4/13/01

Growing Frui

Home Orchard + Vineyard

Outline for
Master Gardener Trai Class

Prepared by

Chuck Ingels
Farm Advisor, UC Cooperative Extension, Sacramento County

April 2001

TABLE OF CONTENTS

Only pages produced by Univ. of California are included.

GROWING FRUIT TREES

I. **Chilling requirement** (see page 16)
   A. The number of chilling hours < 45°F required by a fruit species or variety between November 1 and February 15
   B. Lack of chilling results in extended bloom and poor fruit set

II. **Pollination** (see page 17)
   A. Pollinizer = A tree of one variety that will provide pollen to a tree of a different variety to produce fruit
   B. Pollinator = An insect (usually a bee) that carries pollen from one tree or flower to another

III. **Soil Requirements**
   A. Soil depth
      1. Minimum: 2-3 ft.
      2. Optimal: 3-5 ft. (5-7 ft. for walnuts)
   B. Poor root growth and water movement through:
      1. Cemented hardpan
      2. Clay, sand, or gravel layers
   C. Good drainage is *essential*; soil must be loose and not excessively clayey for root growth and water infiltration.
   D. Solutions to poor drainage or shallow soils
      1. Raised beds
      2. Auger large holes through hardpan
      3. Use trencher to create zones of loosened soil
      4. Build French drains or drainage holes to carry off excessive water

IV. **Soil Amendments**
   A. Usually no need to mix in fertilizer or soil amendments when planting
   B. No harm in thoroughly mixing in well broken down compost and/or balanced fertilizer
   C. Avoid layers or pockets of undecomposed organic matter, especially in clay soils – breakdown products are toxic to roots.
   D. Add mulch or compost to soil surface after planting

V. **Choosing and handling trees**
   A. Use ½ to 5/8 in. caliper trees
   B. Avoid drying out. Never keep roots of unplanted trees unprotected. "Heel in" (plant temporarily in soil or sawdust) immediately if planting must be delayed.

VI. **Tree planting and first year care** (see page 18)
   A. Prune roots
      1. Check for and remove broken or damaged roots
      2. Cut back long roots to about a foot long

Only pages produced by Univ. of California are included.

B. Hole size
   1. Depends on quality of soil
      a. Compacted or hardpan soil – dig hole 4 ft. wide by 2 ft. deep; can use pedestal
      b. Loose, well-drained soil (rare!)– slightly larger than root system
      c. Spread roots to go down and out where possible
C. Plant on mound
   1. Aids in keeping crown dry (reduces risk of Phytophthora)
   2. Prevents basin from forming after settling
D. Plant high
   1. Place uppermost large root just below soil surface
   2. Graft union must be well above ground
   3. Allows for soil settling after planting
   4. Reduces exposure of crown/lower trunk to soggy soil
   5. Anchorage is from deep roots, not deep trunk
E. Orientation
   1. Orient inside of trunk bend (immediately above the bud union) toward the N or NE to reduce sunburn on curvature of union
   2. In heavy wind areas, orient curve into the wind to prevent breakage
F. Pruning
   1. Head back tree to 18-36 in.; low branching means low fruiting
   2. May head higher if higher branching desired (e.g., landscape situation)
   3. If strong, undamaged, well-placed branches are present, cut back to 3-8 in. long
G. Paint trees white
   1. Prevents sunburn and subsequent borer infestation
   2. Use 50:50 mix of interior latex paint and water
   3. Paint entire trunk and 2 in. below soil level
H. Irrigation
   1. In most cases, irrigation at planting is not necessary; rains will water trees in
   2. In heavy clay soil, flooding eliminates air pockets (settling) and may kill trees by creating anaerobic conditions
   3. Place drip emitters 1 ft. away from trunk or create doughnut basin; do not create an irrigation basin that wets the trunk
I. Fertilization
   1. Most soils have adequate P, K, and micronutrients (foothills have low P soils)
   2. Nitrogen
      a. Light application of N (1-2 oz. actual N), split between spring and summer
      b. Suggestions (work into soil)
         - ¼ lb. ammonium sulfate, spring and summer
         - 5 lbs. composted rabbit/poultry manure or 10 lbs. steer or cow manure
         - 15 lbs. finished compost
         - Liquid: label rate of fish fertilizer or fish emulsion
      c. Keep fertilizer 6-8 in. from trunk
J. Mulching
   1. Conserves moisture
   2. Use 2-4 in. wood chips
K. Record location of varieties and rootstocks

VII. **Training systems** (see pages 19-22)

A. Open center
   1. Most commonly used system
   2. Used for stone fruits and almonds; can also use for apples, pears, figs, and persimmons
   3. Select scaffolds during first 2 growing seasons or dormant seasons
   4. Keep center open during summer *from the start*

B. Central leader
   1. Used for apples, pears, and Asian pears that aren't susceptible to fire blight (see under diseases
   2. Maintain central leader by heading it, but head well above the height of other headed branches; avoid heading cuts on side branches
   3. Can create 3-4 whorls of branches or space each limb 8 to 12 in. apart vertically
   4. Use spreaders or tie down branches originating off central leader

C. Modified central leader
   1. Used for walnuts and persimmons; can also use for apples, pears, and figs
   2. Start tree as a central leader, then cut out the leader part way up

VIII. **Pruning**

A. Reasons for pruning
   1. Young Trees
      a. To set the height of the first branches
      b. To establish the proper training system and shape the tree
      c. To produce a strong framework to support the future crop
      d. To produce fruit (after 1st year)
   2. Bearing Trees
      a. To help sunlight reach lower fruiting wood
      b. To remove unproductive fruiting wood and stimulate growth of new fruiting wood
      c. To control tree size
      d. To provide for ladder access
      e. To remove broken, dead, and diseased wood
      f. To remove crossing and crowded branches
      g. To control alternate bearing

B. Responses to pruning
   1. Usually reduces tree size
   2. Invigorates tree (dormant pruning) or devigorates tree (summer pruning)
   3. Usually increases fruit size

C. Types of pruning cuts
   1. Heading cut
      a. Removal of part of branch or shoot
      b. Used to promote branch development, especially on young trees
      c. Stimulates growth just below cuts
      d. Can reduce sunlight penetration

2. Thinning cut
    a. Removal of entire branch or shoot
    b. Used to prevent crowding and improve sunlight penetration
    c. Defines main branches

D. Summer pruning
1. Young Trees – used for selecting scaffold branches; Techniques:
    a. Pinch back unwanted shoots at 4-6 in.
    b. Pinch 2-3 ft. long scaffold branches to promote side branching
    c. Reduces training time and shortens time to first fruit production
2. Bearing Trees
    a. Used for increasing sunlight penetration to improve productivity of lower fruiting wood
    b. Technique: remove most vigorous, upright shoots shading lower wood 1-3 times during season
    c. Can reduce tree vigor
    d. Can sunburn branches if excessive

E. Pruning neglected trees
1. Goals
    a. Reduce tree size and height of fruiting wood
    b. Increase sunlight exposure to lower wood
2. Techniques
    a. Prune sagging branches to more upright laterals
    b. Reduce height and train over 2-3 year period
    c. Consider heading back all scaffold branches but one (nurse limb) in early spring and retrain
    d. Paint limbs exposed on south and west sides with white interior latex paint (50:50 with water)

PRUNING HIGH DENSITY TREES (Fruit Bushes)

A. Spacing
1. Approximate distance between trees (1 tree per hole) or clusters of trees: 6-10 ft.
2. 2 or 3 trees per hole: 1½ ft. apart in cluster
3. 4 trees per hole: 2 ft. apart in cluster
4. Hedgerow: 2-4 ft. apart

B. Pruning
1. First year
    a. At planting, head trees to 15-24 in.
    b. After spring flush, cut back new growth by half (late April/early May)
    c. In late summer (August), cut subsequent growth back by half
    d. May need to prune 1-2 more times
    e. For potted trees trained high, use notching to stimulate low branches; then cut above these branches
2. Second year: Cut back new growth by half in spring, early summer (if vigorous) and late summer
3. Third year: Cut back new growth 2-3 times during growing season at selected tree height

IX. Fruit Thinning (see page 23)

A. Reasons for thinning
   1. Increase fruit size
   2. Improve fruit color
   3. Reduce diseases (esp. brown rot)
   4. Reduce alternate bearing
   5. Reduce limb breakage

B. Timing – when fruit are ¾ to 1 in. diameter (April)

C. Methods
   1. Hand thinning
      a. Most thorough
      b. Can selectively eliminate small, scarred, and disease or insect infested fruit
      c. Most time consuming
   2. Cluster buster
      a. Short piece of hose or rubber on end of mop handle
      b. Quickest method, but not selective, and may damage fruit

D. Apples & pears
   3. Apples: Thin to 1 fruit per cluster
   4. European (Bartlett – no thinning) and Asian pears: Thin to 1-2 fruit/cluster

X. Fruit Taste

A. People often ask why fruit is not sweet
   1. Function of variety, irrigation, and other factors??
   2. Overirrigating dilutes sugars, reduces flavors
   3. Slightly underirrigating can sweeten fruit, but may make it smaller

XI. Fruit drop and split pit

A. Why does fruit drops before ripe?
   1. Some fruit drop is normal, especially in May
   2. Many factors can cause high fruit drop: codling moth or other worms, scab or other diseases, over/under irrigation, excessive fruit load (lack of thinning)

B. Why did pits split?
   1. Some varieties split more
   2. Lack of water followed by heavy watering

XII. Nitrogen fertilization (usually the only nutrient necessary) (see page 24)

A. Large, mature stone fruit trees require about 1 pound or less of actual nitrogen per year; apples require slightly less and nut trees require somewhat more.

B. DON'T OVER FERTILIZE!! ERR ON THE LOW SIDE!!
   – Too much N causes excessive growth and shading of lower wood.

C. Incorporate fertilizer for best results; can also water in

D. Example: Amount of N per tree per year, divided between spring and late summer

	Small frozen orange juice can (1 lb.) of ammonium sulfate	lbs. of fertilizer	lbs. of actual N
1st season after planting	1/2 can	.5	0.1
2nd season	1 can	1.0	0.2
3rd season	1½ cans	1.5	0.3
4th season	2½ cans	2.5	0.5
5th season	3½ cans	3.5	0.7
6th season on	5 cans	5.0	1.0

Alternative fertilization for mature trees:

3 lb. 33-0-0
7 lb. 16-16-16
35 lb. of rabbit manure
70 lb. steer or cow manure

XIII. Irrigation (see pages 25-26)

A. Soil texture largely influences available water held in soils
   1. Sands have about 0.5 in. available water
   2. Loams have about 1.5 in. available water
   3. Clays have about 2.0 in. available water

B. Rooting depth
   1. Roots extract water according to their depth and concentration in the soil profile
      - About 40% occurs in upper 1/4 of root zone
      - About 30% occurs in the second quarter
      - About 20% occurs in the third quarter
      - About 10% occurs in the bottom quarter
   2. Effective rooting depth is at least 2 feet; more on deeper soils

C. Climate – specifically solar radiation (intensity and duration) and wind
   1. Evaporation (E) from the soil surface and plant transpiration (T) driven by climate
      - ET is expressed in inches per day. A typical summer ET is 0.3 inches per day

Knowledge of these factors allows you to say how often and how much to water: the water budget method for irrigation. One catch: ET is expressed for a grass crop. You factor it for your tree crop (e.g. 70% of the reference ET).

XIV. Budding and Grafting (see pages 27-28)

A. Uses
   1. Produce new fruiting tree off sucker growing from tree whose top died
   2. Add pollinizers
   3. Make fruit salad trees

B. T-budding
   1. One of the surest methods for success
   2. Done in spring to produce branch for current season, or late summer to produce branch for next season
   3. Removal of bud/bark of desired variety, insertion in stock

4. Can only be done on 1-year-old wood
5. Cut branch ½ in. above top of bud to force growth

C. Grafting
1. Done in late winter (directly) or spring (scion wood in cold storage)
2. Whip graft on 1-year-old wood
3. Bark or cleft graft on older wood

XV. Pest Management

A. Key insects and mite pests
1. Codling moth (apples, pears, walnuts)
   a. Young larva quickly bores into core
   b. Usually see frass at exit hole (often at calyx end); larva usually leaves before fruit drops
   c. Overwinters as larva in cocoon in sheltered locations (bark, wood piles, etc.)
   d. 3 to 4 generations per year
   e. Control (difficult)
      - Sanitation
      - Mating disruption
      - Trunk banding
      - Fruit bagging
      - Mass trapping (pheromone traps – catch males)
      - Chemicals: Sevin or Malathion every 2 weeks, esp. at petal fall and 2 weeks later
2. Aphids
   a. Cause curling of leaves
   b. Usually aided by ants
   c. Control
      - In-season soap sprays
      - Tanglefoot on trunk
3. Scale (many types)
   a. Attack twigs, leaves, branches, or fruit; can stunt or kill tree
   b. Control
      - Natural enemies; avoid broad spectrum insecticides
      - Supreme- or superior-type oil spray (not "dormant oil")
        - Apply in February before bud swell after rainy or foggy period
      - Narrow-range oil spray in spring (April/May)
        - Timed when crawlers emerging (monitor with double-sided sticky tape)
4. Spider mites
   a. Webspinning mites (e.g., twospotted spider mite)
      - Very common; potentially serious
      - Cause fine webbing and stunting
      - Control: avoid broad-spectrum insecticides; forceful sprays with water; soap sprays

b. European red mite
   - Attacks many deciduous tree crops
   - Control: Supreme- or superior-type oil spray (not "dormant oil")
     - Apply in February before bud swell after rainy or foggy period

5. Peach twig borer
   a. Usually not a serious problem
   b. Bores in new shoots, causes "flagging"; also bore into fruit
   c. Overwinter in hibernacula in bark
   d. Control if necessary: Spray Bt twice during bloom

B. Key diseases
1. Peach leaf curl
   a. Causes leaves of peaches & nectarines to pucker and redden
      - Can be confused with aphid damage
   b. Fungal spores overwinter in bud scales
   c. Control with 1-3 dormant sprays of copper material or lime sulfur
      - No lime sulfur on apricots
      - Thanksgiving, Christmas, and Valentine's Day
      - Most critical timing – Valentine's Day or as buds are swelling
      - Control not possible or necessary after growth begins
      - Infections stop after warm, dry weather
2. Brown rot
   a. Attacks stone fruits and almonds
   b. Kills flowers and twigs, rots fruit (large, soft, brown spots)
   c. Overwinters in twig cankers and mummies
   d. Infection occurs when spores discharged during wet weather at bloom or preharvest
   e. Control methods
      - Remove and dispose of infected twigs and fruit
      - Keep canopy dry
      - Spray with copper once or twice during bloom
3. Apple/pear scab
   a. Causes dark scabby spots on fruit and large velvety spots on leaves, much fruit drops off
   b. Mainly a North Coast problem; only serious here with frequent spring rains
   c. Overwinters in leaves on the ground
   d. Control methods
      - Remove and dispose of fallen leaves
      - Spray fungicides before rains; frequency may not be possible
4. Fire blight
   a. Causes blackening and death of flowers, twigs, and branches; cankers and reddening of inner bark; cracking of outer bark in patches
   b. Inner bark has fermented odor
   c. Most serious in Bartlett pear and some varieties of apple (esp. Pink Lady) and Asian pear (esp. 20th Century)
   d. Bacteria infect flowers with warm, wet weather
   e. Infections occur mainly in flowers (nectaries), but can enter through leaves

f. Infection progresses rapidly down new shoots, slower in older growth
g. Control methods
   - Quickly remove diseased shoot at least 1 ft. below sign of infection
     - Best to dip blade in 10% clorox solution between cuts (but oil afterwards!) – mainly in wet weather
     - Instead of removing major branch, sometimes possible to scrape and then spray with clorox solution
   - Can spray during bloom with copper sulfate, but causes russetting

5. Bacterial canker and blast
   a. Attacks stone fruit and almond trees
   b. Causes rapid death of new shoots, gumming (many causes of gumming), and reddening of inner bark
   c. Inner bark has vinegar-like odor
   d. Bacteria enter through leaf scars or pruning wounds
   e. Tree can die to ground level but rootstock remains alive and may sucker
   f. Often worse in sandy soils; aided by ring nematode
   g. Control method – avoid pruning Oct. through Feb.

XVI. Citrus

A. Types
   1. Standard – to 20 or more feet!
   2. Dwarf – to 6-8 ft.
   3. Meyer lemon (*Citrus meyeri*) is not a true lemon (*Citrus limon*); it was discovered in China in 1908 by Frank Meyer.

B. Soil
   1. Good drainage is essential
   2. Avoid heavy clay soils
   3. Consider using raised beds or containers if soil is poor
   4. Provide plenty of water

C. Planting
   1. Plant high – pot soil line slightly above ground level
   2. Use mulch but not by trunk
   3. May need to use stake
   4. Little pruning required; can remove crossing or side-by-side branches, can cut back shoots to strengthen

D. Fertilizing
   1. Use balanced fertilizer, such as 18-6-6 or same ratio
   2. Fertilize lightly throughout the year, especially late winter for good fruit set
   3. Foliar feeding is good

E. Pruning
   1. Little pruning required – mainly shaping, and removing dead wood
   2. Timing – almost any time, but best is spring after danger of frost
   3. Head or remove strong or excessively vigorous shoots
   4. Keep sides and top pruned to reasonable height and spread annually
   5. Keep skirts pruned up off ground

6. Old, tall trees – reduce height over a 3-year period, not all at once – whitewash any exposed limbs
7. Dwarfs – can prune fairly severely to reshape and reinvigorate tree

F. Problems
1. Scale
   a. Prevent ants with tanglefoot
   b. Use summer oil between July-September
2. Aphids
   a. Prevent ants with tanglefoot
   b. Use soap or oil sprays
3. Mealy or dry fruit
   a. Caused by frost or poor irrigation or other factors

G. Cold hardiness (approx. temperature [°F] below which tree damage occurs)
1. Trees (foliage)

Mexican Lime	29	Meyer Lemon	22
Bearss Lime	28	Sweet Orange	21
Regular Lemon	26	Mandarin/Tangerine	20
Grapefruit	25	Kumquat	19

2. Fruit

Orange		Lemon	
Green	29	Green	28-29
Ripe	27-28	Ripe	29-30

3. Cold hardiness of Rootstocks

Standard		Dwarf	
Rough lemon	low	Flying Dragon	high
Sweet orange	mod.		
Semi-Dwarf			
Sour orange	high		
Trifoliate orange	highest		

Fruit Tree Terminology

Tree Types

Species – Type of fruit tree (e.g., apple, peach).

Cultivar – Variety (cultivated variety, e.g., 'Fuji' apple).

Stone fruit – Any of the *Prunus* spp. fruits with a hard pit surrounding the seed (e.g., peach, cherry).

Pome fruit – Any of the fruit species with a papery membrane surrounding the seed cavity (apple, pear, quince, pomegranate).

Tree Parts: Scion and Rootstock

Scion – The above-ground portion of a tree that is asexually produced from a single parent by budding or grafting.

Rootstock – The below ground portion of a tree which can be either by seed or vegetatively propagated.

Standard rootstock – A rootstock that produces a full-sized tree (i.e., 25-30 ft. tall).

Dwarfing or size-controlling rootstock – A rootstock that produces a somewhat smaller tree than a standard rootstock (i.e., 15-20 ft. tall).

Genetic dwarf – A scion that produces a small tree, even on a standard rootstock.

Tree Parts: Structure and Shoots

Crown – Point of union between the trunk and the root system. Usually at ground level. Sometimes refers to canopy.

Trunk – The main supporting stem of a tree. Connects roots with branches.

Crotch – Junction formed between the trunk and a main limb or between two limbs.

Limb – Any extended permanent branch.

Main (primary) scaffold limbs– Limbs arising from the trunk.

Secondary scaffold limbs – Limbs arising from the main scaffold limbs.

Shoot – A stem with leaves; referred to as current season's growth during the growing season.

Water sprout – A vigorous shoot arising from buds on trunk or branches.

Sucker – A shoot arising from the roots or crown.

Lateral – A shoot arising by growth of a lateral bud (bud on the side of a shoot or limb).

Spur – A short branch specialized for flower and fruit production on many species.

Canopy – The leaf-bearing portion of the tree.

Drip line – The outer circumference or perimeter of a tree's branches or canopy.

Growth Regions and Buds

Callus - Wound-healing tissue.

Cambium – The layer of living cells on the inner bark surrounding the wood in which, by cell division, the tree grows.

Vegetative bud – A bud that produces only shoots and leaves.

Flower bud – A bud containing only a single flower (e.g., stone fruits) or a cluster of flowers (e.g., pome fruits).

Mixed bud – Guess.

Terminal bud – A bud at the tip of a shoot.

Lateral bud – A bud on the side of a shoot.

Growth and Fruiting Characteristics

Dormancy – The condition of rest in a bud. Dormancy begins in summer with the formation of next year's buds.

Chilling hours - The number of hours between November 1 and February 15 below 45° F.

Chilling requirement – The number of chilling hours required by a fruit species or variety.

Parthenocarpic –Fruit produced without seeds or pollination (e.g. Bartlett pear).

Apical dominance – The hormonal regulation of growth by leaf buds. The terminal bud and leaves produce hormones (auxin or IAA) that inhibit the elongation growth of lateral buds.

Terminally bearing – A variety of apple, pear, or walnut that bears most of its fruit terminally on spurs or shoots.

Spur bearing – Species or variety that bears mostly on spurs.

Precocious – Bearing early in the life of a tree.

Pruning Terms

Heading cut – The removal of a part of a branch or shoot. Used to produce lateral branches, to stiffen branch, or to reduce fruit thinning.

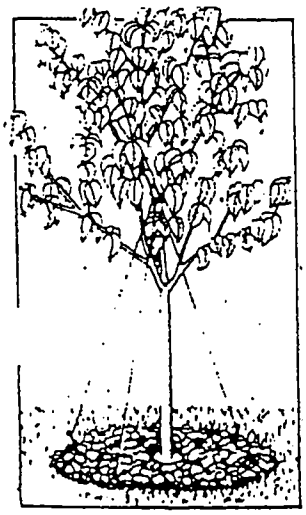
Thinning cut – The complete removal of a branch, or cutting back to a branch 1/3 or more the size of the main branch. Used to encourage light penetration or allow access.

Undercut – A preliminary cut made on the bottom of a large limb that reduces tearing of bark.

Summer pruning – Pruning done any time between early May and early September to train young trees, maintain tree height, and improve light access for lower fruiting wood. Often devigorates tree growth.

Dormant pruning – Pruning during the dormant season. Invigorates tree growth.

WATER MANAGEMENT
for fruit trees
& other plants



Did you know that a large apple tree, on a hot summer day, will use about 50 gallons of water?

DAILY WATER USE in gallons per day (ET)

Plant or ft.² cover	0.10 in/day cool day in early spring or late fall foggy	0.20 in/day warm day in spring or fall some fog	0.25 in/day hot day in mid summer no fog	0.30 in/day very hot (100°) windy mid-summer
1 ft.²	0.062	0.125	0.156	0.187
4 ft.² 1 yr. old fruit tree	0.25	0.50	0.62	0.75
10 ft.² 2 yr. old fruit tree	0.62	1.25	1.56	1.87
36 ft.² 3 yr. old fruit tree	2.25	4.5	5.61	6.73
75 ft.² grapevine mature	4.65	9.4	11.7	14.0
100 ft.² semi-dwarf mature or 4 yr. old	6.2	12.5	15.6	18.7
200 ft.² 2 ft. wide 100 ft. row raspberry	12.4	25.0	31.2	37.4
300 ft.² large std. mature tree	18.6	37.5	46.8	56.1
400 ft.² 4 ft. wide 100 ft. row strawberry	24.8	50.0	62.4	74.8
1 acre solid cover	2715	5431	6788	8146

To water optimally you must know:

1. **Daily water use** - called ET (Evapo-Transpiration) in inches per day.

2. **Soil type** - to estimate water holding capacity (inches of water available to plants).
   a. clay - one ft. of soil depth holds 2.0 to 2.5 in. of water
   b. loam - one ft. of soil depth holds 1.5 to 2.0 in. of water
   c. sand - one ft. of soil depth holds 1.0 to 1.5 in. of water

3. Amount of water applied:
   a. Drip irrigation gal./hr. (measure emitter output)
   b. Sprinkler irrigation in./ft.². Place several "tin" cans in the sprinkler pattern

SOURCE: UC Cooperative Extension, Sonoma Co.

Only pages produced by Univ. of California are included.

and measure inches of water/time.

4. **The area a plant covers** in square feet (ft.^{2}) to the drip line. (% canopy)

5. **Rooting depth;** soil depth down to an impermeable layer, usually.

6. **Statistics:**
   a. 1 acre inch = 27,154 gallons
   b. 1 acre = 43,560 feet^2

7. **Efficiency adjustments** must be made for young trees under drip irrigation. Two to 3 times more water should be applied to small trees less than 20% full size, gradually reducing the adjustment until trees reach 70% full cover.

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 this stored water may be needed later in case the system 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: A young semi-dwarf fruit tree, two years old, and occupying a space of 10 ft^2. It has two 1 gal./hr. emitters and on a warm spring day the water use rate is about 0.20 in./day.

How much: 1.25 gal./day (TABLE) times a factor of about 2.5 for an efficiency adjustment on young trees (10-15% canopy) = 3.13 gal./day.

How often: Everyday, 46.8 divided by 4 emitters = 11.7 hours.
Every other day = 23.4 hours.

For sprinkler irrigation, water is not applied daily, but on a periodic basis to fill the soil, which acts as a storage reservoir for water available to the plant. Soil type and rooting characteristics are very important. Recent research shows beneficial results from irrigating at or before 50-75% depletion of the (soil-stored) available water, then applying what has been used + 20% for efficiency loss.

Example: A mature standard size (large) fruit tree occupying an area of 300 ft.^{2} A rooting depth of 3 ft., loam soil, and a daily water use (ET) of 0.25 in./day in July.

How much: 3 ft. rooting depth X 2" of available water per feet = 6" of available water.

6" X 75% depletion = 4.5" amount of water to apply + 20% = 5.4 in. 300 ft.^{2} divided by 43560 ft. X 27154 gal./acre in. X 5.4 in. = 1010 gal./300 ft.^{2} (for that tree) or 146,360 gal. per acre.

How long: Set open "tin" cans under sprinklers and measure how long it takes to apply 1 in. of water X 5.4 in. = the duration of set.

How often: 5.4 inches of water divided by 0.25 inches of water used per day = 21 days.
1010 gal. of water per tree divided by 46.8 gal. of water used per day = 21 days.

Prepared by: Paul Vossen, Farm Advisor
UC Cooperative Extension, Sonoma County
2604 Ventura Ave., Rm. 100
Santa Rosa, CA 95403
(707) 527-2621