Irrigation Best Management Practices

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Presented by

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Soils

- Water holding capacity (texture and structure)
- Salinity or chemistry issues (saline soils need to be maintained at a higher soil moisture level)
- Infiltration rate (texture, structure, compaction)
- Soil health (water holding capacity, structure, fertility, organic matter, microbiome, etc.)
- Fertility (healthy crops need more water) (yield is function of water use)

Your production goals

- Yield
- Quality
- Fruit size
- Enhance the soil (cover crops, vegetation between produce rows)

Irrigation Water Quality

- Water Total Dissolved Solids (TDS)
- Chemistry (know and understand)

Examples of water quality – Sample 3 is from the Green River, the other samples are from drainage and irrigation runoff from saline soils.

USU Lab Sample	Total (mg/L)	Salts (tons/ac-ft)
1	18,723	25.5
2	17,610	23.9
3	467	0.6
4	17,940	24.4
5	18,379	25.0
6	20,612	28.0

Crops

- Rooting depths – examples of shallow (lettuce, onions, spinach, strawberries), medium (cabbage, cauliflower, carrots, beets, cucumbers, potatoes, beans), deeper (corn, melons, asparagus, fruit trees, grapes, cane fruit)
- Sensitivity to soil moisture (different at each stage of growth)
- Sensitivity to water quality

Controlling weeds reduces water use.

Critical Growth Periods

Transplants (establishment)

Most fresh vegetables (flowering through harvest or senescing)

Sweet corn (silk – harvest)

Tomato (transplanting, early flowering, fruit set, enlargement)

Root crops (tuber/root development)

Melons/squash (pollination and fruit development)

Least sensitive time is generally vegetative growth

Irrigation System

- Irrigation system type
- Irrigation application rate
- Irrigation uniformity

- Sprinkler
- Drip
- Surface

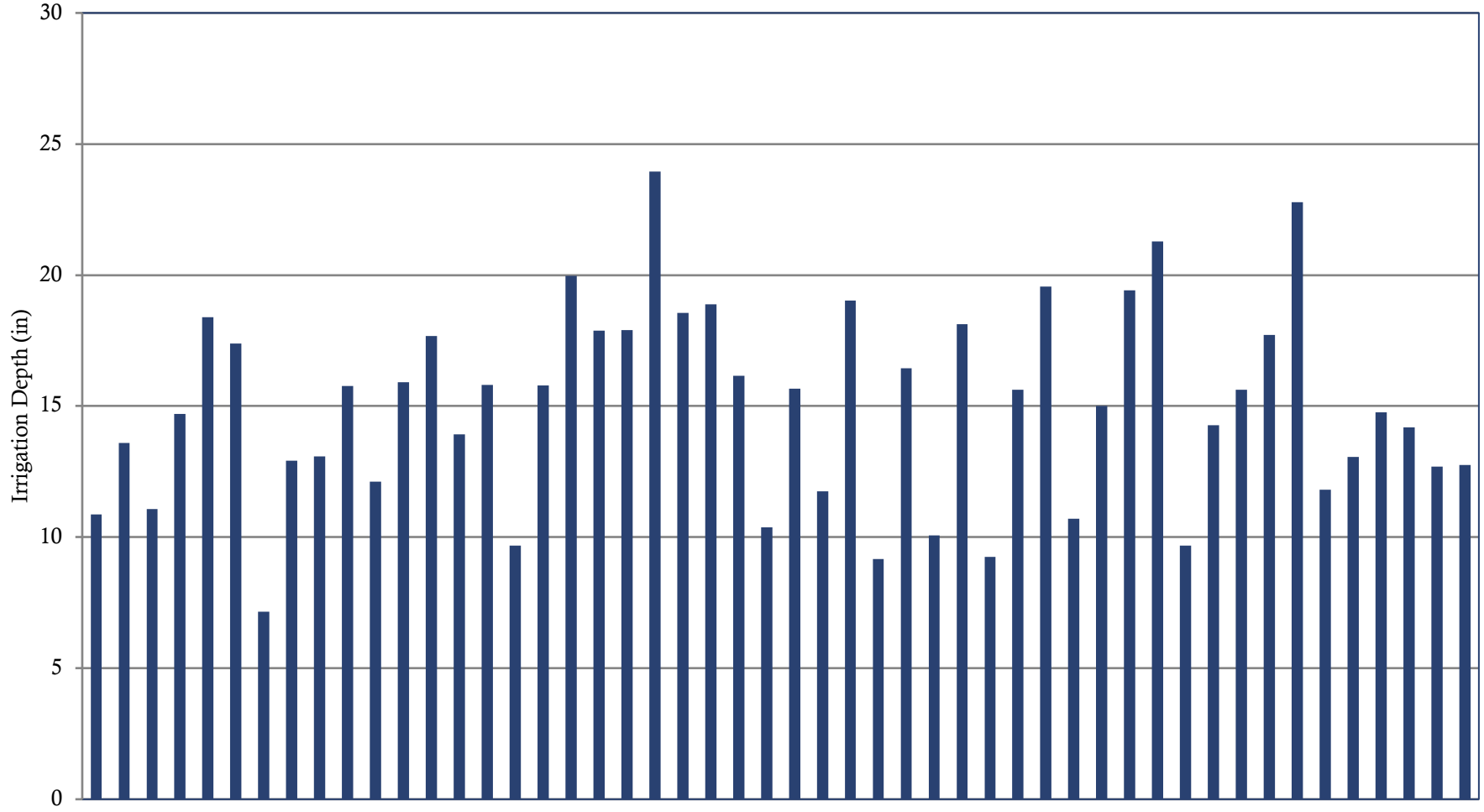
Drip Irrigation

- **First irrigation is important**
  - Wet past seeds or transplants – After the first irrigation it can be difficult to move water past wetting edge of the first irrigation
- Design to minimize pressure differences or use **good pressure compensating emitters**
- Pressure difference can be several psi in large system, or in sloping ground. For example, my yard has about 20 feet (8.7 psi) difference in elevation.
- Irrigate more frequent with drip than with sprinkler or surface (the wetted soil volume is less)

Sprinkler Irrigation

- Proper design
  - Irrigation Uniformity (worse than drip and surface in the scale of sprinkler spacing, for example 40 by 60 foot spacing)
  - Proper pressures is needed for good uniformity (not too high or too low)
  - Application rate
- Field edge affects (overlap improves uniformity)
- Wind affects (can result in a significant water loss)

Irrigation Depth Distribution (80% Coefficient of Uniformity)



Average Irrigation of 15 inches

Increasing Uniformity

- Improve Irrigation System Uniformity (minimize deep percolation)
- Replace sprinklers, gaskets, and fix leaks
- Upgrade irrigation system
- Level fields to uniform and proper grade (when practical)
- Adjust furrow or border flow rate

Surface Irrigation

- Highly dependent on infiltration rate of soil
- Level fields
- Flow rate
- Set time
- Intake opportunity time uniformity

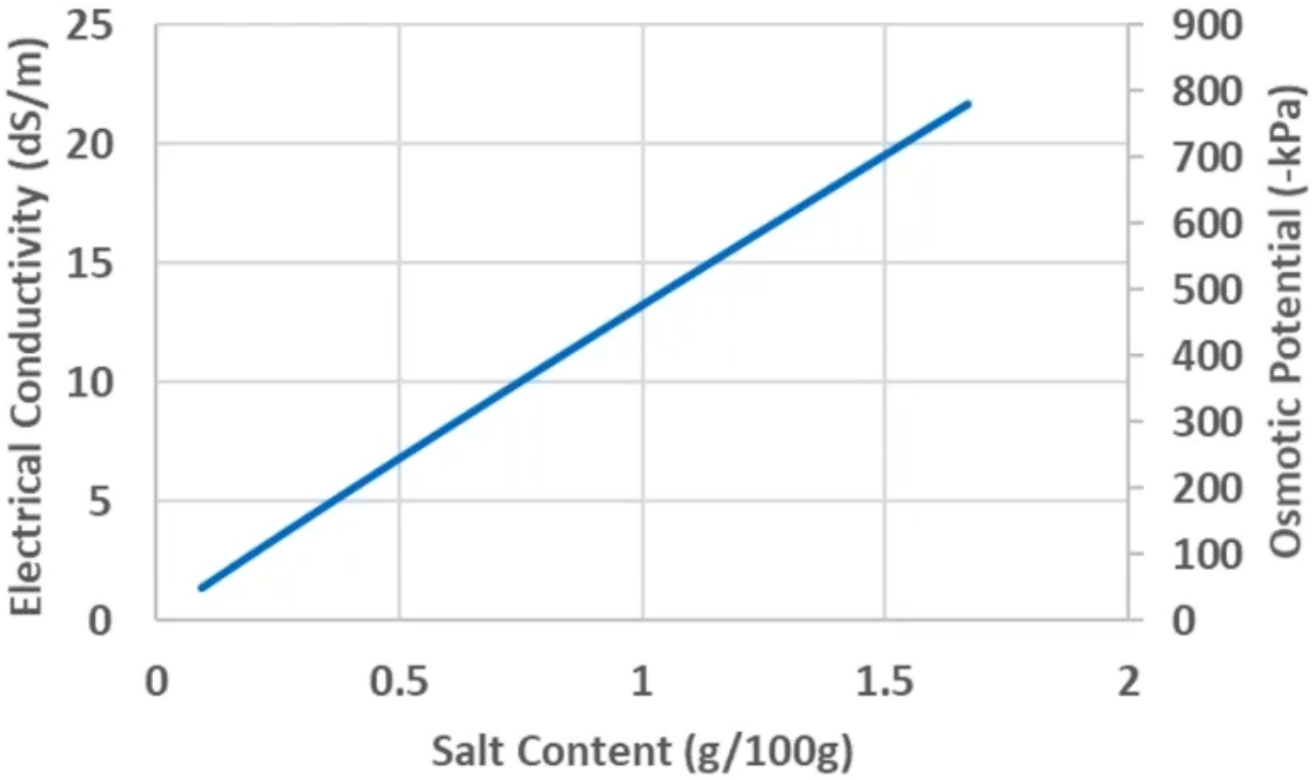
Irrigation System Operation and Maintenance

- Monitor your irrigation (before, during, after) soils, system, etc.
- Run your system in the day when you can observe any problems.
- Leaks, properly operating sprinklers, plugged emitters, etc.

Mulches

- Organic (reduction in soil evaporation)
- Plastic (my experience is about 10 percent less water)

Impact of salts in soil



Crop Soil Water Salinity Tolerance (Maas and Hoffman (1977), plus many other studies.

Sensitive	Moderately Sensitive	Moderately Tolerant	Tolerant
Apple	Alfalfa	Red beet	Barley
Bean	Broccoli	Safflower	Sugar beet
Carrot	Cabbage	Wheat	Asparagus
Onion	Corn	Wheatgrass	
Peach	Cucumber	(many pasture grasses)	
Plum	Grape	Summer Squash	
Strawberry	Lettuce		
Pea	Watermelon, Potato		
Raspberry	Spinach, Radish		
	Tomato, Pepper		

Crops will grow at in more saline soils, but yield will be reduced. Maintaining higher soil water content helps with higher salt.

Electronic Weather Station

Evapotranspiration
Evaporation from ground and wet plants
Transpiration from plants

Reference ET
Potential Crop ET
Actual ET
Units are typically inches or mm per day

Temperature
Wind (velocity and direction)
Humidity
Solar radiation
Soil temperatures
Soil moisture

Utah Ag Weather Network – Real Time Daily

https://climate.usurf.usu.edu/mchd/index.php

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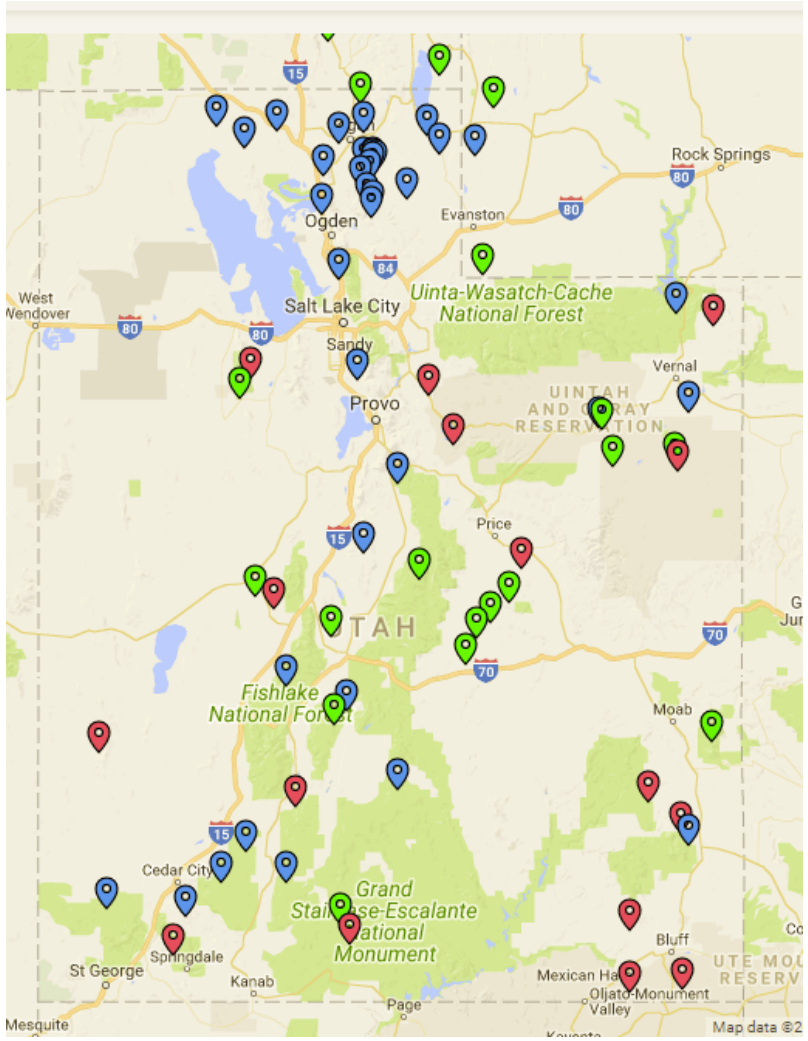

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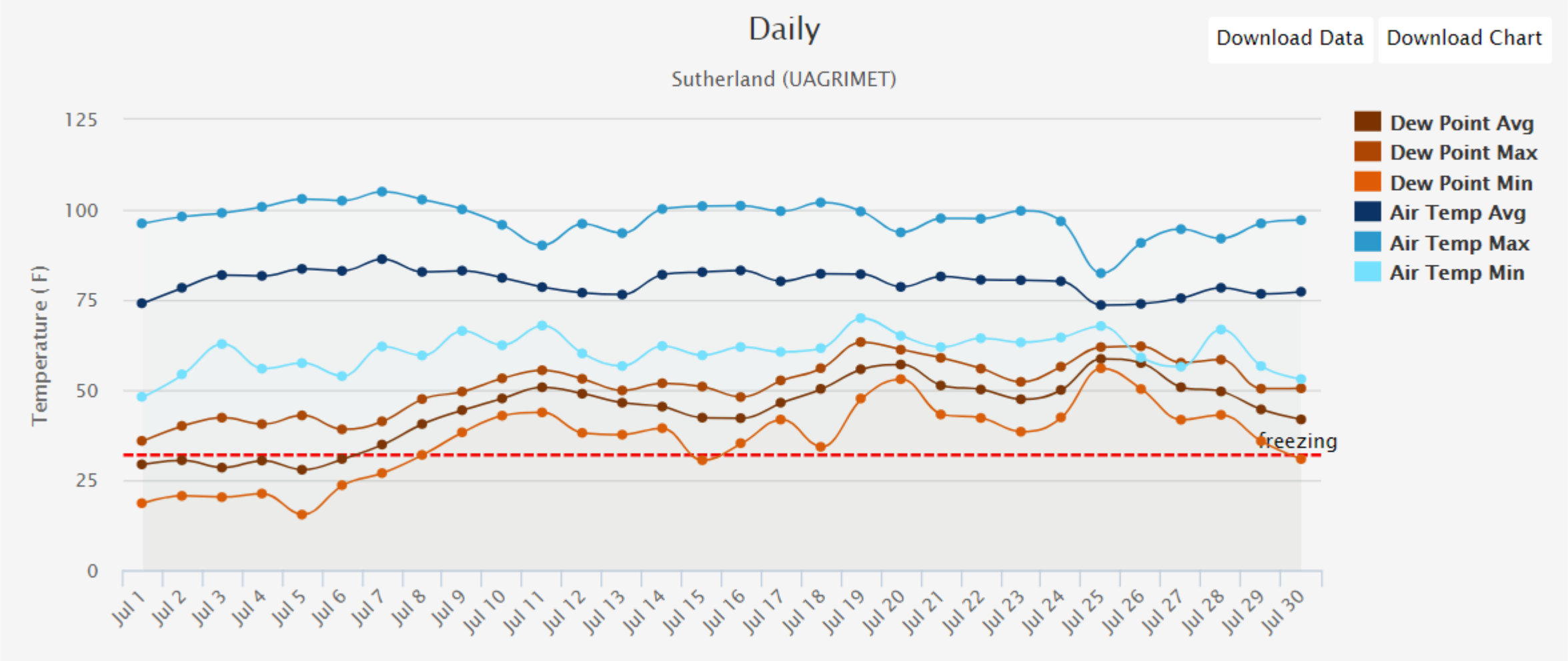
Utah Climate Center – Webpage visit

- https://climate.usu.edu/index.php

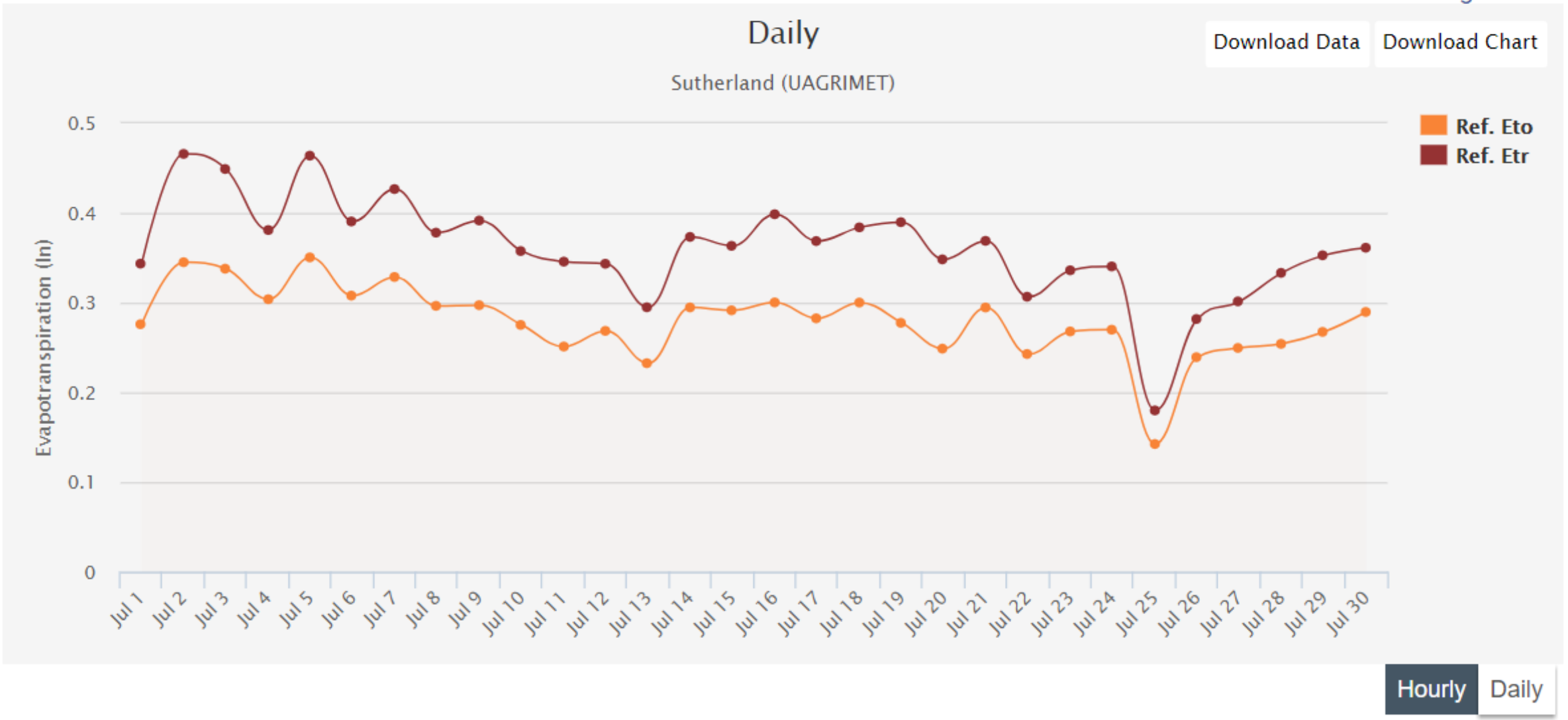
- Use of ETo and ETr

Temperature & Dew Point

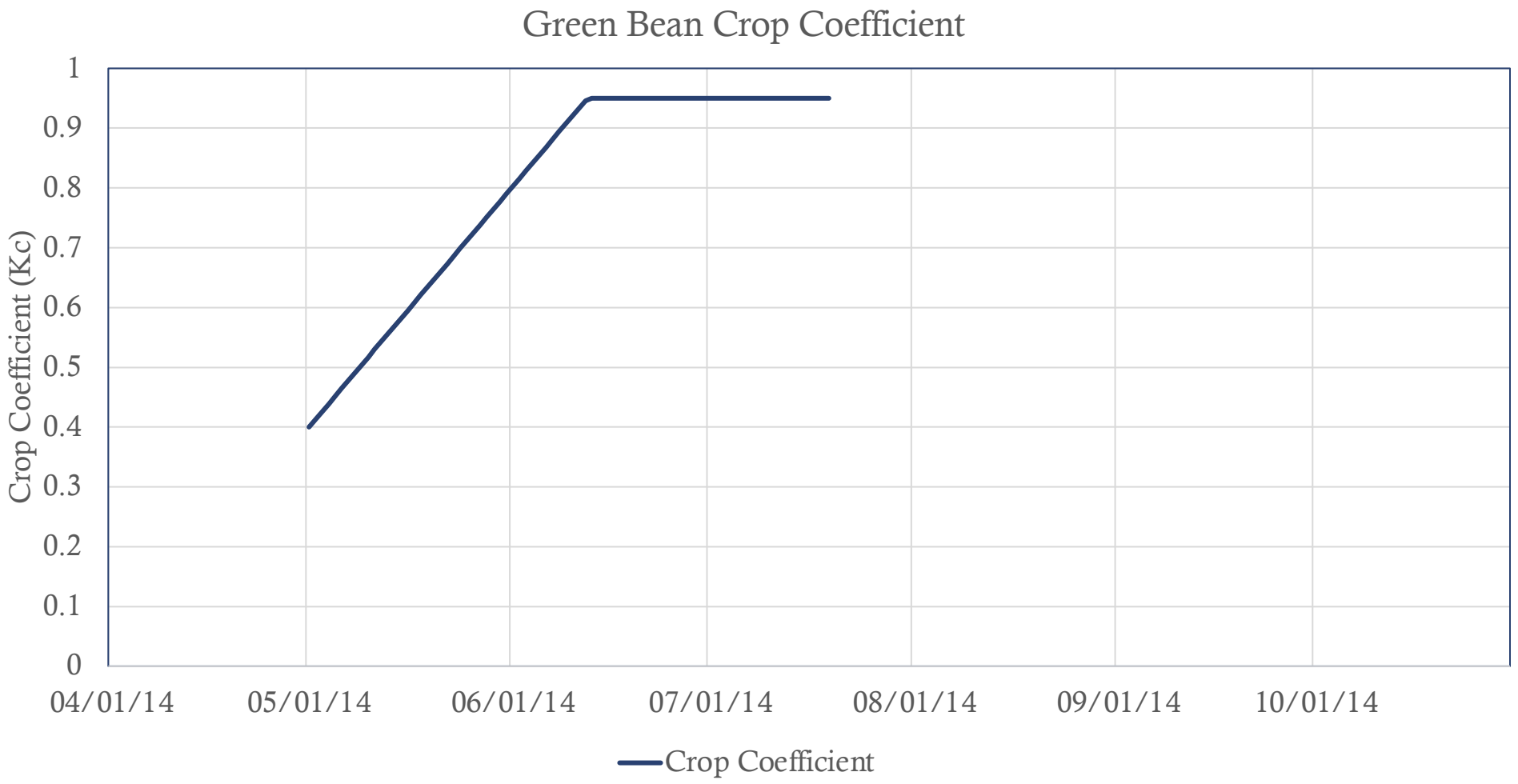
Learn how to use Highcharts



Evapotranspiration



Example of Crop Coefficient
Estimated ET crop = Kc * ETr

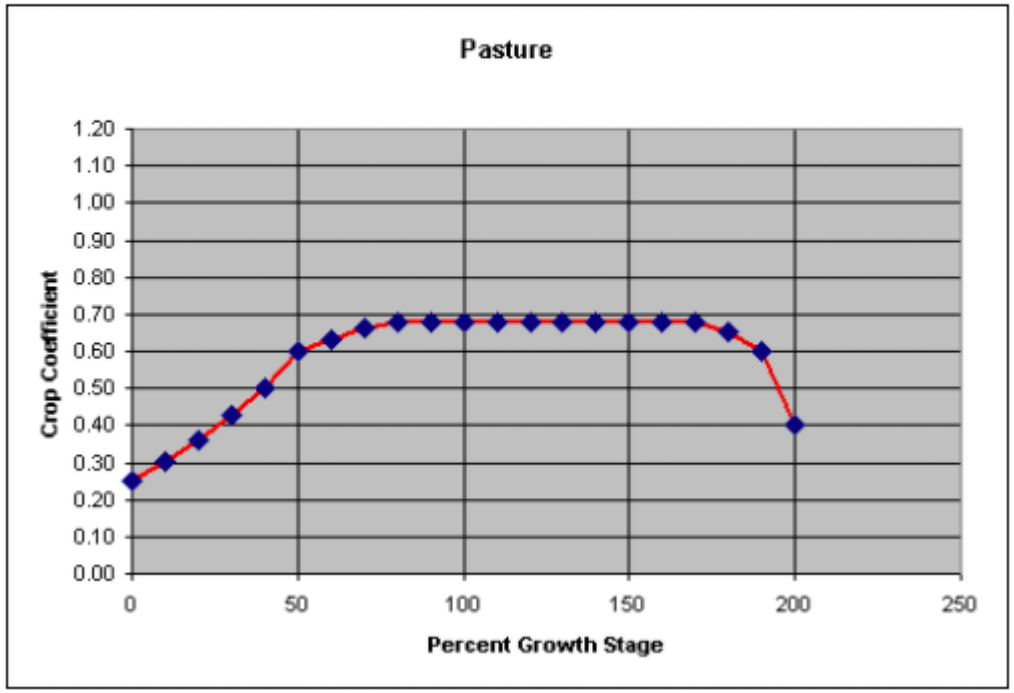


http://www.usbr.gov/pn/agrimet/cropcurves/crop_curves.html

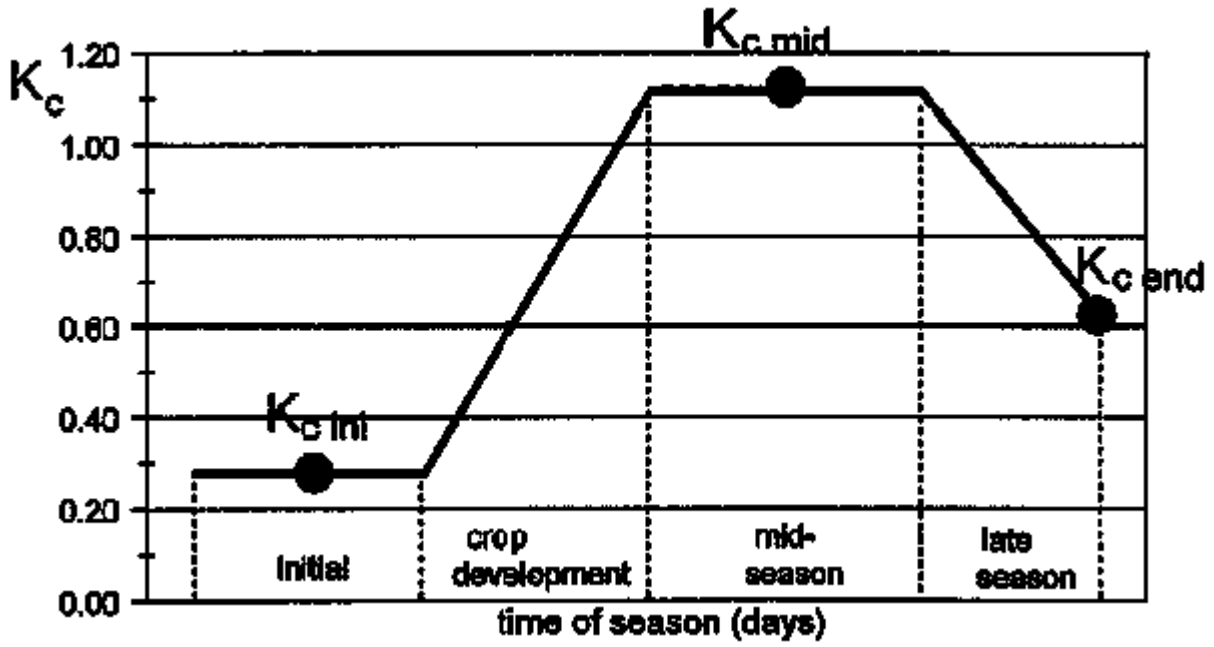
Crop Coefficients (ET=Kc*ETo or ETr)

ETr (alfalfa or tall crop reference)

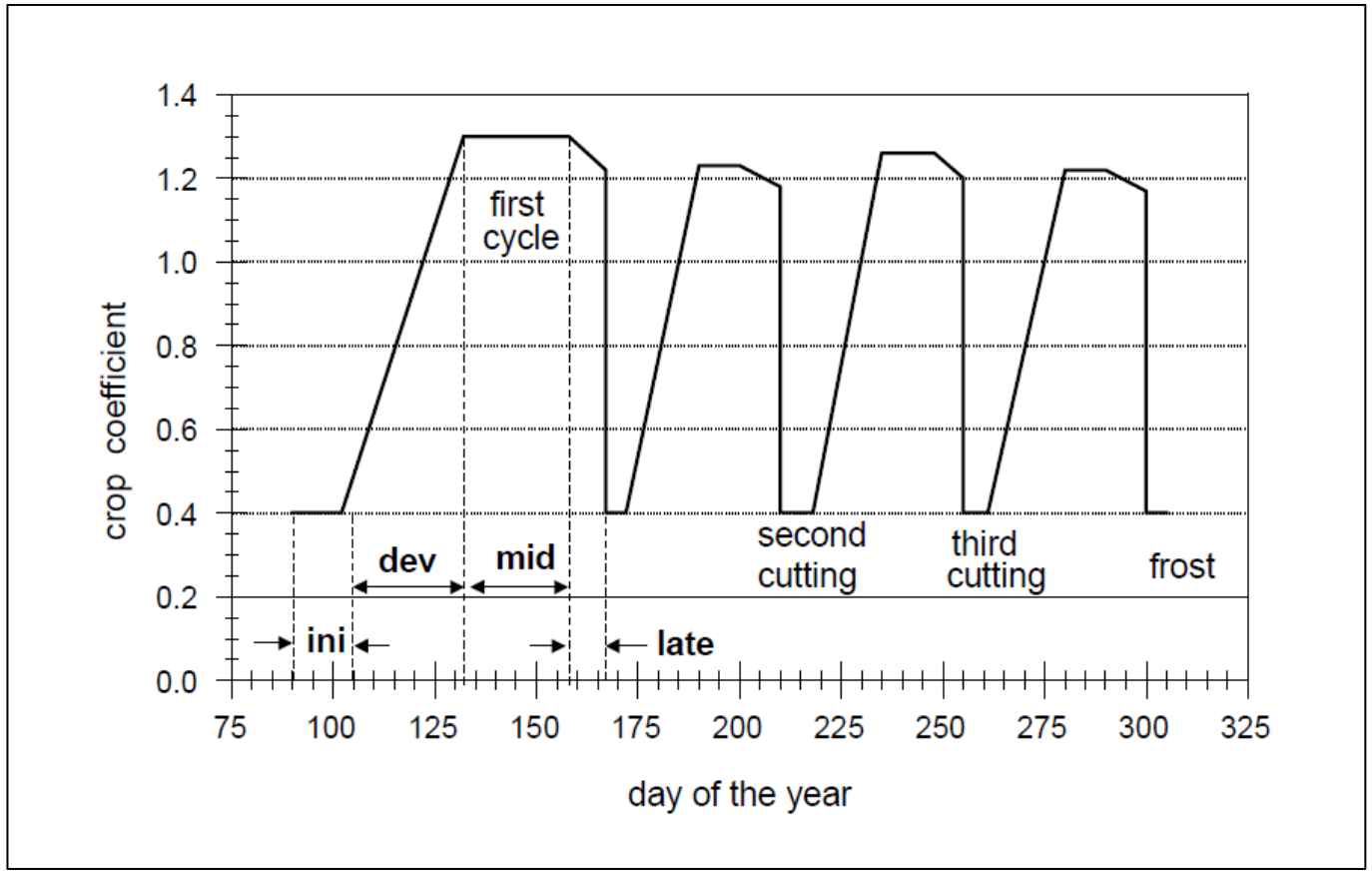
AgriMet Crop Coefficients: Pasture



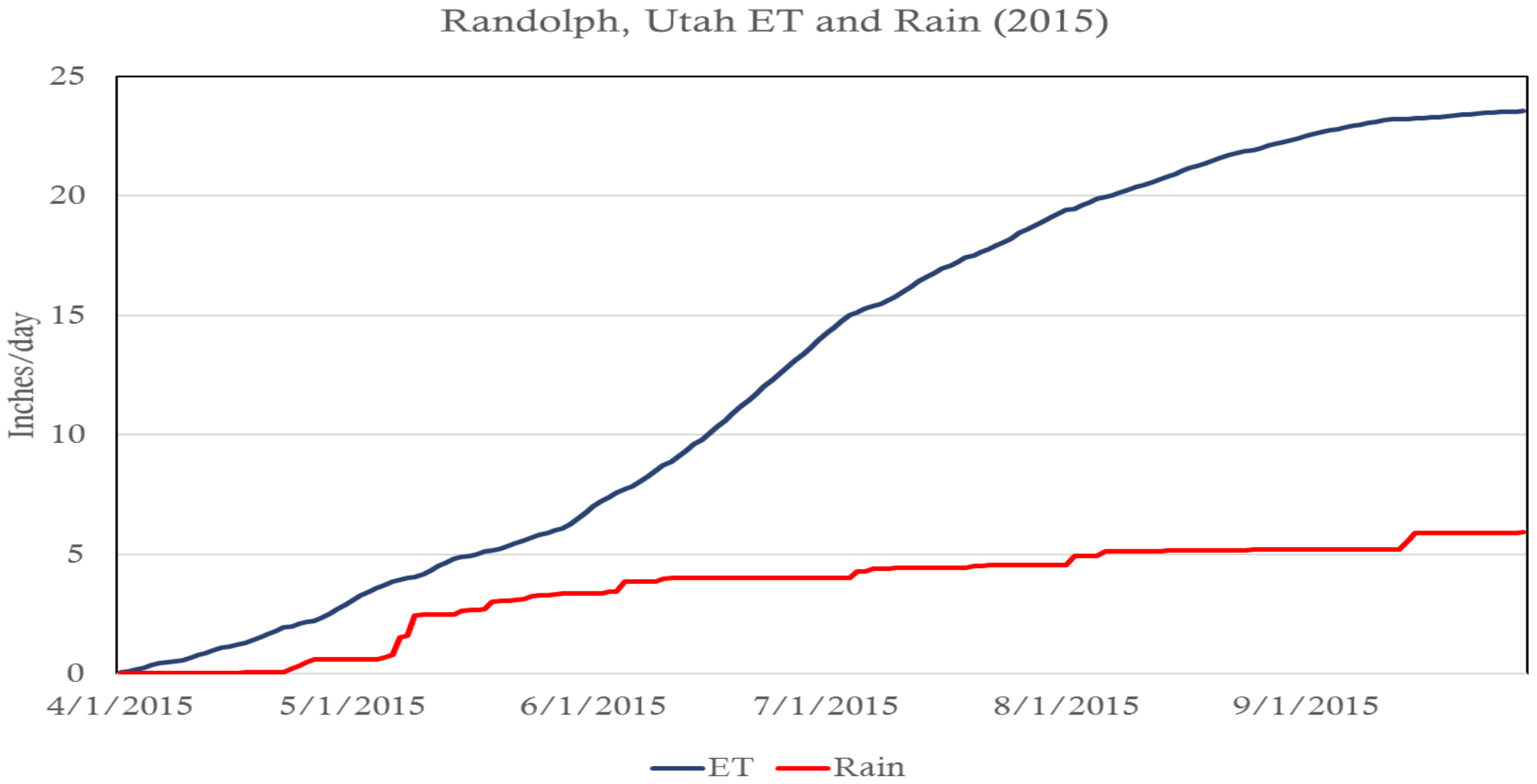
ETo (grass or short crop reference)

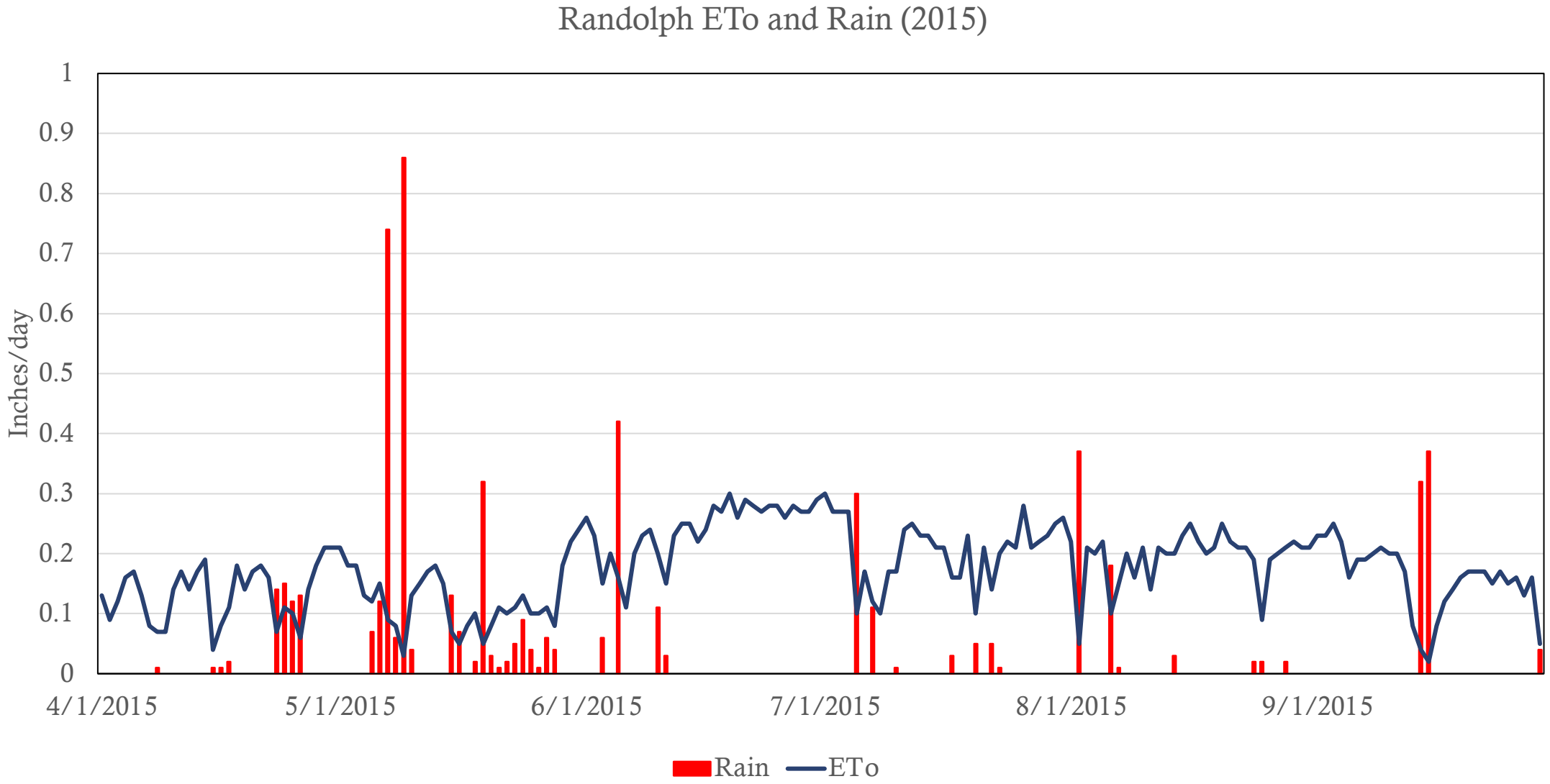


Alfalfa Crop Coefficients for ETo

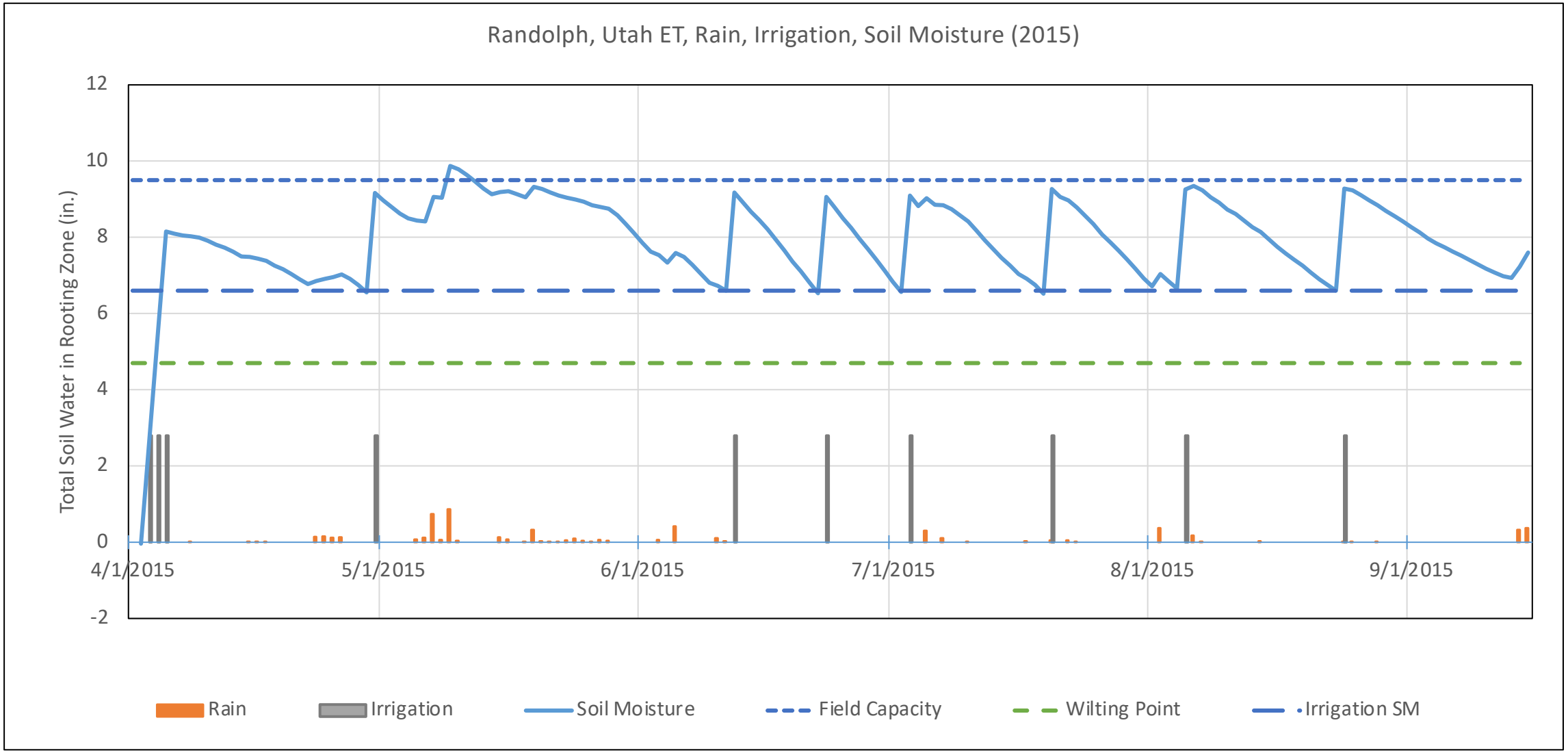


Irrigation Requirement (cumulative ET and Rain)




Randolph ETo and Rain (2015)
Inches/day
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
4/1/2015
5/1/2015
6/1/2015
7/1/2015
8/1/2015
9/1/2015
Rain
ETo

Total Soil Moisture in 2.5 feet (inches)



Summary

- Under irrigation is common
- Irrigate extra for leaching at least in some years if needed
- Irrigation uniformity can have a big impact yields
- Know your irrigation application rates
- At least 2 inches per week net irrigation, my need total of 2.5 inches
- Observe your irrigation system
- Use multiple methods to schedule irrigation
- Check your soil moisture