ALMOND ORCHARD IRRIGATION MANAGEMENT

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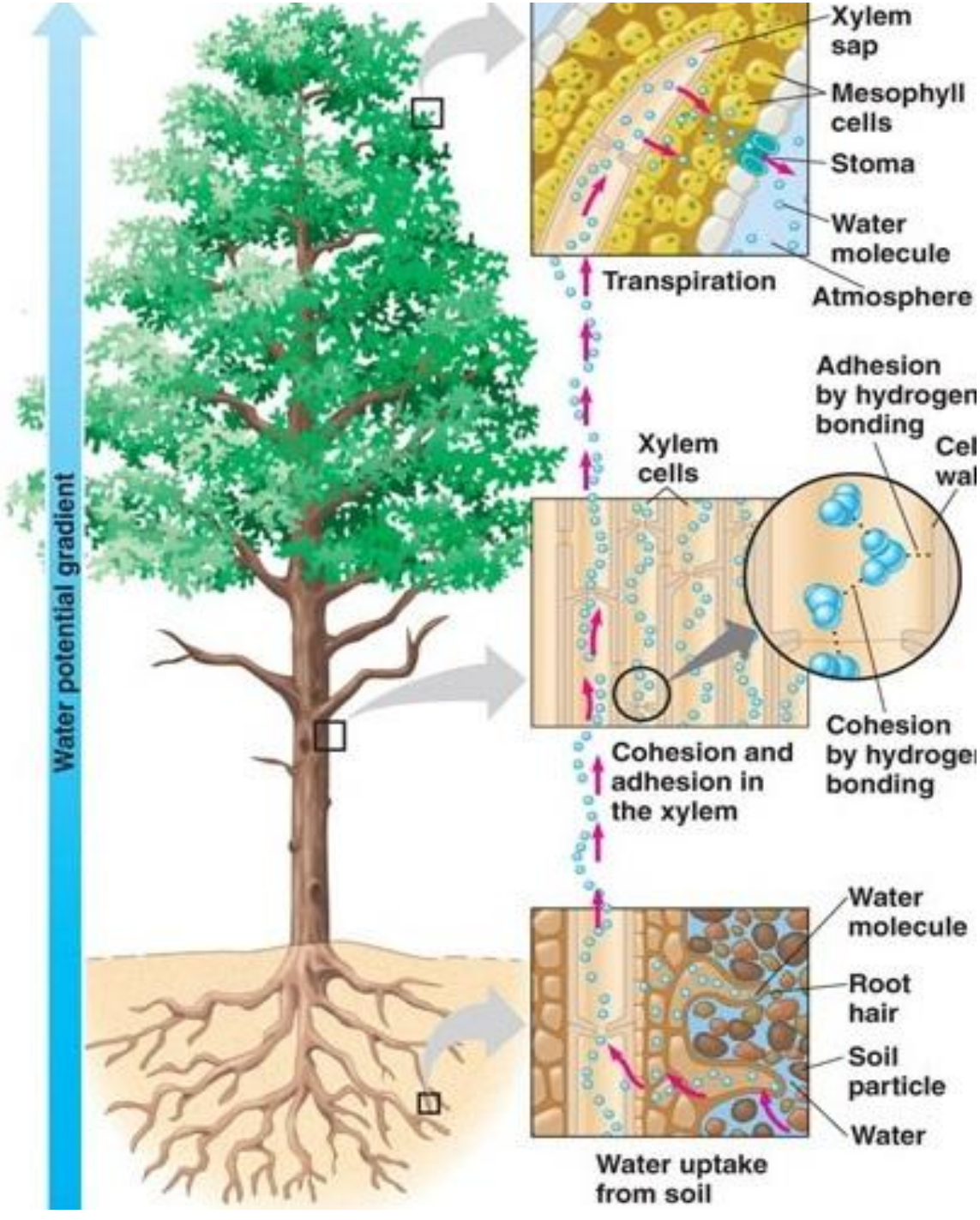
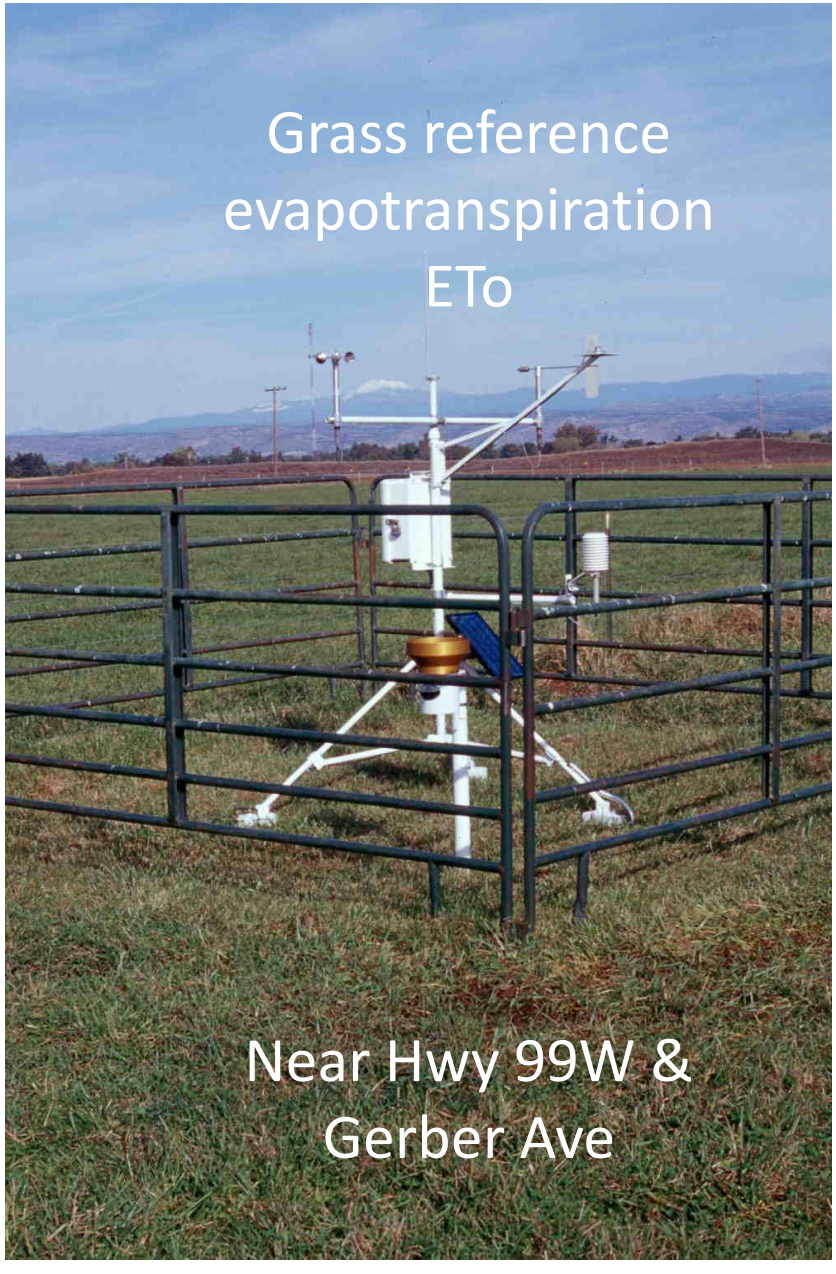
1) When to irrigate
2) How much water to apply

Evapotranspiration or “ET” is the sum of Evaporation from the soil surface “E” and Transpiration “T” from the leaf surface and represents orchard “water use.”

ETo = grass reference

Etc = crop (9,000 gal/ac/day)


Water potential gradient
Xylem sap
Mesophyll cells
Stoma
Water molecule
Atmosphere
Transpiration
Adhesion by hydrogen bonding
Cel wal
Xylem cells
Cohesion by hydroge bonding
Cohesion and adhesion in the xylem
Water molecule
Root hair
Soil particle
Water
Water uptake from soil



DATE	WALNUT Kc[1]	ALMOND Kc[2]
Mar 1-15	NA	0.54
Mar 15-31	NA	0.77
Apr 1-15	0.12	0.94
Apr 16-30	0.53	0.99
May 1-15	0.68	1.02
May 16-31	0.79	1.04
June 1-15	0.86	1.08
June 16-30	0.93	1.11
July 1-15	1.00	1.11
July 16-31	1.14	1.11
Aug 1-15	1.14	1.11
Aug 16-31	1.14	1.06
Sept 1-15	1.08	0.93
Sept 16-30	0.97	0.77
Oct 1-15	0.88	0.65
Oct 16-31	0.51	0.52
Nov 1-15	0.28	0.28

[1] Goldhamer, et.al., 1996, Fulton, et.al, 2011

[2] Sanden, et. al., 2011

Agriculture
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WEEKLY SOIL MOISTURE LOSS IN INCHES

(Estimated Evapotranspiration)

04/15/11 through 04/21/11

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
0.95	4.09	Pasture	0.94	3.87
0.93	4.00	Alfalfa	0.91	3.79
0.72	3.10	Olives	0.72	2.96
0.63	2.65	Citrus	0.61	2.49
0.82	3.27	Almonds (3/1) *	0.81	3.10
0.85	3.24	Prunes (3/15) *	0.84	3.08
0.51	1.79	Walnuts (4/1) *	0.50	1.67
0.99	4.09	Urban Turf Grass	0.98	3.88

Accumulations started on March 27, 2011. Criteria for beginning this report are based on the season's last significant rainfall event where the soil moisture profile is at full capacity.
* Estimates are for orchard floor conditions where vegetation is managed by some combination of strip applications of herbicides, frequent mowing or tillage, and by mid and late season water stress. Weekly estimates of soil moisture loss can be as much as 25 percent higher in orchards where cover crops are planted and managed for maximum growth."

0.29	**Precipitation (Inches)**	**0.08**
0.41	**Accum'd Precip (Inches)**	**0.13**

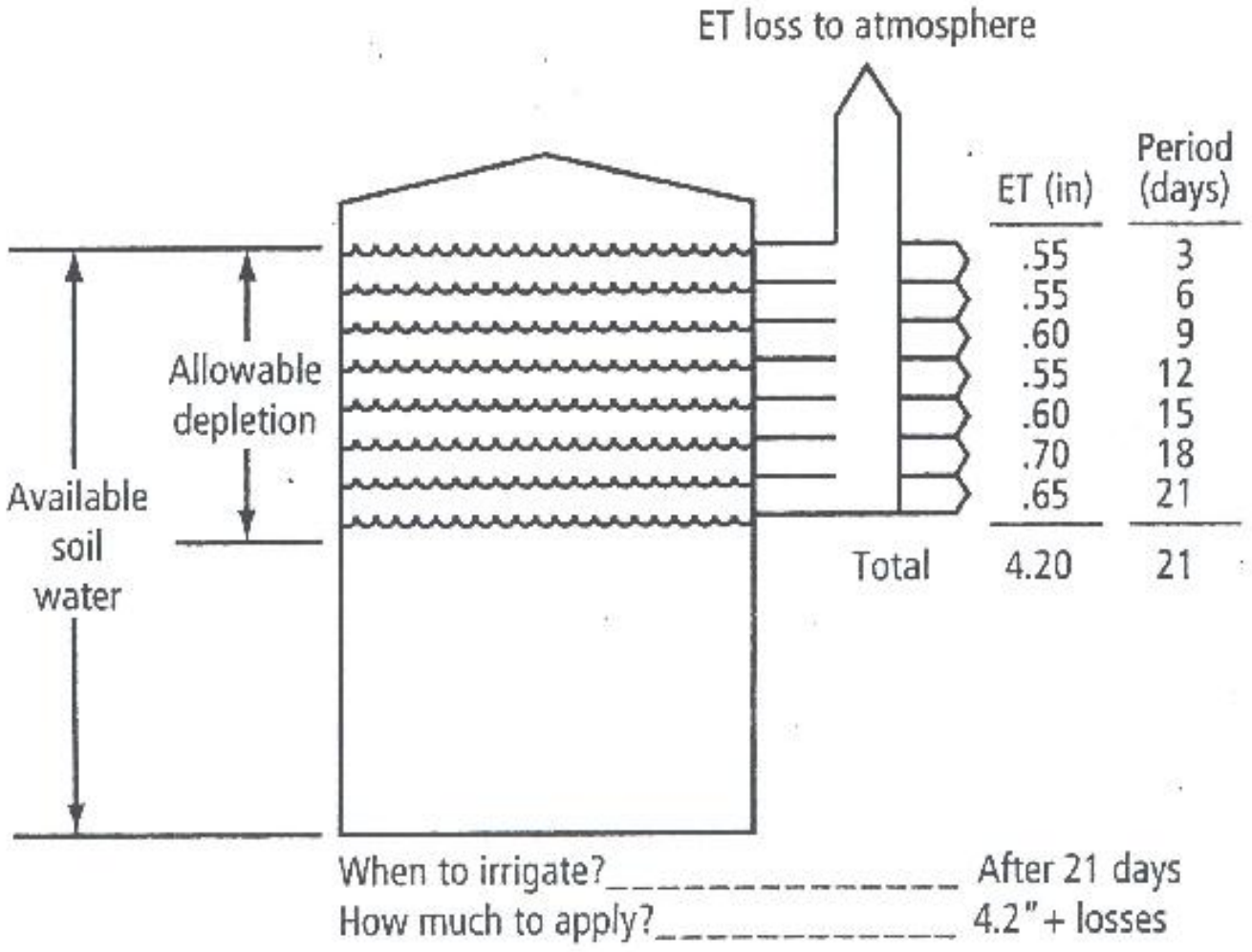
WEEKLY APPLIED WATER IN INCHES[1]

50%	60%	70%	80%	90%	← Efficiency →	50%	60%	70%	80%	90%
1.4	1.2	1.0	0.9	0.8	Olives	1.4	1.2	1.0	0.9	0.8
1.3	1.1	0.9	0.8	0.7	Citrus	1.2	1.0	0.9	0.8	0.7
1.6	1.4	1.2	1.0	0.9	Almonds (3/1)	1.6	1.4	1.2	1.0	0.9
1.7	1.4	1.2	1.1	0.9	Prunes (3/15)	1.7	1.4	1.2	1.1	0.9
1.0	0.9	0.7	0.6	0.6	Walnuts (4/1)	1.0	0.8	0.7	0.6	0.6

[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 concerning all counties receiving this report, contact the Tehama Co. Farm Advisor's office at (530) 527-3101.

Water Budgeting



Example Water Budget

Year	Cumulative Almond ETc	Measured Cumulative Applied Water	Effective In-season rainfall [1]	Needed soil storage contribution	Cumulative ETc Supplied
	INCHES				
2009	41.9	28.2	2.5	11.2	100
2010	39.4	20.1	4.5	14.8	100
2011	39.0	22.6	3.9	12.5	100

[1] Assumed 60 percent of total in-season rainfall to effectively contribute to ETc.

Other ways to monitor and make irrigation management decisions

1) Plant based – Midday stem water potential
2) Soil moisture content
3) Soil moisture tension

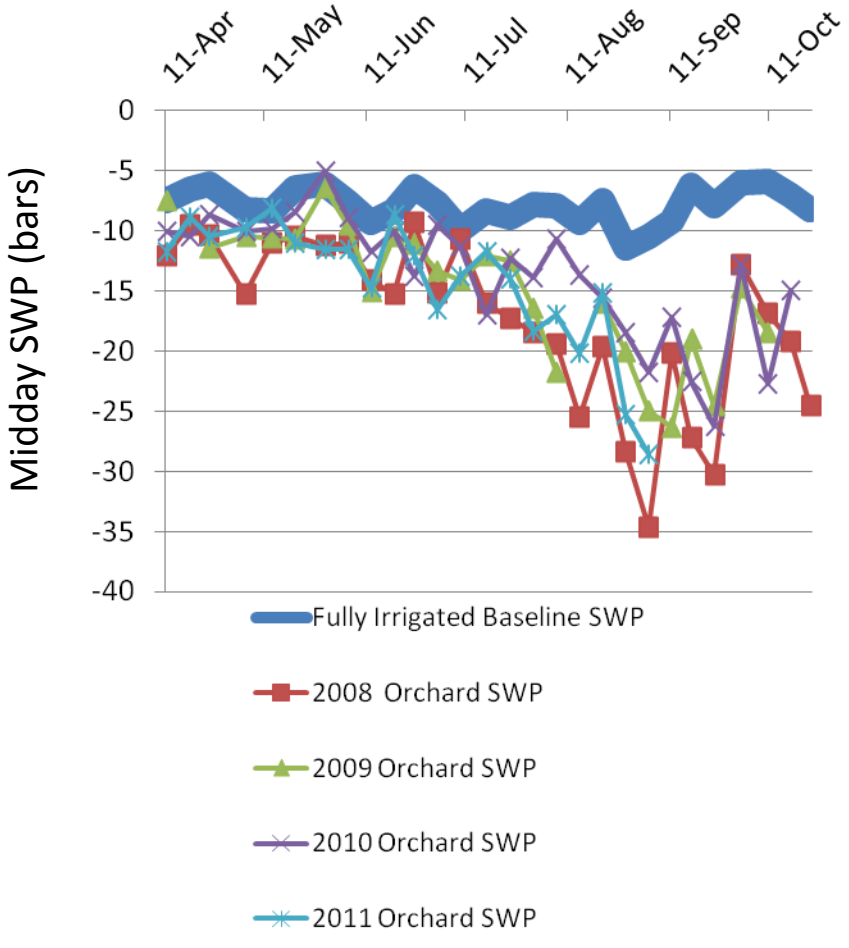
Three types of pressure chambers “pressure bomb” for plant based monitoring

Hand held manual pump up version

PMS suitcase style with external pressure tank

Soil moisture equipment console.

Example of orchard water status (pressure chamber)



2008-11

Pressure Chamber Reading (- bars)		ALMOND
0 to –6.0		Not commonly observed
-6.0 to –10.0		Low stress, indicator of fully irrigated conditions, ideal conditions for shoot growth. Suggest maintaining these levels from leaf-out through mid June.
-10.0 to –14.0		Mild to moderate stress, these levels of stress may be appropriate during the phase of growth just before the onset of hull split (late June).
-14.0 to –18.0		Moderate stress in almond. Suggested stress level during hull split, Help control diseases such as hull rot and alternaria, if diseases are present. Hull split occurs more rapidly
-18.0 to –20.0		Transitioning from moderate to higher crop stress levels
-20 to -30		High stress, wilting observed, some defoliation
Less than – 30		Extensive defoliation has been observed

* These guidelines are tentative and subject to change as research and development with the pressure chamber and midday stem water potential progress. This table should not be duplicated without prior consent by the authors.

Measuring Soil Moisture Content

Soil augers and shovel

Direct, Qualitative Measurement

Sandier

More Clay

Wetter

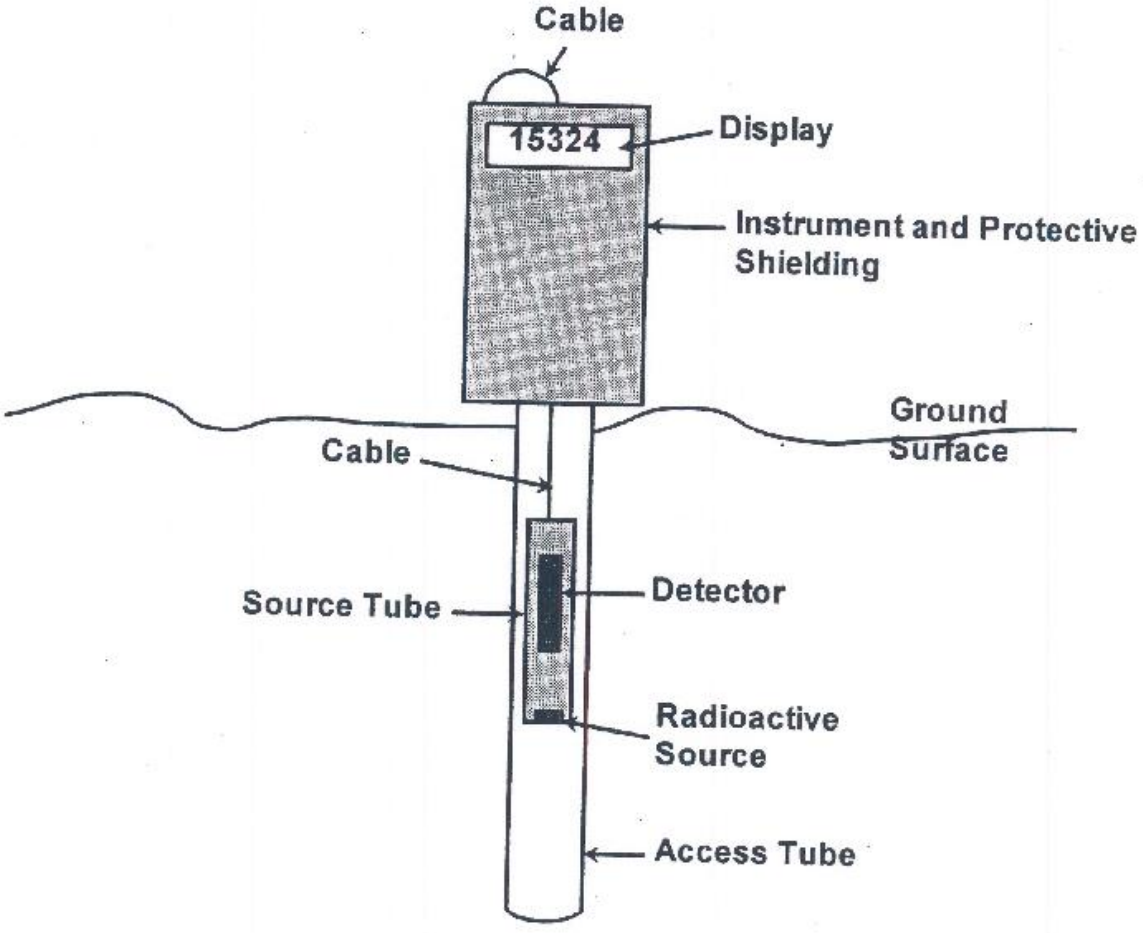


Drier

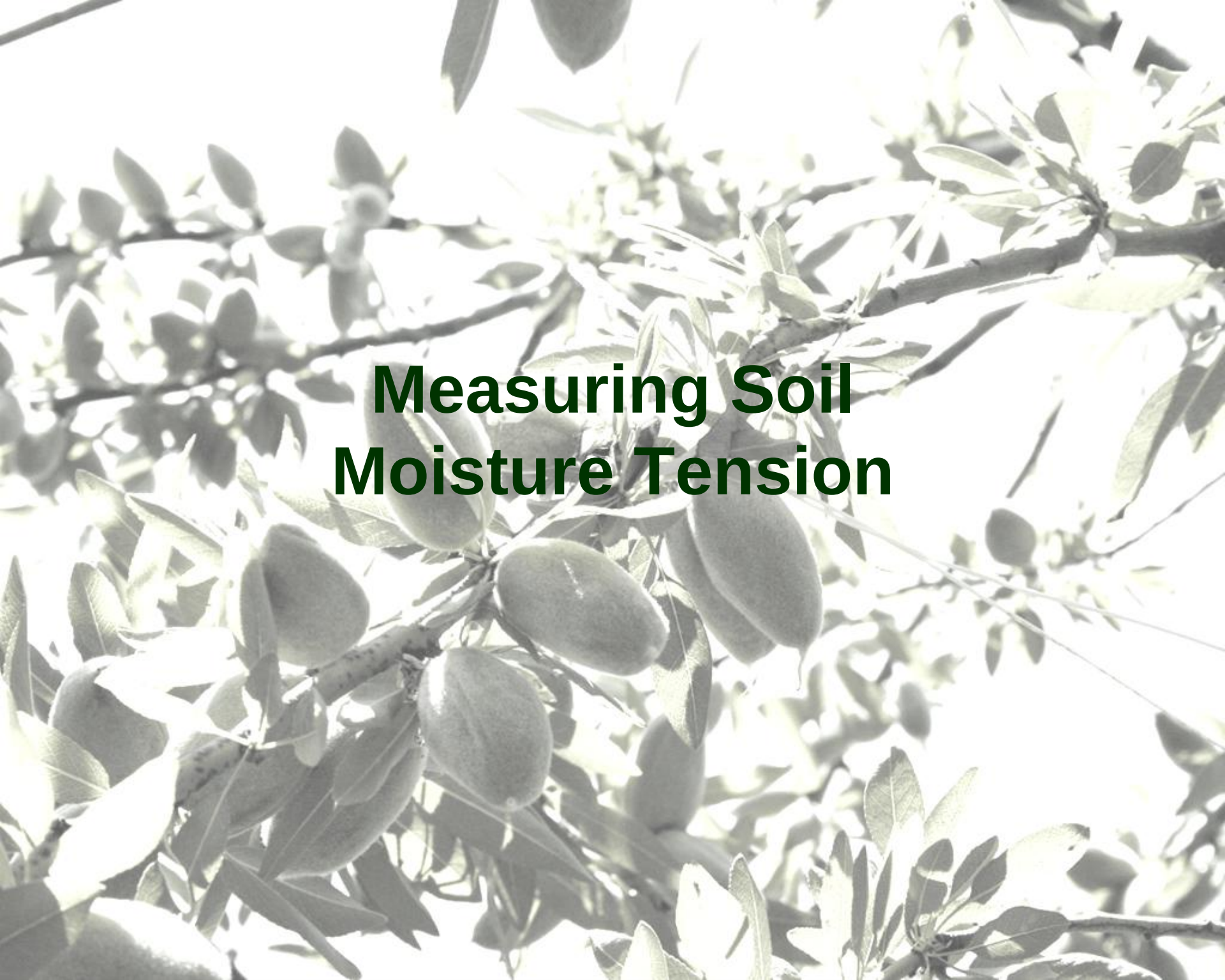


Neutron Probe Moisture Meter

Neutron Probe Moisture Meter



Capacitance Probe



Measuring Soil Moisture Tension

Tensiometers

Watermark soil moisture tension

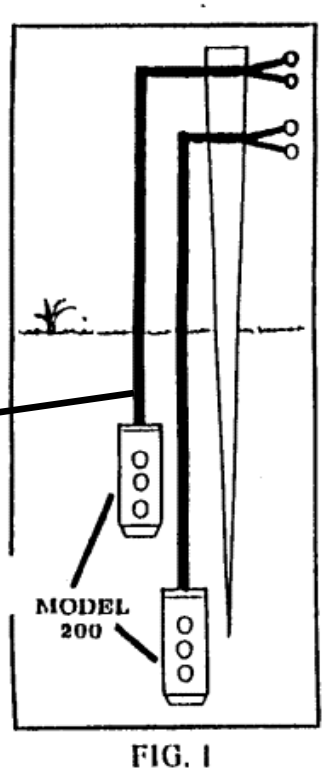
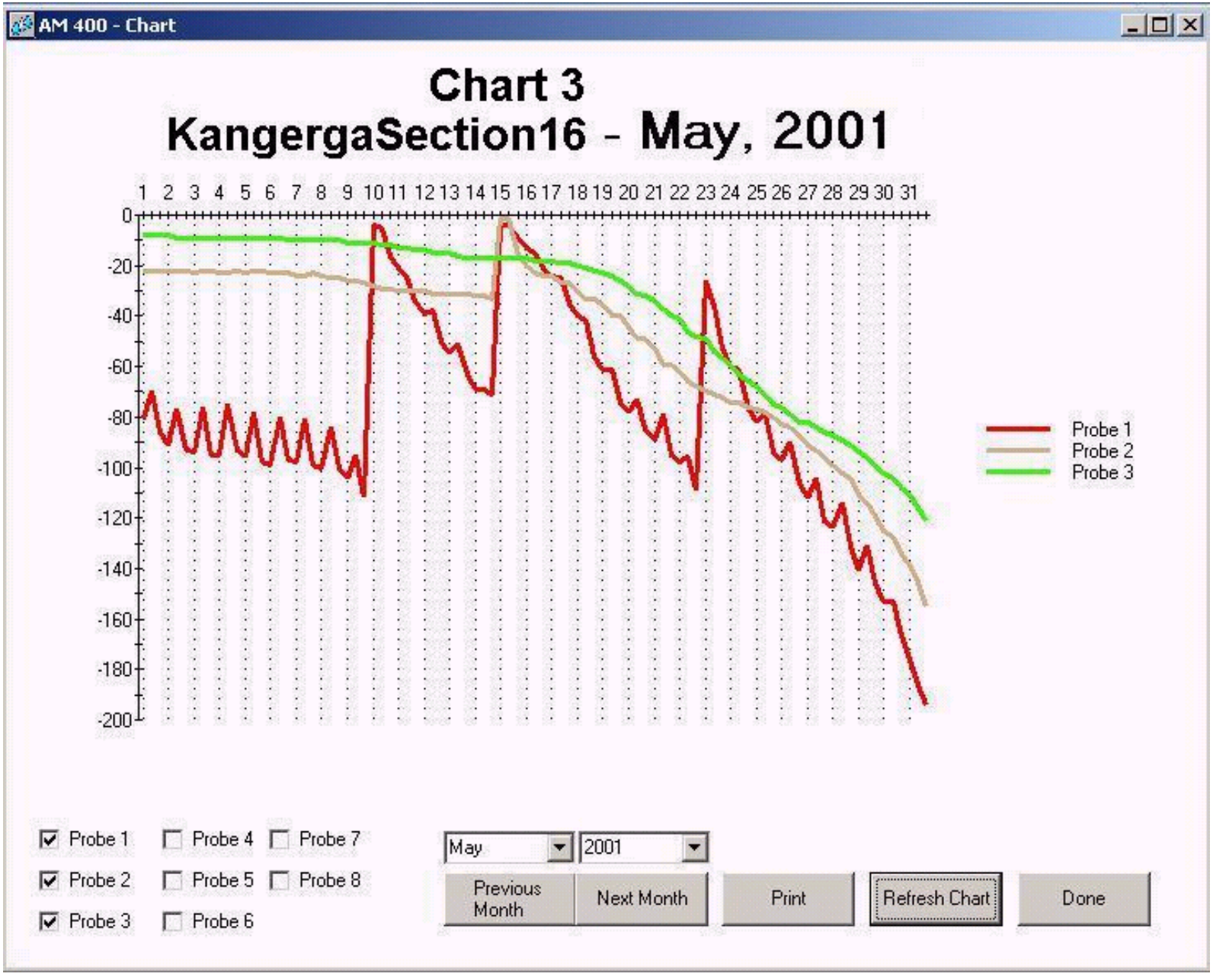


FIG. 1


HANSEN


AM 400 - Chart
Chart 3
KangergaSection16 - May, 2001
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
Probe 1
Probe 2
Probe 3
Probe 1
Probe 2
Probe 3
Probe 4
Probe 5
Probe 6
Probe 7
Probe 8
May
2001
Previous Month
Next Month
Print
Refresh Chart
Done


More irrigation management information is available at
cetehama.ucanr.edu