# Olive Irrigation Management

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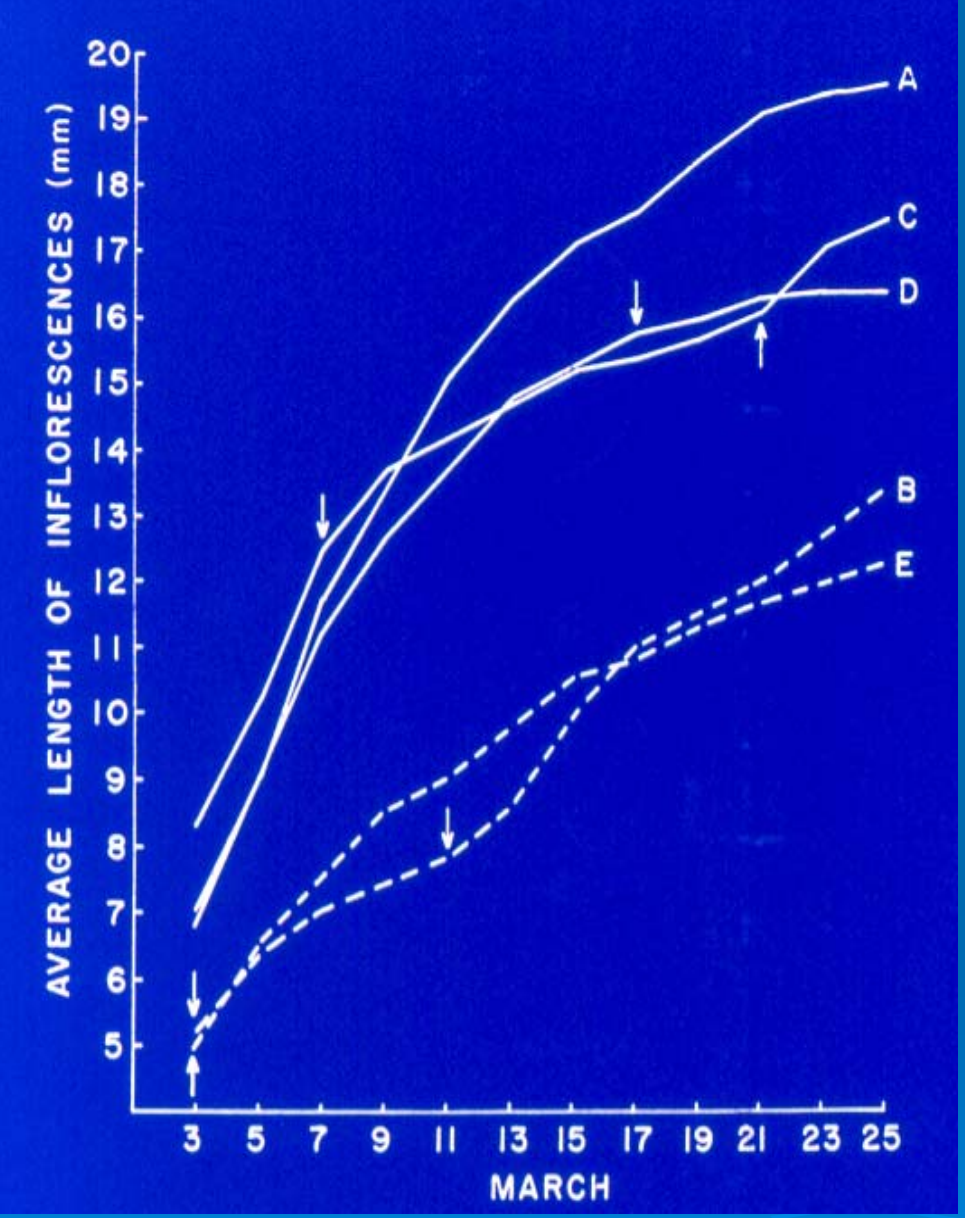
***Proper irrigation is important for good bloom, fruit sizing, total yield, and reduction of alternate bearing***

# *Wildfire !*




* Continuous ample soil moisture.

* Moisture deficit in mid-March, at intermediate flower development.

* Moisture deficit in late March.

* Moisture deficit in early March, an early stage of flower development.

* Continuous moisture deficiency.

Source: Dr. H.T. Hartmann, UCD Pomology

# Inflorescence Growth

# *Effect of Early Spring Water Stress on Barouni Olives (Hartmann, 1960)*

| Water Stress Timing | % Leaf Drop | # Flowers/ Inflorescence | % Perfect Flowers | # Fruits / 100 Inflorescences |
|---|---|---|---|---|
| Control (No stress) | 2.8 | 15.7 | 27.4 | 3.3 |
| 3/3-3/11 | 12.2 | 4.9 | 65.4 | 4.3 |
| 3/7-3/21 | 8.4 | 8.7 | 4.0 | 0.1 |
| 3/18-4/4 | 4.8 | 8.3 | 9.3 | 0.6 |
| 3/1-4/4 | 12.5 | 6.7 | 0.6 | 0.3 |
| P = .05 | --- | 3.2 | 21.4 | --- |

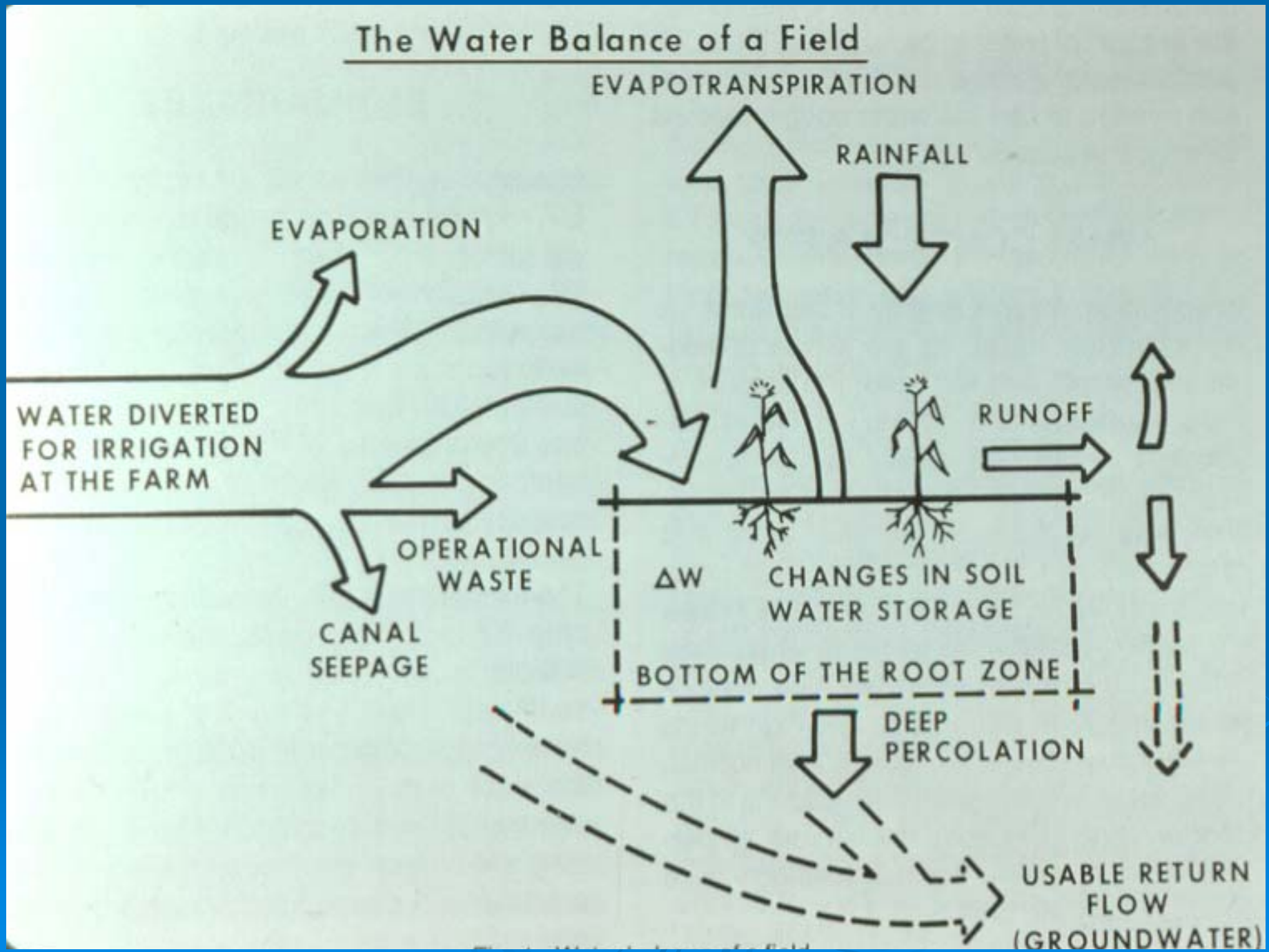
# *Method ?*


Drip


Microsprinklers


Flooding Basins or Furrows

**Management is what matters.**


The Water Balance of a Field
EVAPOTRANSPIRATION
RAINFALL
EVAPORATION
WATER DIVERTED FOR IRRIGATION AT THE FARM
RUNOFF
OPERATIONAL WASTE
ΔW
CHANGES IN SOIL WATER STORAGE
CANAL SEEPAGE
BOTTOM OF THE ROOT ZONE
DEEP PERCOLATION
USABLE RETURN FLOW (GROUNDWATER)

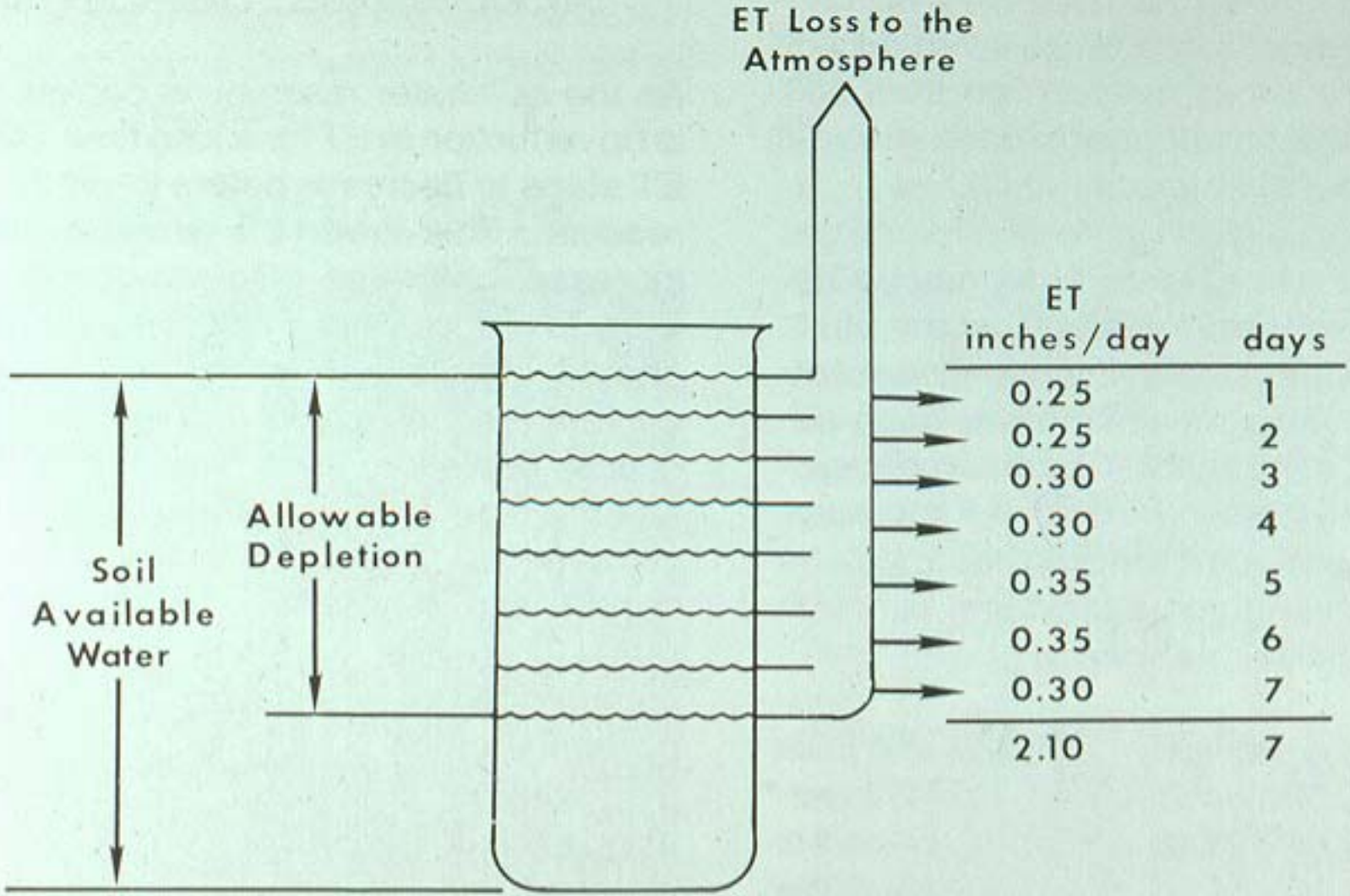
# Average Reference Crop Water Use, (Eto), inches.

| | Fresno | Orland | St. Helena |
|---|---|---|---|
| March | 3.3 | 3.1 | 2.8 |
| April | 4.8 | 4.8 | 3.9 |
| May | 6.7 | 6.7 | 5.1 |
| June | 7.8 | 7.4 | 6.1 |
| July | 8.4 | 8.8 | 7.0 |
| August | 7.1 | 7.3 | 6.2 |
| September | 5.2 | 5.6 | 4.8 |
| October | 3.2 | 3.8 | 3.1 |
| November | 1.4 | 1.7 | 1.4 |
| **TOTAL** | **47.9** | **49.2** | **40.4** |

# *Reference Eto, olive Kc's and orchard water use (clean cultivated) in Orland*

| | Eto (inches) | Kc | Etc (inches) |
|---|---|---|---|
| March | 3.1 | 0.75 | 2.3 |
| April | 4.8 | 0.75 | 3.6 |
| May | 6.7 | 0.75 | 5.0 |
| June | 7.4 | 0.75 | 5.6 |
| July | 8.8 | 0.75 | 6.6 |
| August | 7.3 | 0.75 | 5.5 |
| September | 5.6 | 0.75 | 4.2 |
| October | 3.8 | 0.75 | 2.9 |
| November | 1.7 | 0.75 | 1.3 |
| **TOTAL** | **49.2** | | **37.0** |

# The Water Budget Method of Irrigation




| ET inches/day | days |
|---|---|
| 0.25 | 1 |
| 0.25 | 2 |
| 0.30 | 3 |
| 0.30 | 4 |
| 0.35 | 5 |
| 0.35 | 6 |
| 0.30 | 7 |
| 2.10 | 7 |

IRRIGATE

1. When?--------After 7 days
2. How much?-- Apply 2.10 inches of water + losses (Efficiency consideration)

Enterprise-Record Sunday, August 14, 2005

## WEEKLY SOIL MOISTURE LOSS IN INCHES

(Estimated Evapotranspiration)

**08/05/05 through 08/11/05**

| West of Sacramento River | | | East of Sacramento River | |
|---|---|---|---|---|
| Weekly Water Use | Accum'd Seasonal Use | **Crop (Leafout Date)** | Weekly Water Use | Accum'd Seasonal Use |
| 1.78 | 32.92 | Pasture | 1.63 | 30.66 |
| 1.71 | 31.81 | Alfalfa | 1.56 | 29.58 |
| 1.36 | 24.92 | Olives | 1.23 | 23.29 |
| 1.16 | 21.50 | Citrus | 1.06 | 19.97 |
| 1.71 | 29.95 | Almonds (3/1) * | 1.56 | 27.80 |
| 1.71 | 28.83 | Prunes (3/15) * | 1.56 | 26.73 |
| 1.71 | 27.18 | Walnuts (4/1) * | 1.56 | 25.11 |
| 1.53 | 30.19 | Urban Turf Grass | 1.42 | 28.24 |

## WEEKLY APPLIED WATER IN INCHES[1]

| 50% | 60% | 70% | 80% | 90% | ← Efficiency → | 50% | 60% | 70% | 80% | 90% |
|---|---|---|---|---|---|---|---|---|---|---|
| 2.7 | 2.3 | 1.9 | 1.7 | 1.5 | Olives | 2.5 | 2.1 | 1.8 | 1.5 | 1.4 |
| 2.3 | 1.9 | 1.7 | 1.5 | 1.3 | Citrus | 2.1 | 1.8 | 1.5 | 1.3 | 1.2 |
| 3.4 | 2.9 | 2.4 | 2.1 | 1.9 | Almonds (3/1) | 3.1 | 2.6 | 2.2 | 2.0 | 1.7 |
| 3.4 | 2.9 | 2.4 | 2.1 | 1.9 | Prunes (3/15) | 3.1 | 2.6 | 2.2 | 2.0 | 1.7 |
| 3.4 | 2.9 | 2.4 | 2.1 | 1.9 | Walnuts (4/1) | 3.1 | 2.6 | 2.2 | 2.0 | 1.7 |

[1] The amount of water required by a specific irrigation system to satisfy evapotranspiration. Typical ranges in irrigation system efficiency are: Drip Irrigation, 80%-95%; Micro-sprinkler, 80%-90%; Sprinkler, 70%-85%; and Border-furrow, 50%-75%.

For further information, contact the Tehama Co. Farm Advisor's office at 527-3101.

***ET is available in local papers.***

***Or, over the internet from DWR.***

# *Current water use for irrigation scheduling - - -*

- ✓**Et Data:**

  **www.cimis.water.ca.gov**

# Yield Components in Olive:

- ✓ Fruit load
- ✓ Fruit size and Distribution
- ✓ Oil Content

# *So, with this background, we know ---*

- **Olive is drought tolerant; can survive with little or no irrigation.**
- **Potential water use of olive orchards is at least 35 acre-in./acre/year in Sacramento & San Joaquin valleys.**
- ***Sustained* deficit irrigation drastically reduces production; FRUIT SIZE is the most sensitive yield component.**

# Regulated Deficit Irrigation, a controlled stress

| Date | Treatment 1 Full Etc (in.) | RDI% | Treatment 2 Irr (in.) | RDI% | Treatment 3 Irr (in.) | RDI% | Treatment 5 Irr (in.) |
|---|---|---|---|---|---|---|---|
| Mar 1-15 | 1.2 | 100 | 1.2 | 100 | 1.2 | 100 | 1.2 |
| Mar 16-31 | 1.2 | 100 | 1.2 | 100 | 1.2 | 100 | 1.2 |
| Apr 1-15 | 1.8 | 100 | 1.8 | 100 | 1.8 | 100 | 1.8 |
| Apr 16-30 | 1.8 | 100 | 1.8 | 100 | 1.8 | 100 | 1.8 |
| May 1-15 | 2.3 | 100 | 2.3 | 100 | 2.3 | 100 | 2.3 |
| May 16-31 | 2.5 | 100 | 2.5 | 100 | 2.5 | 50 | 1.3 |
| Jun 1-15 | 2.9 | 100 | 2.9 | 50 | 1.5 | 50 | 1.5 |
| Jun 16-30 | 2.9 | 50 | 1.5 | 50 | 1.5 | 50 | 0.7 |
| Jul 1-15 | 3.1 | 50 | 1.6 | 50 | 1.6 | 50 | 0.8 |
| Jul 16-30 | 3.3 | 50 | 1.7 | 50 | 1.7 | 50 | 0.8 |
| Aug 1-15 | 2.7 | 100 | 2.7 | 50 | 1.4 | 50 | 0.7 |
| Aug 16-31 | 2.8 | 100 | 2.8 | 100 | 2.8 | 50 | 1.4 |
| Sep 1-15 | 2.0 | 100 | 2.0 | 100 | 2.0 | 100 | 1.0 |
| Sep 16-30 | 2.0 | 100 | 2.0 | 100 | 2.0 | 100 | 2.0 |
| Oct 1-15 | 1.2 | 100 | 1.2 | 100 | 1.2 | 100 | 1.2 |
| Oct 16-31 | 1.3 | 100 | 1.3 | 100 | 1.3 | 100 | 1.3 |
| Nov 1-15 | 0.5 | 100 | 0.5 | 100 | 0.5 | 100 | 0.5 |
| TOTAL (in.) | 35.5 | | 31.0 | | 28.3 | | 21.5 |
| Water Saved (in.) | | | 4.6 | | 7.4 | | 14.0 |
| Water Saved (%) | | | 12.9% | | 20.8% | | 39.5% |

***Dr. Goldhammer, Irrigation Specialist, UC KAC, conducted a Regulated Deficit Irrigation trial producing these results for canning olives ----***

| Irrigation Regime (% water saved) | Individual Fresh Fruit Wt. (g) | Fruit Load (#/tree) | Total Fruit Yield (tons/acre) | Crop Value ($/ton) | Gross Revenue ($/acre) |
|---|---|---|---|---|---|
| Control | 4.12 | 19690 | 8.12 | 412 | 3340 |
| T2 (13%) | 4.15 | 18200 | 7.65 | 431 | 3310 |
| T3 (21%) | 4.11 | 20010 | 8.25 | 430 | 3580 |
| T5 (40%) | 4.23 | 16070 | 6.61 | 426 | 2800 |
| | NSD | NSD | NSD | NSD | NSD |

# *Summary ---*

- ✓ **Fruit growth slows during the imposition of *regulated* deficit irrigation (RDI) but accelerates upon reintroduction of full irrigation.**
- ✓ **RDI regime saved up to 21% (7.4 in) of normal water use (35.4 in) and had no effect on fruit size.**

# *Conclusions ---*

- ✓ **Even for canning olives, a RDI strategy can save water while maintaining top yields of high quality fruit.**
- ✓ **Know what you're doing & must have good control of your water applications.**