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Home Vegetable Gardening

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DRIP: Watering the Home Garden

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California home gardeners, increasingly aware of the need to save water, are learning that drip might be a good wav to conserve water. Many are asking how to make drip irrigation work for them. This leaflet is designed to help answer that question.

What is it?
Drip watering is the frequent slow application of water to soil through mechanical devices called emitters. Emitters are built in or attached to small plastic water delivery lines that carry water to each plant. Drip watering results in lower water use by controlled water distribution, less water applied, and lower evaporation losses.

Drip should be part of an integrated watering system. It should be used for vegetable gardens, ornamental and fruit trees. shrubs, vines, and outdoor container plants. Sprinklers can be used for lawns and other ground cover.

Equipments needed
A drip system has three pans (fig. 1), the head (A), which includes controls and a filter; (B) a transmission system of plastic pipes or hose: and (1) the emitters.

The head (fig. 2), includes an on-off valve and a regulating device to reduce the pressure from 40 to 80 pounds per square inch (psi) to the low pressure of 10 to 20 psi for drip systems. If both a vegetable garden and trees or shrubs are to be watered, separate valves will I>e needed because different flow rates, pressures, and watering times are required. The head must also contain a filter to screen out particles that might clog emitters, it should also have one or more pressure-measuring devices to help in adjusting the pressure regulator.

The transmission system is constructed with polyvinylchloride (PVC) pipe. polyethylene (PE) hose, or a combination of both. In most cases, PVC pipe is used to reach the general area of planting, with the final distribution to garden rows or individual trees and shrubs through PE hose to which emitters are attached. It is desirable to bury PVC pipe to protect it against sunlight. physical damage and to keep the entire installation less cluttered.

Emitters are used for watering trees and shrubs. Several types are available. For home use, the type that is mounted on the PE hose is preferred. New plants can be started with one or two emitters, and more can be added as the plants grow. A punch for installing emitters on the PE lines should be purchased with the emitters to insure correct size of opening.

Drip tape is used for row crops where plants are closely spaced. They include single- or double-walled PE tubing with openings in the outer wall every 8, 12, or 18 inches. Various accessories and connecting devices are needed to completely install and place the system in operation. These

are fittings to change from hose bib threads to standard pipe threads, reducers to change from 3/4-inch to 1/2-inch pipe sizes, barbed fittings to connect PE hose to PVC pipe, and adapters to connect drip tape to the PE hose. Drip irrigation equipment has become fairly commonplace in retail stores. It is sold in outlets carrying irrigation equipment, garden supplies, and home building supplies.

Designing the system

First, make a diagram of your property to scale. Figure 1 is an example. Draw in the house and garage (M), driveway, sidewalks, and any other permanent features. Locate all trees (G) and plants U) that you intend to drip irrigate and the position of your present or planned garden (N). Locate the source of water you will use (A).

Next, determine the size of pipe and hose you will need by calculating the rate of flow when the system is in full operation. Drip tape used for vegetables has output rates that depend on the brand, the hole spacing, and the water pressure. Ask the supplier for the output rate of the tubing you plan to use. The average flow listed for drip tape is 1/2 gallon per minute (gpm) per 100 feet. Determine the total length of tape to be operated at one time. Then, to calculate total rate of flow, divide the total length by 100 and multiply by the rate of flow per 100 feet.

Example: 7 rows, 50 feet long; drip tape output 1/2 gpm per 100 feet: calculate 7 rows x 50 feet x 1/2 gpm/100 feet = 1 3/4 gpm total flow. In this case, water can be delivered to the garden area through a 1/2-inch PE hose (see table). If more than 350 feet of tape are to be operated at one time, a larger PE hose is needed.

IDENTIFICATION OF COMPONENTS IN FIGURE 1

A. Head or control center.
B. 1/2-inch PVC buried main line.
C. 1/2-inch PE hose for attaching row crop laterals.
D. 1/2-inch PNC slip tee.
E. 1/2-inch PVC tee with internal barbed outlet for attaching PE lateral.
F. 1/2-inch PVC ell with internal barbed outlet.
G. Trees.
H. 1/2-inch PE hose inserted in barbed outlet E.
I. 1/2-inch PE hose with emitters added.
J. A row of shrubs, roses, other flowers, or ground cover beside house.
K. 1/2-inch PE hose, slightly buried, to which emitters can be attached when needed.
L. 1/2-inch PE hose to which one emitter for each shrub or rose bush has been attached.
M. House.
N. Row crop drip tape in garden.

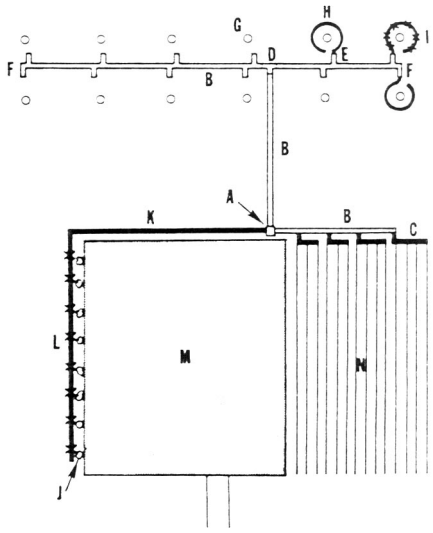

Figure 1. Example layout of a home drip system.

Emitters are used to water fruit and ornamental trees. They are attached to PE hose that is connected to a buried PVC or PE main fine. The number of emitters per tree or plant depends on the plant size. A large fruit or ornamental tree having a canopy spread of 15 feet in diameter or

more needs at least six emitters. A smaller tree or shrub needs one emitter for each 2 1/2 feet of canopy diameter. The number of emitters thus determined, multiplied by the rated output per emitter, will give the flow rate needed to water all the trees and shrubs at once.

In figure 1, there are 12 trees (G) with six 1 gallon per hour (1 gph) emitters per tree at 15 psi. The flow needed at D is 1.2 gpm because 12 trees x 6 gph - 60 min/hr = 1.2 gpm. The table shows that a 1/2-inch main line (B) will be sufficient.

For the eight small shrubs (j) on the side of the house (M), one gph emitter per shrub is indicated (L) on a PE hose (K). Additional plants and emitters may be added later; therefore, a I/z-inch PE hose is advisable.

Installation

Techniques for installing the relatively simple system in figure 1 are described in this leaflet. Professional help is recommended for more complicated situations. Check your local city codes for requirements for anti-backflow devices and their locations.

The lot in figure 1 is 90 by 120 feet, with a 40 by 50 feet house (M). It has 12 fruit trees (G) in back, 8 shrubs (J) on the left side of the house, and a 30 by 50 feet garden space on the right (N). Details of the head (A) are shown in figure 2. The main line (B) will be 1/2-inch PVC, buried about 8 inches. PVC tees (E) and elbows (F) have internal barbs and provide places to connect the PE feeder hose (H) on which individual emitters (D) are placed. Feeder hoses of 1/2-inch PE (H, K, and C) are laid on the ground or buried 2 or 3 inches. These hoses are closed at the ends by folding back 4 inches of hose and slipping a length of PVC pipe over the fold like a napkin ring. This allows quick opening to flush the system once a month.

The garden area to the right of the house (M) is watered by drip tape (N). To supply them, a 1/2-inch PVC or PE main (B) is extended from the head (A) to feeder hose (C). Drip tape can be grouped conveniently along the hose.

Installation Hints:

1. Valves can be manual or electrical and must be made of plastic or brass.
2. PVC pipe is cemented using slip fittings, and PE hose is friction fit to internal or external barbed fittings.
3. Pressure gauges below each valve are useful.
4. The entire head should be firmly supported to avoid water "chatter" or vibration.
5. During construction, be careful to keep soil particles and chips of plastic out of all lines and connections. After the system is installed, it should be flushed with water before operating.

Operation

Correct operation is important in order to obtain the advantages of drip irrigation. Drip wets a smaller area than sprinkling or flooding; therefore, it must be performed more frequently. It is recommended that water should be applied daily or on alternate days during the watering season. Applying water this frequently may cause excessive wetness, unless the amount put on each time is carefully controlled. The amount of water needed with daily applications usually can be

supplied by operating the system somewhere between 15 minutes in the spring to a few hours in the summer. This timing can be adjusted by checking sod moisture. It can be judged by sampling with a sod coring device or auger. Sample 8 to 12 inches from an emitter. Wetness of soil sample can be judged by its feel and appearance. If the soil is drier than it should be, watering time should be increased. If the soil is still quite wet just before the next irrigation, watering time should be decreased.

PLASTIC LINE SIZES FOR LENGTHS LESS THAN 100 FEET

Flow rate (gpm)	Line-size (inches nominal)
1/2 to 2	1/2
2 to 4	3/4
4 to 8	1

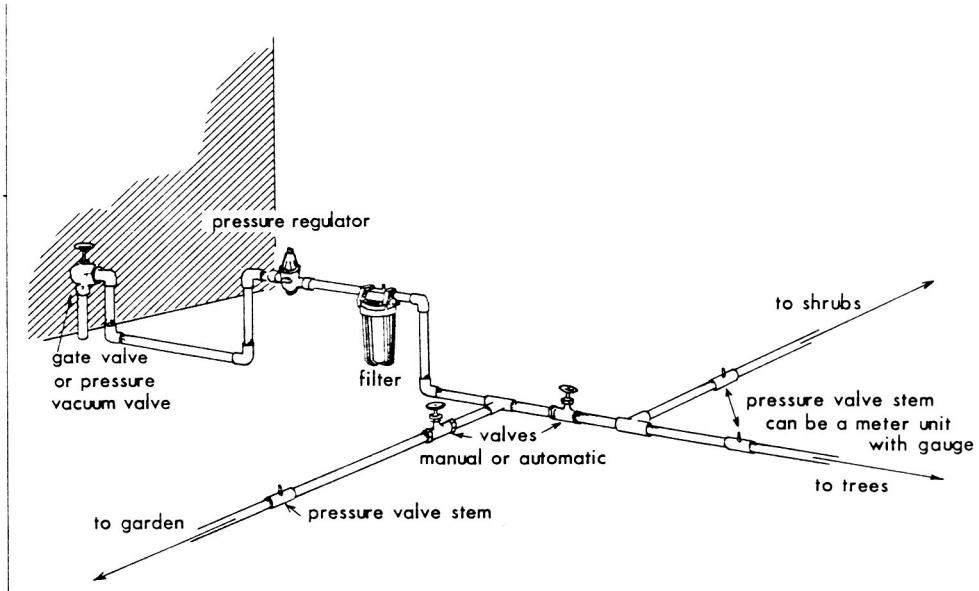

Figure 2. ''Head'' or control center details.

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Environmental Horticulture Notes

EHN 87

COVER CROPPING IN HOME VEGETABLE GARDENS

WHAT IS A COVER CROP?

A cover crop is a crop that is planted for the purpose of improving soil quality and nutrition, and/or for attracting beneficial insects. A cover crop that is planted in the fall and tilled under in the spring, or that is planted in the summer, is often referred to as a "green manure" crop.

BENEFITS OF COVER CROPPING

- Addition of nitrogen
- Improved soil tilth and water penetration
- Addition of organic matter

DRAWBACKS OF COVER CROPPING

- Cannot grow vegetable crops in that space
- Seed can be difficult to find
- Requires chopping and turning under

SELECTING A COVER CROP

The choice of cover crop depends on the main benefit you are hoping to obtain from the cover crop. A primary benefit in a garden is the addition of nitrogen, in which case legumes would be used. For an upright cool-season cover crop that is easy to cut down in the spring, use bell beans or fava beans. The large, round, flat-seeded "horse bean" or fava bean plants are nearly identical to bell bean plants, but bell beans are usually planted as a cover crop because the seed is smaller and therefore less expensive. Of course, you can use fava beans as a cover crop, but remember that a fair amount of nitrogen (in proteins) will be removed when you harvest the seed, making less available for the succeeding crop.

For extra nitrogen, use a mix of bell beans, common vetch, and peas. The vetch and peas are trailing, so they need to be cut into small pieces before incorporation or they will wind around the tines on the rototiller. If your main interest is in building organic matter, use cereals, such as oats or barley, but remember that their incorporation will make nitrogen in the soil temporarily unavailable to the succeeding crop unless extra nitrogen is added. For both nitrogen and organic matter, use a mixture of legumes and cereals.

Cover crops are typically grown in the fall, but warm-season cover crops can be grown during the heat of summer. Warm-season legumes include soybeans and cowpeas (known as black-eyed peas); warm-season non-legumes include buckwheat and sudangrass. Warm-season cover crops are an excellent management tool for controlling weeds and providing a habitat and food for beneficial insects. For additional nitrogen in the summer, use soybeans or cowpeas. Buckwheat is a broadleaf plant that grows densely and quickly smothers summer weeds. It grows to maturity in 30 to 45 days, so more than one planting can be sown in one summer; it grows easily in almost any soil. Sudangrass is a fast-growing tall summer annual grass that provides significant organic matter and quickly smothers weeds.

INOCULATING LEGUME SEEDS

Specialized bacteria on the roots of legumes take nitrogen from the atmosphere (78 percent N) and "fix" the nitrogen in nodules that the bacteria create on the roots. In order to ensure that this fixation occurs, and that maximum growth takes place, it is important to attach the bacteria to legume seeds before planting. So when purchasing seeds, also buy an "inoculant" that contains the bacteria in a peat moss base. Be sure to use an inoculant that is appropriate for the legume(s) to be planted. Different strains of the bacteria work only on specific plant species. For example, cowpeas, soybeans, and fava beans/vetch/peas each need a different inoculant. Use at a rate of at least 1 ounce per 10 pounds of seed. To help the inoculants adhere to the seed, mix 9 parts hot water (non-chlorinated) with 1 part corn syrup (10 percent solution), let cool, and add a small

amount of this solution to the seeds. It is even advisable to inoculate peas and beans that are to be planted for the purpose of harvesting, such as snow peas and string beans.

Because the bacteria are alive, the inoculant should be kept in a cool, dry place and used prior to the expiration date on the package. If kept refrigerated, it may last a little beyond that date. Coat the seeds with inoculant immediately before planting; do not leave the inoculated seed in the sun prior to planting.

WHEN TO PLANT AND ROTOTILL THE COVER CROP

Cool-season cover crops are usually planted from late September through late October. If the cover crop will be incorporated in late February or early March, such as for early tomato planting, sow the cover crop in September or early October. If it can be allowed to grow well into April, such as for planting corn, the cover crop will put on most of its growth in the spring, so it can be planted in late October. The cover crop is incorporated into the soil about 3 to 6 weeks before the spring crop is to be planted. Do not plant seeds into soil in which the cover crop has been freshly incorporated because soil-borne diseases, such as Pythium and damping-off, may be more infective and because soil nitrogen may be "tied up," or unavailable.

Warm-season cover crops need to be planted after the soil has warmed to at least 60°F and the likelihood of frost has passed (usually May in the Sacramento area). They should be tilled or forked into the soil when flowering begins; for buckwheat, that is about 30 days after germination. Buckwheat can become a weed if allowed to go to seed, so cut it down soon after it starts flowering. The hollow stalks of buckwheat are easy to cut and dig back into the soil, and the residue decomposes quickly. Buckwheat also accumulates insoluble phosphorous and, when turned under, releases it into the soil in a plant-available form.

Larger species of both cool-season and warm-season cover crops should be clipped into small pieces before incorporating into the soil.

HOW TO PLANT

A good seedbed should be prepared by rototilling and raking, however, if soil was rototilled in the spring, it may not be necessary to rototill again for a fall-planted cover crop. The seed can be scattered on the ground and then raked in, or planted in rows or on beds. The legumes and grasses discussed above should be planted about ½ to 1½ inches deep. After planting, sprinkle thoroughly and be sure to keep the top of the soil moist for up to a week to ensure that seeds receive continual moisture; however, the soil should be well drained. It helps to lightly cover the bed with leaves or straw to keep moisture in, but be sure not to introduce weed seeds. When weather is warm and/or windy, daily watering may be necessary. Use these seeding rates (per 100 square feet): bell beans, 5 ounces; cereals and bell bean/pea/vetch mix, 4 ounces; soybeans and cowpeas, 4 ounces; buckwheat, 4 ounces; sudangrass, 2 to 3 ounces.

IRRIGATION AND FERTILIZATION

It is usually best to provide additional irrigation after germination, although it is not necessary to keep the top of the soil moist at all times. Remember that young plants need more frequent watering, whereas older plants need deeper watering. If there is little or no autumn or spring rainfall, weekly watering may be necessary. During the winter, no irrigation is necessary if rainfall is normal. Warm-season cover crops will need supplemental irrigation for survival and growth. A cereal cover crop usually benefits from nitrogen fertilizer (organic or chemical) at planting, but legumes and legume/cereal mixes should not be fertilized. If weeds are present, remove them or rototill them in early spring to prevent them from going to seed.

SOURCE OF SEED AND INOCULANTS

Cover crop seed and inoculants are available at some retail nurseries in October each year; call around to see who carries them. Perhaps the largest selection can be found at Peaceful Valley Farm Supply, P.O. Box 2209, Grass Valley, CA 95945 (530) 272-4769; email: contact@groworganic.com; website: groworganic.com.

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