HEALTHY FOOD SYSTEMS • HEALTHY ENVIRONMENTS • HEALTHY COMMUNITIES • HEALTHY CALIFORNIANS

University of California
Agriculture and Natural Resources
Making a Difference for California

UCCE Master Gardeners
of El Dorado County

Public Education 2015

Water Efficient Gardening in the Urban Landscape

By Master Gardener Steve Savage

I. Why Conserver Water

II. Hydrologic Cycle

III. Water Movement in Plants

IV. Managing Irrigation

V. Water Application Methods

VI. Methods that Conserve Water

VII. Measuring Water Loss

VIII. Surviving Drought

Creating an Irrigation Plan

1. How large is your garden or landscape?
2. How much rainfall do you get, and when?
3. Are you subject to drought or heavy flooding?
4. Do you have sandy, fast draining soil, or clay, or compacted soil?
5. How much supplemental watering is practical – cost, water availability (well, city, etc.)?
6. Decide on type of system(s) to be used:
    a. Low pressure (drip)
    b. High pressure (sprinkler)
    c. Row
    d. Basin, etc

    and, where each system can best be used.

Water Management Tips for the Your Landscape

Use a multiple sprinkler controller so different areas of the landscape can be irrigated on separate schedules.

Avoid runoff by watering correctly. On slopes, use short on and off cycles. Match water application rate to the soil's absorption rate.

Water infrequently but deeply.

Group plants of like water needs together and apply water in proper amounts to meet their needs. Hydrozoning.

Water in the early morning when winds and evaporation are lowest.

Install a drip system for shrubs and trees. Choose emitters to discharge the proper amount of water for each type and size of plant.

Aerate lawns, particularly on slopes, and remove excess thatch to increase water and oxygen absorption.

Condition laws to use less water. Use a low nitrogen fertilizer. Increase the height of the mowing cut to shade the ground and reduce evaporation and to allow the root system to expand. Water deeply to encourage deeper rooting.

In shrub beds, use an organic mulch 2" to 3" deep to moderate soil temperature, reduce moisture loss, and retard weed growth.

Remove competing weeds that rob both moisture and nutrition from your plants.

Select a controller with a rain cut off switch, and use it.

Install check valves if there are elevation changes in the system to prevent water from draining out of the lowest elevation sprinkler head.

Choose low water requirement shrubs and ground covers.

Vary water application quantity and frequency based on time of year.

Incorporate organic matter into your soil to improve its water holding ability and enhance water penetration.

Plant close together so, as plants grow, they will shade the soil.

For container plants, group containers so they shade each other, mix water holding polymers into the potting soil, double pot (set small pots inside larger ones) with a layer of sand or gravel between, top dress pots with cobbles, bark, or compost to reduce evaporation and keep cool.

Table 4.7

PRACTICAL HAND-FEEL TEST TO INTERPRET SOIL MOISTURE

Available Moisture	**Sand** (gritty when moist, like beach sand)	**Sandy loam** (gritty when moist, dirties fingers, contains silt and clay)	**Clay loam** (sticky, plastic when moist)	**Clay** (very sticky when moist; behaves like modeling clay)
close to 0%: little or no moisture available	dry, loose, single-grained; flows through fingers	dry, loose flows through fingers	dry clods that break down into powder	hard, baked, cracked surface; hard clods difficult to break
50% or less: approaching time to irrigate	still appears dry, will not form ball with pressure	still appears dry, will not form a ball	a little crumbly but will hold together under pressure	somewhat pliable, will ball under pressure
50% to 75%: enough moisture available	same as comments for 50% or less	tends to ball under pressure but seldom will hold together	forms a ball; a little plastic, might stick with pressure	forms a ball; will ribbon out between thumb and forefinger
75% to field capacity: plenty of moisture available	Sticks together slightly; may form a very weak ball under pressure	Forms weak ball, breaks easily, will not become slick	Forms a ball, very pliable, becomes slick if high in clay	Easily ribbons out between fingers; feels slick
At field capacity: soil will not hold any more water after draining	Upon squeezing, no free water appears but moisture is left on hand	Same as sand	Same as sand	Same as sand
Above field capacity: unless water drains out, soil will be waterlogged	Free water appears when soil is bounced on hand	Free water will be released when kneading	Can squeeze out free water	Puddles and free water form on surface

Source: Harris and Coppick 1977, p. 4

REFERENCE EVAPOTRANSPIRATION (ET_O) AND LANDSCAPE COEFFICIENTS FOR EL DORADO COUNTY

AVERAGE ET_O IN INCHES PER MONTH

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sacramento (Use for Folsom, El Dorado Hills, Cameron Park)	.98	1.76	3.17	4.72	6.35	7.68	8.36	7.20	5.43	3.66	1.65	.92
Camino (Use for Shingle Springs, Rescue, Placerville, Camino, Pollock Pines)	.98	1.68	2.48	3.90	5.98	7.20	7.75	6.82	5.10	3.10	1.50	.93

SPECIES FACTOR (K_S)

	V_L	L	M	H
El dorado Hills to Cameron Park	< .1	.3	.6	.9
Shingle Springs to Placerville	< .1	.2	.5	.8
Camino to Pollock Pines	< .1	.1	.4	.7

DENSITY FACTOR (K_D)

Low	.5 to .9
Avg	1.0
High	1.1 to 1.3

MICRO CLIMATE FACTOR (K_{MC})

.5 to .9
1.0
1.1 to 1.4

Source: UC ANR Pub #21426 – Determining Daily Reference Evapotranspiration (ET_O)

Table 2. Crop Coefficients (i.e., K_C2 for dates C-D and K_C3 for date E) and percentages of the season from planting until the indicated growth dates for field and row crops.

Crop	% of season until date			Crop Coefficients	
	B	C	D	K_C2	K_C3
Alfalfa (cycle)	7	30	99	1.05	0.25
Alfalfa (averaged)	25	50	75	1.00	1.00
Artichokes	6	19	90	0.65	0.65
Asparagus	12	25	95	1.00	0.25
Barley	20	45	75	1.05	0.15
Beans (pinto)	24	40	91	0.90	0.10
Beans (dry)	24	40	91	1.00	0.10
Beans (green)	22	56	89	1.00	0.85
Beets (table)	25	60	90	0.90	0.90
Broccoli	20	50	83	1.00	0.80
Carrots	20	50	83	0.95	0.80
Celery	15	40	90	0.95	0.95
Cereal Grains	20	45	75	1.05	0.15
Corn (grain)	20	45	75	1.00	0.60
Corn (silage)	20	45	99	1.00	0.60
Cotton	20	55	85	1.05	0.65
Crucifers	25	63	88	1.00	0.85
Cucumber	19	47	85	0.85	0.85
Eggplant	23	54	85	0.90	0.85
Lentil	13	33	73	1.00	0.30
Lettuce	25	65	90	0.80	0.80
Melon	21	50	83	0.95	0.75
Millet	14	36	75	1.00	0.30
Oats	20	45	75	1.05	0.15
Onion (dry)	10	26	75	0.90	0.75
Onion (green)	25	70	90	0.90	0.90
Peas	20	47	83	0.95	1.00
Peppers	20	45	85	0.92	0.85
Potato	20	45	78	0.85	0.70
Radishes	20	45	85	0.75	0.75
Rice	20	50	85	1.10	0.90
Safflower	17	45	80	1.05	0.25
Sorghum	16	42	75	1.05	0.50
Spinach	33	67	92	0.87	0.90
Squash	20	50	80	0.83	0.70
Strawberries w/mulch	15	45	80	0.70	0.70
Sugarbeet	15	45	80	1.05	0.95
Sunflower	20	45	80	1.10	0.40
Tomato	25	50	80	1.10	0.65
Wheat	20	45	75	1.05	0.15
Watermelon	20	50	75	1.00	0.75

Source http://lawr.ucdavis.edu

Table 3. Crop Coefficients (i.e., K_{C2} for dates C-D and K_{C3} for date E) and percentages of the season from leaf out until the indicated growth date inflection points for major tree and vine crops.

Crop	% of season until date		Crop Coefficients	
	C	D	C-D	E
Grapevines	25	75	0.80	0.35
Stone Fruits	50	90	1.05	0.65
Apple	50	75	1.05	0.80
Kiwifruit	22	67	1.05	1.00
Citrus	33	67	0.67	0.67
Citrus (desert)	33	67	0.60	0.60
Olives	33	67	0.70	0.70
Avocado	33	67	0.70	0.70
Evergreen	33	67	0.60	0.60
Almonds	50	90	1.05	0.65
Walnuts	50	75	1.05	0.80
Date Palm	33	67	0.95	0.95

METHOD 1: MEASURING WATER LOSS FROM PLANTS AND SOIL DUE TO EVAPOTRANSPIRATION FOR LANDSCAPE PLANTINGS ET_L USING LANDSCAPE COEFFICIENT

FORMULA: $ET_L = K_L \times ET_O$

WHERE:

K_L = Landscape coefficient

ET_O = Reference evapotranspiration

WHERE:

$K_L = K_S \times K_D \times K_{MC}$

K_S = Species factor

K_D = Density factor

K_{MC} = Microclimate factor

DETERMINING K_S

1. Go to the WUCOLS Table and look up the specific plant under Region 2 to determine whether the plant is Low, Medium, or High (L, M, H) water use.

2. Use the handout to determine the specific K_S based on plant water need (L, M, H) and where you live in El Dorado County.

3. Special cases:

    a. Single species plantings: use the K_S given

    b. Multiple species plantings:

        i. All with similar water needs, use the K_S for the water need (L, M, H)

        ii. With dissimilar water needs, use the K_S value that applies to the species with the highest water need.

DETERMINING K_D

1. Assign plantings average density if:
    a. Plantings are all of one vegetation type AND:
        i. Trees: the canopy cover is 70 – 100%
        ii. Shrubs and ground covers: the canopy cover is 90 – 100%
    b. Plantings of more than one vegetation type AND:
        i. One vegetation type predominates while others are sparsely represented.
2. Assign plantings low density if:
    a. It is an immature or sparsely planted landscape.
    b. Trees: with canopy cover less than 70%: lower values for thinner cover, higher for more cover up to 70%.
    c. Shrubs and ground covers: with canopy cover less than 90%.
3. Assign plantings high density if:
    a. It is a mixed vegetation cover where large numbers of different plants are present.
    b. It is a tiered vegetation with plants of many different elevations.

DETERMINING K_{MC}

1. Assign plantings average K_{MC} if:
    a. Site conditions are equivalent to those used to determine ET_O, I.E.:
        i. Open field.
        ii. No extraordinary winds.
        iii. No large heat input from pavement or structures.
    b. Plantings are in a park-like setting
2. Assign plantings low K_{MC} if:
    a. The site is shaded or it is protected from winds typical of the area.
    b. The site is on the north or northeast side of a building.
    c. The site is in a courtyard.
3. Assign plantings high K_{MC} if:
    a. The site is exposed to direct winds that are higher than normal for the area.
    b. The site is exposed to heat sources or reflected light such as near buildings or pavement.
    c. The plantings are located in medians or parking lots or near south or southwest facing walls.
    d. The plantings are in wind tunnel locations

EXAMPLES FOR CALCULATING LANDSCAPE EVAPOTRANSPIRATION

EXAMPLE 1: A large mature planting of star jasmine used as ground cover in an urban landscape in Cameron Park. Exposure: full sun, average wind, August, slight slope.

STEP 1: Determine K_S

- From WUCOLS, star jasmine in region 2 is classified as a moderate (M) water use plant.
- Go to the table in the handout, moderate K_S in Cameron Park is 0.6.

STEP 2: Determine K_D

Since the planting is mature (canopy cover = 100%) and of one type, $K_D = 1.0$.

STEP 3: Determine K_{MC}

Since the microclimate is similar to that of ET_O (full sun, open area, average wind), $K_{MC} = 1.0$.

Step 4: Calculate K_L

$K_L = K_S \times K_D \times K_{MC}$

$K_L = .6 \times 1.0 \times 1.0 = .6$

STEP 5: Calculate ET_L

$ET_L = K_L \times ET_O$

- Determine ET_O: from the handout, ET_O for Cameron Park in August is 7.2 inches/month
- $ET_L = K_L \times ET_O = .6 \times 7.2 = 4.32$ inches/month

STEP 6: Determine Irrigation Efficiency (IE)

- Evaluate the landscape condition for runoff, evaporation, system leakage, wind spray, or other possible sources of water loss.
- Because we are in full sun and there is a slight slope which causes more runoff, we will assign an IE of .80 (80%).

STEP 7: Determine the total water to apply (TWA)

$TWA = ET_L / IE = 4.32 / .80 = 5.4$ inches/month

EXAMPLES FOR CALCULATING LANDSCAPE EVAPOTRANSPIRATION

Example 2: A mixed, mature planting of Sweetgum, Rhaphiolelpis, Wheeler's dwarf pittosporum, Raywood ash, and Hypericum is planted on a ridge line in Camino. Exposure: full sun, windy (hot, dry, dessicating, upslope), July.

STEP 1: Determine K_S

- From the WUCOLS, all plants are listed as Moderate (M) for region 2.
- Go to the table in the handout, moderate K_S in Camino is .4.

STEP 2: Determine K_D

- Since the canopy cover is 100% and this is a tiered planting with three tiers, K_D will be in the high range. Use $K_D = 1.2$.

STEP 3: Determine K_{MC}

- Since the site is in full sun on a windy ridge which receives afternoon upslope winds, K_{MC} will also be in the high range. Use $K_{MC} = 1.3$.

STEP 4: Calculate K_L

- $K_L = K_S \times K_D \times K_{MC} = .4 \times 1.2 \times 1.3 = .62$

STEP 5: Calculate ET_L

- Determine ET_O: from the handout, ET_O for Camino in July is 7.75 inches per month.
- $ET_L = K_L \times ET_O = .63 \times 7.75 = 4.80$ inches/month

STEP 6: Determine Irrigation Efficiency (IE)

- Evaluate the landscape condition for runoff, evaporation, system leakage, wind spray, or other possible sources of water loss.
- Because we are in full sun on a ridge line where there could be some wind anytime, we will assign an IE of .80 (80%). NOTE: if the irrigation system is sprinkler and we run it in the afternoon in upslope wind conditions, IE would drop radically, perhaps to as low as .65 or less.

STEP 7: Determine the total water to apply (TWA)

- $TWA = ET_L / IE = 4.80 / .80 = 6.0$ inches/month
- If IE dropped to .65, then $TWA = 4.80 / .65 = 7.4$ inches/month

METHOD 1: MEASURING WATER LOSS FROM PLANTS AND SOIL DUE TO EVAPOTRANSPIRATION USING CROP COEFFICIENTS

Say I have eggplants growing in July (midseason). The midseason crop coefficient (K_C) for eggplant is .90. I want to know how much water to put down each week to replace the water lost to evapotranspiration. I live in Placerville.

$ET_C = ET_O \times K_C$

Using the reference evapotranspiration ET_O from Camino for July, I find that ET_O is 7.75 inches/month.

1. If you use the 7.75 inches/month, then convert it to inches/week by dividing by 31 and multiplying by 7.

   $$ET_O\text{/week} = \frac{7.75 \text{ inches/month} \times 7 \text{ days/week}}{31 \text{ days/month}} = 1.75 \text{ inches/week}$$

2. Evapotranspiration for this crop (ET_C) is now the product of ET_O and K_C.

   ET_C = 1.75 inches/week x .90 = 1.58 inches/week or about 1.6 inches/week

   This is the amount of water you would have to replace on average each week in July.

3. If you lose water due to runoff, or if you are using sprinklers and you lose water due to evaporation, you must consider this water loss and increase the amount you apply in order to get the required amount to the crop. Usually evaporative loss is considered to be about 20%. Runoff loss may be anywhere from none to nearly 100%. For this example, let's assume it is 15%. So, our total loss is 35% (15 + 20); therefore the irrigation efficiency is 65% (100 – 35), and the actual amount of water you must apply to replace that lost to evapotranspiration is:

   $$\frac{ET_C}{IE} = \frac{1.6 \text{ inches/week}}{.65} = 2.5 \text{ inches/week}$$

CALCULATING HOW LONG TO IRRIGATE

Suppose we have some mature trees whose spread is about 15 x 15 feet. We have an irrigation system that delivers 2.5 GPM. We want to put down 4.5” of water over the entire area beneath the tree. How long must we run the irrigation system?

1. Calculate area under tree
   $15 \times 15 = 225\ ft^2$

2. How many inches of water per sq. ft. per minute can the system deliver?
   $2.5\ GPM \times 1.6\ in/ft^2 = 4\ in/ft^2/min$

3. Calculate run time:
   $225\ FT^2 \times 4.5” \ / \ 4\ in/FT^2/min = 253$ min or about 4.5 hours

4. Efficiency Considerations: If the system efficiency is 75% (that is, the remaining 25% is lost to runoff, evaporation, percolation, or whatever), then the actual run time must be increased.

$$\frac{253\ \text{min}}{.75} = 337\ \text{min or about 5.5 hours}$$

USEFUL CONVERSION NUMBERS AND FLOW RATES

Conversion numbers:

a) 1 acre inch = 27,154 gal
b) 1 acre = 43,560 ft2
c) 1 gallon of water will cover one square foot to a depth of 1.6”

   1 gal H_2O = 1.6” H_2O/ft^2

d) To convert delivery systems from:

   Gallons/minute (GPM) to inches of water per square foot:

   GPM x 1.6 = inches of $H_2O/ft^2/min$

   OR

   Inches of water per square foot/minute to gallons/minute:

   GPM = inches of $H_2O/ft^2/min$ / 1.6

Flow Rates *:

a) Traditional sprinklers = 2 gal/minute
b) Rotary sprinklers = 1 gal/minute
c) Micro-spray = ½ gal/hour
d) Bubblers = 4 gal/hour
e) Drip emitters – 2 to 4 gal/hour (Depends on emitter size. Some emitters are adjustable.)
f) Hose ½ inch in diameter = 6 gal/minute (full force)

Estimated weekly water need for moderate to high water use trees by leaf canopy diameter:*

Diameter (feet)	Water need (gal/week)	Example
5	20	New sapling
10	57	Crabapple
20	230	Birch, Tulip Tree, Coast redwood
30	518	Weeping willow, walnut, oak (non-native)

*Source: Sacramento Bee

DATA NEEDED TO USE METHOD 3 FOR SPRINKLERS

1. Soil Type: To estimate water holding capacity (inches of water available to the plant).
    a. Clay – one foot of soil depth holds 2.0 to 2.5 inches of water.
    b. Loam – one foot of soil depth holds 1.5 to 2.0 inches of water.
    c. Sand – one foot of soil depth holds 1.0 to 1.5 inches of water.
2. Amount of water applied: Sprinkler irrigation is usually measured as in/ft^2 (That is, the depth of water applied per square foot of coverage.)

    If you know the amount you want to apply in in/ft^2, use that number.

    If you want to determine how much your sprinkler system is applying, use the tuna can method – place cans in the sprinkler pattern, run the system for some period of time. Then measure the amount of water in the can(s). If using several cans, you can average the number. This gives you the amount of water in inches applied per time.
3. Area the plant covers: The area the plant covers from its center to the drip line in square feet (ft^2).
4. Rooting depth: The soil depth, down to an impermeable layer or the maximum depth to which the plant's roots are expected to penetrate.

See the table for selected average areas.

METHOD 3: SINGLE PLANT WATER NEEDS
EXAMPLE FOR SPRINKLER IRRIGATION

In sprinkler irrigation, water is not applied daily, but on a periodic basis to refill the soil, which acts as a storage reservoir for water to be available to the plant. Soil type and rooting characteristics are important in determining the amount of water to apply and how often to apply it. Research shows beneficial results from irrigating at or before 50-75% depletion of the soil-stored available water, then applying what has been used (the amount of water used plus 20% for efficiency loss, due to airborne evaporation, over spray, etc.).

EXAMPLE: A mature large fruit tree has a rooting depth of 3 feet in the standard El Dorado County clay soil. It is July.

How Much: Three foot rooting depth times 2.5 inches of available water per foot equals 7.5 inches of available of water.

7.5 X 75% depletion = 5.6" = amount of water to apply plus 20% for efficiency loss = 6.7 inches.

300 square feet (the area covered by the tree) divided by 43,560 ft^2/acre (equals the fraction of an acre covered by the tree) times 27,154 gal/acre-inch (gives the number of gallons required to cover the 300 square ft to a depth of one inch) times 6.7 inches (the number of inches required to restore the water to ground storage) = 1253 gallons.

300 ft^2 / 43,560 ft^2/acre x 27,154 gal/ac-in x 6.7 inches = 1253 gallons.

How Long: Set cans under the sprinklers and measure how long it takes to apply 1 inch of water. Multiply this time by 6.7 to determine the amount of time to deposit 6.7 inches.

How Often: 6.7 inches of water divided by .25 inches of water used per day (7.75 / 31) = 27 days.

OR, USING THE DAILY WATER USE TABLE

1253 gallons of water per tree divided by 46.8 gallons per day = 27 days
You must water every 27 days with 1253 gallons or 6.7 inches of water per tree.

DATA NEEDED TO USE METHOD 3 FOR DRIP IRRIGATION

1. Daily Water Use: Called ET (evapotranspiration) in inches of water per day (in/day).
2. Amount of Water Applied: Drip irrigation is measured as gal/hr (that is, each emitter's output).
3. Area the Plant Covers: The area the plant covers from its center to the drip line in square feet (ft^2).
4. Efficiency Adjustments: Primarily used for young trees under drip irrigation. Two to three times more water should be applied to small trees less than 20% full size, gradually reducing the adjustment until trees reach 70% full size.

EXAMPLE: A mature semi-dwarf fruit tree might cover 100 ft^2. Therefore, such a tree would need the following efficiency adjustments:

Less than 20 ft^2	-	3 times more water
20 to 35 ft^2	-	2.5 times more water
35 to 50 ft^2	-	2 times more water
50 to 65 ft^2	-	1.5 times more water
70 ft^2	-	1 (no adjustment necessary)

METHOD 3: SINGLE PLANT WATER NEEDS
EXAMPLES FOR DRIP IRRIGATION

Water is applied on a daily basis to supply just what the tree is using every day without providing an excess for storage. Start irrigating in early spring before much soil moisture has been used, because the stored soil water may be needed later if the system malfunctions, e.g. insects clog the emitters, or is accidentally shut down. Soil type or depth is almost inconsequential, and only 25 – 40% of the rooting area need be wetted for good tree performance.

EXAMPLE #1: A young semi-dwarf fruit tree, two years old, occupying a space 10 ft^2. It has two 1 gal/hr emitters. The month is June when the water use rate is .24 in/day.

How Much: From the table find a 10 ft^2 tree and reading over to the June column yields a use rate of 1.49 gal/day. Since this is a young tree of less than 20 ft^2 of coverage, use an adjustment factor of 3.

1.49 x 3 = 4.47 gal/day

How Often: = 4.47 gal/day / 2 emitters at 1 gal/hr = 2.24 hrs/day

EXAMPLE #2: A mature escallonia shrub covering about 4 ft^2 is on a single 5 gal/hr emitter.

How Much: From the "Water Use Classification of Landscape Species" publication (available in the Master Gardener Office), we find that escallonia in region 2 (Central Valley) is a moderate water user. In the table "Estimated Species Water Needs" in the appendix, we find region 2 consists of five locations. Using Auburn as most representative of our foothill location, we find a moderate water use plant requires from 3.3 to 4.9 inches of water per month, or a mid-value of 4.1 in/mo. Dividing 4.1 in/mo by 30 days/mo yields about .137 in/day. Now to our own water use table for Camino, find the 4 ft^2 line and read over to the September column (the .17 in/day is closest to our need for .137 in/day) and we find this yields about .42 gal/day.

How Often: Since we have a 5 gal/hr emitter, we could run it for about 35 minutes once a week to supply the water needs.

.42 gal/day x 7 days = 2.94 gal/wk

2.94 gal/wk / 5 gal/hr = .59 hr/wk

EXAMPLE #3: A mature large fruit tree has four one gal/hr emitters with which to supply water in August.

How Much: From the table, we can see a mature fruit tree (large) covers about 300 ft^2. There is no adjustment factor (adjustment factor = 1). In August, we lose .22 in/day, so the table says we need to supply 41.1 gal/day.

How Often: Everyday, 41.1 / 4 = 10.27 hours.

If we had two 5 gal emitters instead,

41.1 / 10 = 4.1 hours everyday or 8.2 hours every other day.

DAILY WATER USE RATE IN GALLONS/DAY FOR CAMINO

PLANT OR FT^2 OF COVER	ET_O IN INCHES/DAY					
	May .193 in/day	June .24 in/day	July .25 in/day	August .22 in/day	September .17 in/day	October .10 in/day
1 FT^2	.120	.149	.155	.137	.106	.062
4 FT^2 (1 Yr old fruit tree)	.48	.60	.62	.55	.42	.25
10 FT^2 (2 Yr old fruit tree)	1.20	1.49	1.55	1.37	1.06	.62
36 FT^2 (3 Yr old fruit tree)	4.32	5.36	5.58	4.93	3.82	2.23
75 FT^2 (Grapevine mature)	9.0	11.2	11.6	10.3	8.0	4.6
100 FT^2 (Semi-dwarf mature or 4 Yr old standard)	12.0	14.9	15.5	13.7	10.6	6.2
200 FT^2 (2 FT wide 100 FT row raspberry)	24.0	29.8	31.0	27.4	21.2	12.4
300 FT^2 (Mature large standard tree)	36.1	44.9	46.8	41.1	31.8	18.7
400 FT^2 (4 FT wide 100 FT row strawberry)	48.1	59.8	62.3	54.8	42.4	24.9
1 Acre solid cover	5241	6517	6788	5974	4616	2715