DRIP IRRIGATION for Community Gardens

Drip systems have become a common method of irrigating vegetable crops, particularly in small- to medium-sized growing spaces. Such a system benefits a community garden by applying water directly to the plant root zone at a rate that can be absorbed by the soil without runoff (Figure 1). This publication discusses steps to install a successful drip irrigation system suitable for community and communal gardens, including small plots and home gardens (Figure 2).

Introduction

Drip (trickle) irrigation was invented in England in the 1940s and has continued to grow in popularity. In addition to conserving water, drip irrigation benefits the plant by providing consistent soil moisture. Drip systems deliver water with precision, which reduces weed growth between rows and limits the spread of plant pathogens. It also allows for fertigation, the injection of fertilizers into irrigation water.

Figure 1. Drip tape running alongside pak choi provides water directly to the root zone.

Figure 2. A communal-type community garden in Olathe, Kansas.

A disadvantage of drip irrigation is that filtration is required to keep particles from clogging emitters. Maintenance of low-pressure (drip tape) systems can be relatively high, and rodents, mowers, and weed trimmers can cause damage. Drip systems must be monitored for leaks and checked regularly to make sure they are functioning properly.

High-pressure and low-pressure are the two basic types of drip irrigation systems. High-pressure drip systems use pressure-compensating emitters that regulate the water flow at each emitter. Low-pressure systems use pressure regulators at the start of the system or where the system connects to the water supply. The flow of water dispersed at each emitter depends on the pressure of the system. In subsurface drip irrigation systems, emitter lines are permanently installed 10 to 15 inches underground and require less maintenance throughout the growing season.

The use of "soaker hoses" is not the same as drip irrigation. Soaker hoses are effective in delivering water to the root zone, but typically do so at a much faster rate than a drip system. Soaker hoses require higher volumes of water than drip systems and may not provide consistent coverage over larger areas as compared to drip/trickle irrigation systems because they are not pressure-compensating systems. This publication focuses on the design and installation of surface drip irrigation systems, which are recommended for community gardens in the Great Plains.

Low-Pressure Drip Systems

Low-pressure drip systems are the most commonly used for annual vegetable production by market gardeners and hobby farms. They are suitable for small plot gardening but can be very useful for mid-size to larger gardens or communal gardens. The components are inexpensive and simple to set up and tear down during the growing season.

Low-pressure systems utilize drip tape, or T-tape, with emitters installed at set spaces (4-, 12-, 18-inch, etc.) along the drip line. Spacing selected depends on the requirements of the crop and soil (Figure 3). A regulator must be used to control the water pressure in the system, which should range from 6 to 20 pounds per square inch (psi). The required psi is also dependent on the emitter and thickness of the drip tape.

When purchasing drip tape and/or pressure regulators, select the correct pressure regulator for the drip tape to ensure accurate operation. One advantage of drip tape is that it can be installed in long rows (>500 feet), and the same amount of water is delivered throughout the entire run. Drip tape can be reused for 1 to 2 years if stored in a rodent-free environment. Drip tape is connected into header (distribution) lines with simple connectors and terminated by making an end cap.

Figure 3. Drip tape is commonly used in larger garden plots and communal gardens. Built-in emitters are available at various spacings.

High-Pressure Drip Systems

High-pressure drip systems use pressure-compensating emitters and are ideal for small plots and home gardens. They are also useful for perennial crops, such as small fruits, or in gardens where similar lengths of drip tube are used every year, such as in community garden plots. Pressure of the system/source can range from 30 to 50 psi, which is typical of city/county water supplies. This type of drip system provides consistent water delivery at each emitter, regardless of the location, because of the pressure-compensating components. With this type of system, it is easy to have high-pressure water available throughout the garden for watering with hoses and/or overhead-type irrigation. Drip emitters can be installed into poly tubing or may come preinstalled (Figure 4). Since this type of drip operates at higher pressure than the low-pressure drip tape, this tubing is much thicker and is easily reused.

Figure 4. In high-pressure drip systems, emitters are either (***A***) preinstalled at the factory or (***B***) installed during assembly.

In many fruit production systems, once drip tubing is installed, it remains permanently. It is less prone to damage from rodents and leaks throughout the growing season. Although high-pressure systems have many advantages over drip tape, there are disadvantages. Pressure-compensating emitters have higher flow volume and require shorter run lengths (<250 feet) to maintain consistent water delivery. They are also much more expensive: Drip tubing costs three to seven times as much as drip tape per linear foot. Similar to drip tape, drip tubing is attached to header lines with simple connectors or adapters. These can be used to attach a garden hose directly to the line as well.

Water Source and Filtration

Water source is a critical first design step to be considered when purchasing or acquiring land for a community garden (Table 1). If surface water is used, significant steps should be taken to filter the water. Sand (Figure 5) or disk filters are typical for primary filtration. Screen filters should also be installed at header lines or near the drip system to serve as a secondary filtration unit (Figure 7A, page 6). Well water is ideal for drip systems because it can be provided inexpensively and does not require primary filtration. Screen filters should be used for both well and surface water sources.

Table 1. Considerations for water sources when using drip irrigation.

	Examples	Primary filter	Screen filter	Typical volume	Cost	Winter
Surface	Pond, creek	Yes	Yes	High	Med	No
Groundwater	Well	No	Yes	Varies	Low	Yes
Municipal	City, county	No	No	Very low	High	Yes

Figure 5. A sand filter (foreground) is used to filter creek water that is pumped with a gas-powered pump (background).

Figure 6. Distribution piping is installed belowground to move water to each bed where header pipes are installed.

Pumping Water

A major advantage of electric pumping systems used in groundwater or surface irrigation is that a pressure tank can be installed to regulate pressure and provide water whenever it is needed. A groundwater pump is installed in a well. An electrical or gas-powered centrifugal pump is used for irrigation from surface water (pond, river, creek) as shown in Figure 5.

Pumps are typically not a consideration for community and communal gardens. Most have access to municipal water sources with ample pressure (40 to 75 psi) to run the typical drip irrigation system. Drip irrigation significantly reduces water use at the community garden during the growing season as compared to hand-watering and overhead irrigation. PVC distribution piping can be installed belowground to prevent damage from equipment and to keep things tidy in the garden (Figure 6).

The Header Pipe

The "header" is the pipe that distributes water to the drip tapes/tubes, and it is typically made from polyethylene. Header size is determined by the total volume/rate of water needed by the system in that area. For small areas, typical of community gardens, a ¾-inch-diameter pipe is sufficient, but larger production fields probably require 1- to 2-inch header pipe.

Installing Drip Tape/Tube

Install drip tape with emitters facing up to keep dirt from being sucked back into the emitters when the system shuts off. Drip tape is typically offset 2 to 6 inches from center to avoid placing it in the middle of the row. This makes planting easier and can save time if posts or stakes are being used for plants such as tomatoes or peppers. If installing drip tape by hand, use a modified "sawhorse" or a similar apparatus to unroll the tape (Figure 9A). Leaving the roll stationary and "unwinding" will lead to folds and kinks (Figure 8) that can result in poor operation. One or two well-placed landscape staples (8 inches) can be used to hold the drip tape in place before mulch is applied (Figure 9C).

To terminate the line (low-pressure systems), fold the end of the drip tape three times and slide a small section of drip

Figure 7. (***A***) Header pipe (left to right) with 1-inch pressure regulator, screen filter, pressure gauge, and valve connect to 1-inch poly piping. (***B***) Header pipe runs perpendicular to rows and distributes water to drip tape in a low-pressure drip system. Fabric mulch can be used to reduce weeds and grass growth under the header pipe. (***C***) Small/short header pipe is shown in a high-pressure system with a valve from underground piping.

Figure 8. Drip tape (low-pressure systems) are prone to kinks if not installed properly.

tape (about 2 inches long) over the end to ensure that it stays folded when pressurized (Figure 10). Use premanufactured end caps to terminate the line of drip tubing for high-pressure systems (Figure 9C). Finally, attach the drip line to the header line using a simple reverse-threaded connector (Figure 9B). The drip tape/tube will be pushed onto the barb of the connector and then a collar that is reverse-threaded is twisted to lock in the drip line. Use a punch tool properly sized for the connectors to attach them to the header line. Connectors vary, but most have another reverse-threaded locking collar that compresses the wall of the header pipe, creating a watertight seal.

Monitoring Soil Moisture

Soil moisture should be monitored daily to ensure proper growing conditions. A number of devices can aid in daily decision-making, but ultimately relying on personal experience with the crop and soil type at the site is the best method for success. Tensiometers (Figure 11) are the most accurate soil moisture measuring devices, although many good soil-moisture sensors are being introduced. Tensiometers do not need power or batteries. They require weekly maintenance and may not work as effectively in soils with high sand content. Electric soil-moisture sensors can be used to monitor soil conditions when using

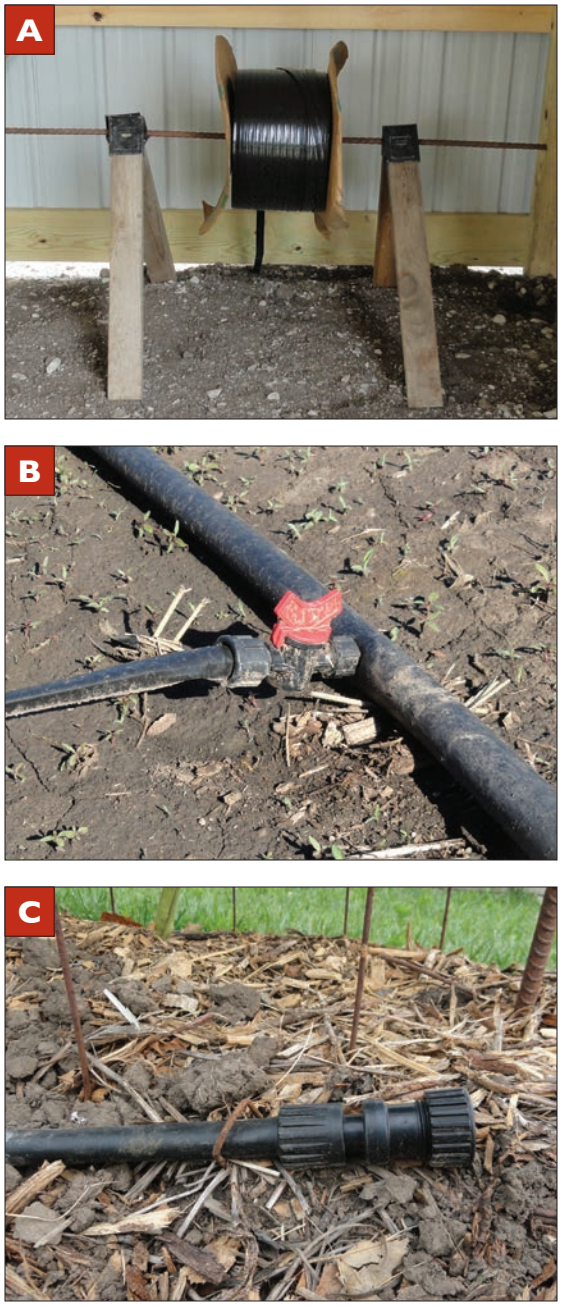

Figure 9. (***A***) A simple system for unrolling drip tape that can be used by a single installer. (***B***) Drip tape is connected to the header pipe with PVC connectors that have reverse-threaded locking collars. (***C***) Drip tubing is terminated with a premanufactured cap.

electric solenoid valves in automatic watering systems. Manually check automatic irrigation systems and soil conditions to assure proper operation. Soil moisture also can be estimated by hand, pressing soil together and observing its "stickiness" and its ability to "clump" together.

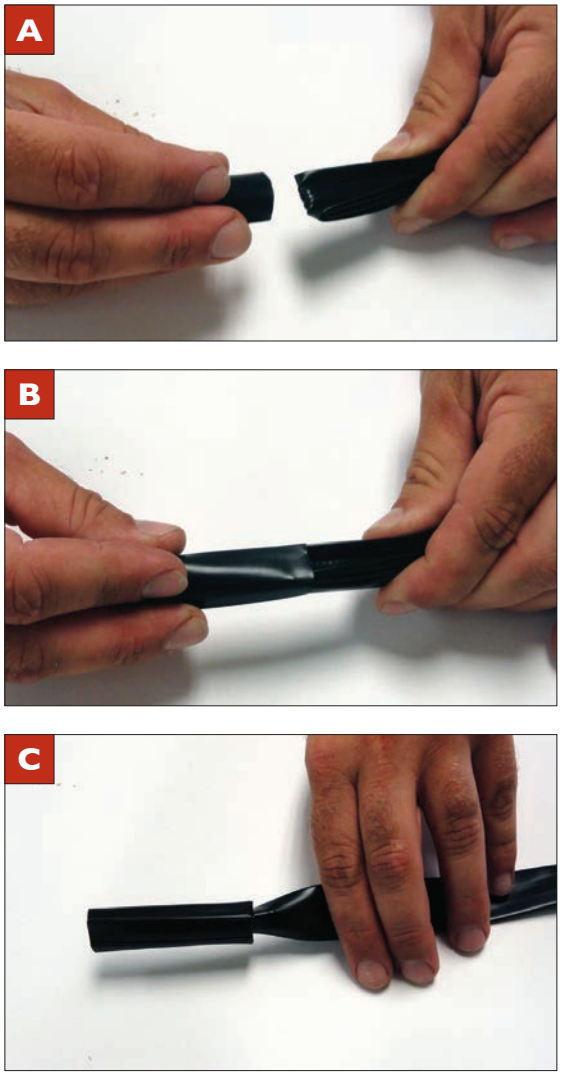

Figure 10. (***A***) The drip tape is folded three times and held securely. Crease and bend the folded end lengthwise to make it easier to place the sleeve over the end. (***B***) Slide the sleeve (about a 2-inch piece of drip tape) over the end until it completely covers the end (***C***), which prevents it from unfolding when pressurized.

Figure 11. A tensiometer can be used to monitor soil moisture.

Conclusions

Drip irrigation systems are ideal for conserving water while maintaining optimum growth and plant performance. They are relatively inexpensive to operate and simple to install and use. Always be sure to watch for leaks and maintain drip systems to conserve water.

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