Olive Irrigation Scheduling

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Critical periods for adequate soil moisture in olives.

Period	Growth events	Low soil moisture effects
Feb. to June	Flower bud development	Reduced flower formation
	Bloom	Incomplete flowers
	Fruit set	Poor fruit set
	Shoot growth	Increased alternate bearing
		Decreased shoot growth
June to July	Stage 1 of fruit growth due to cell division	Small fruit size due to decreased cell division
	Shoot growth	Fruit shrivel
	Less shoot growth	
Late Sept. to harvest	Stage 3 of fruit growth w/ cell enlargement	Small fruit size due to reduced cell expansion
	Shoot growth	Fruit shrivel
		Decreased shoot growth

Average reference evapotranspiration (Eto) in inches per month.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Sacramento Valley Total 51.1	**1.22**	**1.62**	**2.85**	**4.55**	**6.13**	**7.34**	**8.48**	**7.29**	**5.43**	**3.58**	**1.59**	**1.00**
San Joaquin Valley Total 52.3	**1.04**	**1.63**	**3.32**	**4.91**	**6.66**	**7.75**	**8.47**	**7.34**	**5.45**	**3.47**	**1.49**	**0.80**
Southern Calif. Riverside Total 56.3	**2.07**	**2.87**	**4.03**	**4.13**	**6.10**	**7.09**	**7.93**	**7.57**	**6.14**	**4.15**	**2.60**	**1.95**

UC ANR Pub. 21426, Determining Daily Reference Evapotranspiration (Eto).

Average water requirements for Sacramento valley olives.

Month	ETo (in.)	Kc per month	ETc (in.)	ETc (in./day)	Your Calc. (gal/tree/day)
January	1.2	0.75 (1.05)	0.9	0.03	
February	1.6	0.75 (1.05)	1.2	0.04	
March	2.9	0.75 (1.05)	2.1	0.07	
April	4.6	0.75 (1.05)	3.4	0.11	
May	6.1	0.75 (1.05)	4.6	0.15	
June	7.3	0.75 (1.00)	5.5	0.18	
July	8.5	0.75 (1.00)	6.4	0.21	
August	7.3	0.75 (1.00)	5.5	0.18	
September	5.4	0.75 (1.00)	4.1	0.14	
October	3.6	0.75 (1.00)	2.7	0.09	
November	1.6	0.75 (0.95)	1.0	0.04	
December	1.0	0.75 (0.95)	0.8	0.02	
TOTAL	**51.1**		**38.3**		

To Calculate a Young Orchard's ETc

% Ground Shaded at Noon	Correction Factor
55%	1.00
50	.90
40	.80
30	.60
20	.40
10	.20

Drip/ Micro-sprinkler Irrigation Example

Super High Density Oil Olives
Tree spacing: 5 x 13 ft.
App. Efficiency: 90 %
Assumed the Maximum Water Use Rate, ETc July, 0.21 in/day

To convert inches/day to gallons/tree/day:
ETc (gal/tree/day) = ETc (in/day) x tree spacing x Conversion factor

= 0.21 in/day x (5 ft x 13 ft) x 0.622 gal/in/square ft.

= 8.49 gal/tree/day

Irrigation requirement = water use rate / application efficiency
= 8.49 gal/tree/day / 0.90
= 9.43 gal/tree/day

For *Drip irrigation* with two 0.5 gal per hour emitters per tree
The application rate of the system = 1 gal/tree/hr
Run time = 9.43 hours per day
OR, 18.86 hours every other day

However, if olives for oil are irrigated at 65% ETc for optimum oil yield and quality, then.....
Run time= 9.43 x 0.65
= 6.13 hours per day
OR, 12.26 hours every other day

The above calculations assume a mature orchard with a canopy cover shading at least 55 percent of the orchard floor at noon.

If the orchard has less ground shading, a young tree calculation should be made to account for lower water use by young trees with smaller canopies.
For example, at 40% cover, the water use is only 80% of full orchard ETc.
= 6.13 hours per day x 0.80 correction factor
Run time= 4.9 hours per day

CALCULATING IRRIGATION WATER APPLICATIONS

CONVERSION FACTORS

VOLUMES:

ONE ACRE INCH = 3,630 CUBIC FEET
= 27,154 GALLONS

ONE ACRE FOOT = 43,560 CUBIC FEET
= 325,851 GALLONS
= 12 ACRE INCHES

ONE CUBIC FOOT = 1,728 CUBIC INCHES
= 7.481 (APPROX 7.5) GALLONS

ONE GALLON = 231 CUBIC INCHES
= 0.13368 CUBIC FOOT

FLOW RATES:

ONE CUBIC FOOT PER SECOND (C.F.S.) = 448.83 (APPROX 450) GALLONS PER MINUTE
= 0.992 (APPROX 1) ACRE INCH PER HOUR
= 1.984 (APPROX 2) ACRE FEET PER DAY

ONE ACRE INCH PER HOUR = 452.6 (APPROX 450) GALLONS PER MINUTE

AREA: ONE ACRE = 43,560 SQUARE FEET

CALCULATING THE APPLICATION RATE IN INCHES PER HOUR

$$\text{INCHES PER HOUR} = \frac{\text{GALLONS PER MINUTE}}{452.6 \times \text{ACRES}}$$

$$= \frac{\text{C.F.S.}}{1.01 \times \text{ACRES}}$$

$$= \frac{\text{EMITTERS/PLANT} \times \text{FLOW/EMITTER (GALLONS PER HOUR)}}{.623 \times \text{PLANT SPACING (SQUARE FEET)}}$$

$$= \frac{\text{GALLONS PER MINUTE/SPRINKLER} \times \text{SPRINKLERS/ACRE}}{452.6}$$

$$= \frac{\text{GALLONS PER MINUTE/SPRINKLER} \times 96.3}{\text{SPRINKLER SPACING (SQUARE FEET)}}$$