Oregon State University
Western Oregon
Orchard Irrigation Guide

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Total Seasonal Evapotranspiration [in]	28.3
Peak Evapotranspiration Rate [in/day]	0.25
Maximum Allowable Depletion [percent]	75
Critical Moisture Deficit Period	none

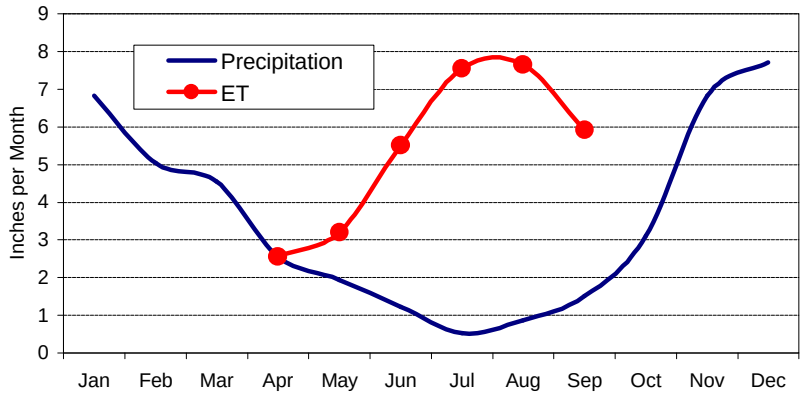

Figure 1: Typical precipitation and orchard evapotranspiration (ET) in the Willamette Valley. Tabulated values of ET are provided on the back of this sheet.

The worksheet for this guide is based upon water use calculations of mature apple trees. Irrigation scheduling with these numbers is appropriate for other full-canopy orchard crops such as cherries, peaches, and pears.

In mature orchards, roots likely extend to considerable depth (up to 6 feet). Therefore, the upper soil may be largely depleted of water before an irrigation is necessary. In addition, the maximum allowable depletion for orchard production is also considered very high (e.g., the use of a maximum allowable depletion of 75% of the available water capacity is common practice). These characteristics have generally resulted in long irrigation intervals for orchard crops. However, young trees with a much less developed root system than mature trees may have to be irrigated up to two times per week.

Water stress early in the season may negatively affect the rate of shoot initiation as well as shoot elongation. Similarly, significant water deficit in the summer and fall is detrimental to the formation of flower buds in the next season. Fruit size, number, and quality also decreases under moisture stress. On the other hand, excess soil moisture combined with poor aeration may lead to the infection of roots and crowns with diseases. A mild water deficit has shown to enhance the color of apples and to reduce their acidity. Another general recommendation is to lessen irrigation after harvest.

The peak water use for apple trees is approximately 0.25 inches per day for August.

On the back side of this page is a worksheet to aid in calculating irrigation schedules for orchard. These calculations are most straightforward for those using side-roll, hand-move, or solid set sprinkler irrigation. For those with linear move or center pivot systems, all information applies except for the set time, which must be gauged to the tower travel speed. For basic schedule information, sprinkler nozzle diameters, operating pressures, and spacing and soil type must be known. To more accurately describe individual systems, the uniformity coefficient of the system and available water capacity of your soil is also needed. This worksheet was designed to be progressed through sequentially starting with item *a*). Equations listed under item headings use item letters for reference. Although the rooting depth is already supplied in the worksheet, if you have reason to believe your site is an exception (e.g. shallow restrictive layer), this may be altered.

References

1. B.A. Stewart and D.R. Nielsen. 1990. Irrigation of Agricultural Crops. American Society of Agronomy Nr.30, Madison, Wisconsin.

Note: For additional background information and references, see "Western Oregon Irrigation Guides: Background and References."

Irrigation Schedule Worksheet: Orchard (Apple)

Use values for your specific soil and depth range from the Appendix, if available.

Otherwise use Table 1 below.

A. Determine Irrigation Interval

Available Water Capacity [in/in]	*a.*	
Maximum Allowable Depletion [percent]	*b.*	75
Effective Rooting Depth [in]	*c.*	36
Peak ET [in/day]	*d.*	0.25
Maximum Irrigation Interval [days]	*e.*	
e = (a * b * c) / (d * 100)		
Your Irrigation Interval [days]	*f.*	
Note: f should be equal to or shorter than e.		

Table 1

Soil Texture	AWC [in/in]
Sandy	0.07 to 0.10
Sandy Loam	0.09 to 0.15
Loam	0.14 to 0.19
Clay Loam	0.17 to 0.22
Clay	0.20 to 0.25

B. Determine Combined Efficiency

Uniformity Coefficient	*g.*	
Combined Efficiency	*h.*	
h = (0.01583 * g) - 0.6327		

Table 2

Irrigation System	Uniformity Coefficient (*)	
Solid set	70	63
Hand move or Side-roll	82	74
Pivot or Linear Move	90	81
Offset Managed Handm.	90	81

C. Determine Depth of Irrigation

		April	May	June	July	August	September
Monthly Evapotranspiration Rate [in/day]	*i.*	0.09	0.10	0.18	0.24	0.25	0.20
Depth of Irrigation per Set [in]	*j.*						
j = (i * f) / h.							

D. Determine Set Time

Application Rate [in/hr]	*k.*	
Measure or see Tables 3 and 4 below to determine your application rate.		

		April	May	June	July	August	September
Irrigation Set Time [hrs]	*l.*						
l = j / k							

Table 3

Pressure [psi]	Discharge [gpm] Standard Tapered Nozzle Diameter [in] 3/32	1/8	9/64	5/32	11/64	3/16	13/64	7/32
35	1.5	2.7	3.40	4.16	5.02	5.97	7.08	8.26
40	1.6	2.9	3.63	4.45	5.37	6.41	7.60	8.87
45	1.7	3.2	3.84	4.72	5.70	6.81	8.07	9.41
50	1.8	3.1	4.04	4.98	6.01	7.18	8.49	9.88
55	1.9	3.3	4.22	5.22	6.30	7.51	8.87	10.30

Table 4

Sprinkler Spacing [ft] -by- [ft]	Application Rate [in/hr] Discharge per Nozzle [gpm] 2	3	4	5	6	8	10
20 20	0.48	0.72	0.96	1.20	1.44	1.93	2.41
20 40	0.24	0.36	0.48	0.60	0.72	0.96	1.20
30 30	0.21	0.32	0.43	0.54	0.64	0.86	1.07
30 40	0.16	0.24	0.32	0.40	0.48	0.64	0.80
30 50	0.13	0.19	0.26	0.32	0.39	0.51	0.64
40 40	0.12	0.18	0.24	0.30	0.36	0.48	0.60
40 50	0.10	0.14	0.19	0.24	0.29	0.39	0.48
40 60	0.08	0.12	0.16	0.20	0.24	0.32	0.40

(*) If your sprinkler spacing/discharge combination falls into gray-shaded area, use uniformity coefficient from the right, also gray-shaded column. Otherwise use values from the left column.

How to use these tables: