



Micro Irrigation Systems for Raised Beds and Small Gardens

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Irrigation Systems

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Small-scale food gardens are the most productive when plants can be provided with all the resources they need to not only survive but thrive. High quality soil (or growing media), proper sunlight and proper fertilization are key points of emphasis for gardeners. However, the ability to provide adequate water is sometimes overlooked. Even though the Tennessee climate is humid with adequate rainfall, on average, for a wide range of crops, the frequency of rain events is often not ideal for optimum growth and plant production. Irrigation is a very useful tool for in-ground gardens but even more essential in raised beds where the growing media is designed to be well-aerated and rapidly draining.

Planning and installing micro irrigation systems in home gardens can ensure adequate and consistent water for plant growth while also reducing overhead (sprinkler) watering that can increase disease risks for our crops. There are several types of irrigation systems available to choose from to enable small-scale irrigation systems to be designed and installed for a range of systems and sites. This publication provides an overview of different types of irrigation systems for raised beds and demonstrates options for their use in non-commercial raised bed or backyard gardens as well as benefits and considerations for different product types. The three main types of small-scale irrigation covered in this publication include:

- Drip tapes
- Online drippers or punch-in drippers
- Spike drippers
- Microspray, microjets, micro sprinklers, and mini sprinklers

Drip Tapes

Drip tape systems are low-pressure; water use efficient irrigation systems made from soft or hard plastic tubing (Figure 1 shows an example of raised bed with drip tape). The plastic tubing has built-in emitters that slowly release water to the crop. Drip tape gets its name because it has thin walls, lies flat when not in use, and can be rolled up like tape. It is commonly used for annual crops like vegetables, strawberries, and other row crops. The tape comes in a variety of thicknesses, including 0.10, 0.15, 0.20, 0.25, and 0.33 mm, though thicker options are also available. In small-scale food production, drip tape can be carefully stored and reused as long as it is protected from damage.

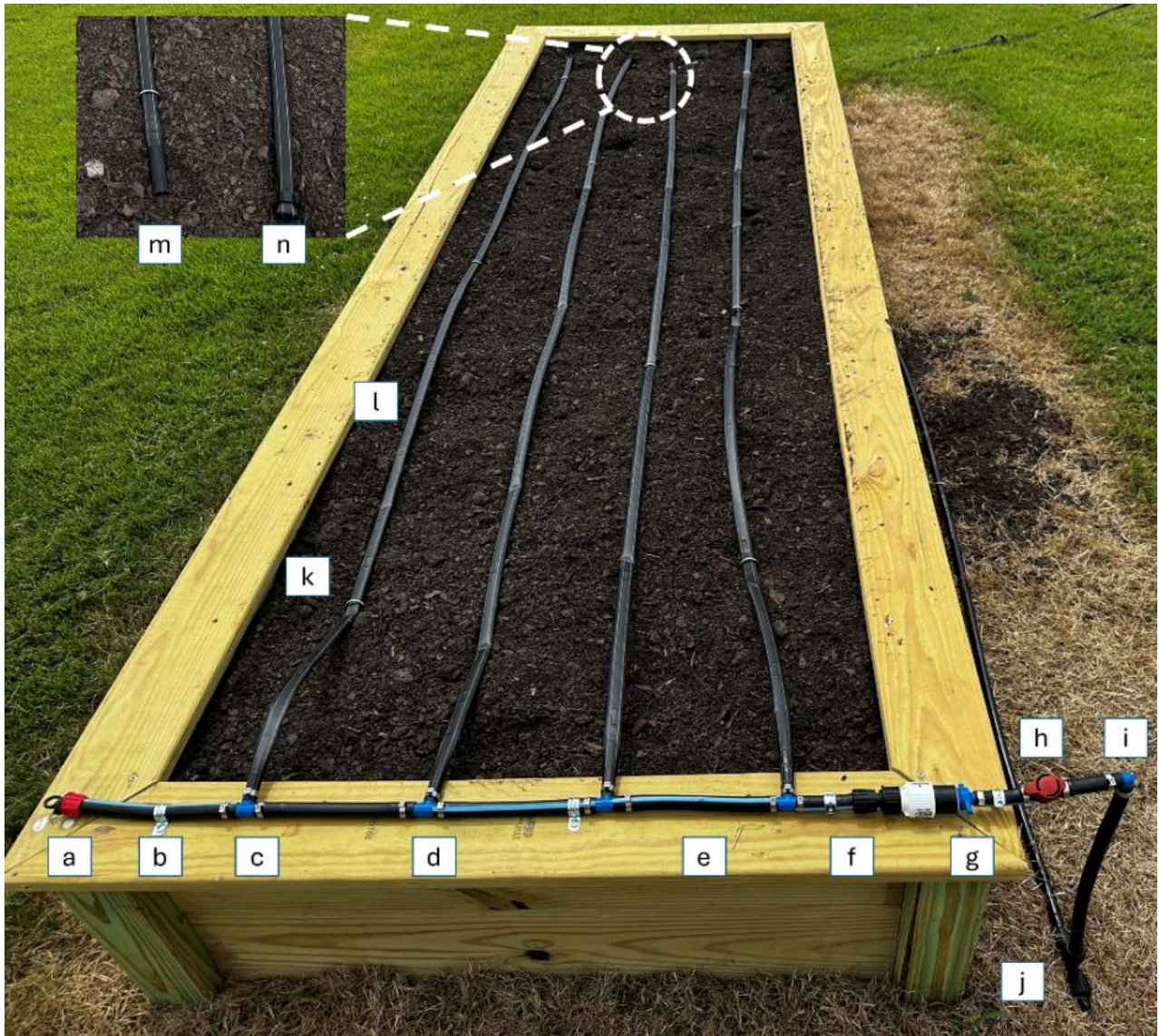


Figure 1. Raised bed with drip tape irrigation system and in-line drippers. The items used for setting up this raised bed include: a) ½-in. end plug, b) ½-in. one-hole strap, c) ½-in. tee insert, d) ½-in. pinch hose clamps, e) ½-in. blue stripe round hose, f) ½-in. hose connector, g) 10-psi pressure regulator, h) barb valve (Teco, Italy), i) ½-in. elbow insert, j) Power-Loc Tee ½-in. drip irrigation tee fittings with ½-in. barbed locked tee connector (Jain, USA), k) ½-in. loop stake, l) ½-in. thin wall drip tape (Netafim, USA), m) End plug using thin wall tape, n) Drip end closure using ½-in. tubing (RainBird, USA).

Emitter spacing for drip tape

Emitter spacing is the distance between individual drip emitters in the plastic drip tape. Spacing has a direct impact on the distribution of water in the bed. Typical emitter spacings include 4, 8, and 12 in. Choosing a drip tape with a spacing that is suited for the irrigation system requires information about the soil type in raised bed and the crop type and planting distance. Most drip tape operates effectively at a pressure range of 6 to 15 pounds per square inch (psi). For home-gardening, the most common emitter spacing is 12 in., but it really depends on the type of soil and the distance between the plants.

Drip tube or tape sizing

Tape diameter for garden beds is typically ½ in. or 5/8 in. but smaller (micro-tube), types of drip that are ¼ in. in diameter. Typically, the larger diameter tapes and tubes enable longer runs from the water source. The most common flow rate for drip tapes is 0.40 gpm/100 ft. (meaning 0.40 gallons per minute per 100 feet of the

tape) and 0.50 gpm/100 ft. Tape flow rates can also be based on the emitter discharge in gallons per hour (gph). For example, 0.40 gpm/100 ft. is 0.24 gph per emitter if emitters are 12 in. apart, 0.50 gpm/100 ft. is 0.3 gph at 12-in. spacing. The lower the flow rate of the drip tape, the longer the run that can be made because there is less pressure loss from the flow in the tape. Lower flows require longer irrigation times but also allow water to be distributed more evenly in the soil, reducing water loss from draining.

<i>Pros of Drip Tape</i>	<i>Cons of Drip Tape</i>
<ul style="list-style-type: none"> • High water-use efficiency (water applied directly to roots) • Operates at low pressure (6–15 psi) • Easy to install and remove • Uniform watering when properly designed • Low cost for annual crops 	<ul style="list-style-type: none"> • Short lifespan; easily damaged • Prone to clogging; requires good filtration • Limited run length due to pressure loss • Must match emitter spacing to soil and crop • Creates plastic waste when replaced each season • Not ideal for perennial crops and long-term installations for vineyards or orchards

Online Drippers or Punch-in Drippers

Figure 2 shows an example of online drippers or punch drippers that can be installed on the same polyethylene line that is used for headers and laterals (often ½ in.). Installing punch-in drippers provides maximum flexibility as any distance and spacing can be created to meet crop needs. Field installation of the online dripper might be more labor-intensive compared to application of inline drip tape or tube.

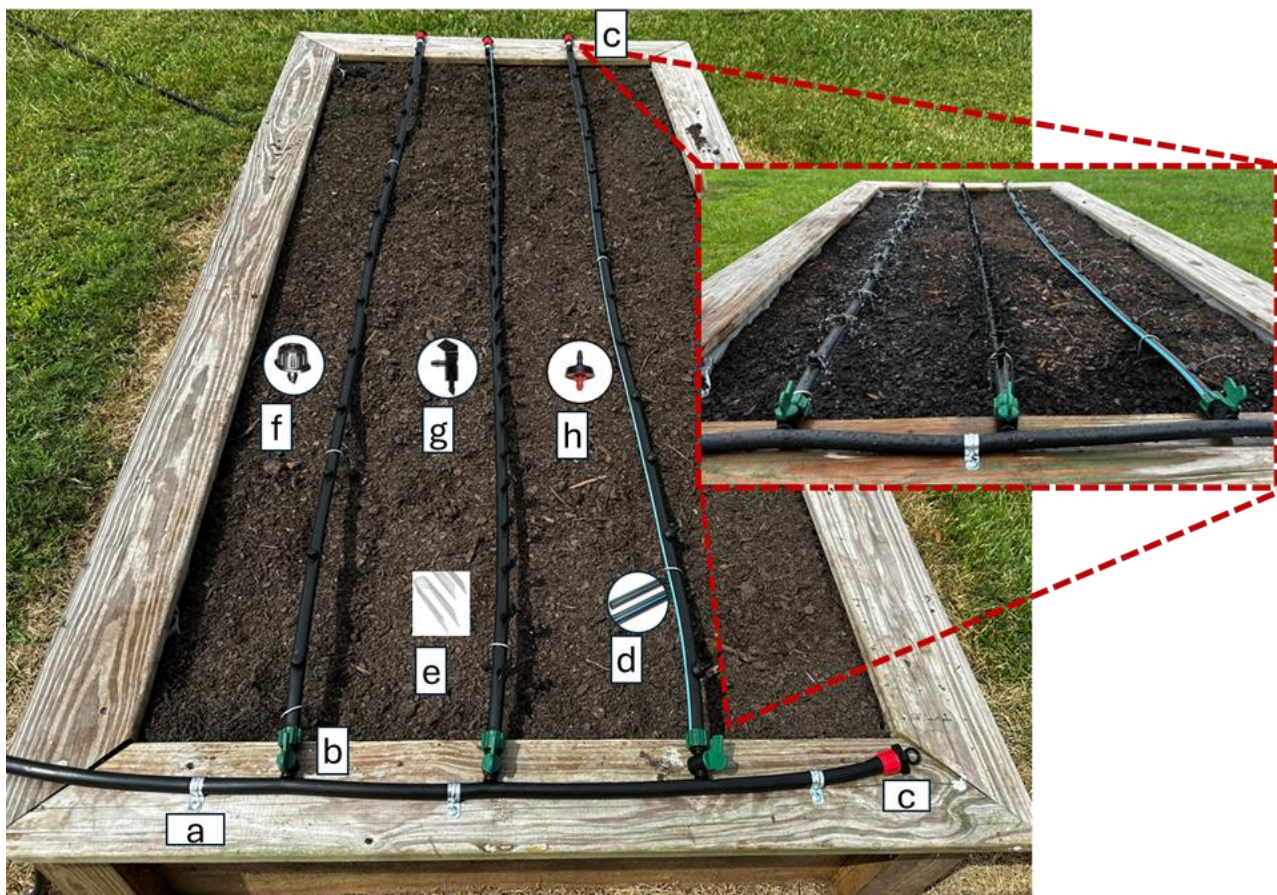


Figure 2. Raised bed with different types of on-line drippers installed at the Middle Tennessee Research and Education Center, University of Tennessee, Spring Hill, TN. The items used for this irrigation system include: a) ½-in. one-hole strap, b) Perma-Loc Tape x Barb Tubing Takeoff Adapter Valve (IrriTec, USA), c) ½-in. end plug (Teco, Italy), d) polyethylene hose, e) ½-in. loop stake (Orbit, USA), f) Adjustable on-line dripper, g) Flag (adjustable) dripper, h) Self-flushing pressure compensating (PC) emitter (TORO, USA).

<p><i>Pros of Online Drippers or Punch-In Drippers</i></p> <ul style="list-style-type: none"> • Flexible spacing to match plant layout • Can be added anywhere on the lateral line • Suitable for individual plants and irregular spacing • Good for raised beds and potted plants • Allows customized flow per plant 	<p><i>Cons of Online Drippers or Punch-In Drippers</i></p> <ul style="list-style-type: none"> • More labor-intensive to install • Requires careful punching to avoid leaks • Can clog without good filtration • Less uniform than inline drip systems • Higher cost per emitter than drip tape
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What are adjustable flow drippers?

Adjustable flow drippers (Figure 2, f and Figure 3, j and k) are a type of drip irrigation emitter that allows users to manually control the amount of water applied to a specific location. By twisting or turning the top of the dripper, you can adjust the flow rate—typically between 0 and 10 gph—as well as the diameter of the water distribution pattern. These emitters are well-suited for raised beds and potted plants. A common setup involves mounting the dripper on a stake and connecting it to the main lateral line using a ¼-in. (“spaghetti”) tube, allowing flexible placement near individual plants as needed. Examples of adjustable flow drippers are the Antelco Shrubblor 360 and 180.

<p><i>Pros of Dripper with Adjustable Flow</i></p> <ul style="list-style-type: none"> • Flow rate can be manually adjusted for each plant • Good for plants with different water needs • Flexible placement using ¼-in. tubing • Works well for raised beds and potted plants • Can control wetted areas (spray diameter) 	<p><i>Cons of Dripper with Adjustable Flow</i></p> <ul style="list-style-type: none"> • Requires frequent adjustment and monitoring • Not suitable for large-scale uniform irrigation • Can clog without proper filtration • Higher cost per emitter than tape/in-line drippers • Flow settings can change accidentally
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What are PC and Non-PC emitters?

Micro Irrigation emitters are generally classified into two types: (1) pressure-compensating (PC) emitters (Figure 2, h), which deliver the same amount of water over a wide range of pressure in the irrigation system, (2) Non-pressure-compensating (non-PC) emitters have a maximum pressure variation of approximately 10 psi (23 ft. of elevation). This classification is based on their ability to deliver uniform water flow over a range of operating pressures. Pressure-compensating (PC) emitters are best suited for irrigation systems with noticeable elevation changes. Most modern PC drippers are durable, resistant to clogging, and built to last. However, they are usually more expensive than non-PC drippers.

Spike Drippers

Spike drippers or drippers-on-a-spike are a type of micro irrigation system designed to deliver water directly to the root zone of the plant. It consists of a plastic spike that can be inserted into the soil next to the plant, usually with built-in adjustable drippers (Figure 3, j and k). These types of emitters are ideal for potted plants, raised beds, and flower boxes where precise watering matters.

<p><i>Pros of Spike Drippers</i></p> <ul style="list-style-type: none"> • Delivers water directly to the root zone • Very precise for individual plants • Easy to install and reposition • Ideal for pots, raised beds, and flower boxes 	<p><i>Cons of Spike Drippers</i></p> <ul style="list-style-type: none"> • Not suitable for large planting areas • Can clog without proper filtration • Requires frequent monitoring and adjustment • Higher cost per plant than drip tape • Can be damaged during handling or cultivation
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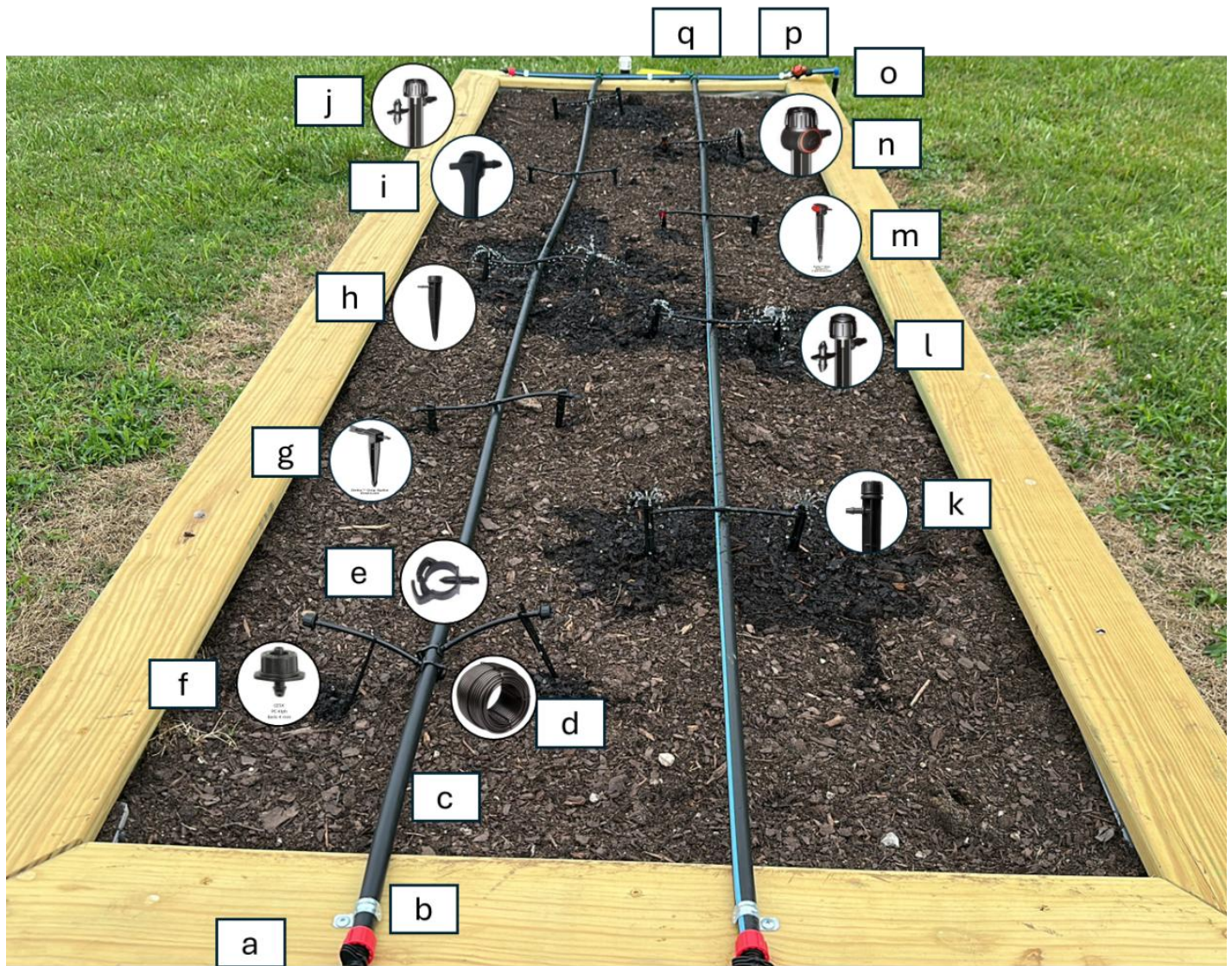


Figure 3. Raised bed with spike drippers installed at the Middle Tennessee Research and Education Center, University of Tennessee, Spring Hill, TN. The items used for this irrigation system include: a) ½-in. end plug (Teco, Italy), b) ½-in. one-hole strap, c) ½-in. tubing (TORO, USA), d) ¼-in. tubing, e) self-piercing, ¼-in. insert connector for ½-in. tubing (Orbit, USA), f) Pressure compensating (PC) dripper, g) Delta Drip Spike End-line (Teco, Italy), h) adjustable drip emitter (Orbit, USA), i) PC dripper spike (Orbit, USA), j) Ottima 180 spike (Teco, Italy), k) Multi-stream spike (Orbit, USA), l) Mini bubbler spike (Teco, Italy), m) Delta drip spike PC (Teco, Italy), n) Ottima spike PC (Teco, Italy), o) ½-in. elbow insert, p) Testa Roja barb valve, q) Tape by ¼-in. barb with valve.

Microspray, Microjets, Micro Sprinklers, and Mini Sprinklers

A microspray irrigation system can be used for any crop where microirrigation is appropriate (Figure 4, i, j). Compared to drip irrigation, microspray systems have a higher flow rate per emitter. Because of this higher flow, larger-diameter lateral pipes are needed for larger areas (not ideal for raised beds). Typically, 1-in. polyethylene (PE) pipes are used for microspray systems, while ½-in. pipes are common in drip irrigation. The two main types of microspray emitters are microjets and mini sprinklers.

Microjets are simple fixed orifice sprays with a deflector plate or cap that directs flow from the orifice into a geometrical pattern (Figure 4, e, f, g, k, l). Flowrate of microjets can vary from 5 to 45 gph. Compared to mini sprinklers, microjets have no moving parts and generally cost less. Microjets have smaller diameter patterns than mini sprinklers.

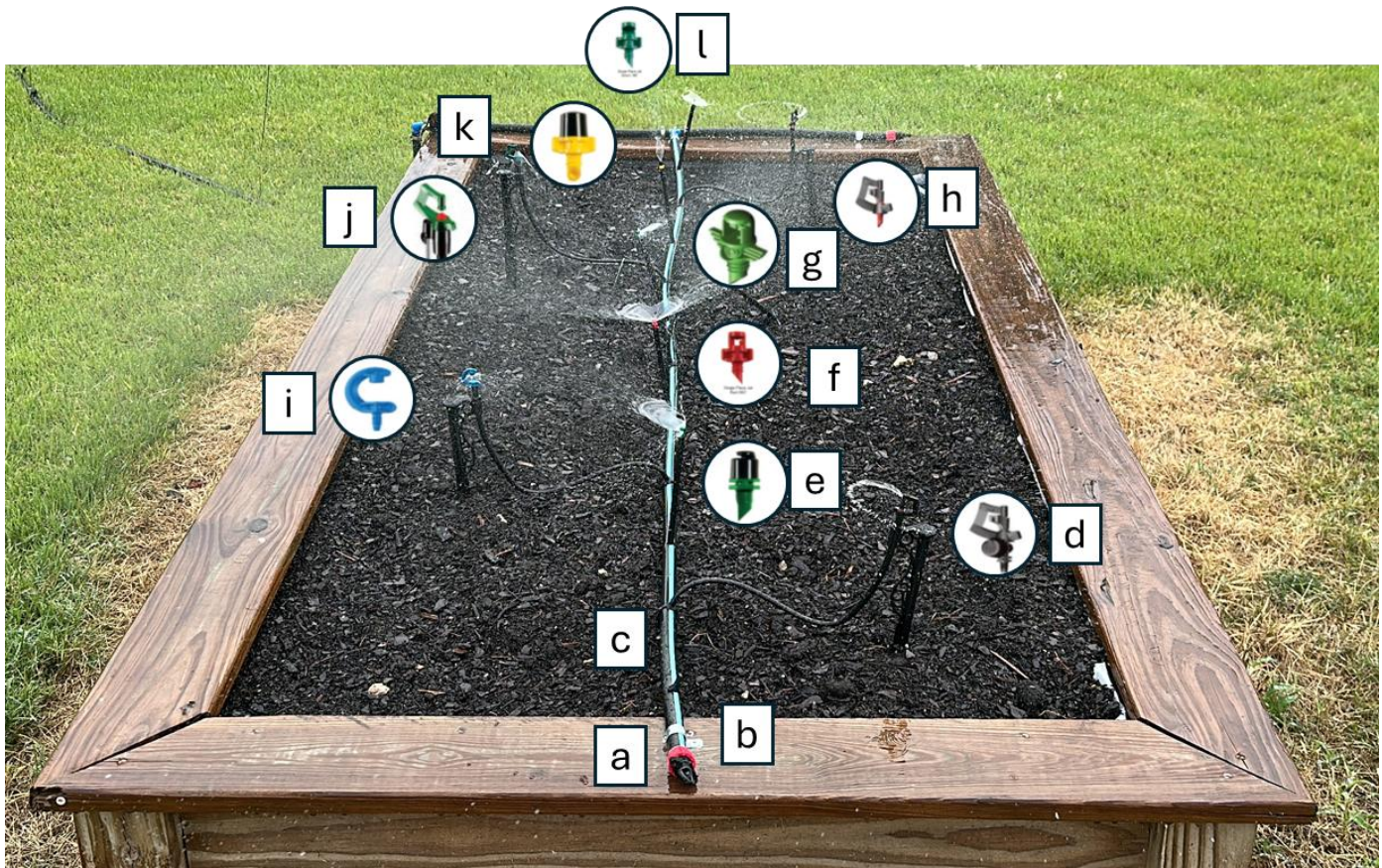


Figure 4. Raised bed with sprayers installed at the Middle Tennessee Research and Education Center, University of Tennessee, Spring Hill, TN. The items used for this irrigation system include: a) ½-in. end plug, b) ½-in. one-hole strap, c) ½-in. blue stripe polyethylene hose (TORO, USA), d) Orbita adjustable Micro sprinkler, e) 180° Fan Jet (Antelco, Australia), f) Single Piece Jet Red 360° (Antelco, Australia), g) Aquila jet (Teco, Italy), h) Orbita Micro sprinkler (Teco, Italy), i) CFd Down spray (Antelco, Australia), j) Down spray pressure compensating (PC) (Teco, Italy), k) Misting spray Winged (Antelco, Australia), l) Single piece jet Green 180° (Antelco, Australia)

Micro-sprinklers and mini sprinklers are types of microsprayers that are set up similarly to microjets, using the same stakes, mounting hardware, and a spinning mechanism to spray water outward in all directions. Micro-sprinkler (Figure 4, d, h, j) flow rates are around 13 gph with spray diameters 1.5-10 ft, while the mini sprinkler flow rates are usually 13-80 gph with spray diameters of 10-20 ft. Compared to jets, micro-sprinklers provide more uniform water coverage. They also irrigate a larger area at lower water pressure. Mini sprinklers are less affected by wind because they produce larger water droplets. Additionally, their wider internal passages make them less prone to clogging and less dependent on fine filtration.

<i>Pros of Microspray, Microjet and Microsprinklers</i>	<i>Cons of Microspray, Microjet and Microsprinklers</i>
<ul style="list-style-type: none"> • Cover a larger area than drip emitters • More uniform wetting than drip tape • Less prone to clogging than drip systems • Work well at low pressure • Mini sprinklers are less affected by wind • Suitable for orchards and widely spaced crops 	<ul style="list-style-type: none"> • Higher flow per emitter than drip (uses more water) • Not ideal for raised beds • Requires larger diameter pipes • More evaporation and wind drift than drip • Higher system cost than drip tape

Conclusion

Selecting the right micro irrigation system for raised beds and small gardens can improve plant health, increase water-use efficiency, and make irrigation management easier for gardeners. Each system has its own

advantages and limitations, and the best choice depends on the crop type, plant spacing, bed layout, water source, and desired level of management. Drip tape is often a practical and economical option for closely spaced annual crops, while online drippers, spike drippers, and adjustable emitters provide greater flexibility for individual plants or irregular layouts. Microsprays and mini sprinklers may be useful in some situations, but they are generally less suitable for raised beds because of their higher water use and wider wetting pattern. Careful planning, proper filtration, and matching the irrigation system to the garden's needs can help gardeners achieve more reliable crop production while conserving water.

References and Further Reading

Peters, R.T., (2011). Drip Irrigation for the Yard and Garden, Washington State University Extension Fact Sheet, FS030E [product-3526-sku-FS030E.pdf](#).

Gunnel, J., Beddes, T., & Barker, B. (2025). The do-it-yourself guide to backyard drip irrigation [Fact sheet]. Utah State University Extension. ["The Do-It-Yourself Guide to Backyard Drip Irrigation" by Jaydee Gunnell, Taun Beddes et al.](#)

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Potential Irrigation Suppliers:

Toro.com

Antelco.com

Netafimusa.com

Teco-Europe.com

Orbit-sprinkler.com

Rainbird.com