Climate based approach to the estimation of water requirements of plants grown in the field

ETo, Class A pan & Kc

- The estimation of crop water use requires two pieces of information:
  - the calculation or measurement of water loss from a standard surface and
  - the coefficient that relates water loss from this standard surface to that of a particular crop.
- The rate of water loss from a standard surface is derived from either measurements of temperature, sun shine hours, wind speed, and humidity or measurement of the depth of water evaporating from a pan.
- The estimate based on measurements of weather variables is known as **reference evapotranspiration (ETo)** and that from depth of water loss as **Class A pan evaporation (Epan)**.

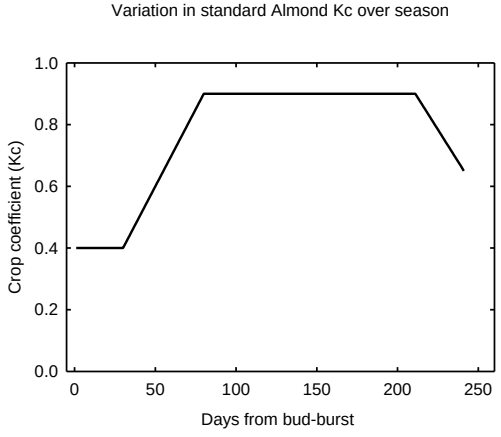
Reference evapotranspiration (ETo)

Class A pan evaporation

- Reference evapotranspiration (ETo) is an estimate of the water use by a well watered grass. Local values can be found at: http://www.bom.gov.au/watl/eto/tables/sa/edinburgh_raaf/edinburgh_raaf.shtml
- Class A pan evaporation (Epan) has been found to represent about 1.25 the value of ETo
- The water use of a crop (ETcrop) is related to that of grass (ETo) through the use of crop coefficients (Kc).

ETcrop = Kc x ETo **OR** **ETcrop = 0.8 x Kc x Epan**

- For a particular crop the values of crop coefficients vary with crop growth stage, climatic region, and the deviations of wind speed and humidity from standard conditions. These values estimate water loss from extensive stand of a non-stressed crop. They can be adjusted by the use of stress factors to account for the effects of that soil salinity and soil drought have on crop water use.



Estimates of almond and potato water use from local data

Estimates of monthly crop water use under standard conditions were based on ETo calculated from the monthly averages of data collected at the Edinburgh_RAAF weather station between 1974 and 2014. The salinity of water received by the crop was calculated assuming that the salinity of irrigation water was 1.8 dS/m and of rain 0.04 dS/m. ETcrop was calculated using crop coefficients applicable to the California USA.

Almond water use (1/9- 30/4), effective rain, irrigation requirement and salinity of received water

	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total/ wghtd av.
ET crop (almond) (mm)	33	69	132	162	174	150	123	64	906
Rain effective (mm)	38	30	16	16	13	12	17	19	161
Irrigation (mm)	0	34	116	145	161	133	106	45	740
Water salinity (dS/m)	0.0	0.7	1.4	1.5	1.5	1.5	1.4	1.0	1.3

Winter potato water use (30/5 – 17/10), effective rain, irrigation requirement and salinity of received water

	May	June	July	Sept	Oct	Nov	Total/ wghtd av.
ET crop (potato) (mm)	3	25	36	64	91	43	262
Rain effective (mm)	2	44	43	39	38	17	183
Irrigation (mm)	0	0	0	0	54	27	81
Water salinity (dS/m)	0.2	0.0	0.0	0.4	0.8	0.8	0.5

Effective rainfall

- Summer: 65% of total rain or the sum of rain falling at a rate greater than 5 mm/24 hours
- Winter: 80% of total rain or the sum of rain falling at a rate greater than 5 mm/48 hours

Use & limitation

Climate based estimations of crop water use can be used to plan irrigations see:

http://www.depi.vic.gov.au/agriculture-and-food/horticulture/vegetables/vegetable-growing-and-management/estimating-vegetable-crop-water-use

However, this approach to planning has uncertainty associated with an absence of data on soil water content at the break of the season and with the assumption that the crop is growing under standard conditions. These uncertainties can be addressed by using this approach in conjunction with measurements of soil water content.