



Do It Yourself Drip Irrigation

Rhonda J. Simmons
Montana Advanced Master Gardener (Helena)
Phone: (406) 431-0807
Email: simmons3mt@msn.com

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Agenda

- Brief Overview
- Benefits of Above-Ground Drip Irrigation
- Inventory Your Starting Point: Soil Texture and Water Supply
- Basic System Components
- Planning Your System
- Installation
- Winterization & Tip for Long-Term Success

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Overview

This presentation is narrative with the hopes it will act as a future written reference when you begin to install your drip irrigation system. We will quickly skim sections where self assessments are to be made, with clear directions provided for completing these necessary assessments at home. Additionally, reference tables are provided to use once you are in planning stages. We will not deep dive into these items during the presentation, but these references will be helpful to you later.

We will focus on components, planning and installation with the hope you will feel comfortable and confident in incorporating drip irrigation into your home landscape. If you played with Legos, Toys, or Lincoln Logs as a kid, you will be well equipped to install your own drip irrigation system.

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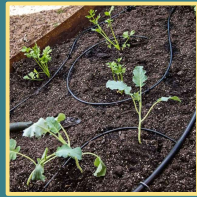
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Reap a Multitude of Benefits!



Variety of Applications!

- Flower beds
- Veggie gardens
- Containers
- Raised beds
- Shrubs and Trees
- Row crops
- Greenhouses



Flexible!

Grow drip system as garden expands by adding zones or more drippers

Move sections around with crop rotation



Saves Water: 30-70%

Slower delivery of water, benefitting all soil types

Provide precise amount at precise location, customize per plant

Excellent for hillsides, minimizes runoff



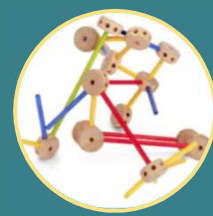
Increase productivity

Reduce weeds

Reduce plant disease and insect problems

Prevent overwatering

Provide uniform wetting patterns



Simple to work with!

- ✓ Easy planning and installation
- ✓ Use immediately
- ✓ Can fully automate
- ✓ Work while watering
- ✓ Save time!

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Understanding How Your Soil Texture Impacts Drip Irrigation Decisions

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Perform a Soil Texture Test

The Glass Jar Soil Test

What you Will Need

- 1 1 tsp dish detergent
- 2 A magic marker
- 3 1 cup of soil
- 4 A jar with a lid
- 5 A ruler



$\% \text{ Clay} = \text{Clay} / \text{Total Dirt}$

$\% \text{ Silt} = \text{Silt} / \text{Total Dirt}$

$\% \text{ Sand} = \text{Sand} / \text{Total Dirt}$

Follow these steps

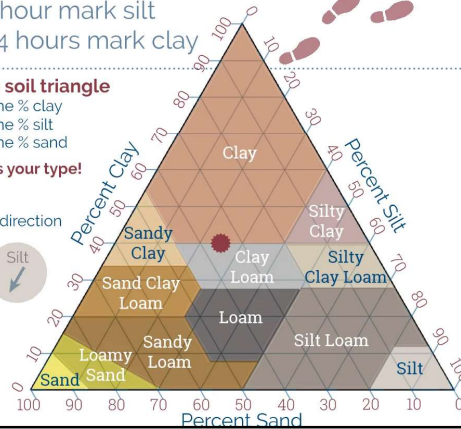
- 1: Add soil to the jar
- 2: Add detergent & fill jar with water
- 3: Replace lid & shake vigorously for 3 min
- 4: After about 1-2 minutes mark sand
- 5: After 1 hour mark silt
- 6: After 24 hours mark clay

How to use the soil triangle

Trace the line for the % clay
Trace the line for the % silt
Trace the line for the % sand

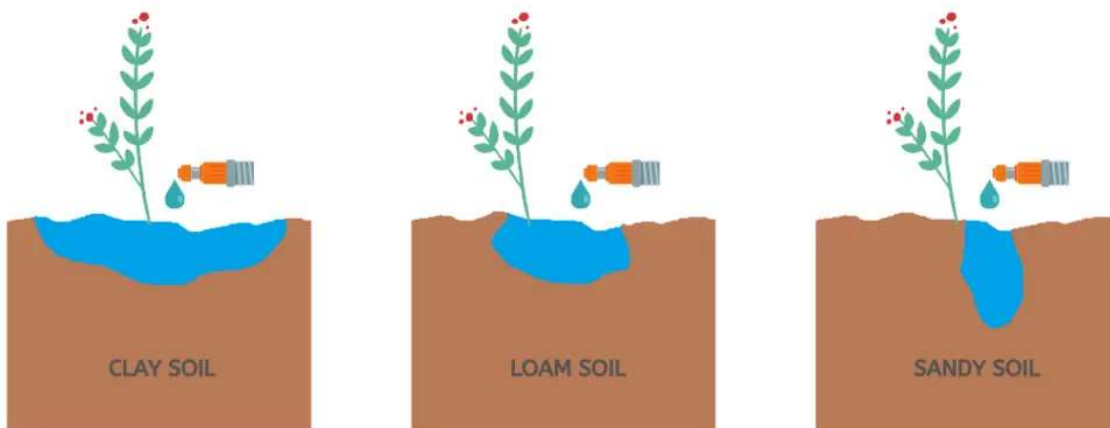
The intersection is your type!

Trace the lines this direction



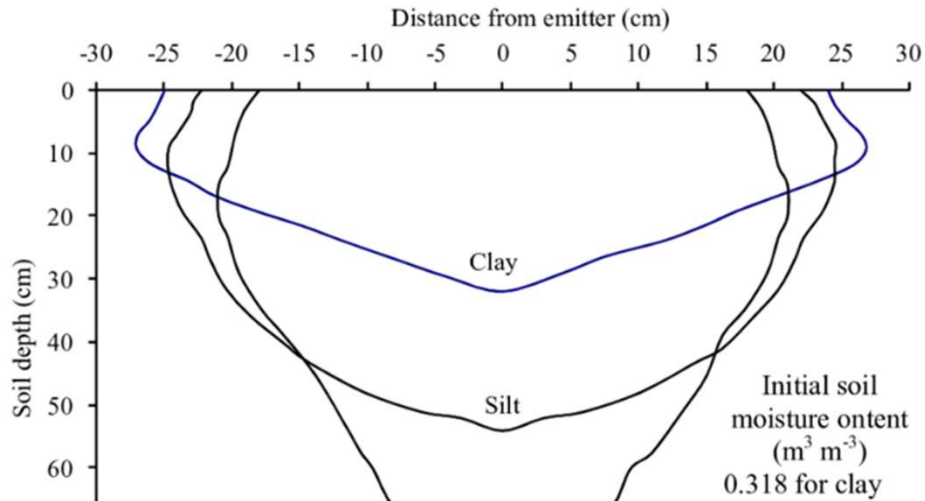
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Saturation based on soil texture



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Saturation depth/width at 2 GPH for 1.5 hours



Wetting patterns front under different soil types with 8 liter/h flow rate of emitter with 1.5 h operating time. Sand

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Texture Effect on Soil Properties

	Water Holding Capacity	Drainage infiltration	Aeration	Cation Exchange Capacity
Sand	Poor	Excellent	Excellent	Low
Silt	Good	Good	Good	Medium
Clay	Excellent	Poor	Poor	High

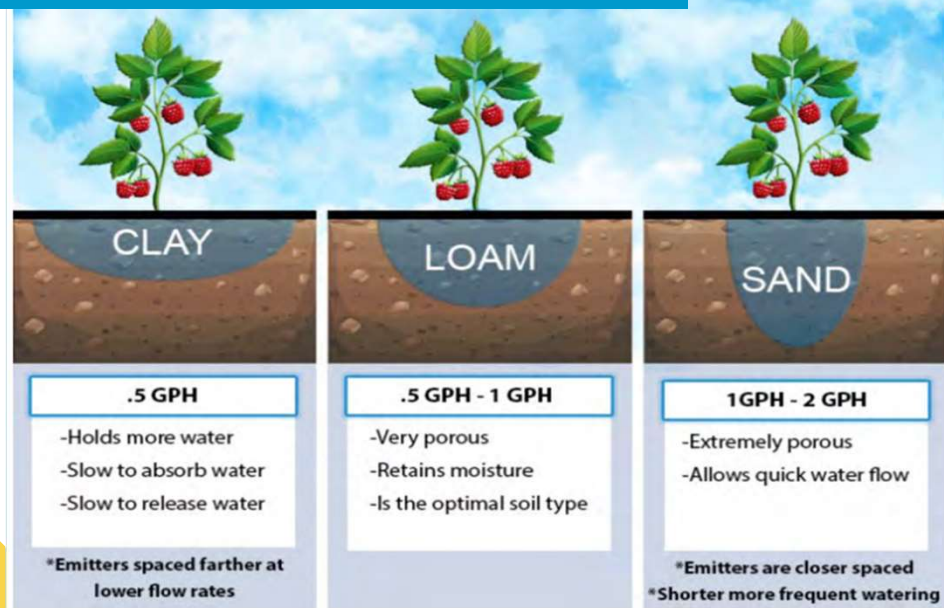
pronounced cat-ay-on

Soils with large surface areas, such as clay and organic matter, have more cation exchange capacity and surface area, and therefore are generally more fertile and can retain more nutrients.

CEC = Measure of soil's ability to hold and exchange positively charged nutrients (ie, Calcium, Magnesium, Potassium)

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Emitter volume relative to soil type



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Wetting Pattern of Drip Emitter in Different Soils

Soil Type	Dripper Flow Rates (GPH)	Wetted Area (ft)	Wetted Area (sq. ft)
Sandy	0.5	1-3	1-7
Sandy	1.0 or 2.0	2-3	7-13
Loamy	0.5	2-4	2-13
Loamy	1.0 or 2.0	3-5	7-20
Clay	0.5	2-3	3-7
Clay	1.0 or 2.0	3-5	7-16
Clay	4.0	4-6	13-28

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Determining Water Pressure and Flow Rate

the flow rate in gpm of water to
5 ft/sec in 2 1/2 inch pipe.

$$Q = \text{Velocity} \times \text{Area}$$

$$Q = 5 \text{ ft/sec} \times 3.14 \text{ ft}^2$$

$$Q = 15.7 \text{ ft}^3/\text{sec}$$

15.7 ft³	60 sec	7.48 gal
sec	1 min	1 ft³

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Water Pressure

- Measure the pressure using a pressure gauge (hardware store)
- If on water system, call water company for this information



- On well, attach to hose bib closest to pressure tank
 - Attach gauge to faucet, close all other taps
 - Turn on water, read PSI
- Alternatively, use clothes washer cold water faucet
- May already be gauge at pump near pressure tank
- Drip irrigation designed to operate at 20-30 psi
- Too much pressure can cause malfunctions
 - Leaks, blown emitters and fittings
 - Emitters releasing water too fast
 - Causing uneven watering
 - Plant damage
 - Wasted water
- Install pressure reducers if pressure is over 35 psi

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Flow Rate

- To determine maximum emitter volume allowable per zone

Be sure to test each hose bib you will use run dripline from!



Seconds to Fill 1 Gallon	Seconds to Fill 5 Gallons	Gallons Per Hour
12	60	300
14	70	257
16	80	225
18	90	200
20	100	180

<https://www.dripworks.com/resources/calculators/flow-estimator>

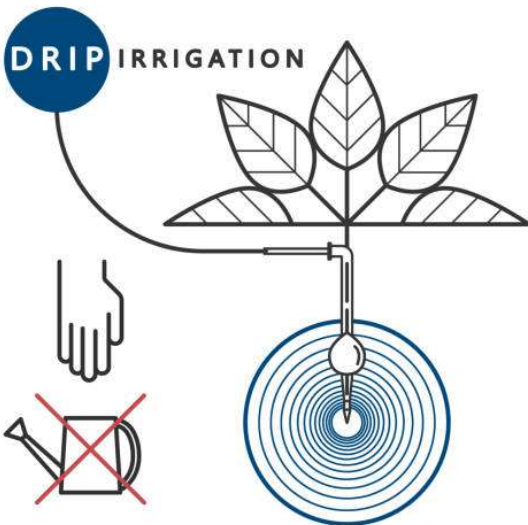
Measure flow rate at each bib you will run drip irrigation from:

- Make sure the water is full on
 - If on a well – the flow rate will increase/decrease based on when the pump is engaged vs. when it's not
 - It's a good idea to try to program your drip irrigation to keep the pump engaged – easier on the pump than cycling on/off

FOR DRIP IRRIGATION YOU NEED TO KNOW GALLONS PER HOUR

- Using a 1 gallon container, time how long it takes to fill with the valve full open
- Using a 5 gallon bucket, time how long to fill bucket, divide minutes by 5

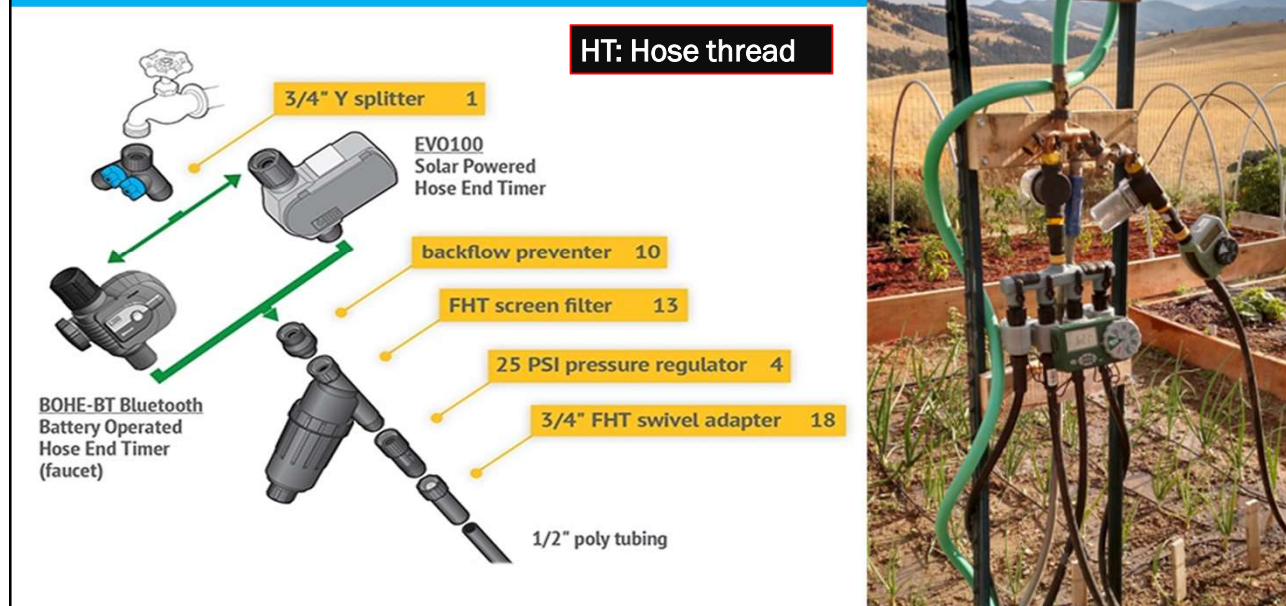
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Basic Components of Tap-Attached System

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Water Supply End



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Backflow Preventer

- Prevents impure water from reversing direction, flowing backwards into your water supply in case of breakage or abrupt water stoppage
- Protects your potable water supply from:
 - Bacteria from animal feces
 - Pests (spiders, beetles), webs, eggs
 - Fertilizer / pesticides when using injector systems
- Relieves pressure when watering cycle stops



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Pressure Reducer

- Maintains the water pressure within the “closed” system
- Protects against spikes or sudden drops in water source pressure
- Ensures pressure within system stays consistent, resulting in optimal performance from emitters
- If there is a surge, water will shoot from the hole to bleed pressure
 - If the water shoots from the hole constantly, it is likely your regulator failed and needs replaced
- **NOTE:** “Pressure compensating” emitters do not take the place of a pressure regulator
 - Pressure compensating emitters maintain same output at varying water inlet pressures – “compensating” for uneven terrain, length of supply tube, and varying inlet flows

Hose Thread
25 PSI



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Water Filter

- Prevents blockage of small openings and narrow pathways which leads to clogged emitters
- Prevents large particle deposits on critical components like control valves and seals
- Clean screens regularly (once per month), inspect a week after install
- To properly clean a drip irrigation filter:
 - Unscrew the cap
 - Remove the aerator
 - Rinse the aerator with fresh water
 - Replace the aerator
 - Resecure the cap
- To discourage algae growth in a clear filter, place a black sock or other light blocking fabric over the clear plastic



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Water Spigot Splitter

- Allows Spigot Use Without Interrupting Drip Irrigation System
- Allows Multiple Zones to Be Run Off Same Spigot



Female Hose Thread Adaptor

- The ½" Poly Distribution Pipe is "Compressed" in the End
- Allows the Distribution Pipe to "Swivel" and Unscrew from the System



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Timer / Controller

This piece of equipment will automate your system, allowing you to customize and program watering times/days by zone. Every timer comes with instructions on how to properly operate and program it.

Features to look for/consider:

- Battery operated
- Bluetooth capable (limited options but more common now)
- Multiple programs/stations
 - Times from 1 minute up to 5-12 hours
- Odd/even day, weekly, interval programmable up to 30 days
- "Off" button to temporary turn off system without losing programming
- "Auto" button so system is entirely self-functioning
- "Manual" button cycles system one time for hot days
- "Skip" button for days when irrigation cycle is not needed



Orbit B-hyve XD Smart Hose
Faucet Timer

Home Depot - \$79.98
Drip Depot - \$75.73
Ace Hardware - \$74.99
Lowe's - \$83.98
Melnor Brand- \$64.98

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Solar powered available

Removable timer

Prices range from \$10.38 to \$99.99+

Plethora of Controllers

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Distribution Supplies and Tools

- These components “distribute” water from the tap-end components to the drippers
 - There are many, many other choices that might be right for your set up, these are what I have found are readily available from multiple suppliers
- The tools shown are my favorite go-to items based on my experience using them
 - Tools are always personal preference, you should experiment also!



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1/2" Poly Tubing (Mainline)

- Transfers water supply from tap to poly micro tubing
- Available in 100' and 500' lengths
- PE = Polyethylene or "poly" tubing
 - Black most common, but also in brown and green
 - Lightweight, flexible, durable, food safe
 - Most stable plastic, common choice for organic and sustainable gardening, often used for potable water systems

Home Depot: 100' \$14.98; 500' \$49.99



HD: 50' \$4.40; 100' \$11.97; 500' \$29.97



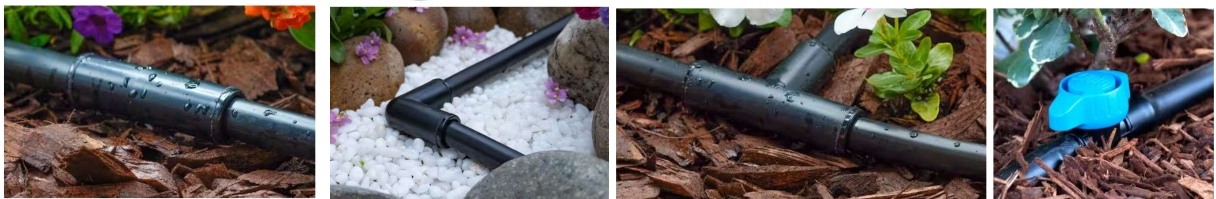
1/4" Poly Micro Tubing

- Transfer water from larger supply tubing to plants
- Available in 50', 100' and 500'

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1/2" Poly Tubing Fittings

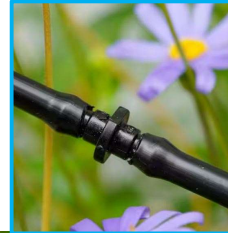
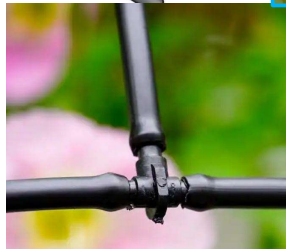
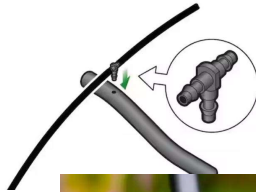
- Sleeves, Elbows, Tees, Shutoffs
- Available as Male or Female Components
 - Highly recommend clamps on male fittings!
- Compression, Barbed or Screw Fittings



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1/4" Poly Micro Tubing Fittings

- Coupling, Elbow, Tee, Goof Plug, Shutoff
- Majority of Drippers are for 1/4" Micro
- Typically Barbed Fittings



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Necessary Tools

Orbit Poly Ergo Cutter \$8.99 HD



Orbit Pro Punch – HD \$8.95



Lowe's Combo Pak - \$14.98



Useful Items to Include in Your Toolbox

- | | | |
|--------------------------|--------------------|--------------------------------------|
| ✓ Eye Protection | ✓ Tape Measure | ✓ Flat Screwdriver |
| ✓ Leather Gloves | ✓ White Marker | ✓ Colored Tape |
| ✓ Channel Locks | ✓ Small Awl | ✓ Few Zip Ties |
| ✓ Plumbers Tape | ✓ Tubing Stakes | ✓ Toolbox and/or Tacklebox for parts |
| ✓ Regular Pliers | ✓ 1/2" Pipe Clamps | |
| ✓ Hammer or Small Sledge | ✓ 1" Wood Screws | |

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Emitters: So Many To Chose From!



Inline Dripper

Used along 1/4" tubing
Sizes: .5, 1, 2 and 4 GPH



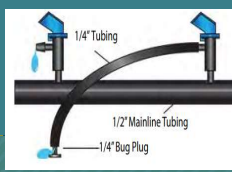
Button Dripper

Used at end of 1/4" tubing
OR punched into 1/2" tubing
Sizes: .5, 1, 2 and 4 GPH



Flag Dripper

Used on top of 1/2" tubing
Disassembles for clearing
particulates



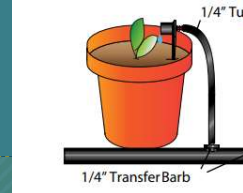
Shrubblers

Used on top 1/2" tubing
Adjustable volume



Pot Dripper

Used at end
of 1/4" tubing "jump"



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Sprayers and More ...



Prespaced Dripline

1/4" tubing with built in
1 GPH emitters
at 6, 12, or 18" intervals



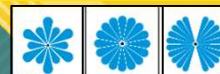
Microsprayers

Qtr, Half, Full Circle Pattern
Adjustable volume



Manifold

Convert 1/2" to 1/4" in bed
2, 4, 8, 12 ports



Bowsmith Fanjets

Used on stake to water
large areas (trees)



Landscape Pins

4" and 6" lengths
Widths for 1/4" and 1/2" tubing

**Female and Male Hose
Connection Ends**

Disconnect sections of tubing



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Your Drip Irrigation System

Considerations and Steps to Take When Designing, Installing, and for Maintaining Your System Long Term

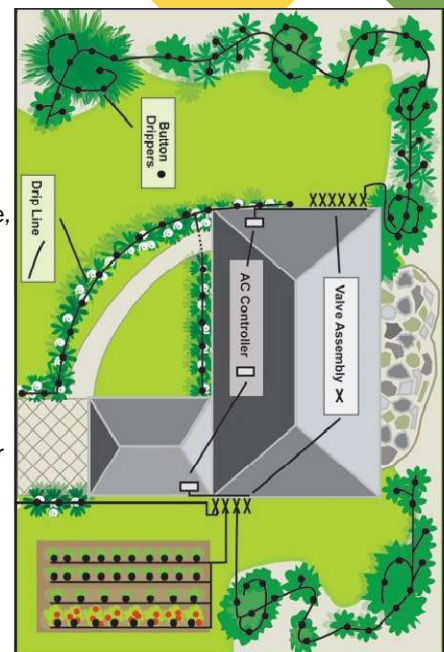
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First Steps in Planning Your System

To get the perfect drip system for YOUR garden, raised beds and landscape, the planning process is critical and will save you time, money, and frustration.

- 1) Sketch your property, including:
 - Your water source(s)
 - Buildings / outbuildings
 - Sidewalks and driveways to be avoided
- 2) Draw the area to be irrigated on your property and sketch out what is or will likely be planted there.
- 3) Use grid paper and stay true to scale (such as 1/10" = 1')
- 4) Determine water use for each area (turf, flower beds, trees, orchard, vegetable gardens)

No systems will EVER be the same because you will tailor to your needs!



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Prepare a detailed sketch of each area

Use your drawing or create a more detailed sketch of each area you want to drip irrigate. First, chart the course for your poly tubing mainline (1/2"), starting at the point of connection to the water source, moving to the farther point of your line.

- Keep the mainline as straight as you can, more bends = pressure loss
 - ✓ If running along raised beds, run along the edge as much as possible to keep out of walkway
- Plan your tap-end components, including the "end cap" on the far end
 - ✓ Start a list of components by name, tally total parts as you plan
- For every 90-degree angle you will need a 1/2" elbow
- Next show the secondary route of your supply line, still using 1/2" tubing, from the primary line to your raised beds or garden area, think of these as "branches." Each branch needs a "Tee" fitting, whether the change in route is horizontal (laying along the ground) or vertical (like rising up the side of a raised bed).
- If the mainline is running over plants that need watered, install drippers directly into the 1/2" tubing. If not, you will need to run 1/4" tubing and connectors (jumps). Each jump need a 1/4" connector to "jump" from the 1/2" tubing to the plant or location to be irrigated.

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Next, plan your dripper styles, sizes and quantity

Decide what GPH you will need for each item, what type of dripper would be best suited to provide it, and continue your parts tallying as you draw jumps and drippers installed on the 1/2" line.

Matching drip emitters to plants and trees involves considering the size and water requirements of the plant, and then your soil type must be factored in. Calculate your run times based on the below pages and the water needs of your plants to determine what size drippers to use. **There is no one size fits all!!**

Decisions on which dripper style to use will evolve as you get comfortable using new styles of drippers. Most plants can be initially accommodated using in-line and button drippers. When unsure of the number of drippers needed, plan for more and err on the side of using more (within reason).

The tables on the pages following the sketch and layout ideas will help you determine the amount of water to supply to each plant and tree on your sketch.

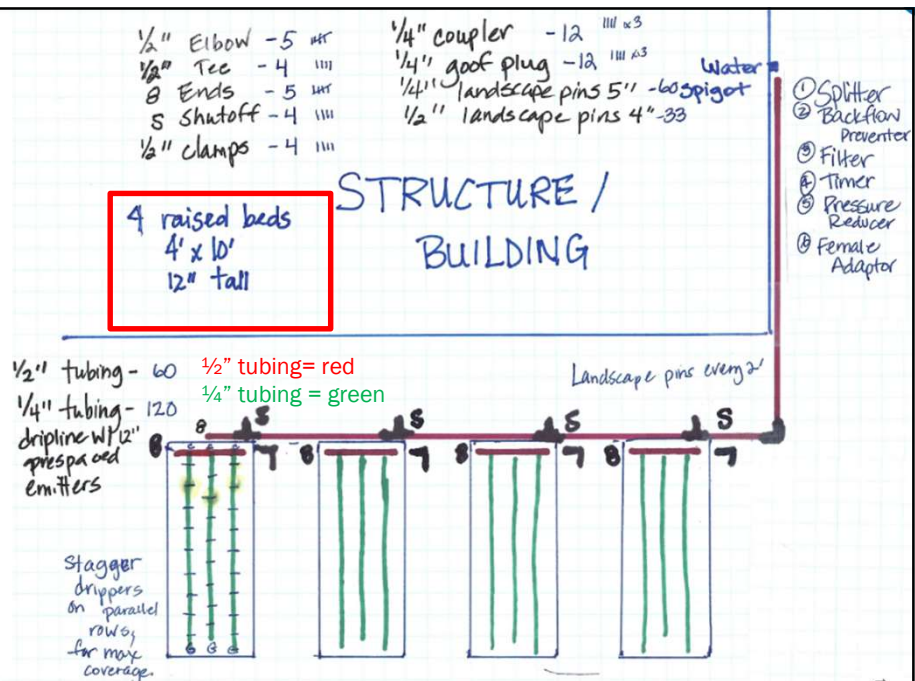
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Sample Sketch Step-by-Step and Layout Ideas

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Steps for Estimating Project Materials

1. Draw diagram using graph paper
2. Record permanent structures
3. Mark your water source
4. Draw out the destination location
5. Go back to the water source, list tap end components needed
6. Draw $\frac{1}{2}$ " pipe course to reach the drip destination, record ft. needed
7. Draw and record the connection hardware needed to get there
8. Draw the drip course through the new destination, record ft. needed
9. Record the hardware needed for the destination runs
10. Total tubing and hardware (connectors, drippers, pins, etc.): this is your project materials list



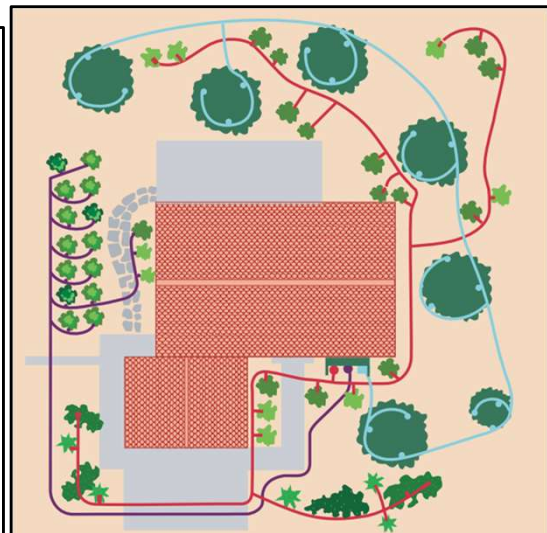
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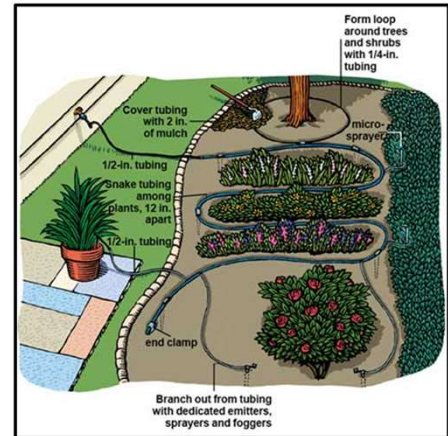
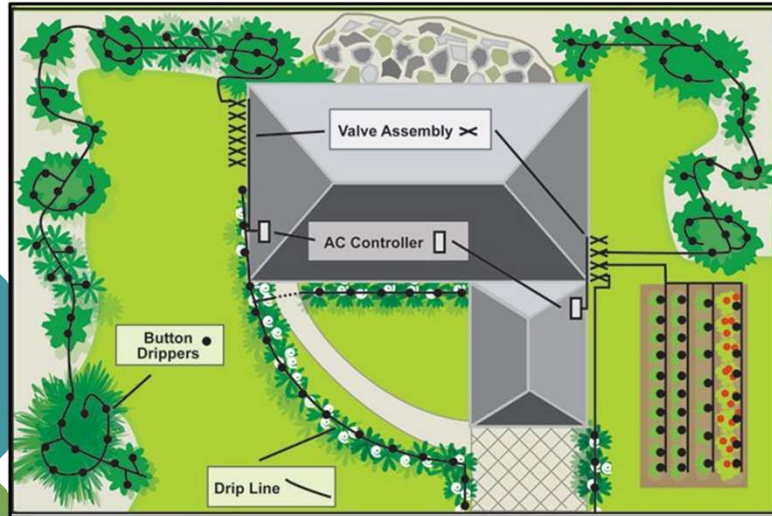
Sample Sketches for Inspiration

For shrubs bed (vs. row crops), use the same steps for estimating your project but instead of calculating pre-spaced tubing, you will count/tally feet of $\frac{1}{4}$ " tubing, and number and style of drippers needed for each plant, adding that to your project list.



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Sample Sketches for Inspiration



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How Many Drippers? Part science, math, and art!

Recall that your property's **FLOW RATE** dictates the number of drippers that can be used on one zone.

The total GPH needed to provide for all emitters installed on a single zone is called **FLOW RATE DEMAND**. Demand should be 20-30% less than Flow Rate to allow for increasing the zone as plants grow.

KEEP WATER PRESSURE LOSS IN MIND!

- Loss is expressed in "pounds per square inch" (PSI)
- Bends or other restrictions impede water flow
- More emitters along the way reduces water flow

You will need to add a new zone once you have maxed out emitter volume on an existing zone. Use this link to calculate system loss and available GPH over longer runs to adjust your zone's maximum run length accordingly.

<https://www.dripdepot.com/irrigation-calculators/pressure-loss-calculator>

Run/GPH Limitations by Tubing Size

Tubing Size	Max Run Length	Max GPH Supplied
1/4 inch	30 feet	30 GPH
1/2 inch	200 feet	200 GPH
3/4 inch	480 feet	480 GPH
1 inch	960 feet	960 GPH

Wetting Pattern of Drip Emitter in Different Soils

Soil Type	Dripper Flow Rates (GPH)	Wetted Area (ft)	Wetted Area (sq. ft)
Sandy	0.5	1-3	1-7
Sandy	1.0 or 2.0	2-3	7-13
Loamy	0.5	2-4	2-13
Loamy	1.0 or 2.0	3-5	7-20
Clay	0.5	2-3	3-7
Clay	1.0 or 2.0	3-5	7-16
Clay	4.0	4-6	13-28

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Dripper Watering Schedule

Type of Plants	Watering Time	Watering Frequency by Climate		
		Hot	Warm	Cool
Flowers, Vegetables	30 min. to 1 hour	1-2 days	3 days	3-4 days
Small Trees, Shrubs	1-2 hours	1-2 days	3 days	3-4 days
Vines	3-6 hours	1-2 days	3 days	3-4 days
Medium Trees, Shrubs	5-7 hours	1-2 days	3 days	3-4 days
Large Trees, Shrubs	6-8 hours	1-2 days	3 days	3-4 days
Pots up to 15" diameter	3-5 minutes	1-2 days	3 days	3-4 days
Pots over 15" diameter	5-10 minutes	1-2 days	3 days	3-4 days

You can always add more time to a zone rather than more drippers if you need to provide more water, however, remember that this decision is impacted by and should factor in your soil type as well.

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Micro Sprinkler Watering Schedule

Type of Plant	Watering Time	Watering Frequency (by climate)		
		Hot	Warm	Cool
Flowerbeds, Ground Cover	30 min. to 1 hour	1-2 days	3 days	4-6 days
Small Trees	1 to 2 hours	2-3 days	4-5 days	5-6 days
Medium Trees	2 to 3 hours	2-3 days	4-5 days	6-7 days
Large Trees	2 to 5 hours	2-3 days	4-5 days	5-7 days
Greenhouses	5-10 minutes	2-4 times/day	2 times/day	1 time/2 days

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Maintenance and Long Term Success

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Winterizing Your System – Controls

- Update your current diagram, including documenting frequency and timing of each zone's settings
- Take a picture of your assembled primary components
- Remove and disassemble all components from the hose bib
- Open valves and drain water from all components
- Let sit for at least 24 hours so residual water evaporates
- Remove any batteries
- Store any electronic components or those with valves where they will not freeze



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Winterizing Your System - Tubing

- If there is any **PVC** in your system, you **MUST** blow it out in the fall to prevent pipes from breaking!
 - **In MOST CASES you can simple gravity drain PE tubing**
- As you will be harvesting or encouraging plants to go dormant, you will naturally water less toward fall, so any water left in the lines will evaporate over time (as long as the weather is cooperative)
- Open end caps, and if you have all level surfaces, walk the surface and lift the supply tube to drain the water toward the end
- Uncouple connections made to drain low-lying pipe where water might pool while system is dormant or where winter activities might interfere with the pipe's course
 - Let gravity drain the system, let it sit for 24 hours, then place caps or screen on ends
- You can always blow out your system with an air compressor to ensure less problems in the spring
 - ✓ If you do, be patient and wait for water to leave the system
 - *First water will run out, then a fine mist, and finally air only*



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Spring Reinitialization of Your System

- Walk the entire length of your system looking for issues
 - Watch for damaged/broken emitters or couplers, split or rodent-damaged tubing*
- Remove caps and screens from any low-lying couplings and re-couple
- Reassemble the components (refer to picture you took in fall if necessary)
- Turn on water and check for leaks at controller components
- Manually turn on supply to each zone, flush entire system
- Replace end caps, turn on water to each zone, walk that zone while it is on looking for issues
 - *For example, damaged/broken emitters or couplers, split or rodent-damaged tubing*
- Set your timers, reprogramming each zone's days and times plus any needed modifications
- You're in business! Enjoy the green and your free time!



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Tips for Long-Term Success



- ❖ New rolls of poly tubing can kink and be stiff, unroll what you think you will need and let it sit in the sun
 - ✓ *Stretch it out across the ground or droop it across your fence posts to straighten*
- ❖ Working with compression fittings is way easier on a warm day, a heat gun helps on cool days, as do steady pressure with a wrist rocking motion
- ❖ Consider mulching over your mainline once installed to increase the tubing's lifespan and help protect it from environmental elements
 - ✓ *Do not bury tubing under soil, breaks are impossible to diagnose*
- ❖ Once the mainline and branch lines are installed, remove debris before closing ends by flushing the lines with clean water, and then install emitters
- ❖ Containers are a great place for drip irrigation! And think overhead – hanging baskets and the like!
- ❖ Inspect drippers, micro sprinklers and tubing periodically to ensure no drippers are clogged or tubing is out of place or damaged:
 - ✓ *Fix a broken 1/2" line with a compression coupler (sleeve); broken 1/4" line with a barbed connector*
- ❖ Having four 1GPH drippers is a better choice than a single 4GPH dripper, if one dripper clogs, there are still three drippers working
- ❖ Instead of a 2GPH dripper on a plant, place one 1GPH dripper on either side for better root development

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Dig Drip Irrigation Guide (*Dig products are generally readily available in the Helena store or online*)
https://www.digcorp.com/wp-content/uploads/digcorp/DIG_Drip-Irrigation-Guide_web.pdf

Drip Depot (*my favorite online retailer, great pricing, and issue-specific online tutorials*)
<https://help.dripdepot.com/support/solutions/folders/11000007964>

DripWorks Drip Planning Guide (*a great online retailer with many valuable online resources*)
<https://www.dripworks.com/content/drip-planning-guide.pdf>

Irrigation Direct Drip Irrigation & Design Guide (*practical, printable guide for planning, design and installation*)
<https://www.irrigationdirect.ca/docs/Drip-Irrigation-Design-and-Installation-Guide.pdf>

Drip Store Learning Center:
<https://www.dripirrigation.com/help-main>

Additional Resources

Capitalize on these online learning forums to further your drip irrigation skills!

Also check out their varied products to find the perfect fit for your drip irrigation needs!

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Thank you

Rhonda J. Simmons
Montana Advanced Master Gardener (Helena)
Phone/Text: (406) 431-0807
Email: simmons3mt@msn.com
Please feel free to reach out with questions.