



Determining Crop Evapotranspiration

By Larry Schwankl¹, Allan Fulton², Terry Prichard³

¹ Irrigation Specialist, University of California Cooperative Extension

² Irrigation and Water Resources Advisor, UC Cooperative Extension, Tehama County

³ Irrigation Water Management Specialist, UC Cooperative Extension

Crop water use (also known as evapotranspiration or ET) will vary as the seasons change and the crop grows. Early after planting, the crop canopy and root zone are small and undeveloped, so it can't take up much water at one time. The growth rate is fairly high, so the plant's need for water is changing fairly rapidly. Ideally, small but frequent irrigations would be preferred. Unfortunately, because the soil has been recently cultivated and because the irrigation infrastructure may not be able to deliver small amounts of water; early season irrigations are often large and, it follows, a high level of drainage may occur.

As the crop grows and temperatures increase, crop ET will reach a plateau in the middle of the season. Then, as the crop approaches maturity, crop ET will taper off, although higher temperatures for spring and summer crops will tend to reduce this effect.

You can use a table to look up the specific crop water needs during a given time period. This is the first step in determining whether leaching is occurring on a specific field during a single irrigation event. Corn, alfalfa, wheat, and barley ET tables are provided below.

To use the tables:

1. For corn, find the table with the planting date nearest to your actual planting date (Tables 1-5). For alfalfa, use Table 6 and go directly to step 2.
2. For wheat and barley, use Table 7 and go directly to step 2.
3. For corn, identify the column nearest to your location. For wheat and barley, identify the column that most closely matches your crop.
3. In the column to the far left, locate the row with the date range that begins nearest to the date of your last irrigation.
4. Follow the row over to the column you identified in #2 above and use the number in the box for daily ET.
5. Multiply the daily crop ET (in/day, from the table) by the number of days that have passed since your last irrigation. This is the crop ET to use in calculating the volume to apply in the coming irrigation.
6. Proceed to CDQAP WDR Binder document 11.5 Determining Whether Nutrients are Leaching from your Fields.

Example of a crop ET calculation:

Crop: Corn
 Location: Madera
 Planted March 15
 Irrigated April 2
 Today's date: April 15

Using Table 2 (plant date March 15), row 2 (time period April 1-15), column 1 (Madera):

Daily ET = 0.03 in/day

Number of days that have passed between the last irrigation and today: 15-2 = 13

Crop ET = 0.03 in/day x 13 days = 0.39 in

The corn only needs 0.39 inches of water to replace what it has used since the last irrigation.

Table 2. Corn (Planted March 15) ET (in/day)

	Location					
	Madera	Merced	Stockton	Modesto	Parlier	Visalia
Mar 16-31	0.02	0.02	0.00	0.02	0.02	0.02
Apr 1-15	0.03	0.03	0.03	0.03	0.03	0.03
Apr 16-30	0.08	0.08	0.08	0.08	0.08	0.09
May 1-15	0.15	0.14	0.14	0.14	0.17	0.16
May 16-31	0.23	0.24	0.22	0.24	0.25	0.24
Jun 1-15	0.29	0.29	0.28	0.30	0.30	0.30
Jun 16-30	0.32	0.32	0.30	0.30	0.32	0.32
July 1-15	0.28	0.28	0.26	0.26	0.27	0.27
July 16-31	0.21	0.21	0.20	0.20	0.19	0.21
Aug 1-15	0.13	0.13	0.12	0.12	0.12	0.13
Total	26.18	26.15	24.56	25.54	26.43	26.51

Information in this document was compiled by UCCE and CDQAP to assist dairy producers in understanding and complying with the General Order Waste Discharge Requirements for Existing Milk Cow Dairies (Central Valley Regional Water Board Order R5-2007-0035). Effort has been made to ensure accuracy, but these summaries are not official regulatory guidance and are not legal advice. Producers are advised that these summaries are not intended to be a substitute for producers reading the complete order and consulting their own legal counsel to ensure compliance with the waste discharge requirements. Should any information here conflict with the General Order and/or official information provided by the Regional Board, Board-provided information takes precedence.

Table 1. Corn (Planted March 1) ET (in/day)

	Location					
	Madera	Merced	Stockton	Modesto	Parlier	Visalia
Mar 1-15	0.02	0.02	0.02	0.02	0.02	0.02
Mar 16-31	0.02	0.02	0.00	0.02	0.02	0.02
Apr 1-15	0.06	0.06	0.06	0.06	0.07	0.07
Apr 16-30	0.14	0.14	0.14	0.14	0.14	0.15
May 1-15	0.22	0.21	0.21	0.21	0.24	0.23
May 16-31	0.26	0.27	0.25	0.27	0.28	0.27
Jun 1-15	0.29	0.29	0.28	0.30	0.30	0.30
Jun 16-30	0.29	0.29	0.28	0.28	0.29	0.29
July 1-15	0.22	0.22	0.21	0.21	0.21	0.21
July 16-31	0.15	0.15	0.14	0.14	0.13	0.14
Total	24.99	25.00	23.60	24.62	25.88	25.72

Table 2. Corn (Planted March 15) ET (in/day)

	Location					
	Madera	Merced	Stockton	Modesto	Parlier	Visalia
Mar 16-31	0.02	0.02	0.00	0.02	0.02	0.02
Apr 1-15	0.03	0.03	0.03	0.03	0.03	0.03
Apr 16-30	0.08	0.08	0.08	0.08	0.08	0.09
May 1-15	0.15	0.14	0.14	0.14	0.17	0.16
May 16-31	0.23	0.24	0.22	0.24	0.25	0.24
Jun 1-15	0.29	0.29	0.28	0.30	0.30	0.30
Jun 16-30	0.32	0.32	0.30	0.30	0.32	0.32
July 1-15	0.28	0.28	0.26	0.26	0.27	0.27
July 16-31	0.21	0.21	0.20	0.20	0.19	0.21
Aug 1-15	0.13	0.13	0.12	0.12	0.12	0.13
Total	26.18	26.15	24.56	25.54	26.43	26.51

Table 3. Corn (Planted April 1) ET (in/day)

	Location					
	Madera	Merced	Stockton	Modesto	Parlier	Visalia
Apr 1-15	0.03	0.03	0.03	0.03	0.03	0.03
Apr 16-30	0.04	0.04	0.04	0.04	0.04	0.04
May 1-15	0.10	0.09	0.09	0.09	0.11	0.10
May 16-31	0.17	0.17	0.16	0.17	0.18	0.17
Jun 1-15	0.25	0.25	0.24	0.26	0.26	0.26
Jun 16-30	0.30	0.30	0.29	0.29	0.30	0.30
July 1-15	0.31	0.31	0.29	0.29	0.30	0.30
July 16-31	0.30	0.30	0.28	0.28	0.27	0.29
Aug 1-15	0.21	0.20	0.19	0.19	0.19	0.20
Aug 16-31	0.12	0.12	0.12	0.11	0.12	0.12
Total	27.20	27.03	25.72	26.16	26.94	27.20

Table 4. Corn (Planted May 1) ET (in/day)

	Location					
	Madera	Merced	Stockton	Modesto	Parlier	Visalia
May 1-15	0.04	0.04	0.04	0.04	0.04	0.04
May 16-31	0.05	0.05	0.04	0.05	0.05	0.05
Jun 1-15	0.14	0.14	0.13	0.14	0.14	0.14
Jun 16-30	0.24	0.24	0.23	0.23	0.24	0.24
July 1-15	0.30	0.30	0.28	0.28	0.29	0.29
July 16-31	0.30	0.30	0.28	0.28	0.27	0.29
Aug 1-15	0.28	0.27	0.25	0.25	0.25	0.27
Aug 16-31	0.20	0.19	0.19	0.18	0.20	0.20
Sept 1-15	0.13	0.13	0.07	0.13	0.13	0.14
Total	24.88	24.59	22.52	23.51	24.03	24.64

Table 5. Corn (Planted June 1) ET (in/day)

	Location					
	Madera	Merced	Stockton	Modesto	Parlier	Visalia
Jun 1-15	0.08	0.08	0.07	0.08	0.08	0.08
Jun 16-30	0.18	0.18	0.17	0.17	0.18	0.18
July 1-15	0.29	0.29	0.27	0.27	0.28	0.28
July 16-31	0.30	0.30	0.28	0.28	0.27	0.29
Aug 1-15	0.28	0.27	0.26	0.26	0.26	0.27
Aug 16-31	0.23	0.22	0.22	0.21	0.23	0.23
Sept 1-15	0.15	0.15	0.08	0.14	0.14	0.16
Sept 16-30	0.07	0.07	0.07	0.07	0.07	0.07
Total	23.72	23.41	21.34	22.22	22.63	23.47

Table 6. Alfalfa ET (in/day)

Date	Location				
	Orland	Davis	Stockton	Fresno	Bakersfield
Jan 1-15	0.04	0.03	0.03	0.03	0.03
Jan 16-31	0.05	0.04	0.03	0.04	0.05
Feb 1-15	0.06	0.05	0.05	0.06	0.07
Feb 16-28	0.08	0.07	0.07	0.08	0.08
March 1-15	0.10	0.10	0.10	0.10	0.11
March 16-31	0.12	0.13	0.12	0.13	0.14
Apr 1-15	0.15	0.17	0.16	0.17	0.17
Apr 16-30	0.18	0.19	0.18	0.19	0.20
May 1-15	0.21	0.22	0.21	0.22	0.23
May 16-31	0.23	0.24	0.23	0.24	0.25
June 1-15	0.25	0.26	0.24	0.26	0.27
June 16-31	0.26	0.27	0.25	0.27	0.28
July 1-15	0.27	0.28	0.26	0.27	0.28
July 16-31	0.25	0.28	0.25	0.25	0.28
Aug 1-15	0.23	0.26	0.24	0.24	0.27
Aug 16-31	0.22	0.24	0.21	0.22	0.24
Sept 1-15	0.19	0.03	0.18	0.19	0.21
Sept 16-30	0.17	0.04	0.16	0.15	0.18
Oct 1-15	0.14	0.05	0.12	0.13	0.15
Oct 16-31	0.11	0.07	0.10	0.09	0.12
Nov 1-15	0.09	0.10	0.06	0.07	0.09
Nov 16-30	0.07	0.13	0.05	0.04	0.06
Dec 1-15	0.06	0.17	0.03	0.03	0.05
Dec 16-31	0.05	0.19	0.03	0.02	0.04
Total	53.7	54.15	50.4	52.35	57.75

Table 7. Wheat and Barley ET (in/day) for the Central Valley of California

Month	Wheat Boot Forage Planted 12/1	Wheat Dough Forage	Wheat Grain Planted 12/15	Barley Grain Planted 12/1
Dec 1-15	0	0	0	0.01
Dec 16-31	0	0	0	0.02
Jan 1-15	0.01	0.01	0.01	0.02
Jan 16-31	0.02	0.02	0.02	0.03
Feb 1-15	0.03	0.03	0.03	0.04
Feb 16-28	0.05	0.05	0.05	0.07
Mar 1-15	0.11	0.11	0.11	0.11
Mar 16-31	0.16	0.16	0.16	0.16
Apr 1-15	0.19	0.19	0.19	0.19
Apr 16-30		0.22	0.22	0.19
May 1-15		0.25	0.25	0.19
May 16-31		0.25	0.25	0.11
Jun 1-15			0.19	0.01
Total	8.55	16.9	22.7	17.25