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Planning Your Drip Irrigation System

When installing your water-saving, drip irrigation system, it's essential to plan ahead! To make planning as convenient as possible for you, we've outlined five simple steps to help guide you to the right drip products for your landscape, and ensure drip system success!

What We Will Cover

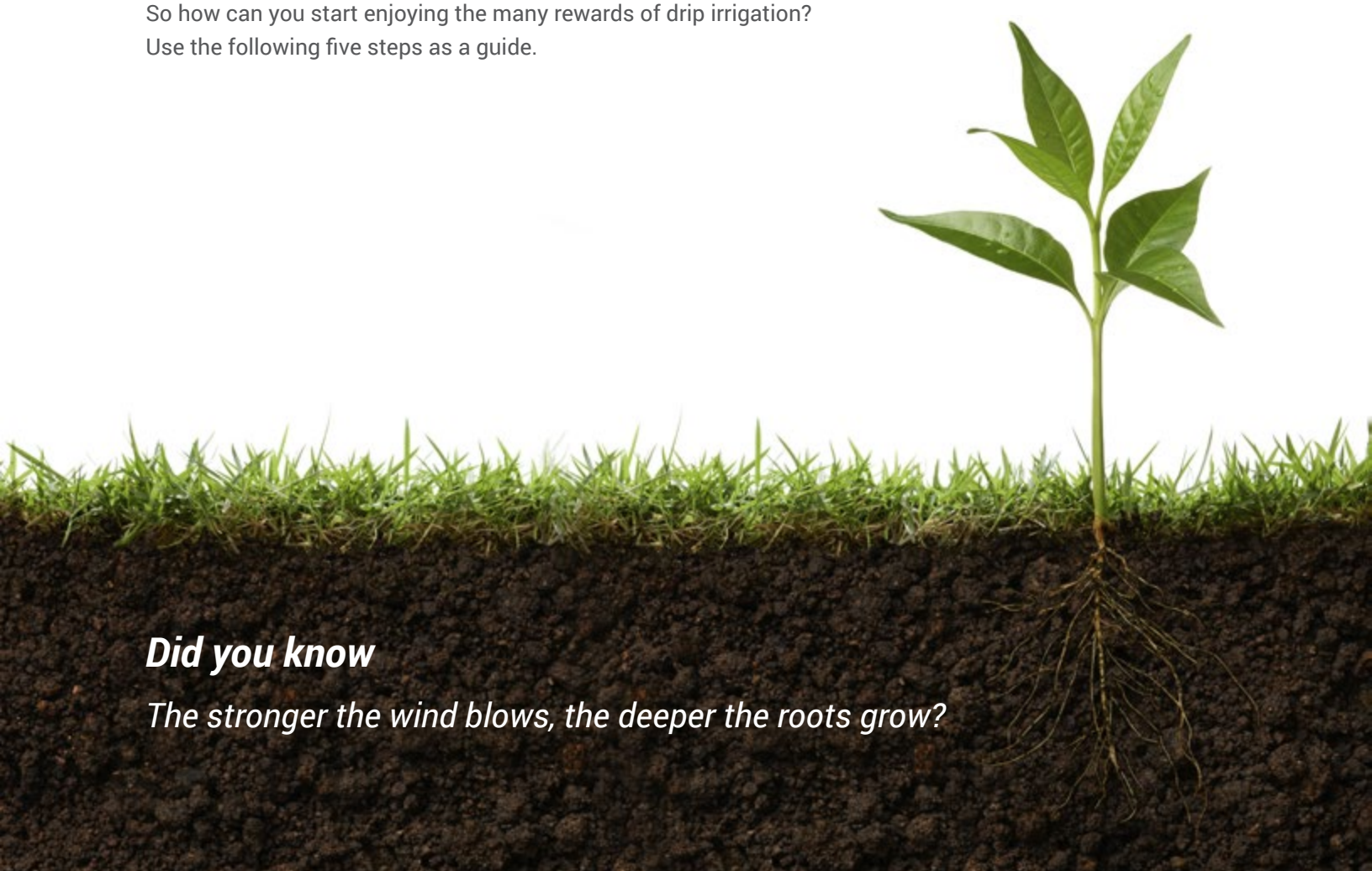
- Sketch the Area
- Determine the Soil Type
- Determine Watering Frequency
- Calculate Water Requirements
- Determine Distance for Drip System

Simple Setup With Big Rewards

Plan Your Drip Irrigation System in Five Simple Steps

Compared to conventional sprinkler systems, drip irrigation systems are simple to design, inexpensive, and easy to install. They can also reduce disease problems associated with high levels of moisture on the leaves of some plants. Unlike traditional high-volume and high-pressure sprinkler systems (which require careful planning, extensive trenching, and special tools), drip irrigation systems can be easily installed above or below ground, without special tools or extensive technical knowledge. Drip irrigation delivers water measured in gallons per hour (GPH), and applies water only where necessary. This yields big rewards—improved plant health, water conservation, and reduced weed growth!

So how can you start enjoying the many rewards of drip irrigation? Use the following five steps as a guide.



Did you know

The stronger the wind blows, the deeper the roots grow?

1) Sketch the Area

Start by making an accurate top view sketch of the areas that need to be watered. Make sure that on the site's outline it includes your home, any retaining walls, sidewalks, paved areas, and water sources accurately and to scale. This will require measuring the area. We recommend using graph paper with small squares to make drawing to scale easier. Each small square on this manual graph can represent one foot of your property (usually appropriate for residential landscapes), or you can use 1" graph = 10' of your area.

☐ = 1'

Be sure to note and list the locations of your small and large trees, shrubs, groundcover, flowerbeds, containers and vegetable garden. You will select the water emission devices and estimate the total flow rate based on the soil type and concentration of plants.

2) Determine Soil Type

To determine which type of soil you have in a given area, take a handful of dry soil, grip tightly and release. Sandy (coarse) soil will crumble and fall apart. Loamy (medium) soil will hold together but easily break apart. Clay will mold without breaking.

Water Movement in Soil

Sandy Soil		the water will tend to move straight down	micro sprinklers or closely spaced (12" apart) 1 or 2 GPH drippers can be used.
Loamy Soil		the water will move slowly and spread evenly	using .5 or 1 GPH drippers with a 16" to 18" spacing is most beneficial.
Clay Soil		the water will percolate very slowly	low flow such as .5 or 1 GPH drippers at a wider spacing of 20" to 30" can be used.

Soil Matters!

The soil is a storage room for the plants' nutrients, and the medium through which water and nutrients move. It is the anchor for plants and the reservoir of water for plant growth. There are various types of soil with differing characteristics, which determine what types of plants can be grown. Each type of soil will require a different drip or micro sprinkler layout and spacing.

The Soil and Water Relationship

A micro irrigation system is essentially a transportation system which delivers water to a point in or near the plant's root zone. The final link in this transportation system is the soil. The soil's physical and chemical properties determine its ability to transport as well store water and nutrients.

Key Terms

Capillary Moisture	the water held in pore spaces by the surface tension between the water and the soil particles. Capillary moisture is the primary force in spreading the water horizontally.
Gravitational Water	free water in the soil which moves downward under the influence of gravity. After the soil is saturated, the gravitational water will percolate downwards, leaving the soil at field capacity.
Field Capacity	a measure of the water held by the soil against the influence of gravity. If soil is saturated by rainfall or irrigation, and then allowed to drain freely for 24 hours, the soil is usually at field capacity. For most plants, soil moisture content near field capacity is the ideal moisture level for vegetative growth because there is a good balance between soil moisture tension and aeration. The soil will lose very little water after it has drained to field capacity if there are no plants growing in it. Plants will remove water by transpiration and reduce the soil moisture. On hot days, plants may use water faster than the soil can supply the roots, or faster than the roots can supply the rest of the plant. This will cause the plant to wilt. Normally, given sufficient soil moisture the plant will recover during the night.
Permanent Wilting Point	the soil moisture content at which the plant wilts and remains in a wilted state, ceasing normal growth and transpiration.

3) Determine Watering Frequency

It's all about timing. Determining how much and how often to water your plants is critical to keeping them healthy.

Where to use drip

Drip Irrigation		trees, shrubs, vines, vegetables, and any individual plant.
Micro Sprinklers		best used on ground cover, flower beds, groups of plants, hillsides and/or on very sandy soils (as water will percolate downward before it can spread far enough horizontally). Avoid micro sprinklers in areas where it is windy; high winds will disturb the micro sprinkler spray pattern.
Drip Soaker Tape		ideal for vegetable beds and planters and narrow planting areas.

Did you know

That drip irrigation helps to reduce pest problems and weed growth?

Getting the Timing Right for Drippers

Ideal for irrigating vines, flowers, vegetable gardens and more, drippers are a small and compact watering device designed to deliver water at a very low rate and pressure. The following chart offers recommendations as to the length of time a drip system should run.

Dripper Watering Schedule

Type of Plants	Watering Time	Watering Frequency (by climate)		
Flowers, Vegetables	30 minutes - 1 hour	1-2 days	3 days	3-4 days
Small Trees or 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 or Shrubs	5-7 hours	1-2 days	3 days	3-4 days
Large Trees or Shrubs	6-8 hours	1-2 days	3 days	3-4 days
Pots up to 15"	3-5 minutes	1-2 days	3 days	3-4 days
Pots over 15"	5-10 minutes	1-2 days	3 days	3-4 days

= Hot Climate = Warm Climate = Cool Climate

Getting the Timing Right for Micro Sprinklers

Micro sprinklers throw water over a wide area and are a great way to irrigate flowerbeds, groundcover, greenhouses and more. The following chart offers recommendations as to the length of time a micro sprinkler system should run.

Micro Sprinkler Watering Schedule

Type of Plants	Watering Time	Watering Frequency (by climate)		
Flowerbeds, Ground Cover	30 minutes-1 hour	1-2 days	3 days	4-6 days
Small Trees	1-2 hours	2-3 days	4-5 days	5-6 days
Medium Trees	2-3 hours	2-3 days	4-5 days	6-7 days
Large Trees	2-5 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

= Hot Climate = Warm Climate = Cool Climate

4) Calculate Water Requirements

Different plant species can vary considerably in their rates of evapotranspiration. Some plants transpire large amounts of water, while others use relatively little. Values for plant factor or crop coefficients are sometime available through local sources such as Agricultural Extension Services and local newspapers. If you have all the information concerning the individual plant site, the following pieces of the puzzle will fall into place.

While reading through these steps and examples, be sure to consult our tables for reference.
Table 1 – Ks = Landscape Coefficient
Table 2 – Estimated Emitter Uniformity
Table 3 – ETr = Reference Evapotranspiration Rate and Climate Efficiency
Table 4 – Wetting pattern of Drip Emitter in Different Soils

Step 1: Determine Water Requirements per Day, per Plant

Use the formula below to calculate the amount of water that each plant will need.

$$\text{Gallons per day per plant} = \frac{.623 \times \text{plants area} \times Ks \times ETr}{\text{climate efficiency} \times \text{estimated emitter uniformity (in decimal form)}}$$

Especially in hot, dry weather, citrus trees can require a lot of water to bear juicy fruit! Drip irrigation systems help fruit trees to produce dense roots which are able to drink enough water for healthy fruit production.

Table 1 – A Landscape Coefficient (Ks)

Vegetation	High	Average	Low
Trees	0.90	0.50	0.20
Shrub	0.70	0.50	0.20
Ground Cover	0.90	0.50	0.20
Mixed	0.90	0.50	0.20
Turf Grass	0.80	0.75	0.60

= High = Average = Low

Table 2 – Estimated Emitter Uniformity

Emitter Type	Poor	Fair	Good
Inline Dripper	65%	80%	90%
PC Inline Dripper	85%	90%	95%
Button Dripper	60%	75%	90%
PC Button Dripper	80%	85%	90%

= High = Average = Low

Table 3 – ETr and Climate Efficiency

ETr varies as a function of the mix of plants, density of plantings, and the effects of microclimate.

Climate	**Definition** (mid-summer)	**ETr** (worst case, inches per day)	**Climate Efficiency** (%)
Cool Humid	<70 degree F > 50% H	.10-.15"	100
Cool Dry	<70 degree F > 50% H	.15-.20"	95
Warm Humid	<70-90 degree F > 50% H	.15-.20"	95
Warm Dry	<70-90 degree F > 50% H	.20"-.25"	90
Hot Humid	<90 degree F > 50% H	.20-.30"	90
Hot Dry	<90 degree F > 50% H	.30-.45"	85

= Hot Climate = Warm Climate = Cool Climate H = Humidity

Step 2: Determine How Many Drippers to Use

Deciding on the number of drippers to use is part science, part math, and partly a judgment call. Remember that you must wet at least 60% of the plant's root zone. When unsure of the number of drippers needed, always use more. You must find the proper balance based on the formula and actual site conditions. You also need to be aware of the number of drippers to use. If you have one 4-GPH dripper watering a plant, and it plugs and stops working, what will happen to your plant? On the other hand, if you have four 1-GPH drippers, the plant has a better chance to survive and to grow.

Use the formula below to calculate how many drippers are needed to apply 12 gallons per day to the 10' tree.

$$\text{Number of drippers per plant} = \frac{\text{Square foot of plant root zone area}}{\text{Square foot of dripper wetted area}}$$

Example

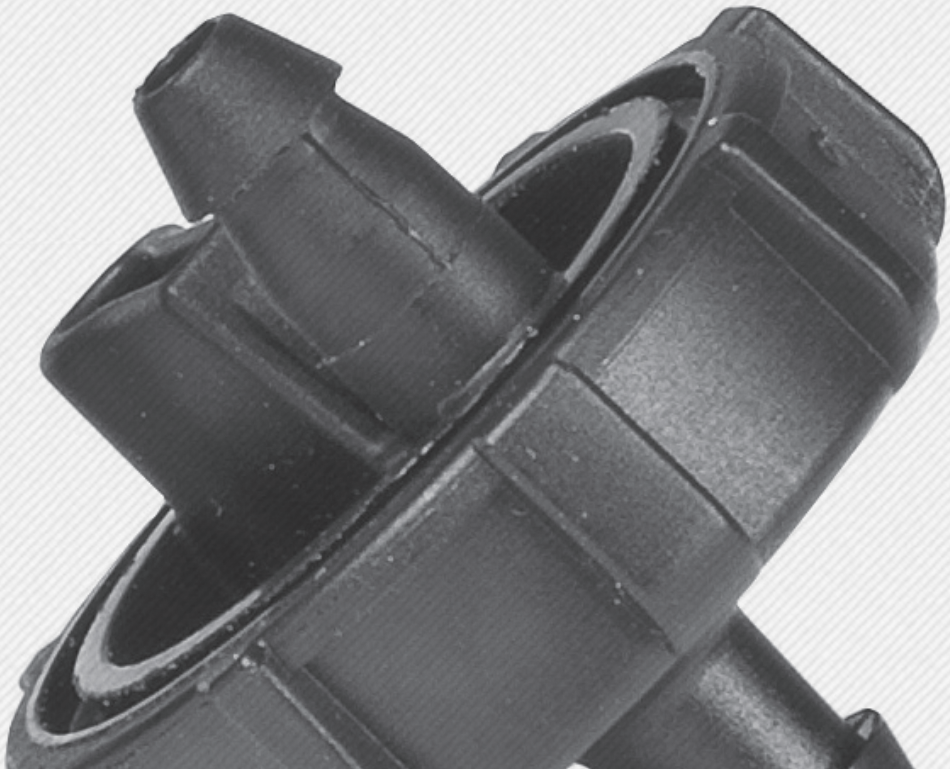
Our plant root zone area is 78.5 sq.ft. If we have sandy soil, we can see from table 4 that you can expect 7-13 sq. ft of wetted area from a 1 GPH dripper. Let's stay on the conservative side and use 10 sq. ft of wetted area. The number of drippers for the 10 ft tree is 7.8 1 GPH drippers. Let's round it to 8 drippers.

$$\text{7.8 drippers} = \frac{\text{78.5 sq. ft}}{\text{10 sq. ft with 1 GPH dripper}}$$

Table 4 – 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	3-4	7-13
Loam	0.5	2-4	2-13
Loam	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

= Sandy Soil = Loamy Soil = Clay Soil



Step 3: Determine the Watering Time of Your System.

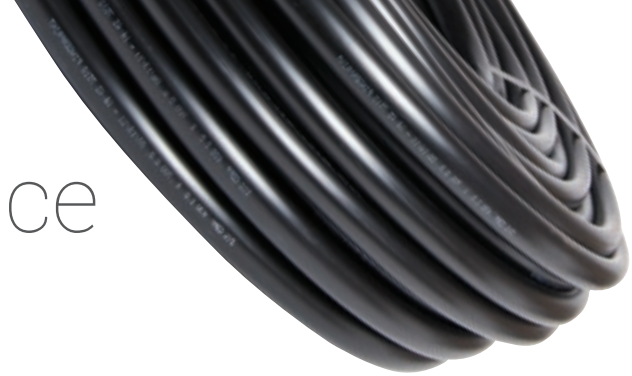
To determine the system run timer per day, use the formula below.

$$\text{Run time per day} = \frac{\text{Plant water requirement (GPD)}}{\text{Flow rates} \times \text{Number of drippers per plant}}$$

Example
If the tree needs 12 gallons per day, we have a run time of 1.5 hours every day, or 3 hours every two days.

$$1.5 \text{ hours} = \frac{12 \text{ GPD}}{1 \text{ GPH} \times 8 \text{ drippers}}$$

Conclusion
Turn the water on for 1.5 hours every day using 8 drippers at a flow rate of 1 GPH.



5) Determine Distance for Drip System

Every landscape is unique. Designating the appropriate amount of space between drippers, or determining the right amount of dripline will make all the difference for your plants.

Recommended Distance to Run a Drip System
Maximum Run of 1/4" Distribution tubing and 1/2" (.600 ID) Drip Hose with Button and Flag Drippers
Maximum Run of 1/4" Distribution Tubing or 1/2" (.600 ID) Drip Hose with PC Dripper

Flow Deviation		**Dripper Spacing on 1/4" Distribution Tubing (feet)**					**Dripper Spacing on 1/2" Poly Tube (feet)**				
Products	**Flow Rates**	1'	2'	3'	4'	5'	1'	2'	3'	4'	5'
PC Button Dripper	1 GPH	35	50	72	88	105	320	530	670	820	970
PC Button Dripper	2 GPH	25	36	45	56	65	190	310	420	510	610
PC Button Dripper	4 GPH	14	22	30	36	40	120	200	250	320	450
Button Dripper	1 GPH	17	26	36	24	45	140	230	310	350	400
Button Dripper	.5 GPH	26	40	50	64	70	195	320	430	525	610
Button Dripper	2 GPH	10	16	21	24	30	80	145	175	230	270
Flag Dripper	1 GPH	17	26	36	40	45	125	220	300	330	370
Adjustable Dripper	1 to10 GPH	Depends on flow rates									

■ = 1/4" Tubing ■ = 1/2" Tubing

Maximum Recommended Drip Tubing Length on Flat Terrain Using a PC Dripper

Maximum Run of 1/4" Distribution Tubing and 1/2" (.600 ID) Drip Hose with Button and Flag Drippers

Maximum Run of 1/4" Distribution Tubing or 1/2" (.600 ID) Drip Hose with PC Dripper

Flow Rate (GPH)	Dripper Spacing (inches)	Drip Tubing Size .620 OD			Drip Tubing Size .700 OD		
		Inlet Pressure					
		15	30	45	15	30	45
0.5	12	218	337	406	274	422	512
0.5	16	271	422	508	340	528	640
0.5	20	323	502	607	403	627	759
0.5	24	370	574	696	455	713	865
0.5	30	432	680	809	521	838	1013
0.5	40	512	809	990	640	1016	1221
0.5	50	611	941	1155	749	1188	1419
1	12	152	234	281	188	294	356
1	20	224	350	422	277	436	528
1	30	304	472	571	373	584	706
1	40	363	568	693	442	706	858
1	50	422	660	812	521	825	1010
2	12	96	149	178	119	185	224
2	24	142	221	267	175	274	330
2	30	195	300	363	234	370	449
2	40	231	356	429	271	442	538
2	50	271	422	502	327	515	627

= .620 OD Drip Tubing = .700 OD Drip Tubing

Maximum Run of Dripline with PC Dripper 1.0 GPH

This chart describes the maximum length you can run the dripline and operate it properly.

Length of Run (feet)	Inlet Pressure (inches)				
	12"	18"	24"	30"	36"
100	1.3	0.6	0.3	0.2	0.2.
200	10.5	4.2	2.4	1.6	1.1
300	35.0	13.2	7.5	4.9	3.4
400	78.8	29.7	16.7	10.8	7.6
500		55.6	31.2	20.2	14.2
600			52.0	33.6	23.7

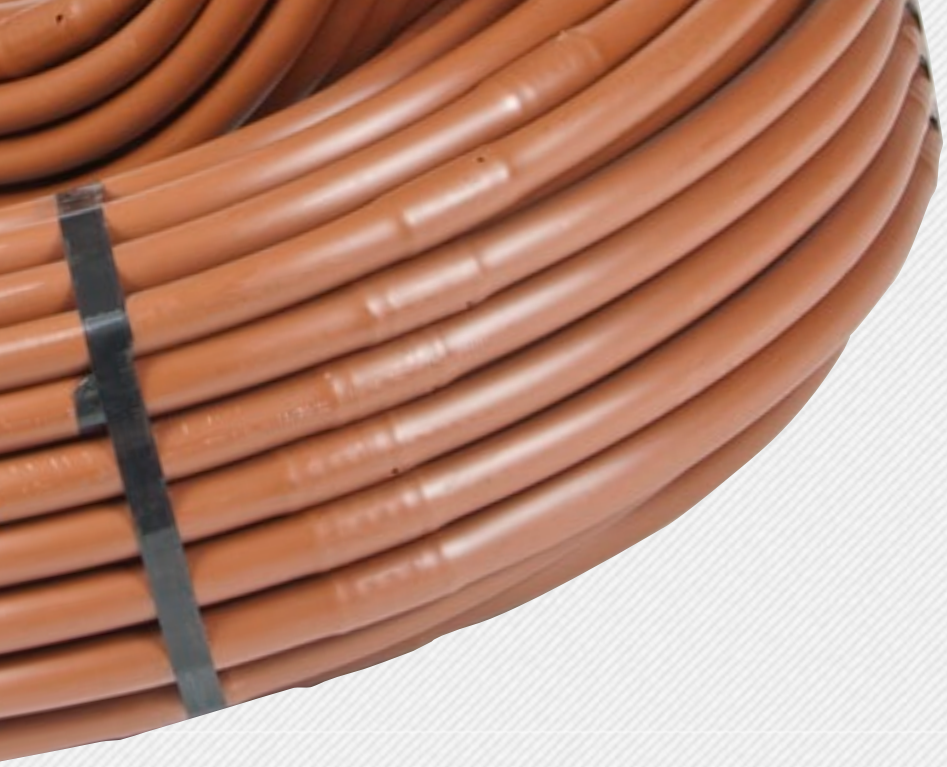
= not recommended

Maximum Run of Dripline with PC dripper .5 GPH

This chart describes the maximum length you can run the dripline and operate it properly (table demonstrates PSI loss per 100').

Length of Run (feet)	Drippers Spacing (inches)				
	12"	18"	24"	30"	36"
100	0.6	.2	0.1	0.1	0.1
200	3.75	1.6	0.9	0.6	0.4
300	12.9	5.1	2.9	1.9	1.3
400	30.1	11.4	6.4	4.2	3.0
500	56.5	21.3	12.0	7.8	5.5
600	85.0	35.5	20.0	13.0	9.2
700		54.8	30.8	20.0	14.1
800		79.8	44.8	29.0	20.5

= not recommended



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Chapter in Review

Laying the Foundation

The foundation of a successful drip system is successful planning, and we hope that in this chapter you've discovered exactly how to plan your drip installation for your unique landscape. If you ever have any questions regarding the planning process or which products to use, you can always call our Customer Care team at The Drip Store.

We're available Monday through Friday, 7 p.m.– 4 p.m. (PST) at 760-597-1669 or toll free at 877-597-1669. Use the chart on the right to make sure that you've completed each step of the Drip Guide.

My Drip Planning Checklist

1) Sketched my area

2) Determined my soil type

3) Determined my watering frequency

4) Calculated my water requirements

5) Determined distance to run my system