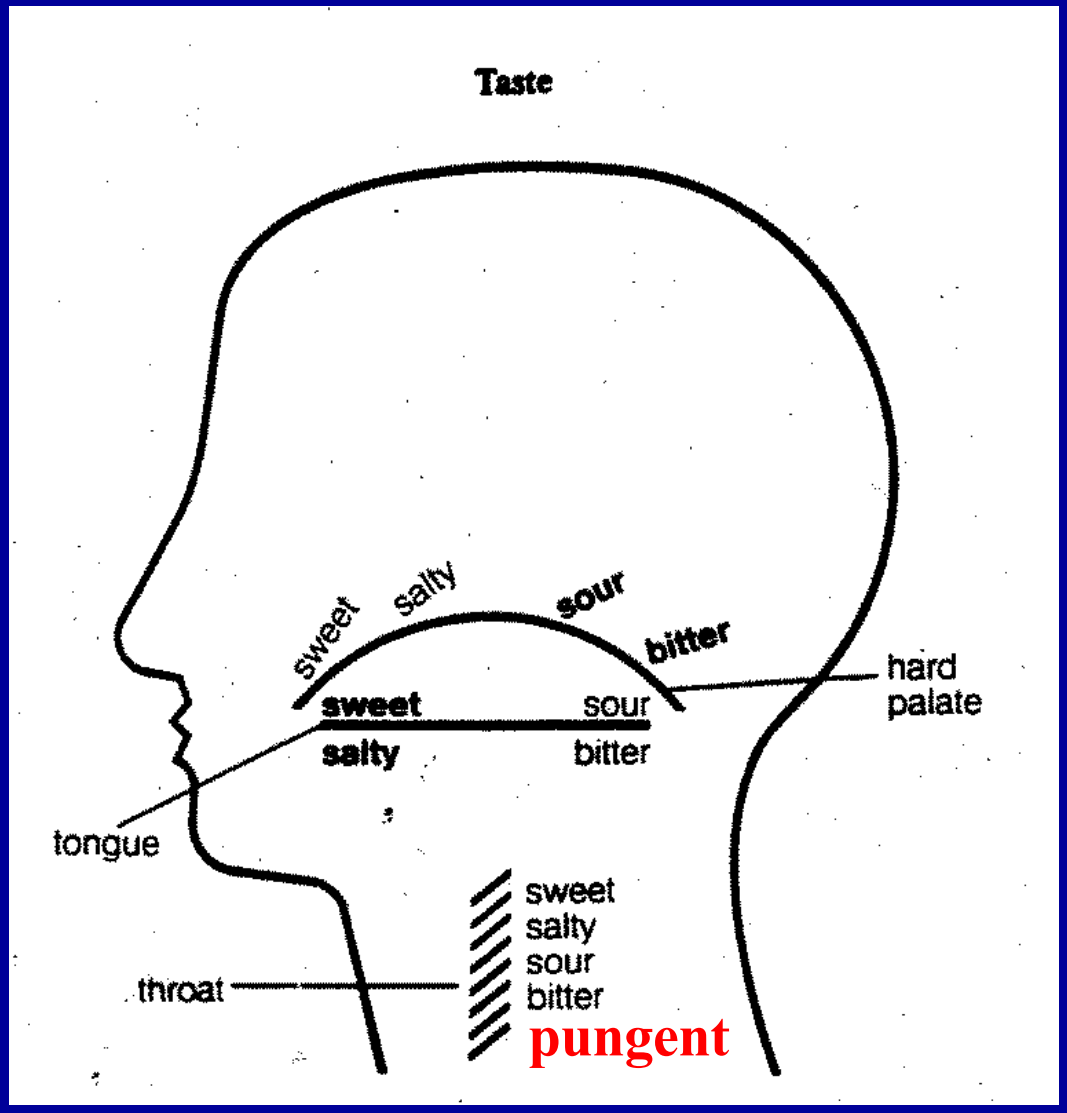
Olfactory – Smell-Aroma



Bitterness
(harsh, dull-stinging)



Pungency (burning, coughing, hot chili pepper, irritation)



Fruitiness (Ripe Fruit)

apple, berry, tropical, peach, etc.

Fruitiness (Green)

herb, grass, tomato leaf, mint, tea, eucalyptus, nettle, cinnamon, spice, etc.

Overall Evaluation:

- Complexity
- Balance
- Freshness
- Overall Quality

Small-Scale Gourmet Production

Costs to Establish and Produce Gourmet Bottled Oil

Medium Density (MD) orchard

- Coastal California 2011 $22,000/acre
- Hand assisted harvest $500/ton
- Any varieties
- 18’ X 9' spacing, 269 trees per acre
- 15 contiguous acres – 10 in trees
- Drip irrigation
- 40 year orchard life

MD Coastal Expected yields and prices *(375 ml bottles)*

- Marketable production in the 4th year
  - 4th year – 1.00 t = 403 bottles
  - 5th year – 1.25 t = 504 bottles
  - 6th year – 1.50 t = 605 bottles
  - 7th year – 2.00 t = 807 bottles
  - 8th year – 2.50 t = 1,008 bottles
  - 9th year – 3.00 t = 1,211 bottles
- Expected yield range: 100 – 120 gallons/acre
- Expected price range: $100 – $300/gallon

Break Even Yield and Cost/bottle *(375ml)*

	Yield Tons/Acre						
	1	2	3	4	5	6	7
	Yield (375ml Bottles/Acre)						
	403	807	1,211	1,614	2,015	2,418	2,821
OPERATING COSTS/ACRE:							
Cultural Cost	1,280	1,280	1,280	1,280	1,280	1,280	1,280
Harvest (Pick, Haul, Process, Bottle, Market)	2,743	5,493	8,243	10,986	13,716	16,459	19,202
Interest on operating capital @ 5.75%	38	52	65	78	91	104	117
TOTAL OPERATING COSTS/ACRE	4,061	6,825	9,588	12,344	15,087	17,843	20,599
TOTAL OPERATING COSTS/Bottle	10.08	8.46	7.92	7.65	7.49	7.38	7.30
CASH OVERHEAD COSTS/ACRE	727	727	727	727	727	727	727
TOTAL CASH COSTS/ACRE	4,788	7,552	10,315	13,071	15,814	18,570	21,326
TOTAL CASH COSTS/Bottle	11.88	9.36	8.52	8.10	7.85	7.68	7.56
NON-CASH OVERHEAD COSTS/ACRE	2,394	2,394	2,394	2,394	2,394	2,394	2,394
TOTAL COSTS/ACRE	7,182	9,946	12,709	15,465	18,208	20,964	23,720
TOTAL COSTS/Bottle	17.82	12.33	10.49	9.58	9.04	8.67	8.41

Costs of Production/acre

Costs	Bulk	Gourmet
Establish (1st yr.)	$5,000	$14,849
Cultural Costs	$1,000	$ 1,280
Harvest & Haul Costs	$ 328	$ 1,605
Overhead (tax, land, inst, bldg, equip)	$1,433	$ 3,121
Process-Bottle-Market	- - - -	$ 6,638
TOTAL COSTS	$2,761	$12,644

Based on $14/gallon SHD and $116/gallon MD

External Cost Factors

- Labor
- Machinery
- Autos and tractors
- Fuel
- Ag chemicals
- Fertilizers - Compost
- Seeds
- Water
- Electricity
- Property tax
- Insurance
- Office
- Management
- Capital Recovery Cost (annual depreciation and interest for capital investment)

Lots of Competition

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Challenges - Opportunities

- Produce Super Premium Oil (not just EV)
- Keep Costs down
- Develop a Specialized Market
- Differentiate Your Oil from Bad Oils

- Huge Increasing Market
- Olive Oil is VERY Healthy
- Olive Oil Tastes Great
- Enhancement & Contrast with Food

Direct Market

Taste Oils # 2

Super Premium Olive Oil Prices

- $15 to 30/bottle = $30 to 60 per liter
- $113 to $227/gallon

Growing Olives

Site *(climate, terrain, soil, water,)*

Varieties *(table & oil)*

Systems *(high & super density)*

Cultural Practices *(organic & conventional)*

Give yourself every possible advantage

Site Evaluation (beyond climate)

Elevation – Slope - Soil

- **Above or Below ? ft.** = *temperature problems*
- **Over 35% slope** = *equipment danger, more hand labor, erosion threat, and high cost*
- **Poor drainage** – *clay soil, seepage, high rainfall, limited surface water movement, restrictive layers*
- **Shallow soil** = *less drainage & low water holding capacity*
- **Mineral toxicity** = *high Mg – B – Na – etc.*

Mediterranean Soils

Deep Gravely Limestone

Young olive tree roots - sand

Well drained deep soil with little rainfall to prevent uncontrolled vigor


Low spots
with poor
drainage

Raised planting beds

Too cold

Damaging Climatic Conditions for Olives

- Winter – young trees < 25°F
- Winter – mature trees small branches < 22°F
- Winter – mature trees killed ~ <15°F
- Autumn – fruit before harvest < 29°F
- Spring – rain, very high humidity, or hot dry wind at bloom

Lowest spot on valley floor is not the best

Soil Chemical Properties

saturated paste extract

- Soil pH 5.0 – 8.5
- High Magnesium (< 1:1 ratio with Ca)
- High Calcium (> 8:1 ratio with Mg)
- Adequate Phosphorous (> 10 ppm P) = OK
- Adequate Potassium (> 125 ppm K) = OK
- High Boron (> 2 ppm B)
- High Chloride (> 10-15 meq/l Cl^-)
- High Sodium (SAR > 15)

Spending a lot of money on exacting soil conditions is probably a waste for olives

HOW MUCH WATER IS NEEDED TO GROW OLIVES by CLIMATE?

- **Young Trees = 100% ET**
  - **(500 mm cool – 1,000 mm hot)**
  - **(20 to 40 in) = 540,000 - 1,086,160 gal/acre**

- **Mature Oil Olives = 45-60% ET**
  - **(250 mm cool – 600 mm hot)**
  - **(10 to 30 in) = 272,000 – 814,000 gal/acre**

EVAPOTRANSPIRATION (ET)

Temperature

Relative Humidity

Wind

Measuring ETo (reference)

Mathematical Formula:
Temp. + RH + Wind

Direct measure from a free water surface

Water Gallons/tree/day

Water Use Based on Evapotranspiration for Carmel Valley - Laguna Seca - Salinas South Climatic Zones

GALLONS PER TREE PER DAY - OLIVES

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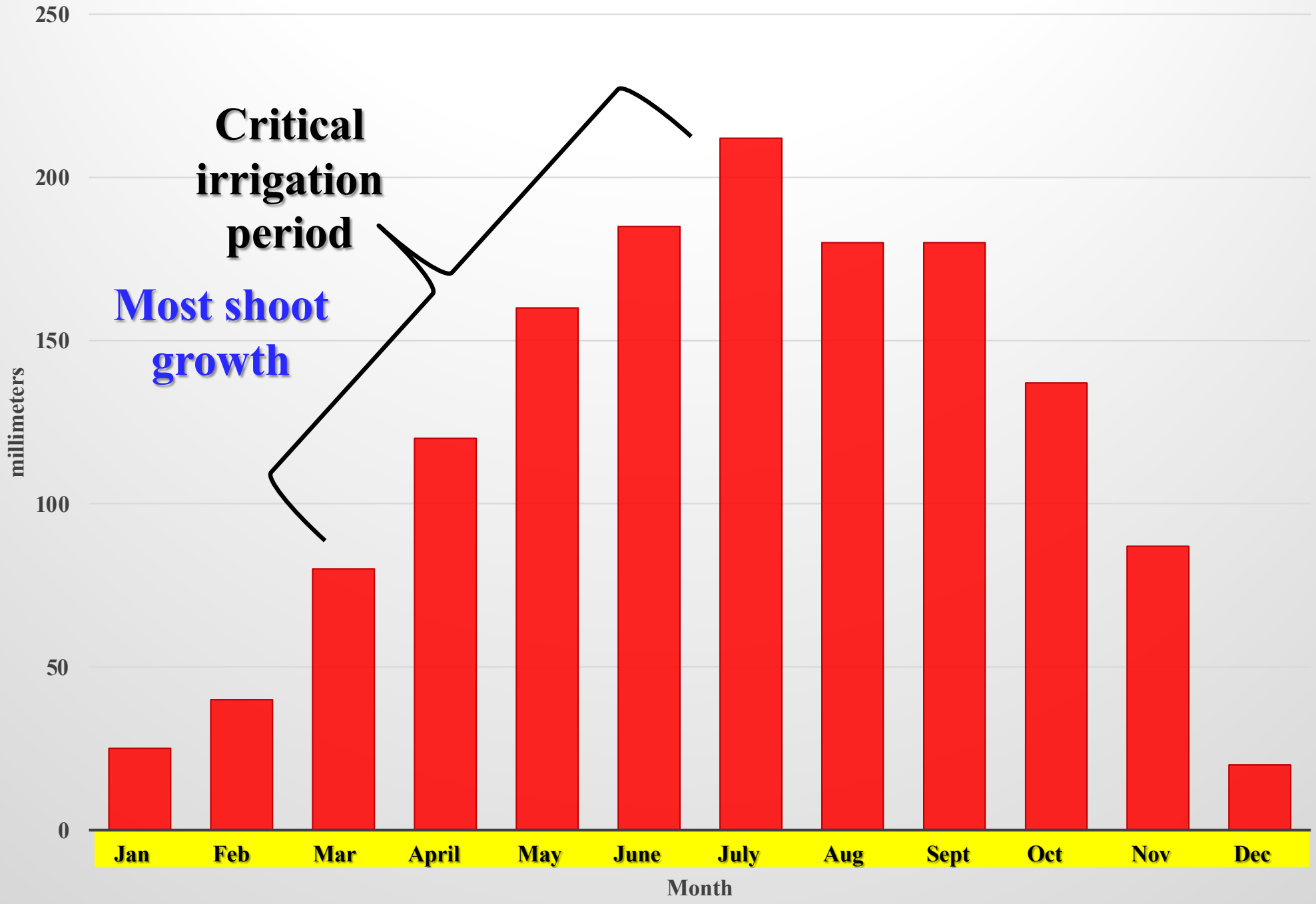
	Jan	Feb	Mar	April	May	June	July	August	Sept	Oct	Nov	Dec	Total
ETo Carmel Valley Area	1.75	2.68	3.34	4.66	5.47	6.16	5.52	5.05	4.32	3.32	1.97	1.13	45.37

27,154 gallons in an acre of water 1 inch deep
43,560 square feet in an acre
0.6234 gallons per foot, 1 inch deep

- *Olive trees use 75% of ETo (reference evapotranspiration). This is called ETc (the olive coeficient)*
- *Young olive trees should receive 100% of ETc especially in March-October when they grow the most*
- *In wet winters - no irrigation is necessary from the first rainfall through spring*
- *Start irrigations in the spring when the cover crop/weeds start to go dry*
- *Drip irrigation should be applied daily or at least every-other-day*
- *Mature trees (full size) should get about 50% of ETc since they don't need to grow so much & stress improves flowering*
- *There are: 27,154 gallons/acre inch and 43,560 ft²/acre = 0.6234 gal/1ft² based on 1 inch of water*
- *One acre of solid cover refers to a mature orchard with 80% foliage cover + cover crop*
- *MD = medium density. Mature trees 20x20 ft. @ 80 % coverage = 320 ft²*

		Jan	Feb	Mar	April	May	June	July	August	Sept.	Oct.	Nov	Dec
ETo, inches/day		0.06	0.10	0.11	0.16	0.18	0.21	0.18	0.16	0.14	0.11	0.07	0.04
ETc, inches/day		0.04	0.07	0.08	0.12	0.13	0.15	0.13	0.12	0.11	0.08	0.05	0.03
Size of tree	Tree age	*gallons per tree/day*	*gallons per tree/day*	*gallons per tree/day*	*gallons per tree/day*	*gallons per tree/day*	*gallons per tree/day*	*gallons per tree/day*	*gallons per tree/day*	*gallons per tree/day*	*gallons per tree/day*	*gallons per tree/day*	*gallons per tree/day*
4 ft²	new tree	*0.2*	*0.4*	*0.4*	*0.6*	*0.7*	*0.8*	*0.7*	*0.6*	*0.5*	*0.4*	*0.2*	*0.1*
9 ft²	young tree	*0.2*	*0.4*	*0.5*	*0.7*	*0.7*	*0.9*	*0.7*	*0.7*	*0.6*	*0.5*	*0.3*	*0.2*
25 ft²	young tree	*0.7*	*1.1*	*1.3*	*1.8*	*2.1*	*2.4*	*2.1*	*1.9*	*1.7*	*1.3*	*0.8*	*0.4*
49 ft²	young tree	*1.3*	*2.2*	*2.5*	*3.6*	*4.0*	*4.7*	*4.1*	*3.7*	*3.3*	*2.5*	*1.5*	*0.8*
81 ft²	young tree	*2.1*	*3.6*	*4.1*	*5.9*	*6.7*	*7.8*	*6.7*	*6.2*	*5.5*	*4.1*	*2.5*	*0.7*
121 ft²	young tree	*3.2*	*5.4*	*6.1*	*8.8*	*10.0*	*11.6*	*10.1*	*9.2*	*8.1*	*6.1*	*3.7*	*2.1*
169 ft²	young tree	*4.5*	*7.6*	*8.5*	*12.3*	*13.9*	*16.2*	*14.1*	*12.9*	*11.4*	*8.5*	*5.2*	*2.9*
225 ft²	young tree	*5.9*	*10.1*	*11.3*	*16.3*	*18.6*	*21.6*	*18.7*	*17.1*	*15.1*	*11.3*	*6.9*	*3.8*
320 ft²	mature MD 20 x 20 ft.	*4.2*	*7.2*	*8.1*	*11.6*	*13.2*	*15.4*	*13.3*	*12.2*	*10.8*	*8.0*	*4.9*	*2.7*
	1 acre solid cover gal/acre	*gallons per acre/day*	*gallons per acre/day*	*gallons per acre/day*	*gallons per acre/day*	*gallons per acre/day*	*gallons per acre/day*	*gallons per acre/day*	*gallons per acre/day*	*gallons per acre/day*	*gallons per acre/day*	*gallons per acre/day*	*gallons per acre/day*
43,560 ft²		*1,150*	*1,949*	*2,194*	*3,163*	*3,594*	*4,182*	*3,626*	*3,318*	*2,933*	*2,181*	*1,337*	*742*

Water Use - Reference ET (millimeters)



Irrigation Water Quality

problems

mg/l ~ ppm

- **High Boron > 2 ppm**
- **Bicarbonate > 3.5 ppm**
- **Total Salt > 3 dS/m EC - 480 ppm**
- **High Sodium > 3 meq/l - 9 SAR**
- **High Chloride > 345 ppm**

Olive Tree Nutrition

~ 40-80 lbs. N + some K

Leaf sampling for tissue analysis

Element	*Deficient*	*Sufficient*	*Toxic*
Nitrogen	< 1.40	1.50 – 2.00	
Phosphorous	< 0.08	0.10 – 0.30	
Potassium	< 0.40	> 0.80	
Calcium	< 0.30	> 1.00	
Magnesium	< 0.08	> 0.10	
Manganese		> 20	
Zinc		> 10	
Copper		> 4	
Boron	< 14	19 - 150	> 185
Sodium			> 0.20
Chlorine			> 0.50

Adequate nutrients

Especially nitrogen

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Break

Influences on Oil Flavor

Huge

1. Variety
2. Ripeness
3. Water Status
4. Processing
5. Storage
6. Time

Very small

- *Organic - conventional*
- *Soil type (Terroir)*
- *Fertilizers used*
- *Tree density*
- *Elevation*
- *Pruning*
- *What's growing nearby*

Fruit Handling & Climate

Variety Selection

1. **Lowering Cost**
   - Over-the-row harvest
   - Trunk shaker harvest

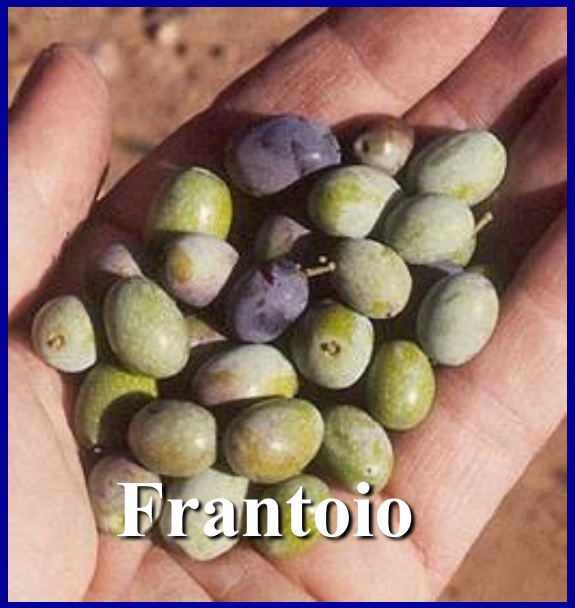
150 varieties = 90%

3 varieties = 50%

2. **Production**
   - Yield – oil/ha
   - Alternate bearing
   - Cold hardiness
   - Disease resistance

3. **Marketing**
   - Flavor
   - Stability
   - Rarity

Wonderful Traditional Flavors



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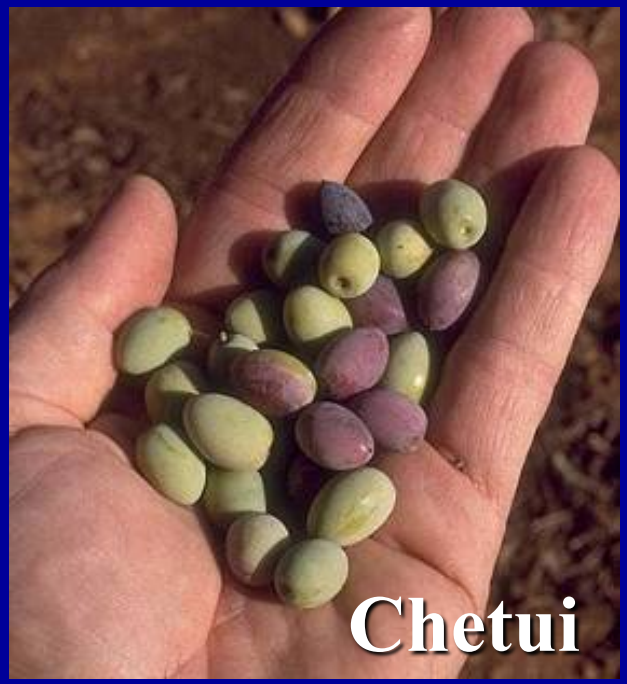
Unique Flavors



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Olive Pollination

- Some varieties are very self fertile (maybe)
- Most are self sterile
- Barouni and Sevillano are incompatible
- Manzanillo and Mission are incompatible
- Frantoio and Leccino are incompatible
- Some are somewhat self incompatible
- Set better with cross pollination – especially with bad weather
- Pollenizer within 200 feet

SPACING

19 ft.

23 ft.

Olive Tree SPACING – 20 ft.

Vigorous Varieties 14’ apart

Trees too close = shading

Improper spacing

- Heavy shading
- Hard pruning
- Excess vigor
- Poor cropping

Excess Vigor

Good Nursery Tree

Planting: Afterwards

- Stake loosely, if needed
- Unstaked trees will grow stronger trunks
- Keep weeds 3’ away from young trees
- Soak – then irrigate as needed
- Fertilize in moderation
- Minimal pruning
- Of all possible inputs, olive trees need adequate water and weed control

Olive Pruning Basics

- **Energy is in the leaves**
  - Prune as little as possible
- **Light penetrates 3 ft.**
  - Don't train until tree is 7 ft, wide
  - Keep the top pruned out = lower light
- **Natural form is a bush**
  - Laterals as strong as a central leader
  - Large central leader has disadvantages
- **Single trunk for shaker harvest**
  - Remove watersprouts below 3 ft.

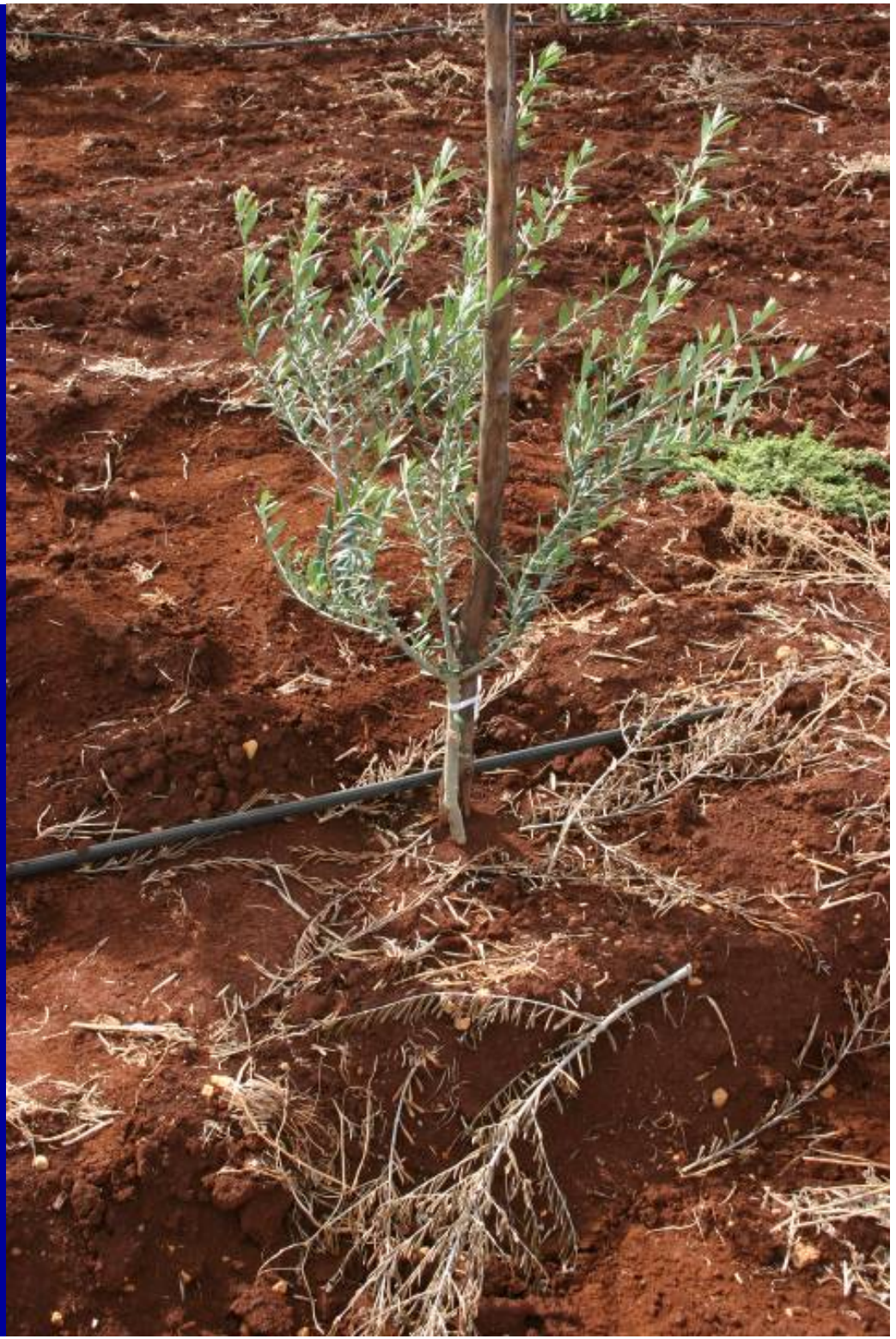
NO PRUNING FIRST 5 YEARS

Worst Case

Short trunk

Scaffold selection too early

Removed 50% of the tree



1st year

2nd year


4th-5th
year

Pruned and Un-pruned

Pruning – vase shape

Thin out center over 6 years

MD – opening tree centers 6th year

Thin out center

Cut to an outside branch

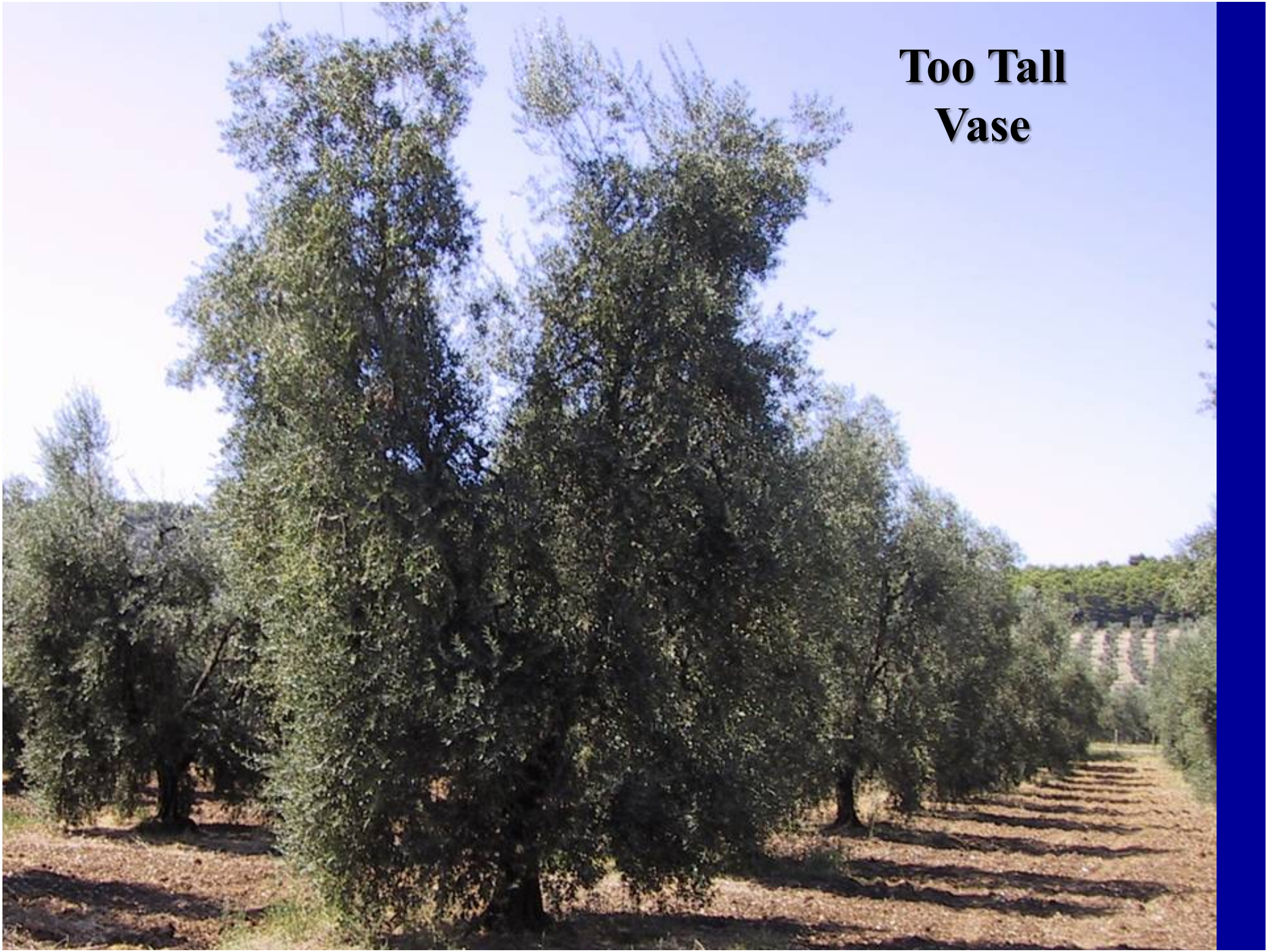
Narrow Tree Training (palmette)

Palmette System – side view

Keep removing suckers & watersprouts

Don’t follow bad examples

Central Leader Monocone not a natural shape for olive


Too Tall
Vase


Too Wide
Vase


Proper
Vase

OLIVES DON'T LIKE WEEDS


11 year old
trees with
no Weed
Control

Weed Control Comparisons

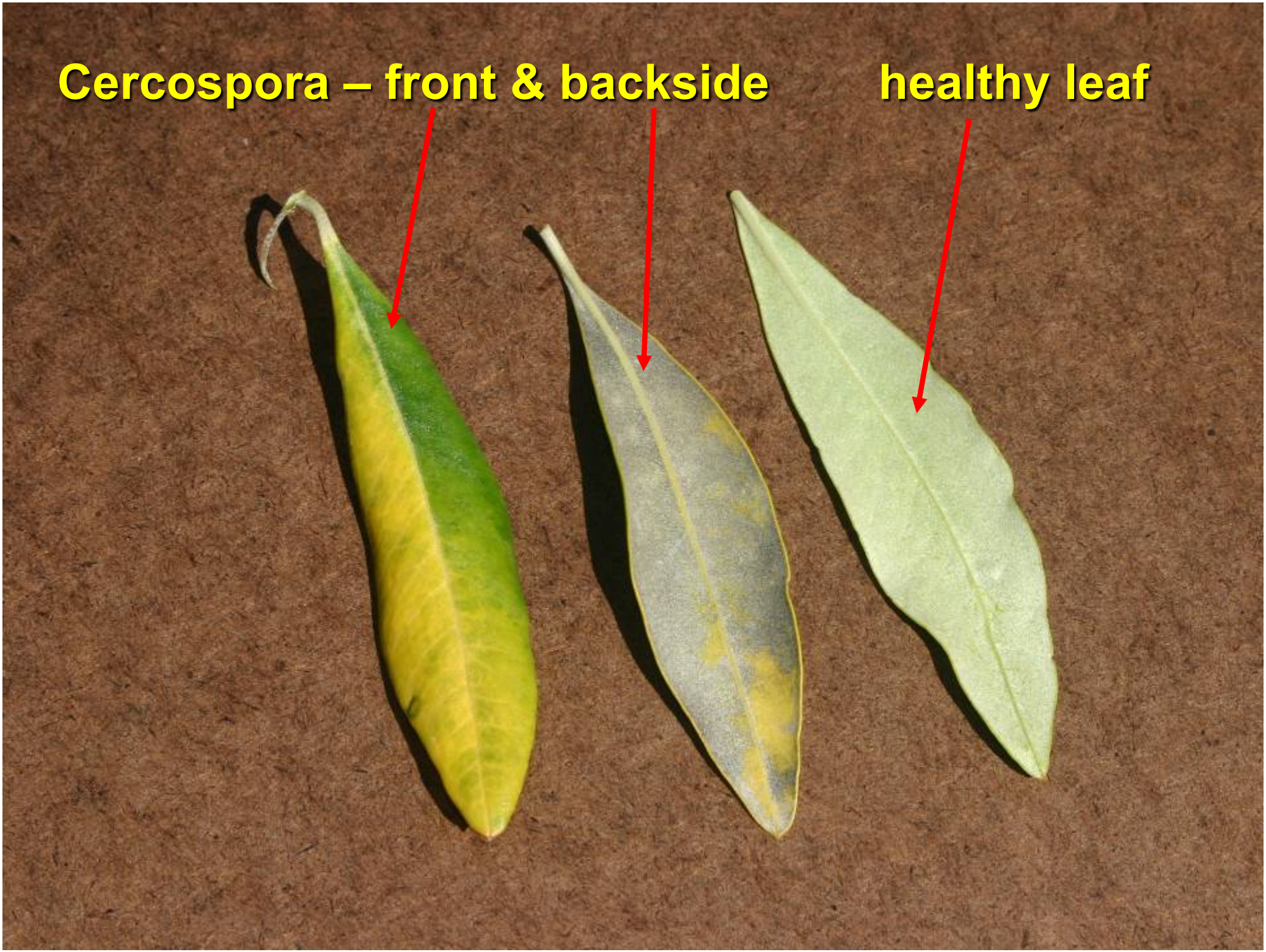
Weed Management

Young Trees

Mature Trees

Disease Management

- Peacock Spot & Mycocentrospora (Cercospora)
- Olive Knot
- Root Rot
- Verticillium Wilt
- Botrospheria
- Neofabrea
- Xyllela fastidiosa (Olive Scorch)


Cercospora – front & backside
healthy leaf

Nifty 50


DANGER
PELIGRO
OPERATOR RESPONSIBILITIES
CAUTION
THIS UNIT NOT INTENDED FOR HIGHWAY USE
STAINLESS STEEL TANK
MECHANICAL AGITATION

Cercospora & Peacock Spot Control

- Copper sprays- fall before winter rains start - 95% control vs. 50%
- Timing more important than repeated sprays
- Consistent program important – disease builds over time and then is difficult to control

Insect Management

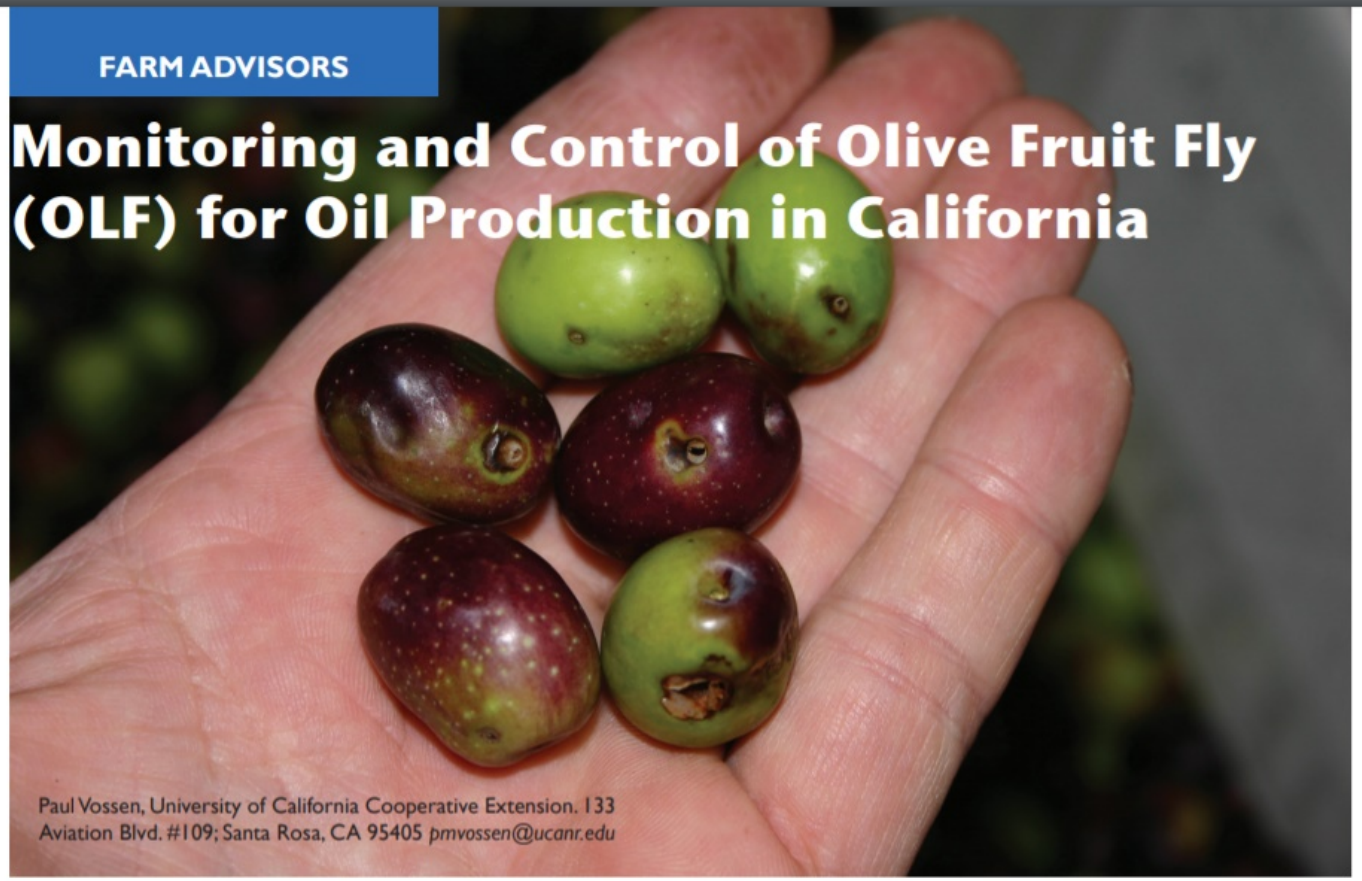
- Olive Fly (OLF)
- Black Scale
- Weevils
- Other Miscellaneous Pests
- Gophers & Deer

On-line Publication

http://cesonoma.ucanr.edu/files/203835.pdf

FARM ADVISORS

Monitoring and Control of Olive Fruit Fly (OLF) for Oil Production in California



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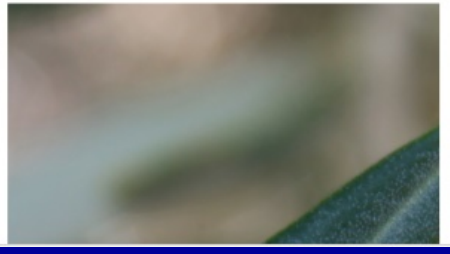
Introduction:

Olive fruit fly (OLF) *Bactrocera oleae* was found for the first time in urban Los Angeles, California in 1998 and rapidly spread to the rest of California by 2002. The standard treatment over the last fifteen years has primarily relied on

experimenting with their own mixes of various baits and generic spinosad. Consequently, when the perfect weather conditions led to higher than normal insect numbers, they got blindsided.

Olive Fly Biology:

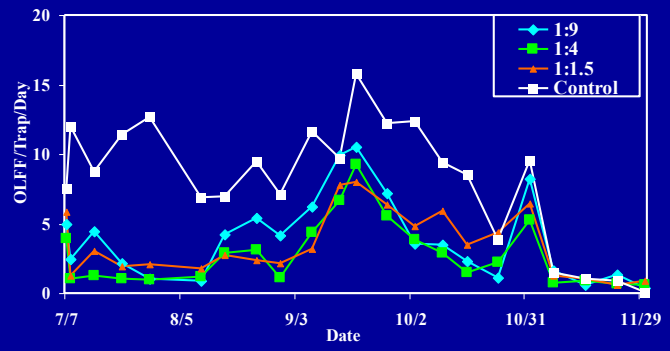


Olive Fly Research

Life Cycle Stages

OLF Life Cycle Specifics

Life Stage	SUMMER	WINTER
Eggs	2-4 days	12-19 days
Larva	10 days	15 days
Pupa	10-12 days	47-49 days
Total	22-26 days	74-83 days
Pre-oviposition	10 days	60 days
Generation Time	32-36 days	134-143 days
Adult Life Span	50-80 days	168-175 days



Temperature Thresholds for Development

Life Stage	LOWER THRESHOLD	UPPER THRESHOLD
Egg	42.8°F	93.2 to 95°F
Larva	46.4°F	86°F
Pupa	44.6 to 50°F	96°F
Adult	32°F	104°F

Active 60-90°F
Ideal 73°F
Likes some moisture
Female lays 200-500 eggs

Monitoring for Stings

4 weeks later

6 weeks later

Lowering Olive Fly Control Costs for Oil

- Use low cost mass trapping in combination with fewer sprays of GF-120 – then kaolin clay
- Don't start spraying until fruit gets pea size
- Monitor damage (stings) not traps
- GF-120: Once per week (4:1) 1 oz/tree
- Spray once (autumn) with kaolin clay before when most damage occurs
- Harvest earlier
- Tolerate some damage as long as it is not rot

When to Harvest?

FRUIT MATURITY

Degree of Ripeness

Hard Green

Soft Yellowing

Black Skin - Flesh Green to White

Black Skin and Flesh

Large influence on attributes

Early Harvest

- Can be Rough, if too early
- Astringent
- Strongly Bitter
- Strongly Pungent
- Ligneous
- Strong Green Tea
- High Polyphenols
- Less oil and lower extraction %

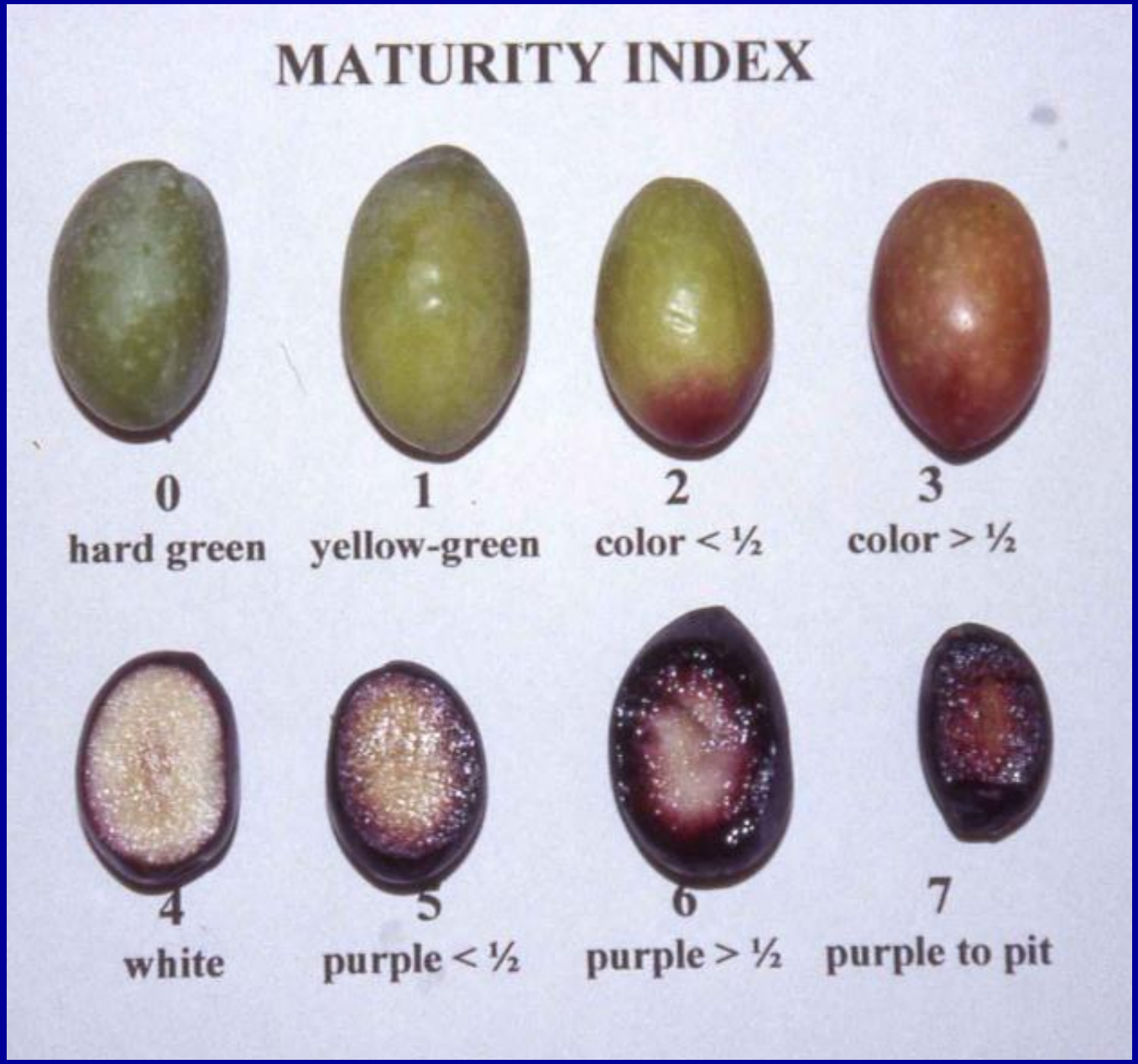
Intermediate Harvest

- Balanced
- Sweet & Astringent
- Bitter
- Pungent
- Ripe & Green
- Floral
- Medium Polyphenols
- High oil content
- Easy to extract

Late Harvest

- Can be Bland
- Sweet
- Non Bitter
- Non Pungent
- Ripe Fruity
- Tropical
- Low Polyphenols
- More oil – more difficult to extract

Maturity Index



Harvest Efficiently – not by hand

- Use nets under the trees
- Shake with trunk shaker or mini shaker
- Knock olives off simultaneously with poles
- Rake off with electric rakes

Paul Vossen

Hand Harvest

Spreading nets under the trees

Electric Rake – Assisted Harvest


Mini Shaker
Paul Vossen

COMPARISON OF HAND HARVEST METHODS IN ONE ORCHARD ON THE LECCINO VARIETY ON THE SAME DAY WITH THE SAME LABORERS – YIELD 3.5 TONS/ACRE

Tree canopy's were 11-12 ft. (3.4-3.7 m) high and 7-8 ft (2-2.5 m) in diameter	*Hand Pick Buckets*	*Hand Pick Onto Nets*	*Pneumatic Combs*	*Mini Shaker + Poles*	*Poles Alone*
No. limbs broken/tree	4.16	3.75	18.7	22.3	28.0
No. fruit damaged/lb.	0.1	4.0	4.2	3.5	5.3
Minutes/tree/man	20:15	16:30	11:20	7:45	7:10
Pounds of fruit/man/hr.	39.8	47.8	71.6	103.5	111.4
Efficiency compared to hand pick into buckets	1.0 a	1.2 a	1.8 b	2.6 c	2.8 c

Paul Vossen

Harvest – trunk shaker & poles

COMPARISON OF HAND HARVEST METHODS IN SIX DIFFERENT ORCHARDS 2003 and 2004 (*POUNDS OF FRUIT PER PERSON PER HOUR*)

Orchards	*Hand Pick Buckets*	*Hand Pick (Nets)*	*Pneumatic Combs (Nets)*	*Mini Shaker + Poles (Nets)*	*Poles*	*Trunk Shaker (nets)*	*Wrap-round Shaker*
Very large Mission trees 70/acre (light crop)	-	-	-	-	62.5	-	-
Large Frantoio trees 155/acre (medium crop)	25.0	28.8	-	150.5	-	-	-
Medium Tuscan trees 155/acre (heavy crop)	-	28.9	-	326.5	182.1	-	-
Small-med Tuscan trees 272/acre (medium crop)	22.2	-	-	115.1	-	-	-
Italian trial trees (medium crop)	-	-	68.9	170.2	-	272.0	617.4


OLEOTE
VILLA
CAMPESTR

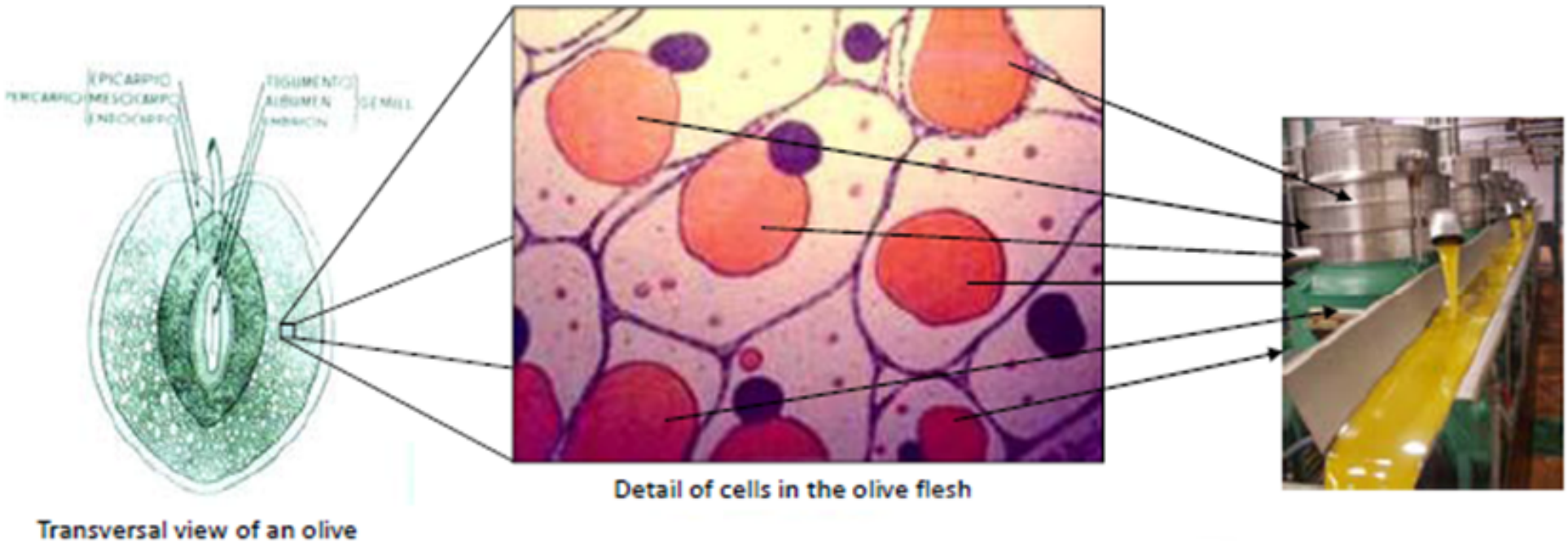
Producing Extra Virgin Olive Oil

Simple as 1-2-3-4-5

1. Good Fruit – no rot – not frozen
2. Handled carefully – no damage – short storage
3. Processed quickly – in modern clean equipment
4. Stored well – clean stainless steel - purged
5. Sold – within a year or less

Fruit Should be Perfect

Cut/Break the cell walls and membrane surrounding the oil



Transversal view of an olive

Detail of cells in the olive flesh

Aggressiveness of the crusher and fineness of the paste influences flavor

Source: Leandro Ravetti, Modern Olives, 2009

OLIVE CRUSHING

- Hammermill
- Disc Crusher
- Fruit Pitter
- Stone Mill

Knife Blade Crusher

MALAXATION (MIXING)

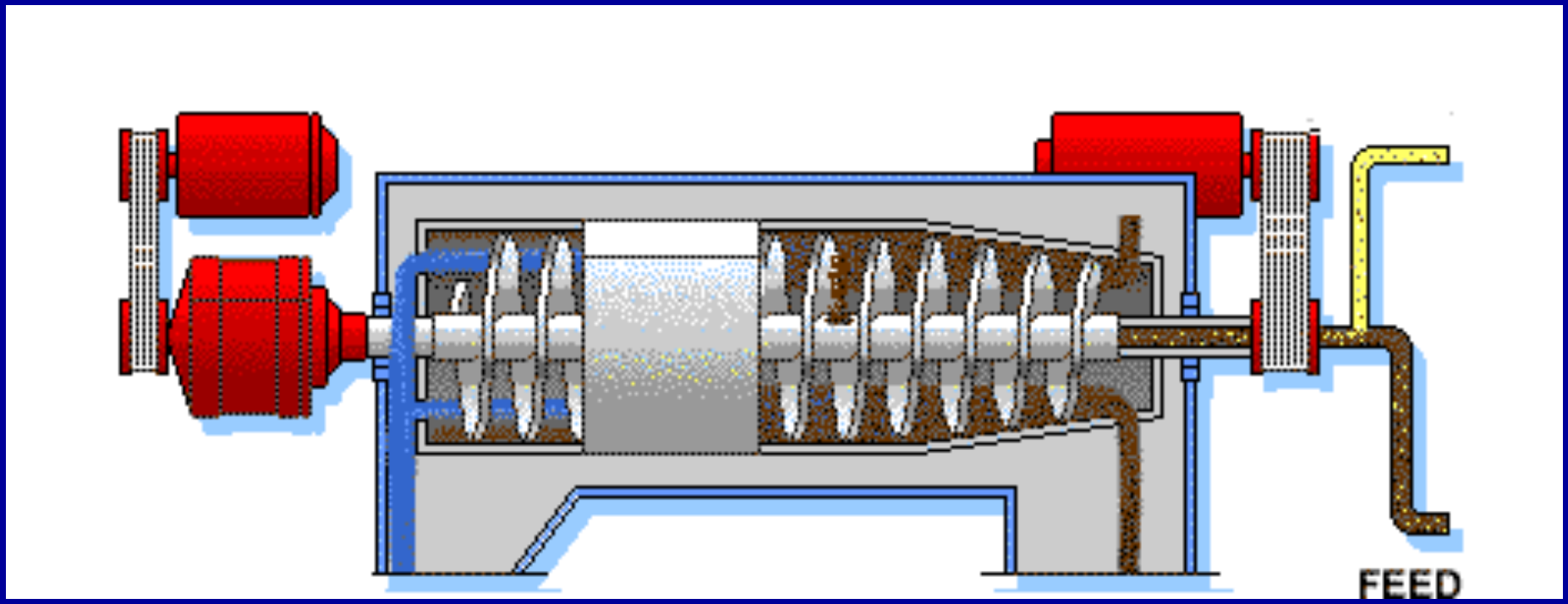
- Paste is slowly mixed - forms larger droplets
- 35 minutes to 1.5 hours
- Temperature $< 80 - 86^{o}F$ = "cold"
- Reverses Homogenization

Malaxation tank – jacketed to slightly warm paste

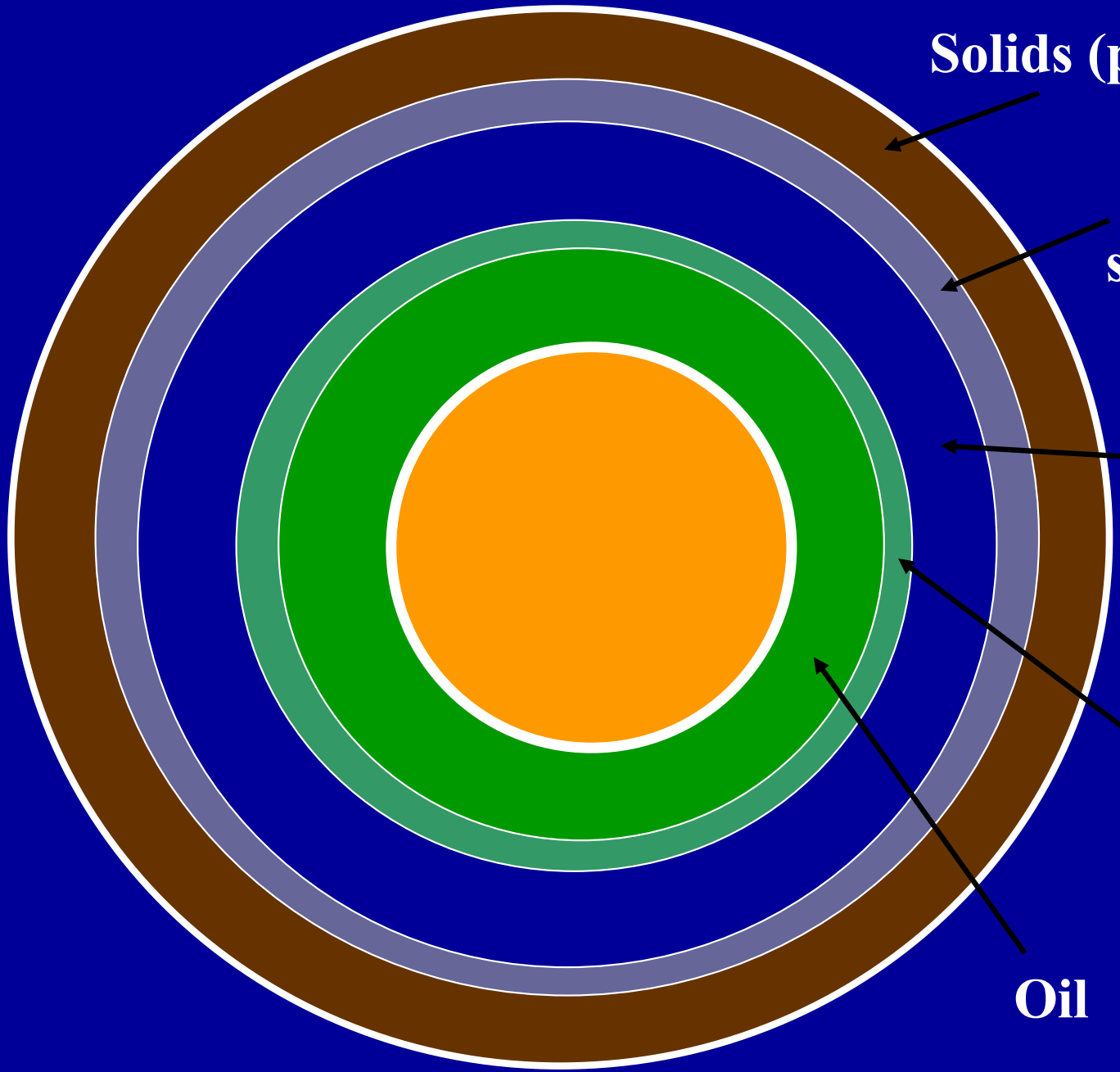
Paste with free oil

DECANTERS

- Horizontal centrifuge (decanter)
- Spins at 3,000 rpm, force decants oil
- Separates oil from the solids and fruit-water



PHASE SEPARATION WITHIN A DECANTER



Vossen, Masters Oil Processing Course

DECANTER – Horizontal Centrifuge

Oil and Fruit-water and Solids

OIL CLEANING

VERTICAL CENTRIFUGE

- Spins at 6,000 rpm = 4 X Separation
- Cleans oil of water and solids
- Cleans wastewater of oil
- Warm water added to increase interface

Vertical Centrifuge

Purging (oil floats to the top – water and solids sink to the bottom)

Filtration

To maintain oil quality – oils are filtered using either **paper**, or **diatomaceous earth**

Water or solids in the oil allows for continued enzymatic breakdown of the polyphenols.

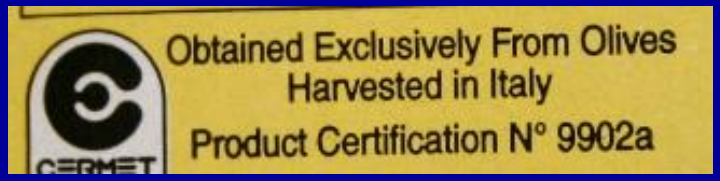
Filtered Oils Keep Better

Oil Storage Area

- ***Storage Conditions:***
  - Time
  - Light
  - Temperature
  - Tank Material
  - Tank Shape
  - Tank Atmosphere
  - Pipeline Material

USA Olive Oil Primary Users

- Well educated (post graduate)
- White – Upper middle class
- Say their family diet is healthy
- Buy for health mostly
- Purchase at gourmet store
- Pay attention to type and color and origin
- Say they know where oil comes from



USA Olive Oil Secondary Users

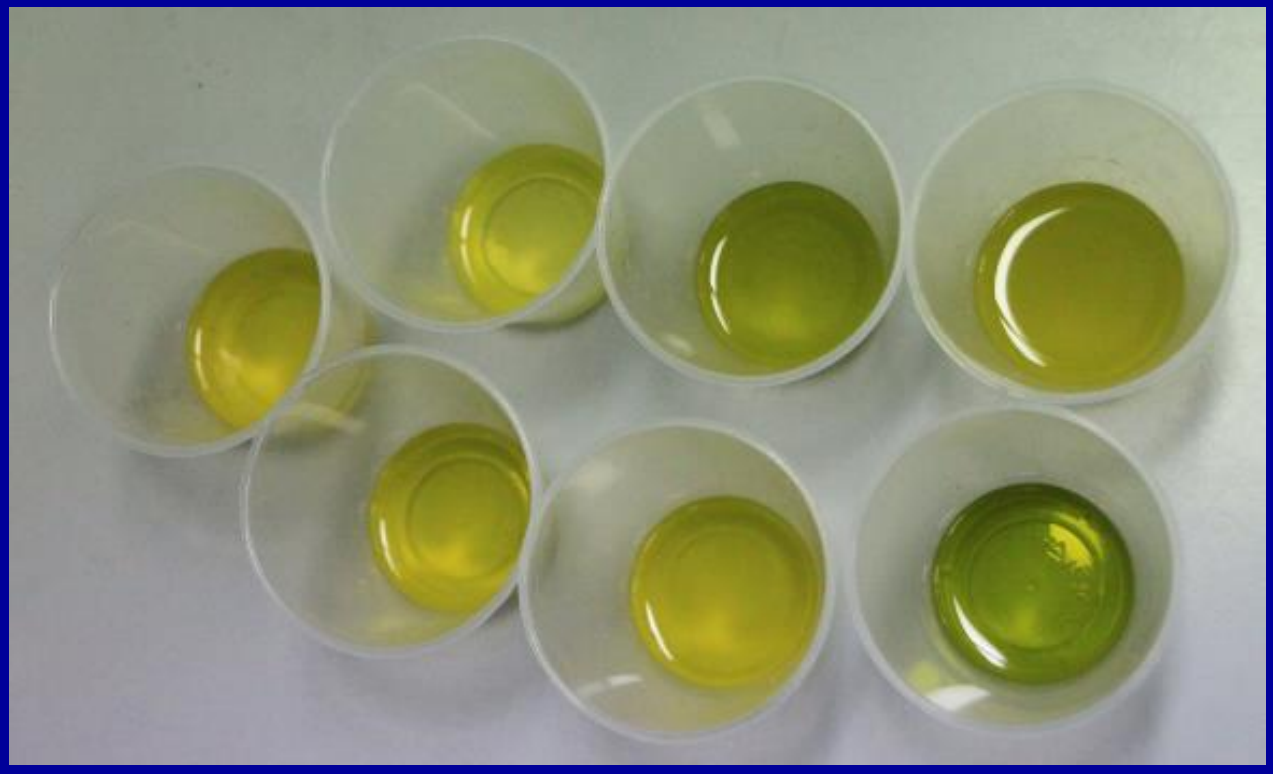
- Some education (high school graduate)
- Income below $50K
- Say family diet is average
- Use vegetable oil most often
- Use olive oil monthly
- Say olive oil is too expensive
- Buy mostly from supermarkets
- Don’t know much about olive oil

Choosing is Confusing

- Not sure what is important
- Only recognized USDA certification

USA Olive Oil Myths

- Color is related to quality
- Like wine – olive oil improves with age
- Light tasting olive oil has fewer calories
- Extra Virgin grade is for cold or raw use only



USA Olive Oil Market

- Consumption will increase
- Myths should be debunked
- Encourage health, flavor, substitution, and cooking with olive oil
- Education about freshness and keeping quality

This begs for a great olive oil seasoning

DIFFERENCES BETWEEN SEED OILS and OLIVE OIL

Virgin Olive Oil

- Mechanical separation of oil from fruit-water and solids at 50°-85°F
- Natural antioxidants (Polyphenols)
- No solvents
- Monounsaturated fat
- Natural *cis* form
- Flavor

Seed Oil

- Solvent extraction w/hexane
- Fractionally distilled
- Expeller pressed - refined
- Acidity neutralized w/soda
- 340-500°F to remove color, odor, & solvent residue
- Artificial antioxidants added (BHT) (BHA)

Polyunsaturated fat

- Hydrogenated *trans* form
- Bland –greasy

Two Secrets about Olive Oil

1. **Oil Physically Separated from Fruit**
   - *No solvent, no heat, no chemicals*
   - *All seed oils are solvent extracted*
   - *? Solvent remnants in seed oils – pomace oil ?*

2. **EV has Flavor – but most don't know what it is supposed to taste like or how to use it**
   - *Should be bitter and pungent*
   - *Positive influence on food*
   - *Contrasts & stimulates*
   - *Compliments and enhances*
   - *Traditional – ethnic flavors*

Distinguished by Flavor

Basics

- Freshness
- No Defects
- Fruitiness
- Bitterness
- Pungency
- Delicate – Medium – Robust STYLE

Specific Character

- Balance
- Complexity
- Green – Ripe
- Grassy, Herbal, Nettle, Artichoke, Green Tea, Mint, Nutty, Floral, Buttery, Tropical, etc.

Olive Oil Goes with Food

Healthy and Savory

Choking down vegetables is a lot easier with olive oil

Ham with olive oil


Needs a drizzle of olive oil
©Paul Vossen

Freshness

Producing Olive Oil in CA

- Olives are easy to grow
- They have few pest problems
- Use less water than most other crops
- Beautiful tree
- Healthy product
- Great flavor
- Huge USA market
- Market is saturated with cheap oil
- Make money by selling a specialty product direct to the consumer - or big volume/low cost