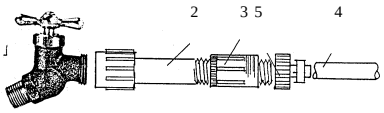
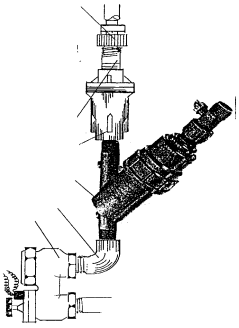
University of California
Agriculture and Natural Resources

DRIP IRRIGATION

Parts of a typical drip system.





1. Anti-siphon valve (not shown)

2. Filter

   All drip systems must have a filter to prevent emitters from plugging.

3. Pressure Regulator

   Most homes using municipal water have a water pressure of 30 to 45 PSI -pounds per square inch Required to reduce water pressure to 15 to 30 PSI

4. Tubing

   - Polyethylene (Comes in several sizes, ½ inch is the most common)
   - Spaghetti or distribution.
   - Laser drip. (Soaker hose)

5. Fittings

   - Female hose swivel
   - Couplings, elbows, tees, 1/4" fittings for distribution tubing
   - Goof or end plugs
   - End piece or figure eight
   - Reduction coupler

6. Punch

7. Emitters

   Color Code

Red	½ gal./hr.
Blue or Black	1 gal./hr.
Green	2 gal./hr.

8. Optional Components

   - Pressure test gauge
   - Fertilizer injection equipment

Design Your System

Step 1: Analyze your site.

Soil Type	Characteristics	Wetting Pattern
Coarse	**Soil particles are loose, sandy grains. Squeeze it in your hand. If it's dry, it will fall apart as soon as you open your hand. If it's damp, it will form a lump and then crumble easily when you touch it.**	
Medium	**A moderate amount of sand and very little clay. When dry, it breaks easily. When wet, it forms a lump.**	
Fine	**Mostly clay. When dry, it forms hard lumps or clods. When damp, it is flexible and can be molded into shapes**	

Microclimates are the variations of climate within your site.

Plants

Group the plants with like water requirements together into one drip system, dividing them according to water needs: low, medium, and high water use. If you are planting a new site you will simplify setting up your drip system by arranging the landscape so plants with similar water needs are grouped together on the same run.

Step 2: Make a diagram of your site.

Design your Watering Zones

Determine how much water each plant needs. The following charts are general guides.

Watering Chart

Courtesy of the University of California Cooperative Extension
This is a general guide. Times will vary depending on soil type and season.

Type of Plant	Time (Hrs)	Interval (Days	Flow (GPH)	No. of Emitters	Placement of emitters
Low Shrubs (2-3')	3	2	1	1	At plant
Shrubs & trees (3-5')	2	2	1	2	6-12" on either side
Shrubs & trees (6-10')	2	3	2	2-3	2" from tree, equally spaced
Shrubs & trees (11-20')	2.5	3	2	3-4	3" apart, equally spaced
Shrubs & trees (21' +)	3	3	2	6+	At plant
Flower Beds	1	2	1	1	At plant
Ground Covers	1	2	1	1	At plant
Vegetables (close spacing)	1	2	1	2	Every 16"
Vegetables (wide spacing)	1.5	2	1-2	1	At plant
Potted Plants: 1 gal.	1/6	1	1	1 per plant	At plant
5 gal.	1/3	1	1	1 per plant	At plant
25 gal.	1.5	2	1	1 per plant	At plant

Midsummer Water Use for Selected Plants

Midsummer water use (gallons per day)

	Canopy diameter (ft)													
Plant type	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**
Coastal														
A	0.08	0.17	0.34	0.54	0.69	0.94	1.30	2.0	2.9	5.2	8.1	11.7	18	33
B	0.05	0.15	0.22	0.37	0.53	0.67	0.88	1.5	2.0	3.5	5.5	7.9	12	22
C	0.04	0.12	0.18	0.25	0.39	0.49	0.64	1.0	1.4	2.5	4.0	5.7	9	16
D	0.02	0.05	0.10	0.11	0.15	0.24	0.31	0.4	0.6	1.3	2.0	2.8	4	8
Inland														
A	0.13	0.35	0.53	0.88	1.23	1.68	2.19	3.4	4.9	8.8	13.7	19.7	31	55
B	0.09	0.22	0.38	0.60	0.83	1.12	1.47	2.3	3.3	5.9	9.2	13.2	21	37
C	0.06	0.12	0.24	0.44	0.63	0.82	1.08	1.7	2.4	4.3	6.7	9.7	15	27
D	0.03	0.05	0.15	0.20	0.31	0.39	0.51	0.8	1.1	2.0	3.2	4.6	7	13

Midsummer water use (gallons per week)

	Canopy diameter (ft)													
Plant type	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**
Coastal														
A	0.5	1.2	2.4	3.7	4.9	6.6	9.1	14.2	20.5	36	57	82	128	228
B	0.4	1.0	1.5	2.6	3.7	4.7	6.2	10.3	13.9	25	39	56	87	154
C	0.3	0.9	1.3	1.7	2.7	3.4	4.5	7.0	10.0	18	28	40	63	111
D	0.1	0.3	0.7	0.7	1.1	1.7	2.2	3.0	4.3	9	14	20	31	55
Inland														
A	0.9	2.4	3.7	6.2	8.6	11.8	15.4	24.0	34.5	61	96	138	216	384
B	0.6	1.6	2.7	4.2	5.8	7.9	10.3	16.1	23.1	41	64	93	145	257
C	0.4	0.9	1.7	3.1	4.4	5.8	7.5	11.8	17.0	30	47	68	106	188
D	0.2	0.3	1.0	1.4	2.2	2.7	3.6	5.6	8.0	14	22	32	50	89

Plant types:

A: Fruit trees, lush ground covers, vegetables, and flowers

B: Mature and unthirsty trees, shrubs, and groundcovers

C: Young and low-water-use trees, shrubs, and groundcovers

D: Mature and low-water-use trees, shrubs, and groundcovers; low-water-use native plants

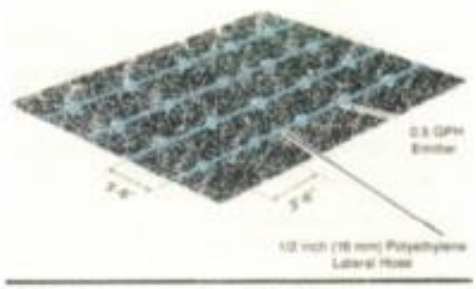
For more information on determining irrigation requirements for landscape plantings, see *Estimating Water Requirements of Landscape Plantings—The Landscape Coefficient Method* (University of California Division of Agriculture and Natural Resources Publication 21493).

Typical Layouts

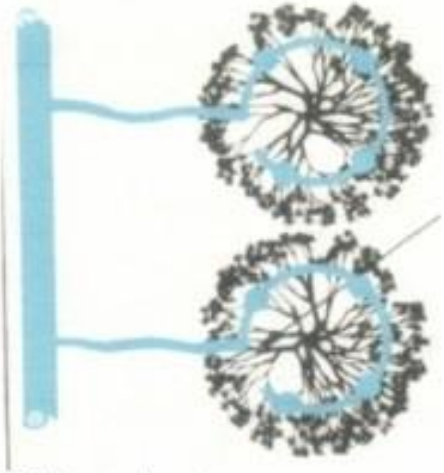
Medium to large trees over long distances

Small Trees and ground covers

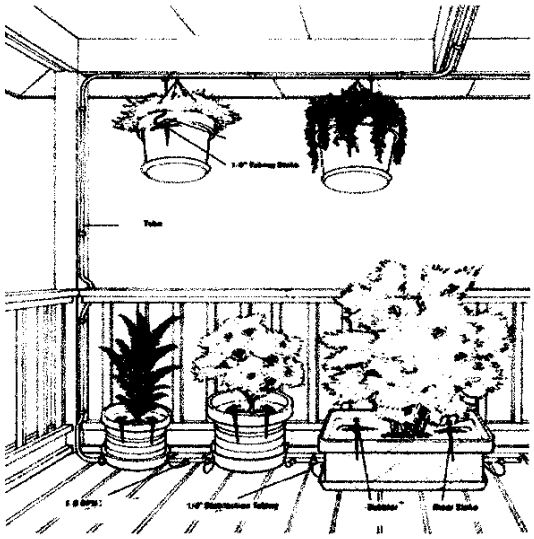
Large Trees



Ground cover and garden bed



Medium to large trees



Containers

The Practical Hand *Feel* Test to Interpret Soil Moisture

Amount of readily available moisture for plants	**Sand** (gritty when moist, like beach sand)	**Sandy Loam** (gritty when moist, dirties fingers, contains silt & clay	**Clay Loam** (sticky, plastic when moist	**Clay** (very sticky when moist; behaves as 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	Soil feels dry; will not form ball with pressure	Soil appears dry; will not form a ball	A little crumbly, but will hold together with pressure	Somewhat pliable; will ball under pressure
50% to 75% Enough moisture available	Same as 50%; soil appears dry; will not form ball w/pressure	Tends to ball under pressure, but seldom will hold together	Forms a ball; a little plastic. Might stick together w/pressure	Forms a ball; will ribbon out between thumb & 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	Upon squeezing, no free water appears, but moisture is left on hand	Upon squeezing, no free water appears, but moisture is left on hand	Upon squeezing, no free water appears, but moisture is left on hand
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 forms on surface

Advantages of a Drip System

1. Minimized fertilizer and nutrient loss due to localized application and reduced leaching.
2. Water application efficiency is high if managed correctly.
3. Field/bed leveling isn't necessary.
4. Irregular shaped fields/beds are easily accommodated.
5. Recycled non-potable water can safely be used.
6. Moisture within the root zone can be maintained at field capacity.
7. Soil erosion is lessened.
8. Weed growth is lessened.
9. Water distribution is highly uniform, controlled by output of each nozzle.
10. Fertigation can easily be included with minimal waste of fertilizer.
11. Foliage remains dry, reducing the risk of disease.
12. Water distribution is not affected by strong winds.

Disadvantages of a Drip System

1. Start up costs can be higher than that of overhead systems. (sprinklers)
2. Sun can affect the tubes, shortening useable life.
3. If not properly filtered and maintained, clogging can occur.
4. If system is sub-surface you can't see the amount of water being applied. Can result in over watering causing a waste of water or under watering causing under developed plants and/or crops.
5. Might be unsatisfactory if herbicides or top dressing fertilizers need sprinkler irrigation for activation.
6. Rodent damage.
7. Human damage.