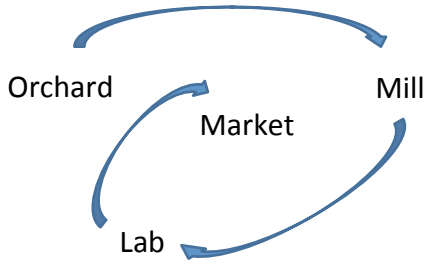
Perspectives

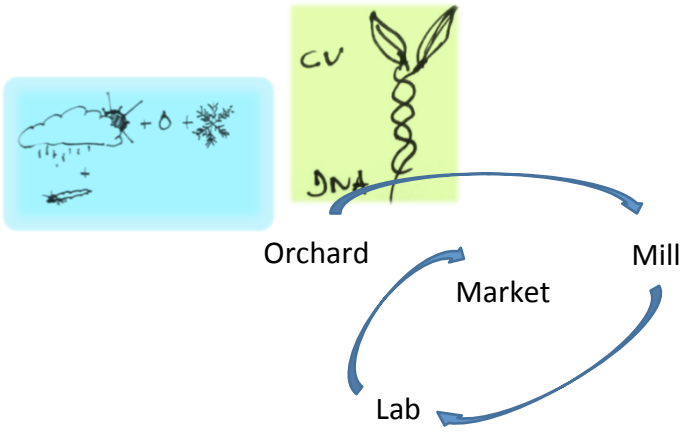
Perspectives

- **Genetics**
- **Chemistry**
- **Agronomy/Farming**

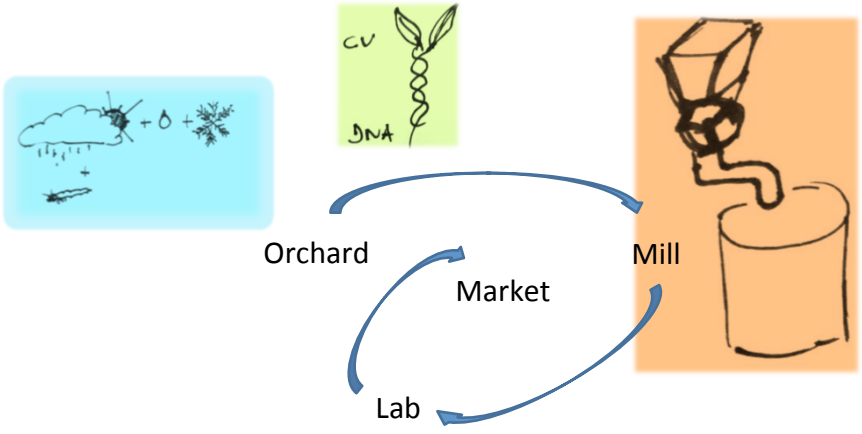
Olive Oil Quality Tour

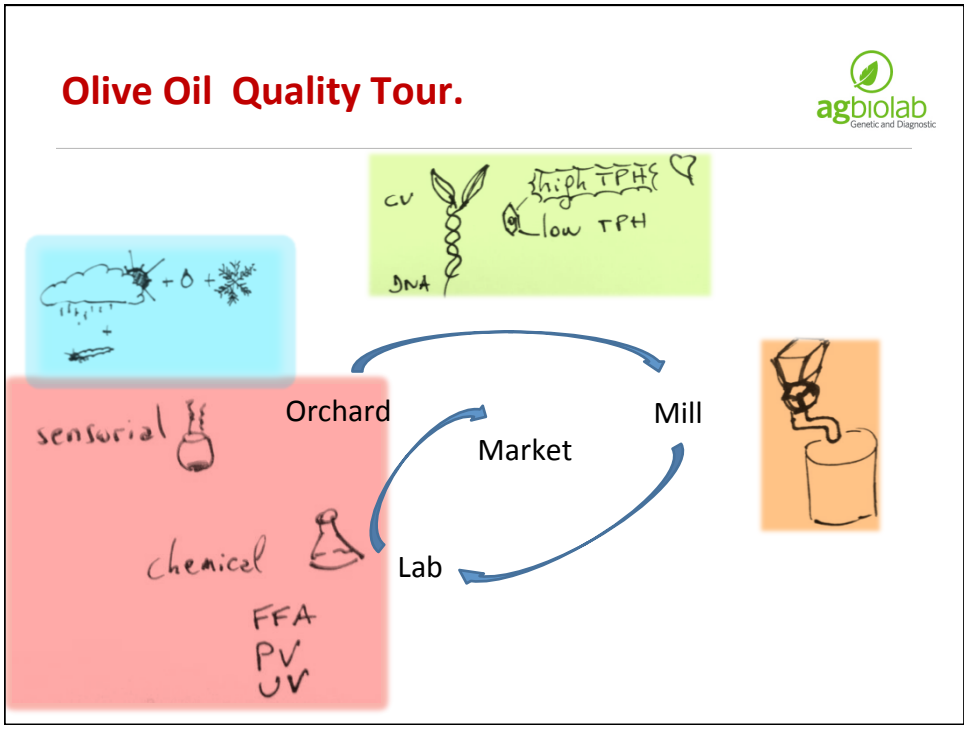


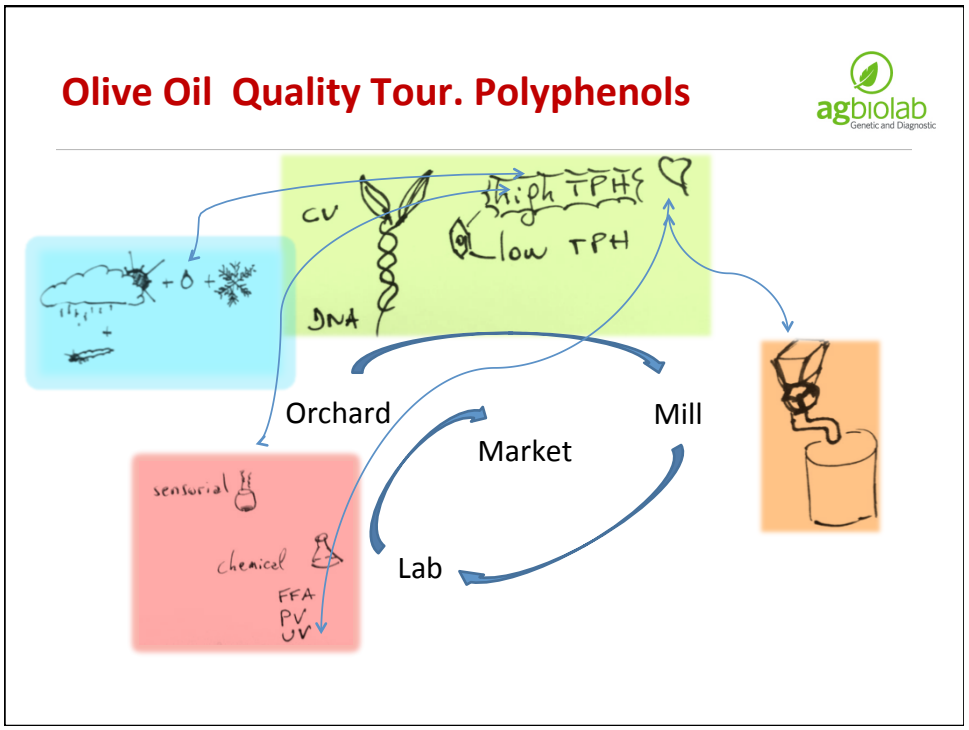
Olive Oil Quality Tour



Olive Oil Quality Tour



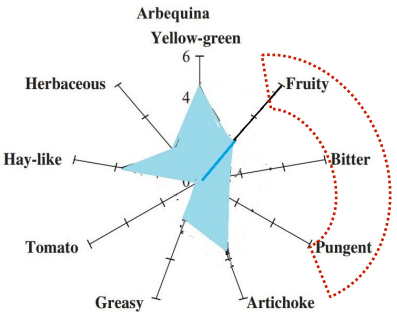

Olive Oil Quality Tour.
agbiolab
Genetic and Diagnostic
CV
high TPH
low TPH
DNA
sensorial
chemical
FFA
PV
UV
Orchard
Mill
Market
Lab


Olive Oil Quality Tour. Polyphenols
agbiolab
Genetic and Diagnostic
CV
high TPH
low TPH
DNA
sensorial
chemical
FFA
PV
UV
Orchard
Mill
Market
Lab

Olive Oil Quality with limited water. Taster perspective

Arbequina olive oil (non-bitter, non pungent; oil style MILD)

Radar (or spider) graph representation

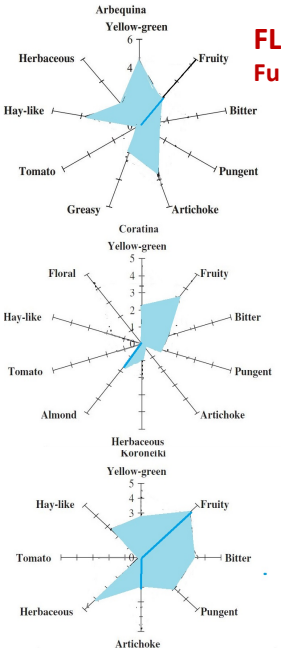


Arbequina, a low polyphenol cultivar, fully irrigated

Focus on

- **Fruitiness (aroma),**
- **Bitterness**
- **Pungency**

Int Jo Food Sc Technology(2011)46:1964-1976



FLAVOR of 3 monocultivar oils

Fully irrigated (100%ETc)

Arbequina

Coratina

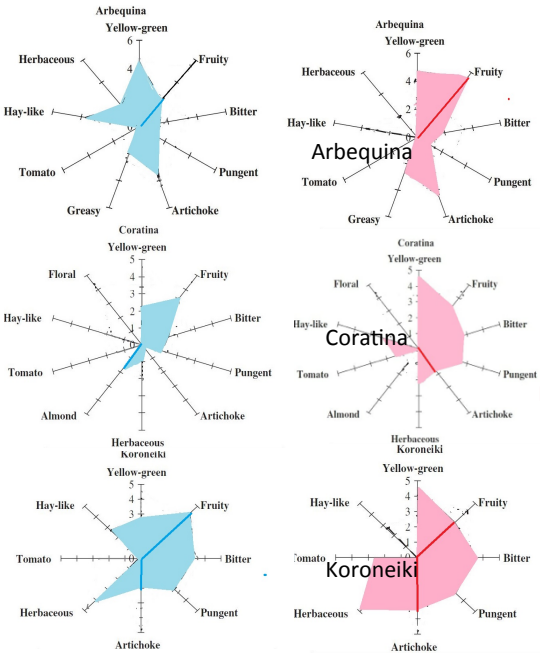
Koroneiki

Differences (mostly genetic) for low and high polyphenol cultivars in :

- Fruitiness,
- Bitterness
- Pungency

Oil Styles: Mild, Medium, Robust

Int J Food Sc Technology(2011)46:1964-1976



FLAVOR of olive oils comparison:

100%ETc (fully irrigated) vs 50% ETc (deficit irrigated)

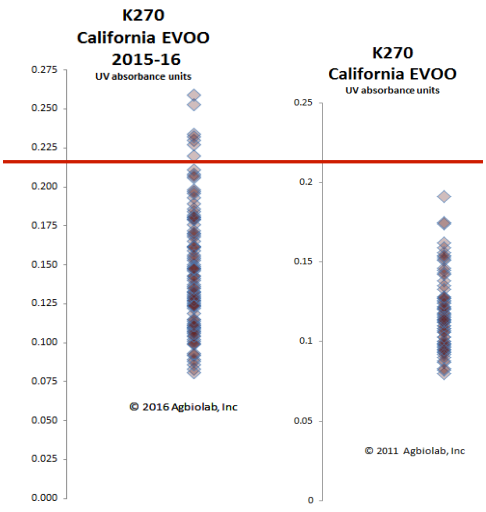
Response to deficit irrigation differs

- **Flavor profile can be positively or negatively affected**
- **Total polyphenol (TPH) increases**
- **UV absorbance increases**

Int J Food Sc Technology(2011)46:1964-1976

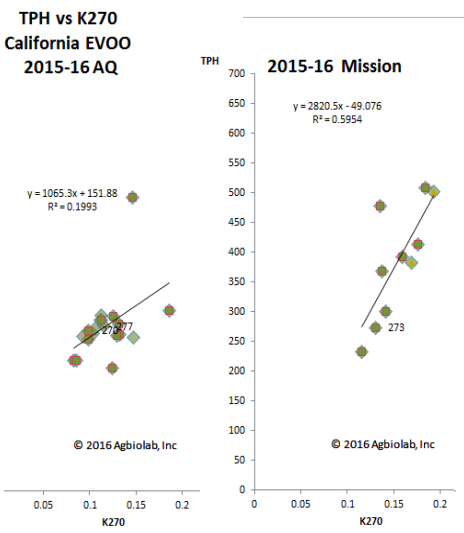
Olive Oil Quality with limited water.
Lab perspective

Comparison of K270
2015-16 vs 2009-10 harvest



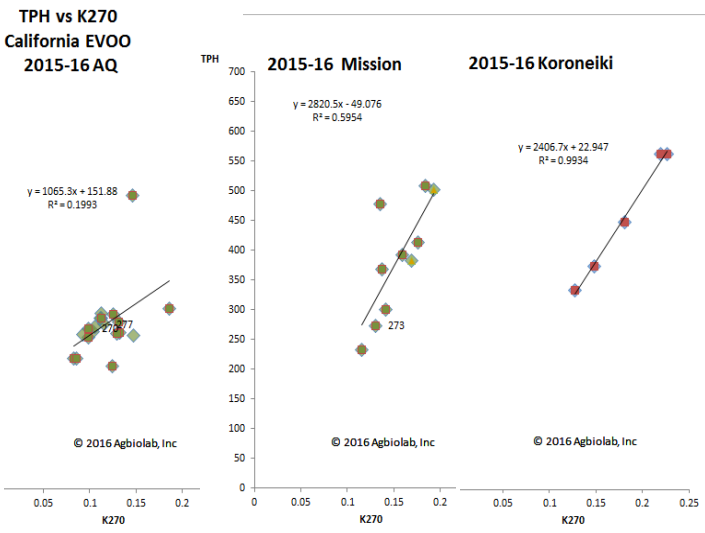
In recent drought years, K270 values have spread around and above the 0.220 EVOO limit

Olive Cultivar Series. TPH vs K270
Arbequina and Mission. Low and High polyphenol

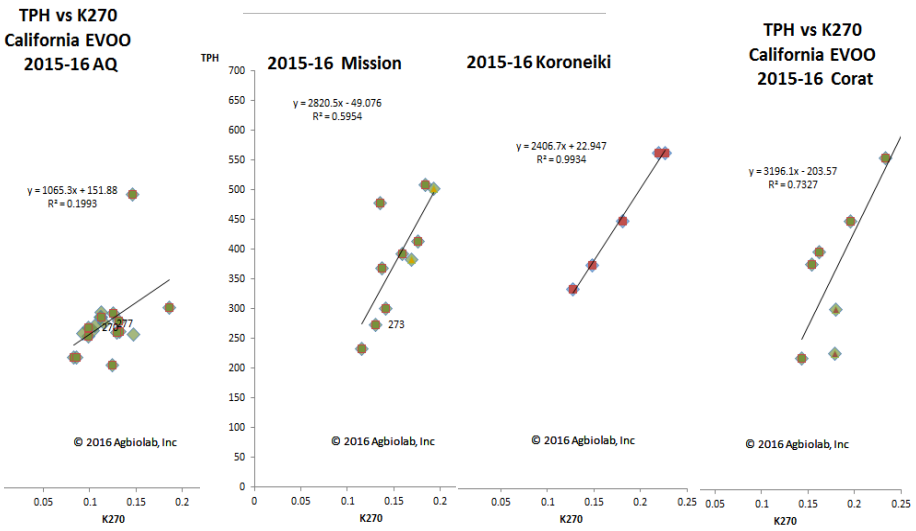


Mission reaches higher polyphenols than Arbequina (higher slope) without exceeding K270 EVOO limit =0.220

Olive Cultivar Series. TPH vs K270

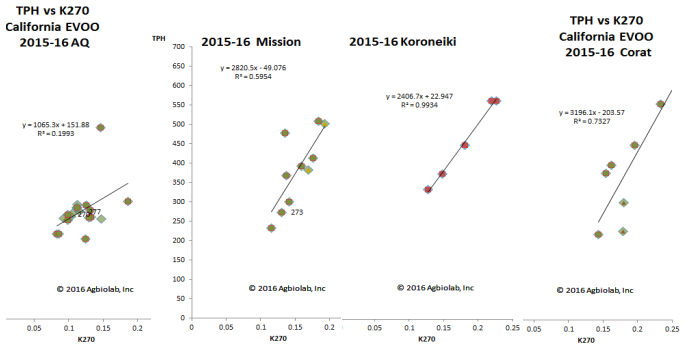


Olive Cultivar Series. TPH vs K270



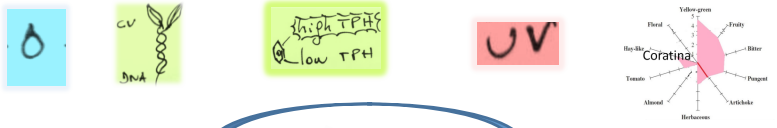
Olive Cultivar Series. TPH vs K270. Conclusion

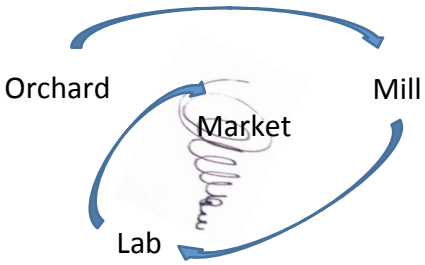
Coratina , Koroneiki and some Tuscan blends may exceed K270 limit with higher polyphenol content (not Arbequina)



Olive Oil Quality with water deficits. Summary

↓Irrigation + Cultivar ≡ ↑ Polyphenols + ↑ UV absorbance + ↑ Bitterness





Deficit Irrigation. Timing and intensity. Agronomy perspective

Most Frequent Errors in Irrigation

according to R Gucci

- **Interpretation of tree water status (*'deficit irrigation intensity)'***
- **Calculation of Irrigation Volume**
- **Wrong timing of application**
- **Non-uniform application**
- **No adjustment to crop load**
- **Lack of maintenance of irrigation system**

Topics In red, can be addressed by Mobile Irrigation Labs, sponsored by county or irrigation districts at no expense to the grower

.

Olive Phenologic Stages.

Deficit Irrigation Timing. FAO publication (Gucci, et al)

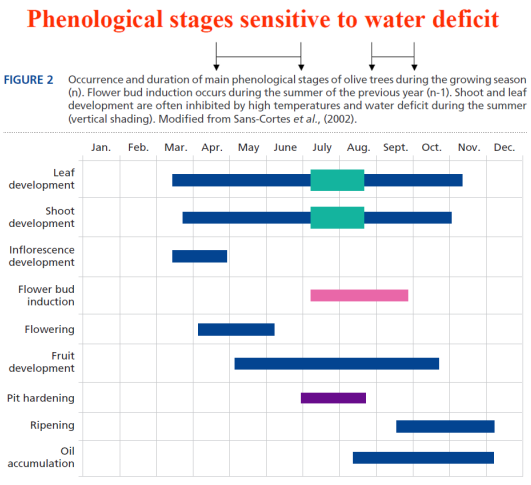
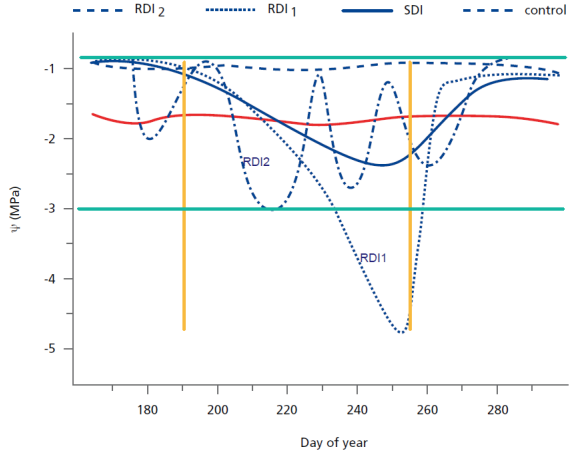


FIGURE 2 Occurrence and duration of main phenological stages of olive trees during the growing season (n). Flower bud induction occurs during the summer of the previous year (n-1). Shoot and leaf development are often inhibited by high temperatures and water deficit during the summer (vertical shading). Modified from Sans-Cortes *et al.*, (2002).

agbiolab.com

STEM WATER POTENTIAL under deficit irrigation. Three different schemes. FAO publication (Gucci, et al)

FIGURE 5 Hypothetical seasonal course of leaf or stem-water potential for olive trees subjected to different strategies of deficit irrigation. Green horizontal lines bracket the range between fully hydrated trees and turgor loss point, vertical orange lines limit the interval of water deficit. Values will vary in different climate and soil conditions. Legend: broken line, fully-irrigated baseline; solid line, SDI; dotted line, RDI_1; broken and dotted line, RDI_2.



RDI= regulated deficit irrigation
SDI= sustained deficit irrigation
green lines = ideal range for SWP
orange lines= period of deficit (Jul-Aug)

Most Frequent errors in Irrigation. Recap

according to R Gucci

- **Interpretation of tree water status** (aim for 75% ETc in RDI)
- Calculation of Irrigation Volume
- **Wrong timing of application** (RDI from 'pit hardening', during Jul-Aug)
- Non-uniform application
- **No adjustment to crop load** (suggested >75% ETc on ON-years)
- Lack of maintenance of irrigation system

Plus….

- **No adjustment based on olive cultivar (high or low polyphenol?)**

Additional information

(in files to review at our Agbiolab exhibit, or to download from thumb drive, or via e-mail.)

- Chapter Olive deficit irrigation (FAO)
- Paul Vossen's tables of Olive Irrigation based on daily ET (irrigation estimates of gal/day/tree)
- Soil-water balancing based on precipitation, soil type, ET. An Excell spreadsheet from Ohio Univ.

If interested I can also explain SWP measurements

Contacts:

Mobile Irrigation Lab (N Sacramento Valley): Kevin Greer; kevin@tehamacountyrcd.org
Or contact me: liliana@agbiolab.com

Panel discussion and Q/A

Milagros Castro (Olive Advisor)
Thom Curry (Temecula Olive Oil)
Pamela Marvel (Grampy Goats Farm)

Controlled deficit irrigation. Olive

Based on daily ETo for unknown location.

Paul Vossen (UCCE Sonoma)

agbiolab Genetic and Diagnostic

CONTROLLED DEFICIT IRRIGATION FOR MATURE TREES (20 X 17ft.)

Growth Stage	Wks	ETo	ETc	100%	g/t/d	75%	g/t/d	60%	g/t/d	48%	g/t/d
April											
*New shoot growth	2	0.16"	0.12"	100%	20.3	100%	20.3	100%	20.3	67%	13.6
*Flower buds appear	3	0.16"	0.12"	100%	20.3	100%	20.3	100%	20.3	67%	13.6
Full Bloom (FB)	2	0.20"	0.15"	100%	25.5	100%	25.4	100%	25.4	100%	25.4
Cell division	4	0.20"	0.15"	100%	25.5	100%	25.4	67%	17.0	67%	17.0
Spring growth	3	0.23"	0.17"	100%	28.8	100%	28.8	67%	19.3	67%	19.3
Summer	8	0.24"	0.18"	100%	30.5	67%	20.4	67%	20.4	33%	10.0
Fruit enlargement	6	0.17"	0.13"	100%	22.0	67%	14.7	33%	7.3	33%	7.3
Before harvest	4	0.11"	0.08"	100%	13.5	33%	4.5	33%	4.5	33%	4.5
*Harvest	4	0.06"	0.04"	0%	0	0%	0	0%	0	0%	0
Dec, Jan, Feb, Mar *Winter	16	0.03"	0.03"	0%	0	0%	0	0%	0	0%	0
TOTAL Applied	52	-	-	32 wks 5,396 g/t/y 27 wks 4,686 g/t/y		32 wks 4,271 g/t/y 27 wks 3,561 g/t/y		32 wks 3,521 g/t/y 27 wks 2,811 g/t/y		32 wks 2,705 g/t/y 27 wks 2,229 g/t/y	

*Trees do not need to be irrigated unless the ground is dry – 5 weeks in spring (low winter rainfall)

17 g/t/d ~ 0.10"ETc

Soil water holding capacity (AWC [in water/ft soil depth]): 1.2" (sand) ↔3.6" (clay)
Water infiltration rate in soil: 1.2"/day ↔ >7.2"/day

Controlled deficit irrigation. Olive

Paul Vossen (UCCE Sonoma) [compared to FAO]

agbiolab Genetic and Diagnostic

2 g/hr/drip?

CONTROLLED DEFICIT IRRIGATION FOR MATURE TREES (20 X 17ft.)

Growth Stage	Wks	ETo	ETc	100%	g/t/d	75%	g/t/d	60%	g/t/d	48%	g/t/d
* New shoot growth	2	0.16"	0.12"	100%	20.3	100%	20.3	100%	20.3	67%	13.6
*Flower buds appear	3	0.16"	0.12"	100%	20.3	100%	20.3	100%	20.3	67%	13.6
Full Bloom (FB)	2	0.20"	0.15"	100%	25.5	100%	25.4	100%	25.4	100%	25.4
Cell division	4	0.20"	0.15"	100%	25.5	100%	25.4	67%	17.0	67%	17.0
Pit hardening Spring growth	3	0.23"	0.17"	100%		100%	28	10 g/t/d ?	19.3	67%	19.3
Summer	8	0.24"	0.18"	100%	30.5	67%	20.4	67%	20.4	33%	10.0
Fruit enlargement	6	0.17"	0.13"	100%		67%	14.7	9 g/t/d	7.3	33%	7.3
Before harvest	4	0.11"	0.08"	100%	13.5	33%	4.5	33%	4.5	33%	4.5
*Harvest	4	0.06"	0.04"	0%	0	0%	0	0%	0	0%	0
*Winter	16	0.03"	0.03"	0%	0	0%	0	0%	0	0%	0
TOTAL Applied	52	-	-	32 wks 5,396 g/t/y 27 wks 4,686 g/t/y		32 wks 4,271 g/t/y 27 wks 3,561 g/t/y		32 wks 3,521 g/t/y 27 wks 2,811 g/t/y		32 wks 2,705 g/t/y 27 wks 2,229 g/t/y	

33% 560 Gal?

67% 252 Gal

*Trees do not need to be irrigated unless the ground is dry – 5 weeks in spring (low winter rainfall)

17 g/t/d ~ 0.10"ETc

Soil water holding capacity (AWC [in water/ft soil depth]): 1.2" (sand) ↔3.6" (clay)
Water infiltration rate in soil: 1.2"/day ↔ >7.2"/day

Gallons per tree. Olive estimates
Paul Vossen (UCCE)

agbiolab Genetic and Diagnostic

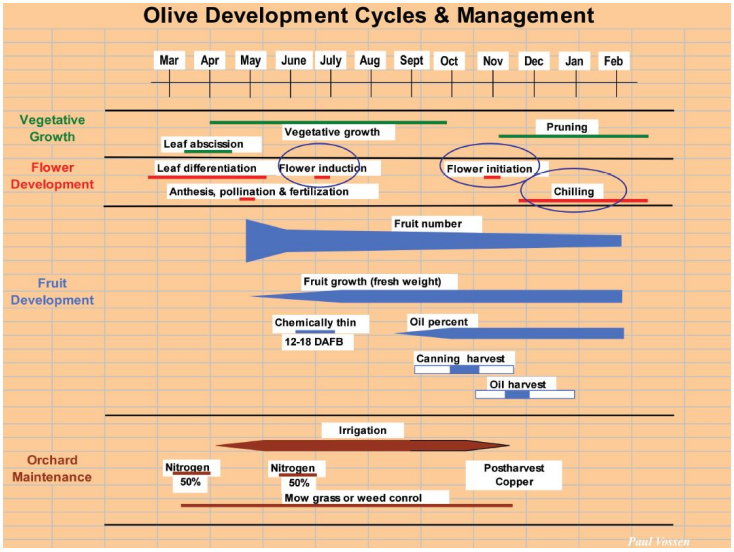
WATER USE BASED ON EVAPOTRANSPIRATION - OIL OLIVES = ETo x 75% = ETc
WARM CLIMATIC ZONE (GALLONS PER TREE PER DAY) (by *PAUL VOSSEN*)

Tree Age Size	May ETo = 0.29"/day ETc = 0.18"/day	June ETo = 0.23"/day ETc = 0.17"/day	July ETo = 0.24"/day ETc = 0.18"/day	August ETo = 0.21"/day ETc = 0.16"/day	Sept. ETo = 0.17"/day ETc = 0.13"/day	Oct. ETo = 0.11"/day ETc = 0.08"/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	0.5	0.6	0.7	0.5	0.5	0.5
9 ft² young tree	1.0	1.0	1.0	1.0	1.0	0.5
25 ft² young tree	2.3	2.6	2.8	2.5	2.0	1.3
49 ft² young tree	4.6	5.2	5.5	4.9	4.0	2.5
81 ft² young tree	7.6	8.6	9.0	8.1	6.5	4.0
121 ft² young tree	11.3	12.8	13.5	12.0	9.8	6.0
169 ft² young tree	15.8	18.0	19.0	16.8	13.7	8.5
225 ft² young tree	21.0	23.8	25.2	22.4	18.2	11.3
*272 ft² mature tree	12.7	14.4	15.2	13.6	11.0	6.8
	4,073	4,616	4,886	4,345	3,530	2,172

*Mature trees should get about 50% of ETc
** Newly planted trees should get 200% of ETc

Olive phenology
Paul Vossen (UCCE Sonoma)

agbiolab Genetic and Diagnostic



Kc Crop Coefficients for Irrigation Deciduous vs Evergreen

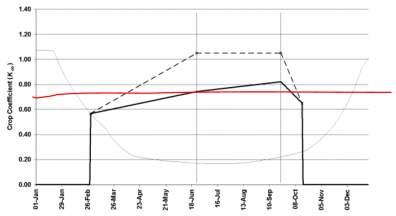


Figure 7. Crop coefficient curve for a stone fruit orchard grown near Fresno, California. The dashed line is for a clean cultivated, mature orchard and the solid line is for an immature orchard having C_g=35% and C_d=40% at the beginning and end of the midseason period. The dotted line is for bare soil evaporation.

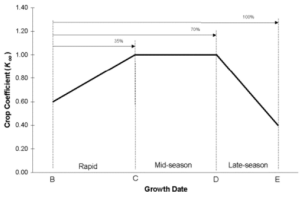


Figure 5. Hypothetical crop coefficient (K_{cb}) curve for typical deciduous orchard and vine crops showing the growth stages and percentages of the season from leaf out to critical growth dates.

In red= Kc for mature olive orchard, an evergreen, is ~0.75 year around

Daily ETo curves. SWP decrease along year

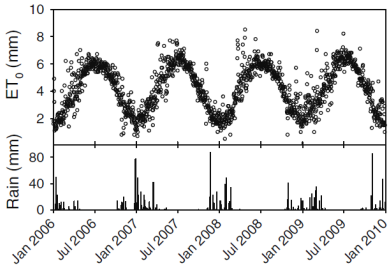


Fig. 1 Daily reference evapotranspiration (ET_0) and rainfall during the experiment

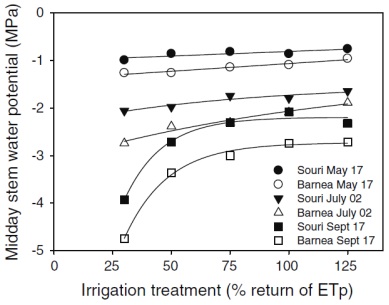
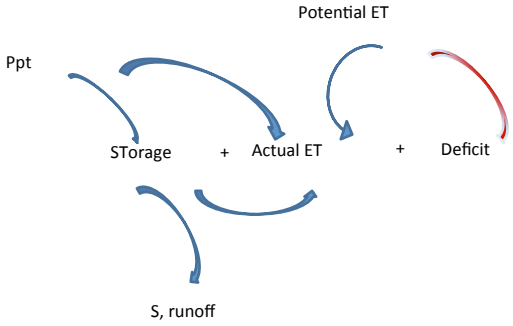


Fig. 3 Stem water potential as a function of irrigation rate at three dates during the 2007 irrigation season. *Symbols* are average of 10

Ben-Gal A et al Irrig Sc (2011)

Water budget balancing flow



Pressure chamber (or bomb) to measure SWP

QUALITY OLIVE OIL with WATER DEFICITS

Thom Curry

Temecula Olive Oil Company

Some Practical Points

- Some of us may be deficit irrigating already and we don't know it
- Irrigation systems must be regularly monitored and maintained
- Does your irrigation system match your plans and environment.
- Is there ample water to be applied to recover the trees?
- We found that in these drought conditions with basically no reserve water in the soil that the older established trees took longer to recover than normal
- Drip is a good system but in some soils and conditions it is not always practical
- Some of our groves in the low desert of Imperial valley we are having more success with micro sprinklers
- Be very aware of salinity build up

Some Points on Quality

- We talk about quality olive oil as if it is a quantitative well defined goal.
- Although there are some quantitative aspects such as the criteria for Extra Virgin this is merely the bar we need to reach how far a you go over that bar and in which direction is solely up to YOU!
- Quality by definition is a qualitative goal and is truly in the eye of the beholder
- Although you can achieve higher polyphenol content using deficit irrigation techniques an arbequina with 600 ppm polyphenol count may not be what your customers are looking for.
- Deficit irrigation is one of many tools in your tool box to achieve the goals you have set for your olive oil It is important to assess whether it is the proper tool to use