Paul Vossen

UC Cooperative Extension

Sonoma County

133 Aviation Blvd., Suite 109

Santa Rosa, CA 95403

Precision Small-Scale Farming Equipment Workshop

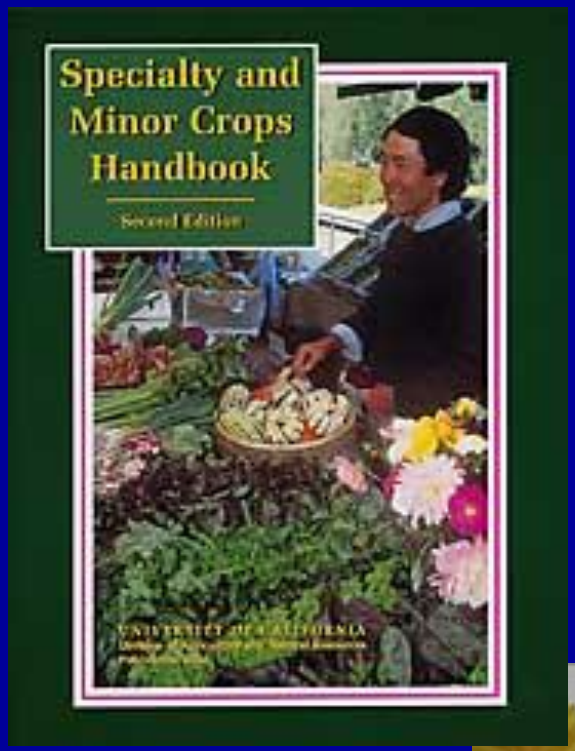
May 21 - 2015

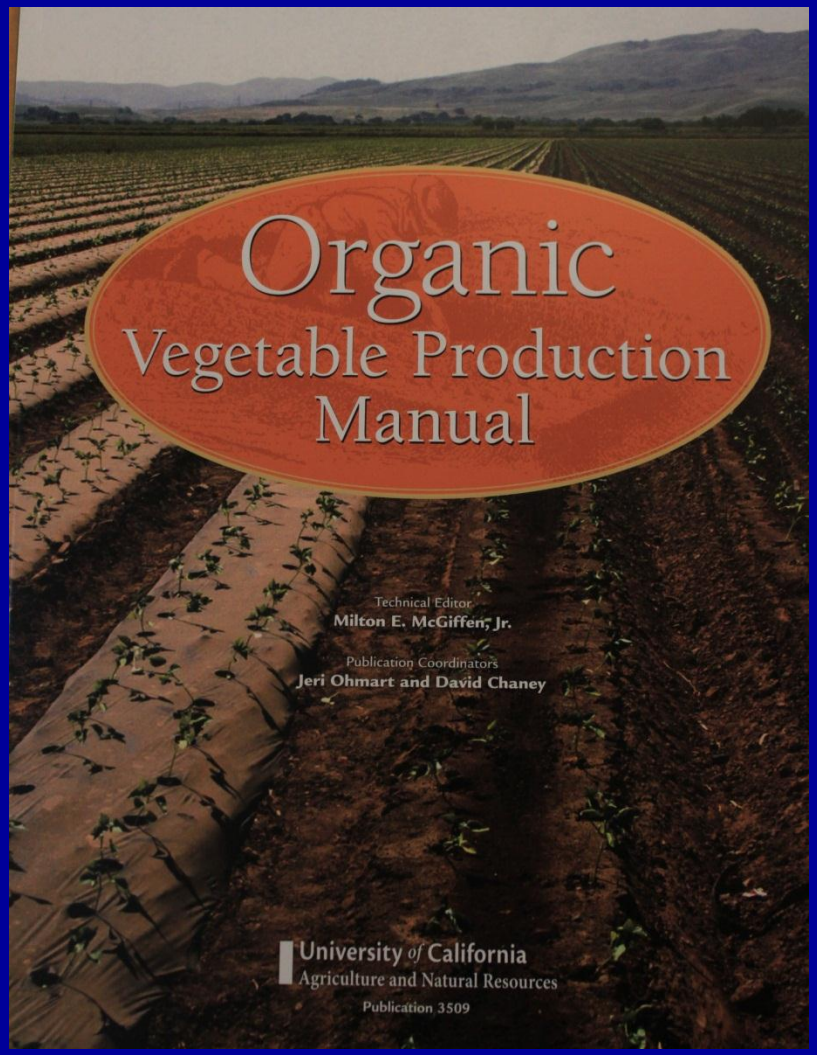

SRJC Farm

University of California
Cooperative Extension

Research and Education

Written Materials





UC Cost Studies

UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

2009

SAMPLE COSTS TO PRODUCE

MIXED VEGETABLES

Tomatoes, Winter Squash, Melons

Small Farm

SIERRA NEVADA FOOTHILLS
Placer & Nevada Counties

UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

2012

SAMPLE COSTS TO PRODUCE
FRESH MARKET

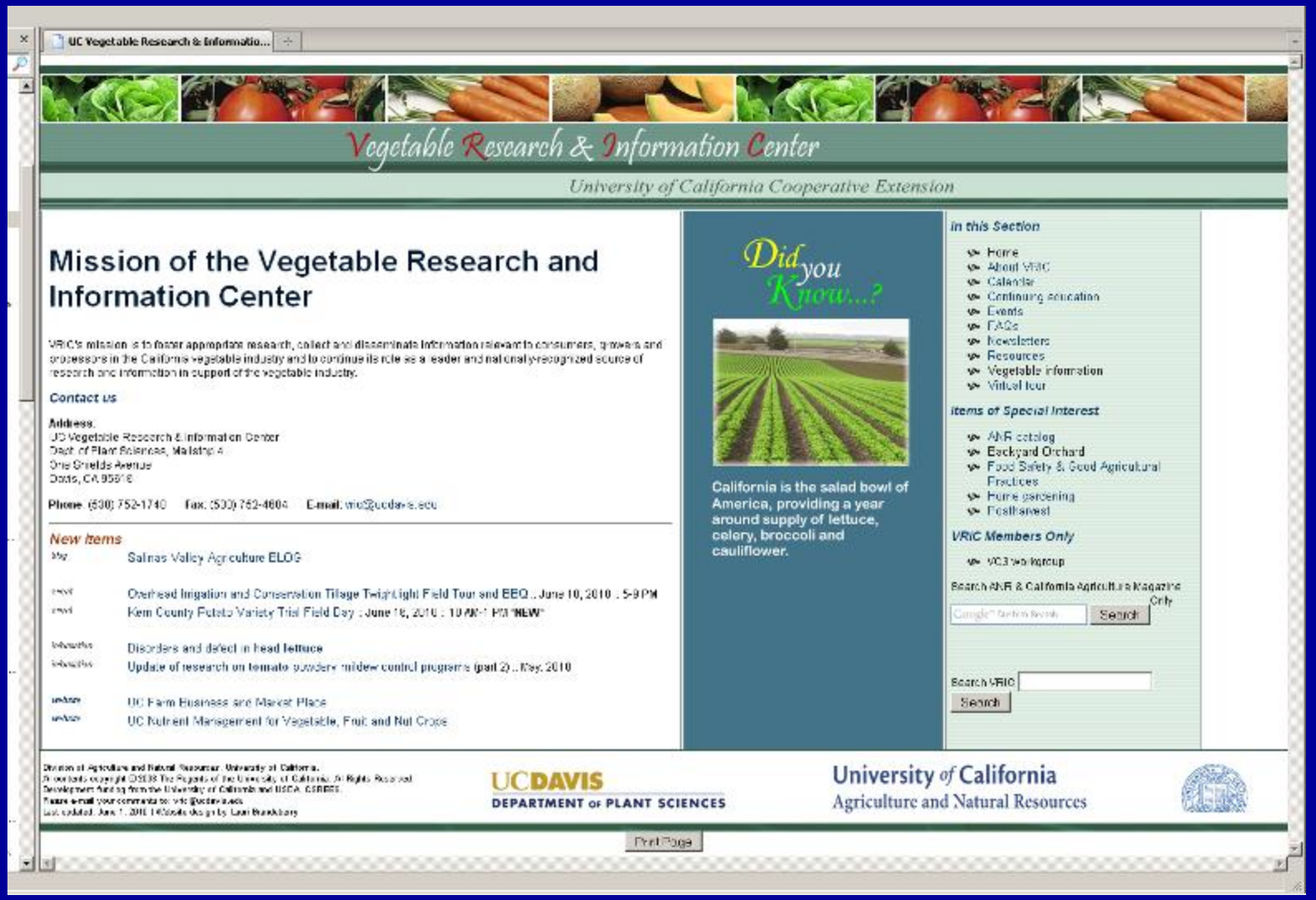
BROCCOLI

CENTRAL COAST REGION – San Luis Obispo County

Surendra K. Dara — UC Cooperative Extension Farm Advisor, San Luis Obispo County
Karen M. Klonsky — UC Cooperative Extension Specialist, Department of Agricultural and Resource Economics, UC Davis
Kabir P. Tumber — UC Cooperative Extension Staff Research Associate, Department of Agricultural and Resource Economics, UC Davis

More Information

http://vric.ucdavis.edu/



Many Choices

- Fruit Trees
- Grapes
- Christmas Trees
- Berries
- Vegetables
- Cut Flowers
- Herbs

Mission Impossible Without Water

Making it Less Bad

- Save as much soil moisture as possible
- Increase OM content of soil – over time
- Irrigate responsibly – don't waste water
- Manage deficit irrigation – timing
- Select & time crops that use less water
- Mulch
- No weeds

Drought Management

Rainfall from Mother Nature

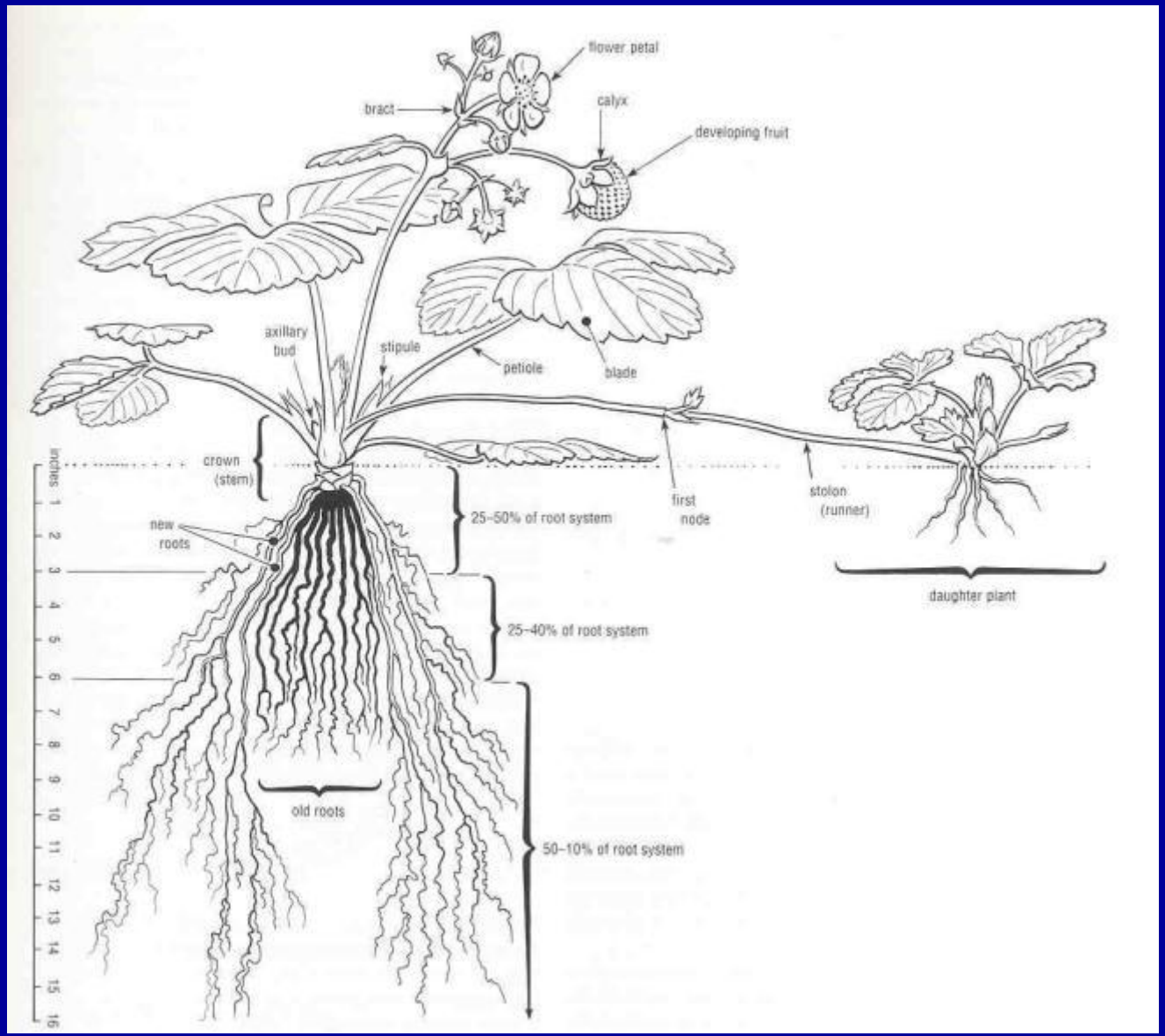
Rainfall 20 – 90” per year

Most of it runs off

Soil Water Holding Capacity

- **Clay = 2.0 to 2.5 inches per foot**
- **Loam = 1.5 to 2.0 inches per foot**
- **Sand = 1.0 to 1.5 inches per foot**

Soil – Root - Profiles



Vegies and Berries are in the top 1 foot = 2”

Preserving as much rainfall soil-stored moisture as possible

- No weeds
- No cover crop
- Mulch
- Herbicide
- Cultivate
- Add OM
- At least - keep weeds short

Cover crops use water

Weeds can steal 2” water

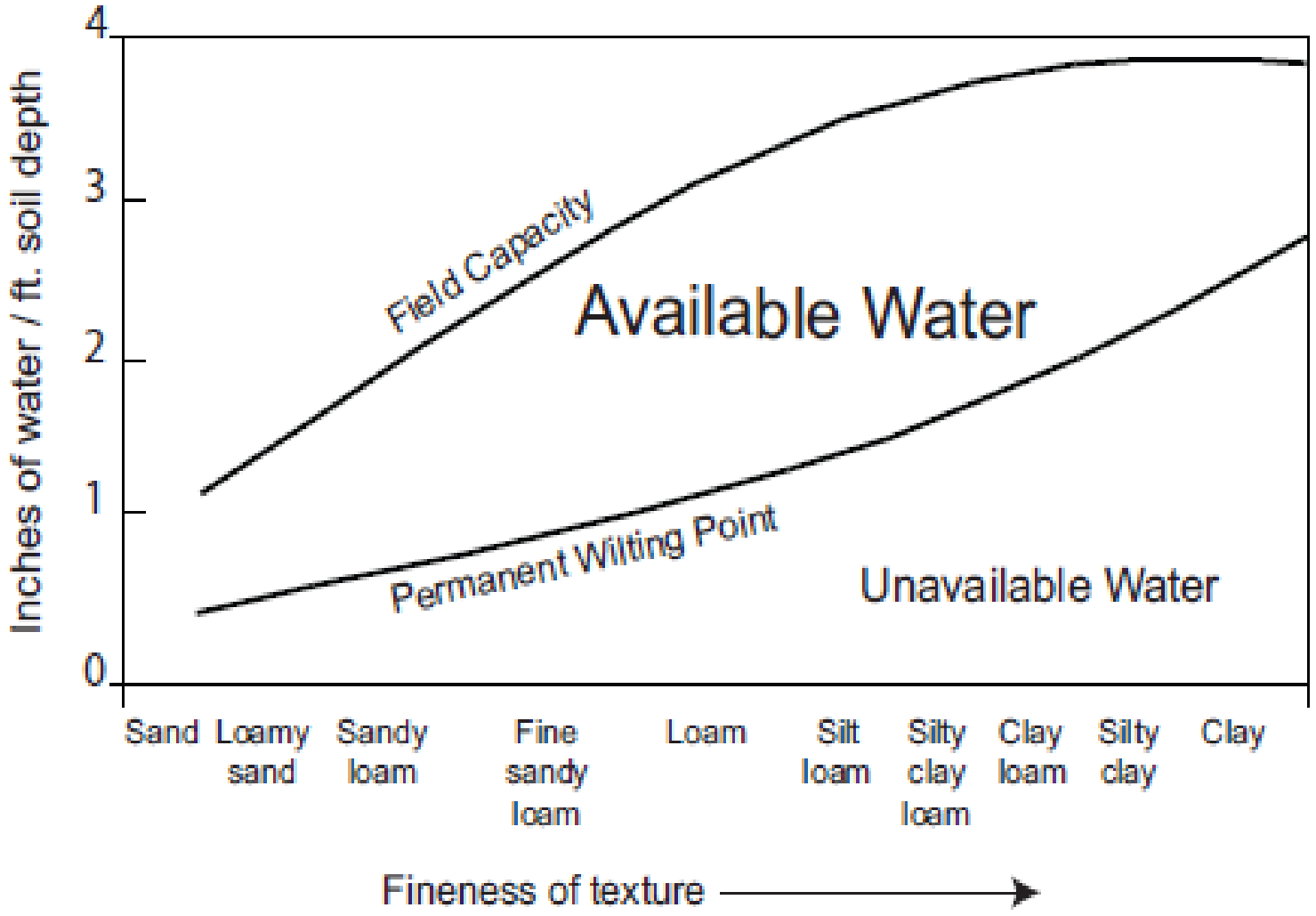
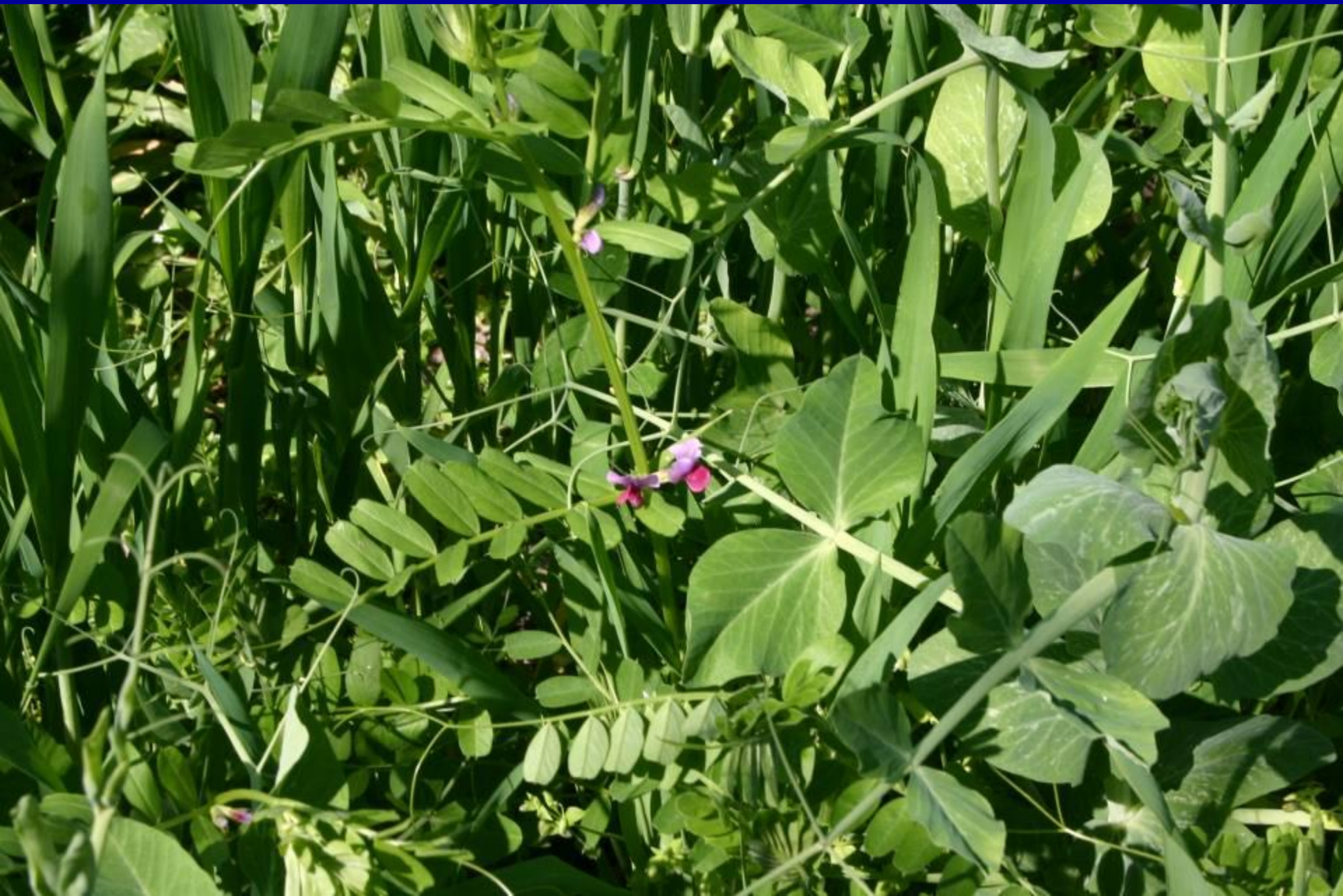


Figure 1. General relationship between soil moisture and texture. Ohio Agronomy Guide, 14th edition, Bulletin 472-05

Cover Crops add OM and Nutrients



Till in cover crops as early as possible when the soil is workable

Provides organic matter, tilth, water retention, and nutrients

Cultivation Increases Erosion Risk

Soil Quality Indicators

Increasing soil OM by 1% increases water holding capacity by about 0.03 ft^3. (0.23 gallons) per ft^3.

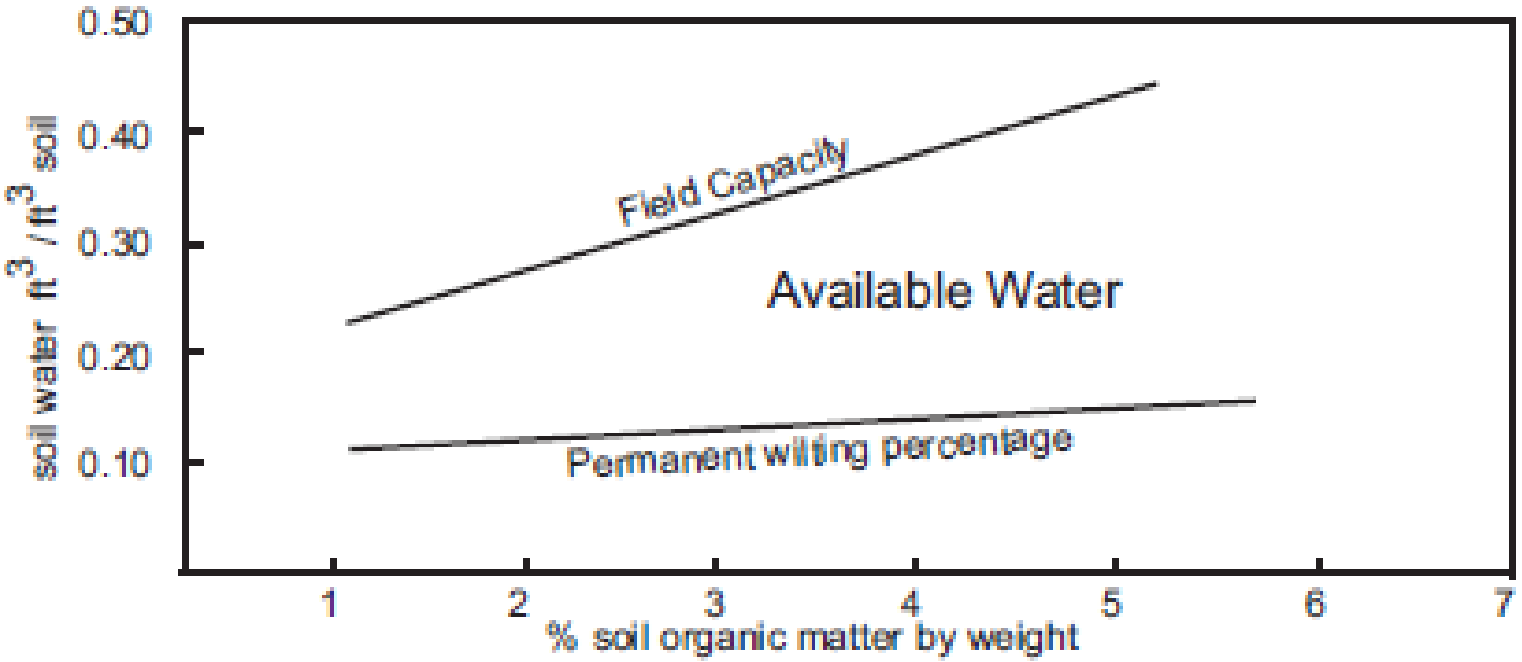


Figure 2. Effect of increasing organic matter on available water capacity of silt loam soils. Adapted from Hudson, SWCS, 1994.

Loam soil holds about 1 gallon of water per cubic foot

- ~ 10,000 gallons per acre = enough water to last about a 2 weeks
- Increasing OM by 1% would increase water holding capacity by about 25%
- Adding 10 tons of compost per acre (1% of top 8” of soil) every year for many years
- Need to add 20+ tons/acre to significantly raise OM – and limit cultivation

OM increases water holding capacity but not very much & its expensive

2 tons/acre compost

10 vs. 20 tons/acre

- Cubic Yard (yd^3) = about 850 lbs. = 0.43 tons so 5 yd^3 = 2 tons
- 10 tons/a = 24 yd^3 at $15 per yd^3 = $360 + delivery and spreading

Making Your Own

Sonoma Compost ?

Irrigate Responsibly

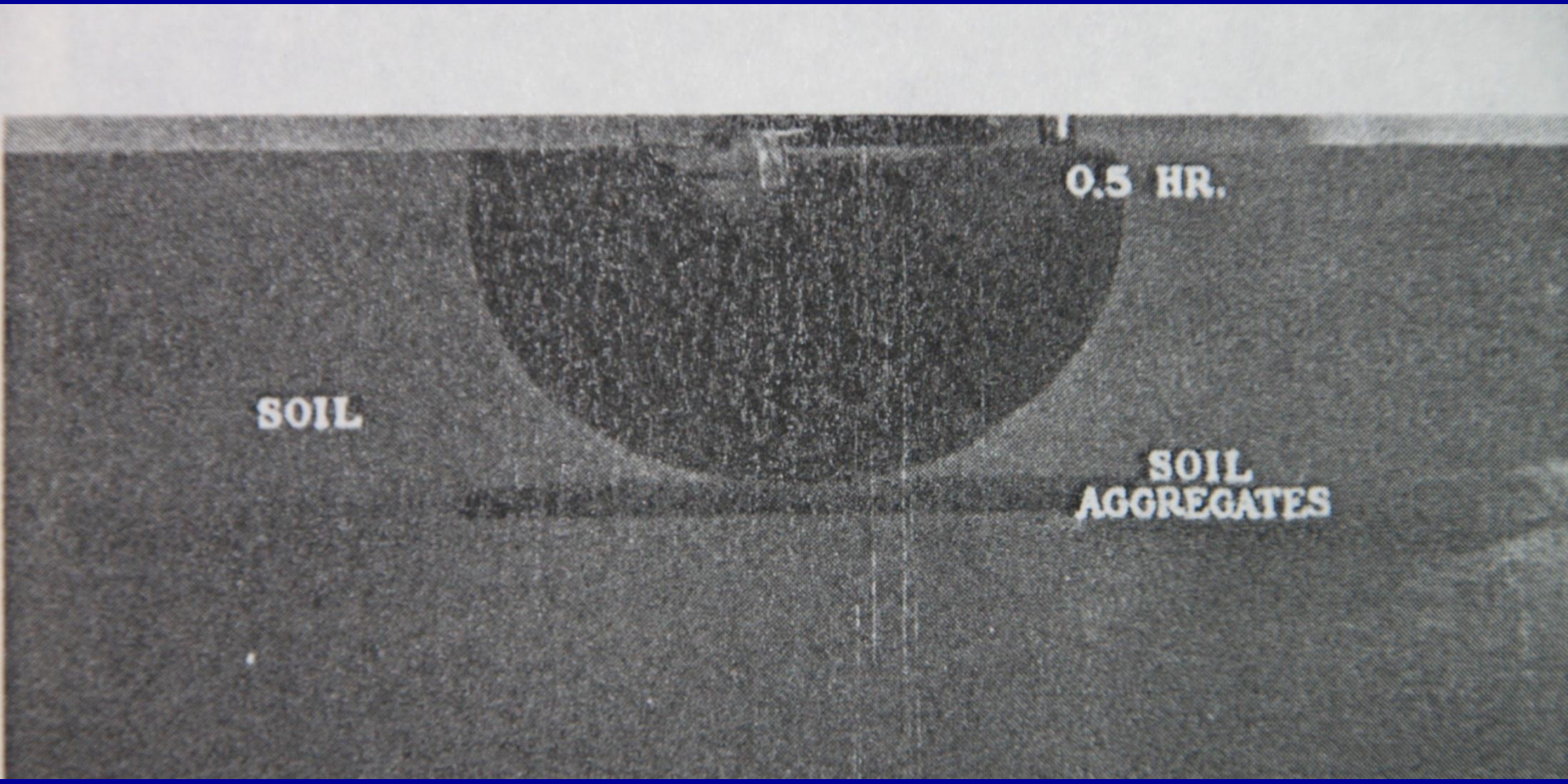
- Stop leaks
- Reduce waste (drip)
- Don’t over-irrigate
- Keep it uniform
- Time appropriately
- Right frequency

Convert to Drip & save ~ 20%

Drip Irrigation

- Water plant daily – lightly – shallow
- Give the plant what it needs/wants
- Need is determined by ETo + coefficient
- Exact an acceptable amount of stress
- Soil water holding capacity is not important

For shallow rooted plants irrigate lightly every day



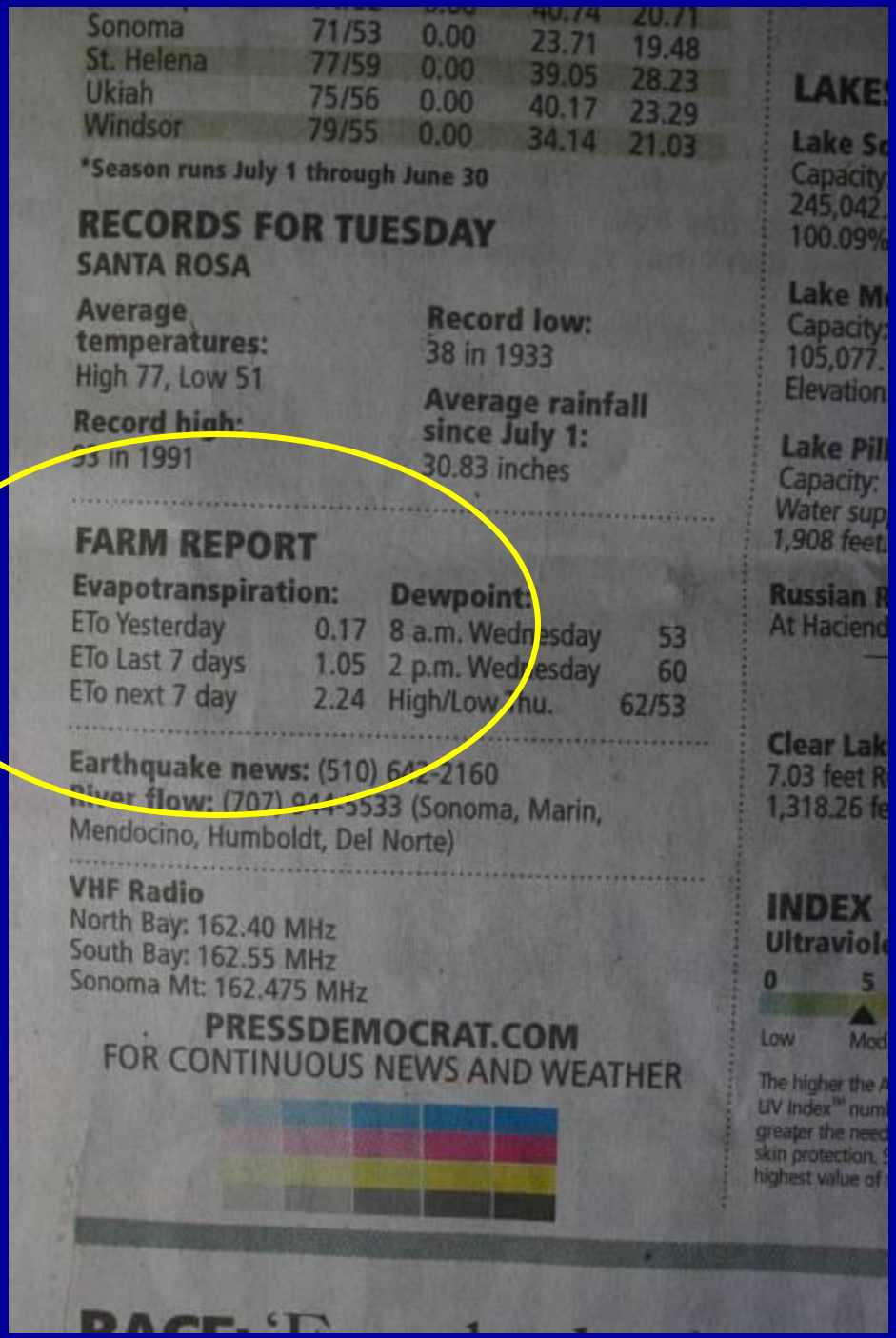
Plant - USE RATE

How Much Water Plants Use

Evapo - Transpiration (ET)

- Evaporation from soil surface = 10%
- Transpiration = 90% cooling of the leaves

ETo Rates in the Press Democrat



Sonoma	71/53	0.00	23.71	19.48
St. Helena	77/59	0.00	39.05	28.23
Ukiah	75/56	0.00	40.17	23.29
Windsor	79/55	0.00	34.14	21.03

*Season runs July 1 through June 30

RECORDS FOR TUESDAY
SANTA ROSA

Average temperatures: High 77, Low 51

Record high: 93 in 1991

Record low: 38 in 1933

Average rainfall since July 1: 30.83 inches

FARM REPORT

Evapotranspiration:		Dewpoint:	
ETo Yesterday	0.17	8 a.m. Wednesday	53
ETo Last 7 days	1.05	2 p.m. Wednesday	60
ETo next 7 day	2.24	High/Low Thu.	62/53

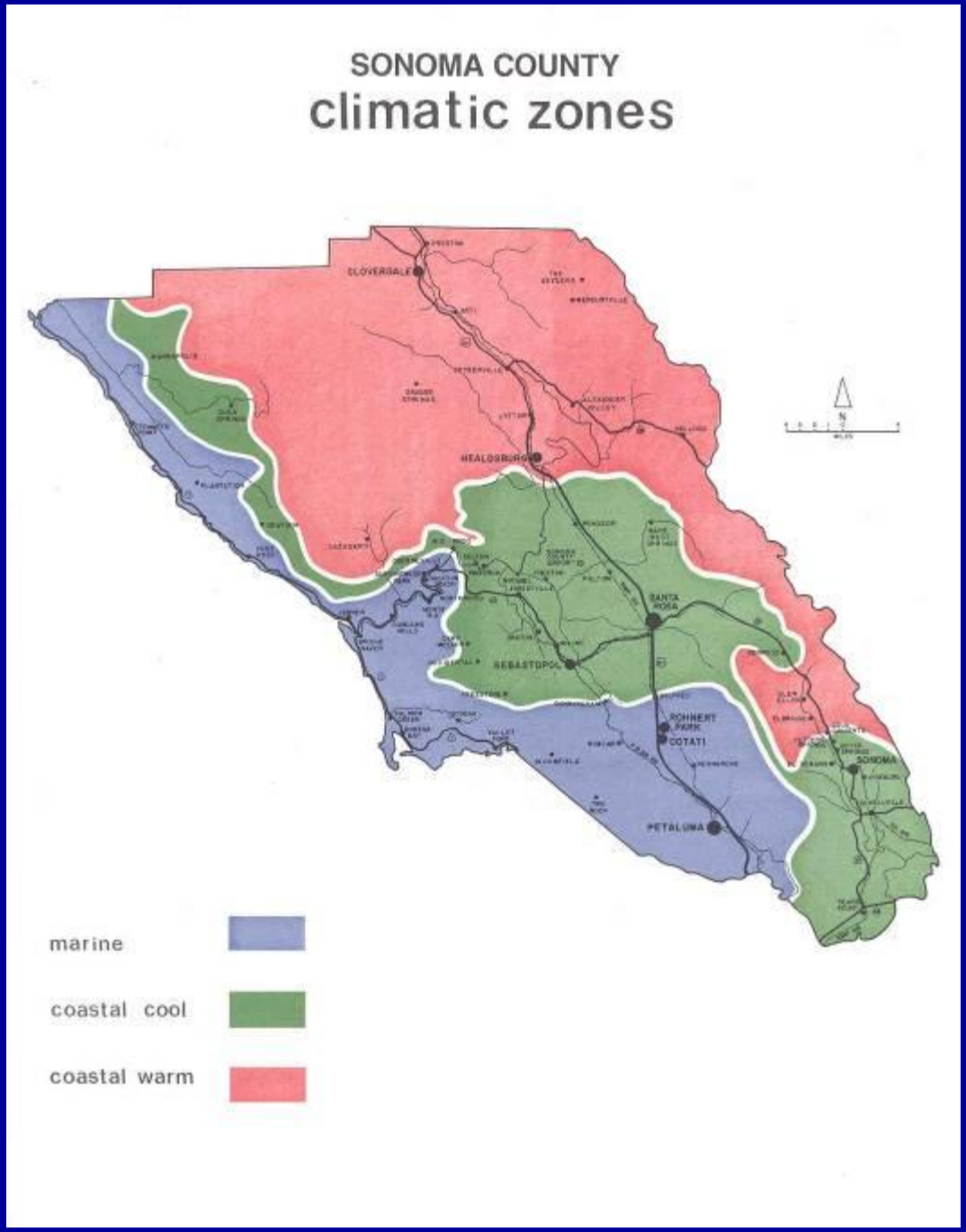
Earthquake news: (510) 642-2160
River flow: (707) 944-5533 (Sonoma, Marin, Mendocino, Humboldt, Del Norte)

VHF Radio
North Bay: 162.40 MHz
South Bay: 162.55 MHz
Sonoma Mt: 162.475 MHz

PRESSDEMOCRAT.COM
FOR CONTINUOUS NEWS AND WEATHER

LAKE
Lake So
Capacity
245,042
100.09%
Lake M
Capacity:
105,077.
Elevation
Lake Pill
Capacity:
Water sup
1,908 feet
Russian R
At Haciend
Clear Lak
7.03 feet R
1,318.26 fe

INDEX
Ultraviol
0 5
Low Mod
The higher the
UV Index™ numb
greater the need
skin protection.
highest value of



Marine

Coastal Cool

Coastal Warm

Seasonal Water Requirement

April - October (30 yr. average in inches) (Sonoma County)

	Marine	Coastal Cool	Coastal Warm
April	2.8	4.0	4.5
May	2.9	5.8	6.9
June	2.8	5.6	7.0
July	3.4	6.1	7.9
August	3.1	5.2	6.8
Sept.	3.1	4.4	5.7
Oct.	3.1	3.3	3.7
TOTAL	21.2	34.4	42.5

Typical water use patterns ETo - Inches per day

- Spring or fall with short cool days = 0.1
- Warm summer days with fog = 0.15
- Hot summer days with some fog = 0.20
- Hot summer days - no fog = 0.25
- Very hot days and windy = 0.30

Climatic Zones

Marine: Foggy, windy, cool

- 2,185 degree days (1,800-2,800)
- Water use ~ 20-22”

Coastal Cool: Intermediate – some fog

- 2,582 degree days (1,900-3.600)
- Water use ~ 30-34”

Coastal Warm: Warm – little fog

- 2,920 degree days (2,100-4,200)
- Water use ~ 36-42”

Max Potential Water Use (April-October)

	ET (inches)	Gal/Acre	Gal/Min	Gal/1,000ft^2
Marine	20	543,080	2.04	12,464
Coastal Cool	34	923,236	3.50	21,195
Coastal Warm	42	1,140,468	4.22	26,181

Water Use in Gallons / Day

Plant Size

ETo →	0.1"/day	0.2"/day	0.25"/day	0.3"/day
1 ft^2	0.062	0.125	0.156	0.187
10 ft^2	0.62	1.25	1.56	1.87
36 ft^2	2.25	4.50	5.61	6.73
100 ft^2	6.20	12.5	15.6	18.7
200 ft^2	12.4	25.0	31.2	37.4
300 ft^2	18.6	37.5	46.8	56.1
1 acre	2,715	5,431	6,788	8,146

4 gpm X 60 min/hr X 24 hrs/day = 5,760 gallons per day

What NOT to Grow

- Plants that sunburn and die from water stress
- Plants where fruit size is important (fresh)
- Plants that have shallow root systems
- Late maturing varieties
- Plants that need heat and water

- -

Strawberry, raspberry, blueberry, blackberry, table olive, table grape, peach, nectarine, pear, asparagus, pepper, eggplant, squash, cutting greens, spinach, watermellon, corn, beans, summer onion

What to Grow

- Plants that have been successfully dry farmed
- Plants that are deep rooted
- Plants where fruit size does not matter (processed)
- Plants that naturally tolerate water stress
- Plants that mature in winter & spring
- Short season varieties (early maturing)

- -

- Oil olives, wine grapes, processing apples, some pears, plums, prunes, apricots, potatoes, tomatoes, cole crops, radishes, peas, winter greens, winter alliums, bunch lettuce, melon - -

Organic Mulch

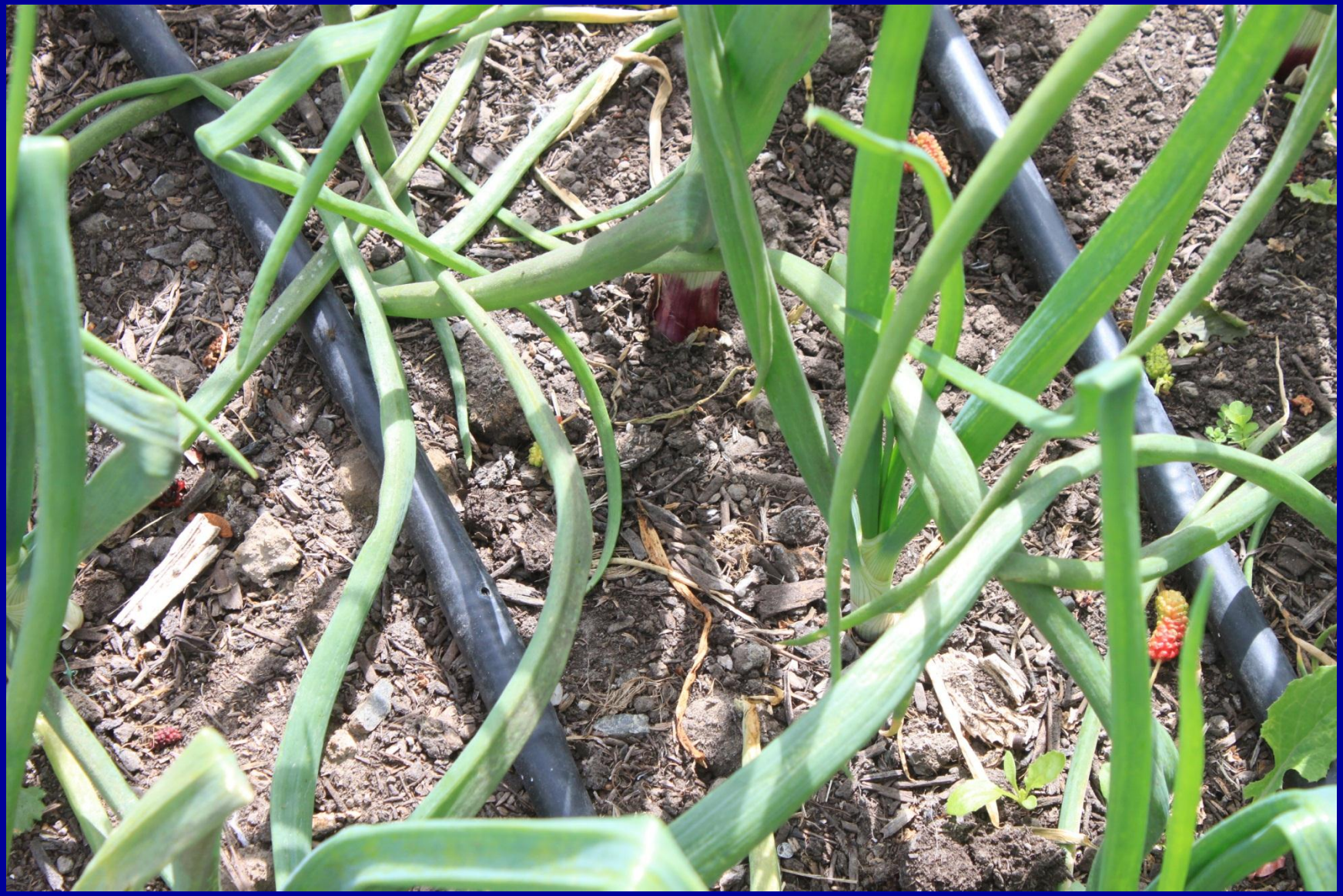
Mulch in furrows

Plastic Mulch

Hand Buried Plastic

Plastic Mulch

Good Weed Control = No Competition



Weeds

Lots of hand weeding

Transplant to get ahead of weeds

Transplanted Onions

Transplanting requires more labor

Precision Weeding Equipment

Precision Transplanter

Mechanized Precision Beds

Precision Seeders

Precision Bed Cultivation

Thanks! – Questions?