

MASTER GARDENER



YAVAPAI COUNTY

Backyard Vegetable Garden Irrigation

Master Gardener

University of Arizona Cooperative Extension

Yavapai County



THE UNIVERSITY
OF ARIZONA

**The University of Arizona
Master Gardener Association
Yavapai County Cooperative Extension**

Prescott Office: 840 Rodeo Drive, Bldg C
Prescott, AZ 86305
928-445-6590 x222
prescottmg@gmail.com

Verde Valley: 2830 N Commonwealth Drive, Ste 103
Camp Verde, AZ 86322
928-554-8999
verdevalleymg@gmail.com

Master Gardener Web: extension.arizona.edu/yavapai
Speakers' Bureau Email: ycmgspeakersbureau@gmail.com
Facebook: [yavapaicountymastergardeners](https://www.facebook.com/yavapaicountymastergardeners)



Topics to be Covered

- Why irrigation is important to backyard vegetable gardeners
- Types of irrigation systems
- Choosing the right irrigation system
- Maintaining your irrigation system
- Troubleshooting your irrigation system



Topics covered in previous presentations available at:

<https://extension.arizona.edu/yavapai-county-presentations>

- Landscape irrigation systems
- Fruit tree/berry/grape irrigation systems
- Rainwater collection/gravity fed irrigation systems



Introduction

What is it and Why is it important?

- ▶ Irrigation is the art and science of applying the right amount of water to keep your vegetables healthy, growing and producing a tasty crop
- ▶ “Too much or too little water has probably caused more failures in the home vegetable garden than any other growing condition”

-Mel Bartholomew in Square Foot Gardening (2005)



Why it is important

- ▶ It is particularly important for backyard vegetable gardens in the west because the climate is characterized by low rainfall, a long dry season or both.
- ▶ Vegetable crops are not drought tolerant.
- ▶ Gardens in most areas of Arizona and California require that the soil be kept moist with regular irrigation during the crop cycle in order produce to produce good quality vegetables.



Why it is important

- ▶ Maintaining uniform soil moisture can benefit the garden in many ways:
 - ▶ Aids in seed emergence
 - ▶ Reduces soil crusting
 - ▶ Improves germination and plant stand
 - ▶ Reduces wilting and checking of growth in transplants
 - ▶ Increases fruit size of tomato, cucumber and melon
 - ▶ Prevents premature ripening of peas, bean, and sweet corn
 - ▶ Maintains uniform growth
 - ▶ Improves the quality and yields of most crops



Why it is important

- ▶ While growing, vegetable crops need about an inch of water per week in the form of rainwater, irrigation water, or both
- ▶ As a rule, it will be necessary to irrigate your vegetable garden 2 to 4 times a week in the warmest/driest summer months and once or twice per week or less in other seasons.
- ▶ Ideally, wet the soil to just beyond the bottom of the root system at each watering



How much and How often

- ▶ If possible, adjust the amount and frequency of irrigation according to the water use and root depth of each type of vegetable you grow
- ▶ When this is not possible, adjust irrigation to meet the needs (6 to 12 inches) of the shallow rooted crops as the medium- and deep-rooted crops will get enough water
- ▶ This same rule applies anywhere topsoil is shallow such as in raised beds and many urban properties



Comparison of Root Structures

Deep-rooted crops and shallow-rooted crops have different watering needs.

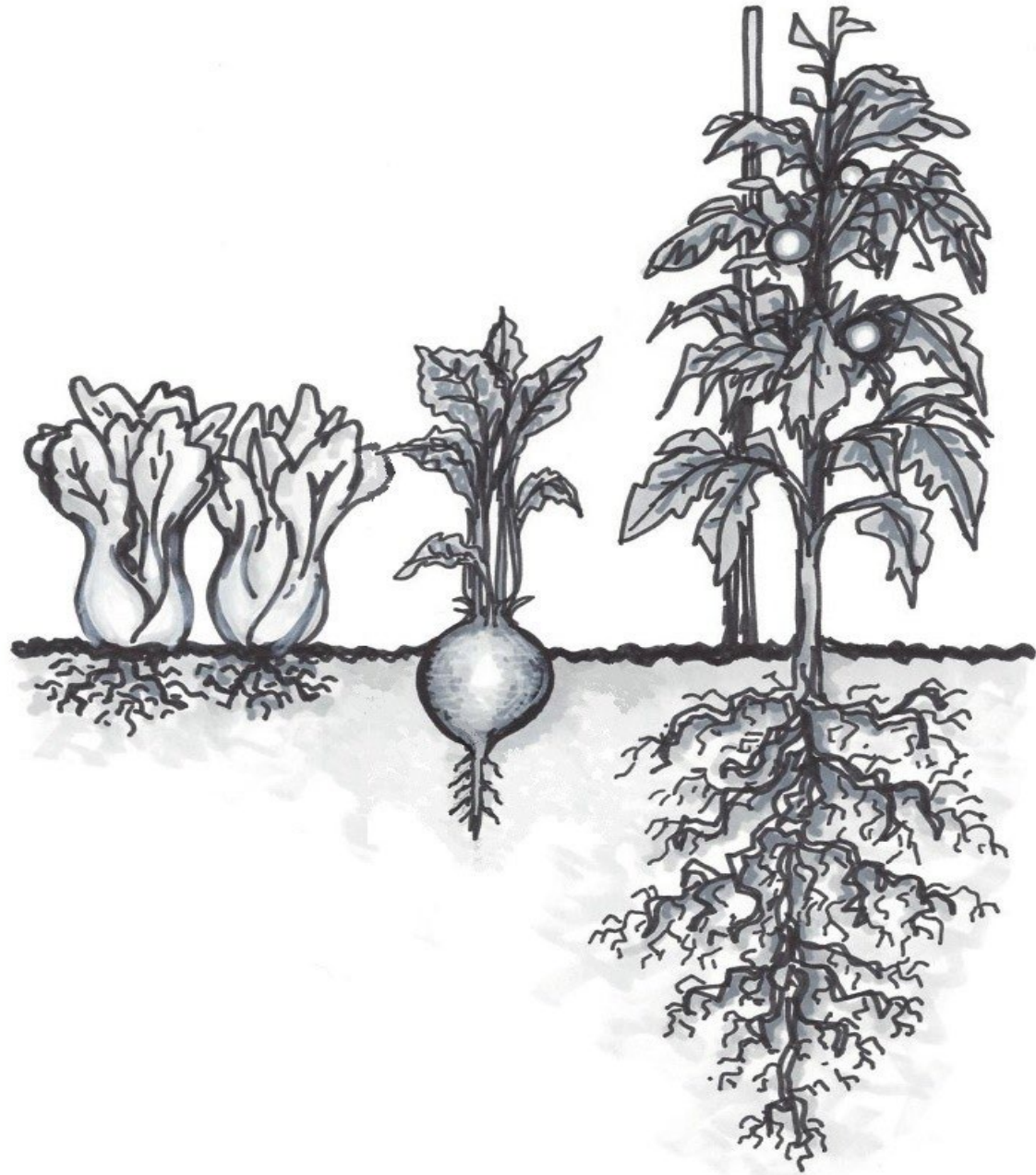


Image - courtesy of Oregon State University Extension



How much and How often

- ▶ To manage and schedule irrigation effectively, you must know how deep and how long soil remains moist after an irrigation cycle or series of cycles
- ▶ In the case of a vegetable garden in which digging a hole could damage the roots of the plant, pushing a long screwdriver or soil probe serves as a good indicator of water penetration



Types of Irrigation Systems

- ▶ Hand irrigation
 - ▶ Cup (Square Foot gardening)
 - ▶ Watering can
 - ▶ Hand-held Shower nozzle/water wand
- ▶ Furrow/Basin/Berm irrigation
- ▶ Sprinkler irrigation (fixed or hose-end)
- ▶ Soaker hose
- ▶ Micro-irrigation (includes drip, bubblers and spitters)



Types of Irrigation Systems

Hand Irrigation

- ▶ Using a cup to irrigate a small 4 x4 foot bed is very cheap but is difficult in larger gardens in warm summer climates
- ▶ Watering cans are a good way to keep a close eye and customize delivery of exact amounts of water but difficult in a large garden in hotter weather



Types of Irrigation Systems

Hand Irrigation

- ▶ Hand-held shower nozzle/water wand
 - ▶ A water wand or shower nozzle can be used to duplicate natural rainfall
 - ▶ A long-handled water wand can place the water at the base of the plant and avoid wetting the foliage





Hand-Held Shower Nozzle

Photo - courtesy of Oregon State University Extension

Hand-Held Water Wand



www.acehardware.com/departments



Types of Irrigation Systems

Furrow/Basin/Berm Irrigation

- ▶ This is often used for the application of water for agricultural purposes and is also used in backyard vegetable gardens
- ▶ It is widely used for furrowed rows, fruit trees, grape/berry vines
- ▶ Very low equipment cost other than a long hose
- ▶ Unfortunately, this technique is subject to a great deal of evaporation in hot dry climates
- ▶ Watering in the cool of the morning will reduce this



Types of Irrigation Systems

Furrow/Basin/Berm Irrigation



grownbyyou.com



Dreamcivil.com

Furrow Irrigation



Basin & Berm Create a Moat

treesformissoula.org

Types of Irrigation Systems

Sprinkler Irrigation

- ▶ Although fixed sprinkler irrigation can be used for vegetable gardens it is beyond the scope of this presentation as it is mostly used for lawns and permanent landscaping
- ▶ Hose-end sprinklers are convenient to use and easy to reposition for maximum flexibility of delivery



Sprinkler Irrigation



www.ad.nl/binnenland/luxetaks-voor-drinkwater

The simplest way to apply water evenly over a large surface is by sprinkling (essentially producing artificial rainfall)

Types of Irrigation Systems

Sprinkler Irrigation

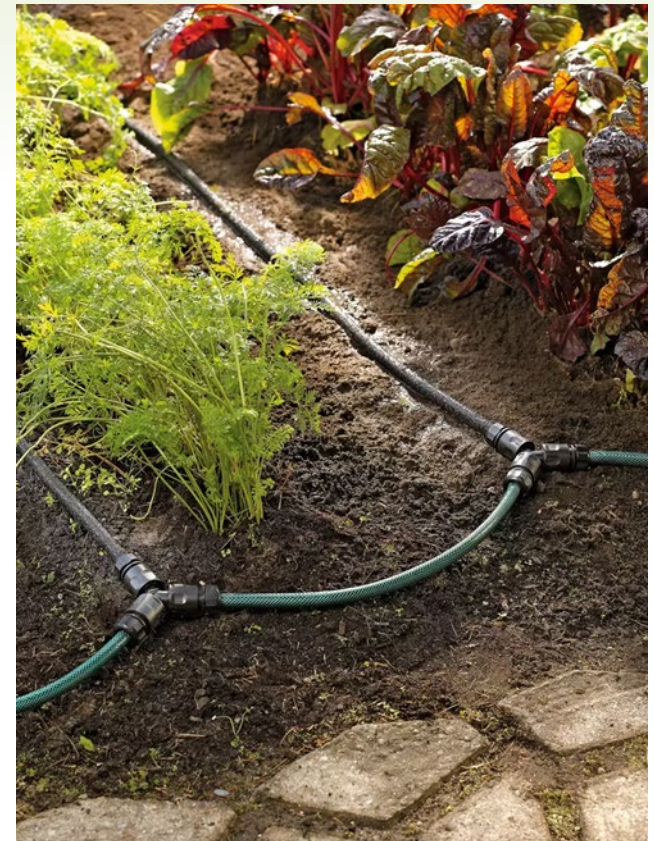
- ▶ Wastes water when wind and evaporation carries it away
- ▶ Waters hardscape and soil between plants
- ▶ Fosters disease causing organisms on wet leaves and stems of plant
- ▶ Watering in the cool of the morning will reduce evaporation as well as allow leaves to dry by day



Types of Irrigation Systems

Soaker Hose Irrigation

- ▶ Soaker hoses are a form of drip irrigation and can be used to advantage if rows of plants are short (20 to 25 feet)
- ▶ For longer row or on sloping soil, soaker hoses cannot be expected to provide as uniform an irrigation as that provided by true drip systems
- ▶ Although much less expensive and easier to deploy, they deteriorate in the weather much faster than true drip systems



www.gardeners.com



Types of Irrigation Systems

Micro-Irrigation

- ▶ The most water efficient irrigation systems in use today are those using micro-irrigation
- ▶ Micro-irrigation systems include:
 - ▶ Drip
 - ▶ Spitter/mini sprinkler
 - ▶ Bubbler



Types of Irrigation Systems

Micro-Irrigation

- ▶ Perhaps the best-established micro-irrigation system is drip (trickle) irrigation in which tiny emitters attached to plastic tubing apply water to the soil surface alongside individual plants.
- ▶ Water is applied at a low rate (sometimes drop by drop) but at a high frequency, with the objective of maintaining optimal soil water availability in the immediate root zone while leaving most of the soil volume dry.



Conventional Drip System



Photo - courtesy of Oregon State University Extension

Types of Irrigation Systems

Drip Irrigation

- ▶ A basic drip system has 3 parts:
 - ▶ A control head which includes:
 - ▶ A flow control
 - ▶ Pressure regulator
 - ▶ Filter
 - ▶ A transmission system of flexible plastic pipes or hose (usually polyethylene tubing)
 - ▶ The emitters



Types of Irrigation Systems

Drip Irrigation

CONTROLLERS



Battery operated: need special solenoid

PRESSURE REGULATORS



- Regulators
 - In-line rated by flow rate & psi regulation
 - Direction of flow important
- Check valves
 - Use where elevation changes are > 5'
 - Install 'in-line' downstream of filter



Images - University of Arizona Cooperative Extension

EMITTERS



- Pressure compensating
 - Various flow rates – Gallons-per-hour (GPH)
 - Insert 'sharp' barb end onto 1/4" distribution tubing
 - Insures balanced flow from all emitters on lateral
- Flag emitters (not recommended)
 - Not pressure compensating
- 'Shrubbler'
 - Used to cover larger areas
- Multi-port
 - Manifold for distribution of more than one emitter
- Micro-spray



DRIP SYSTEM FILTERS

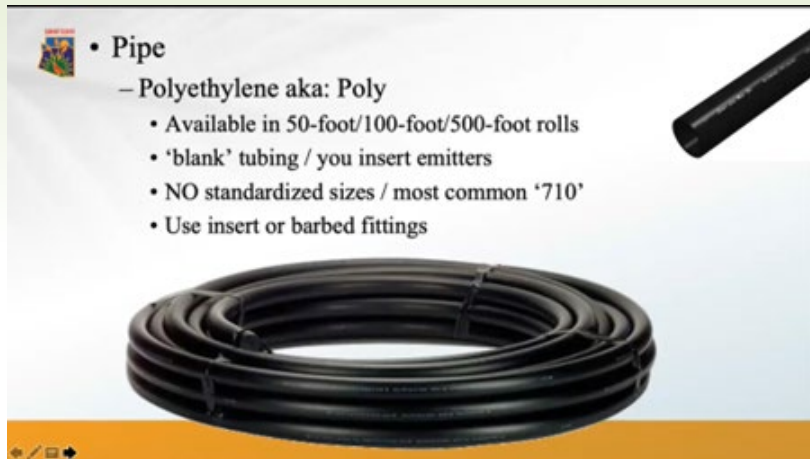
- Filters
 - Type needed depends on water source & application
 - Here, assume clean potable water
 - Usually installed down stream, but models available for use under constant pressure
 - Mesh size dependent on velocity of water / gph
 - For 1+ gph use 150 mesh
 - For 0.5 gph use 200 mesh
 - On mixed systems that have different emitters installed, use 200 mesh
 - Models available that are filter-regulators combined
 - Saves space inside valve box



*Check specs on emitters for recommended mesh size

Types of Irrigation Systems

Drip Irrigation



lizbethsgarden.files.wordpress.com

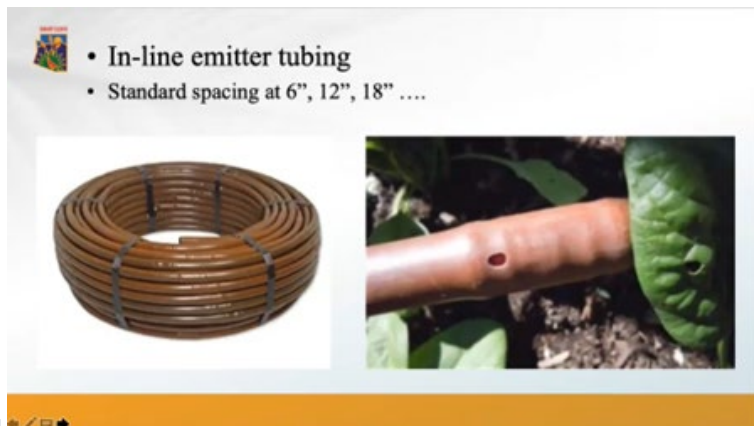


Image - University of Arizona Cooperative Extension

Types of Irrigation Systems

Drip Irrigation

- ▶ Emitters are built in or attached to ½-inch-diameter or smaller flexible plastic water delivery lines that carry water to each plant.
- ▶ Drip irrigation offers several advantages to home gardeners:
 - ▶ Water is placed more accurately and efficiently in the root zone
 - ▶ Water is applied at a slow rate that reduces water loss from runoff, plant foliage remains dry, reducing the potential for disease
 - ▶ Dry soil between plants permits work in the garden during irrigation



Types of Irrigation Systems

Drip Irrigation

- ▶ The disadvantages (of drip irrigation) are the added cost of the drip irrigation equipment and occasional problems of plugging of the tiny drip orifices
- ▶ However, the advantages generally outweigh the disadvantages, and a drip irrigation system, when correctly installed and maintained, can be very helpful to the serious gardener.
- ▶ In contrast to sprinklers, drip irrigation systems can be efficiently operated any time of day since they emit water directly to the soil surface directly to the root zone of the plant.
- ▶ It prevents the germination of weed seeds between plants



Choosing the right irrigation system (for you)

- ▶ Factors to consider
 - ▶ Size of your garden
 - ▶ Small to medium size you can hand water
 - ▶ Medium to large use furrow, sprinkler, soaker hose or drip
 - ▶ Your soil type
 - ▶ Type of plants you grow
 - ▶ Your budget



Choosing the right irrigation system (for you)

- ▶ Factors to consider
 - ▶ Your soil type you have determines how much water is made available to plants and how quickly the water will drain away after each rain or irrigation event.
 - ▶ Clay soils hold more water than do sandy soils. Loamy soils have an intermediate capacity and are ideal for management of water in a vegetable garden

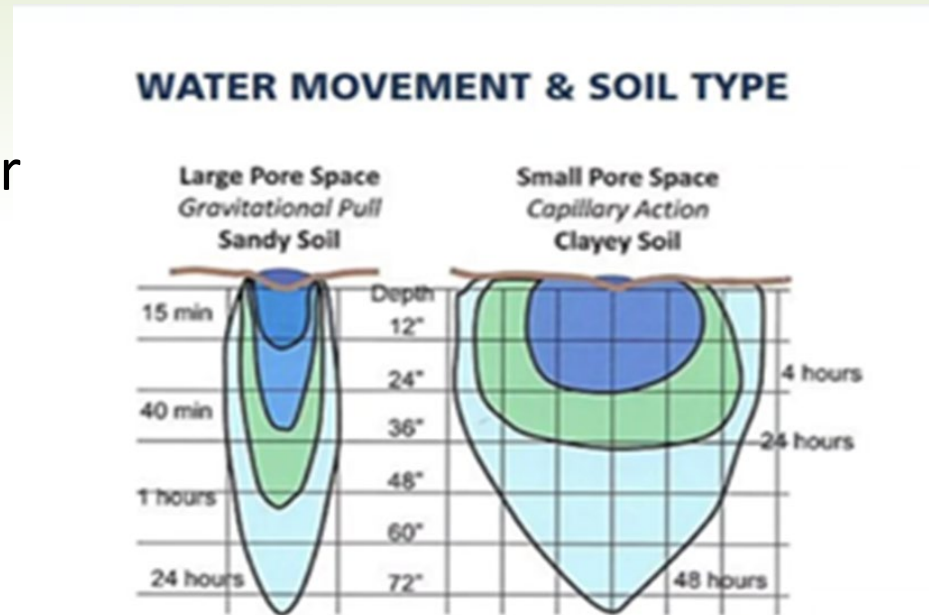


Photo credit: Colorado State University Extension

www.canr.msu.edu

Choosing the right irrigation system (for you)

- ▶ Factors to consider
 - ▶ Types of plants you grow
 - ▶ Under ideal soil conditions, shallow rooted crops have root systems in the top 6 to 12 inches of soil. Examples are cabbage, cauliflower, lettuce, celery, sweet corn, onion, white potato, and radish
 - ▶ All types of irrigation will work and hand watering will be more than adequate



Choosing the right irrigation system (for you)



Category	Vegetable Plants	Maximum Root Depth
Shallow-rooted Vegetables (max. 18" - 30")	Onions, Radish, Celery, Spinach, Lettuce	12" - 18" (1.0 - 1.5 ft)
	Broccoli, Brussels sprout, Potato	18" - 24" (1.5 - 2.0 ft)
	Mint, Green Beans, Cabbage	18" - 30" (1.5 - 2.5 ft)
Medium-rooted Vegetables (max. 36" - 42")	Artichoke, Parsnip, Squash	24" - 36" (2.0 - 3.0 ft)
	Turnip (white)	18" - 36" (1.5 - 3.0 ft)
	Beets, Peas	24" - 42" (2.0 - 3.5 ft)
	Pepper, Carrot	18" - 42" (1.5 - 3.5 ft)
	Chard	30" - 42" (2.5 - 3.5 ft)
Deep-rooted Vegetables (max. over 48")	Sweet Corn, Cucumber, Sugar Beet, Eggplant	30" - 48" (2.5 - 4.0 ft)
	Pumpkin	36" - 48" (3.0 - 4.0 ft)
	Sweet potato	42" - 60" (3.5 - 5.0 ft)
	Tomato	24" - 60" (2.0 - 5.0 ft)
	Asparagus	48" - 72" (4.0 - 6.0 ft)

Source: USDA

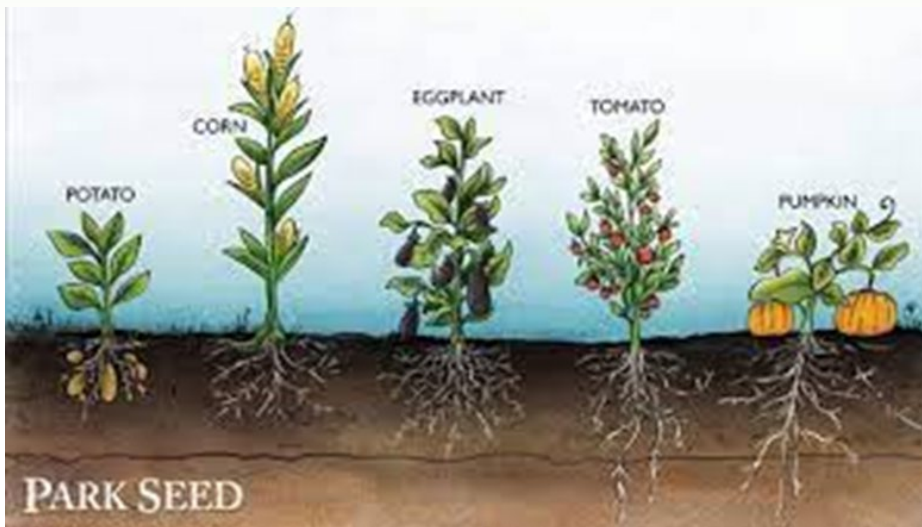
VeggiesGrow.com

www.reddit.com

GARDENER



YAVAPAI COUNTY



Laidbackgardener.blog



Choosing the right irrigation system (for you)

- ▶ Factors to consider
 - ▶ Types of plants you grow
 - ▶ Moderately deep-rooted crops are those with the main root system in the top 1 to 2 feet of soil. Examples are snap beans, carrot, cucumber, eggplant, peas, pepper, and summer squash
 - ▶ Furrow, berm, basin and drip irrigation allow for longer infiltration time to reach deeper root zones



Choosing the right irrigation system (for you)

- ▶ Factors to consider
 - ▶ Types of plants you grow
 - ▶ For deep-rooted crops, the main root system is in the top 2 to 4 feet of soil. Examples are asparagus, globe artichoke, cantaloupe, pumpkin, tomato, and watermelon
 - ▶ Furrow, berm, basin and drip irrigation allow for longer infiltration time to reach the deeper root zone, but furrow, berm, and basin will allow excessive evaporation with an even longer infiltration time



Choosing the right irrigation system (for you)

- ▶ Your budget is small
- ▶ Hand watering is the most inexpensive system needing as little as a bucket of water and a cup, a watering can, a hose, topping out with an adjustable water nozzle (with or without a long-handled watering wand) \$-\$\$



Choosing the right irrigation system (for you)

- ▶ Your budget is small
- ▶ Furrow, berm, basin irrigation just takes time and a hoe to shape the soil around your plants and a long hose or bucket to deliver the water
\$-\$\$



Choosing the right irrigation system (for you)

- ▶ Your budget is small to medium
- ▶ Sprinkler system
 - ▶ Hose end sprinkler \$\$
 - ▶ Fixed sprinkler system \$\$-\$\$\$



Choosing the right irrigation system (for you)

- ▶ Your budget medium to large
- ▶ Drip irrigation system
 - ▶ A basic DIY kit for small to medium garden \$\$\$
 - ▶ A professionally designed and installed fully automated drip irrigation system \$\$\$\$



Choosing the right irrigation system (for you)

- ▶ Your budget is large
- ▶ Drip irrigation system
 - ▶ For large vegetable gardens
 - ▶ A professionally designed and installed fully automated drip irrigation system \$\$\$\$
 - ▶ Consult a professional to get actual costs
 - ▶ Watch the videos listed at the end of this presentation to get an idea of what is involved



Installing an irrigation system

- ▶ Hand watering, furrow/basin/berm, hose-end sprinklers and soaker hoses require placement but no significant installation
- ▶ DIY is suggested for small to medium vegetable gardens or even part of a large vegetable garden
- ▶ Hire a professional for year-round irrigation for landscape plants and large vegetable gardens



Installation of a drip irrigation system

- ▶ Follow the steps for a DIY installation
 - ▶ Determine your water source
 - ▶ Check your water pressure
 - ▶ Map your garden space and determine the plants you will grow
 - ▶ Decide whether it will be permanent or seasonal
 - ▶ Underground (digging required, hard to see)
 - ▶ Above ground (easily accessible, tripping hazard)



Installation of a drip irrigation system

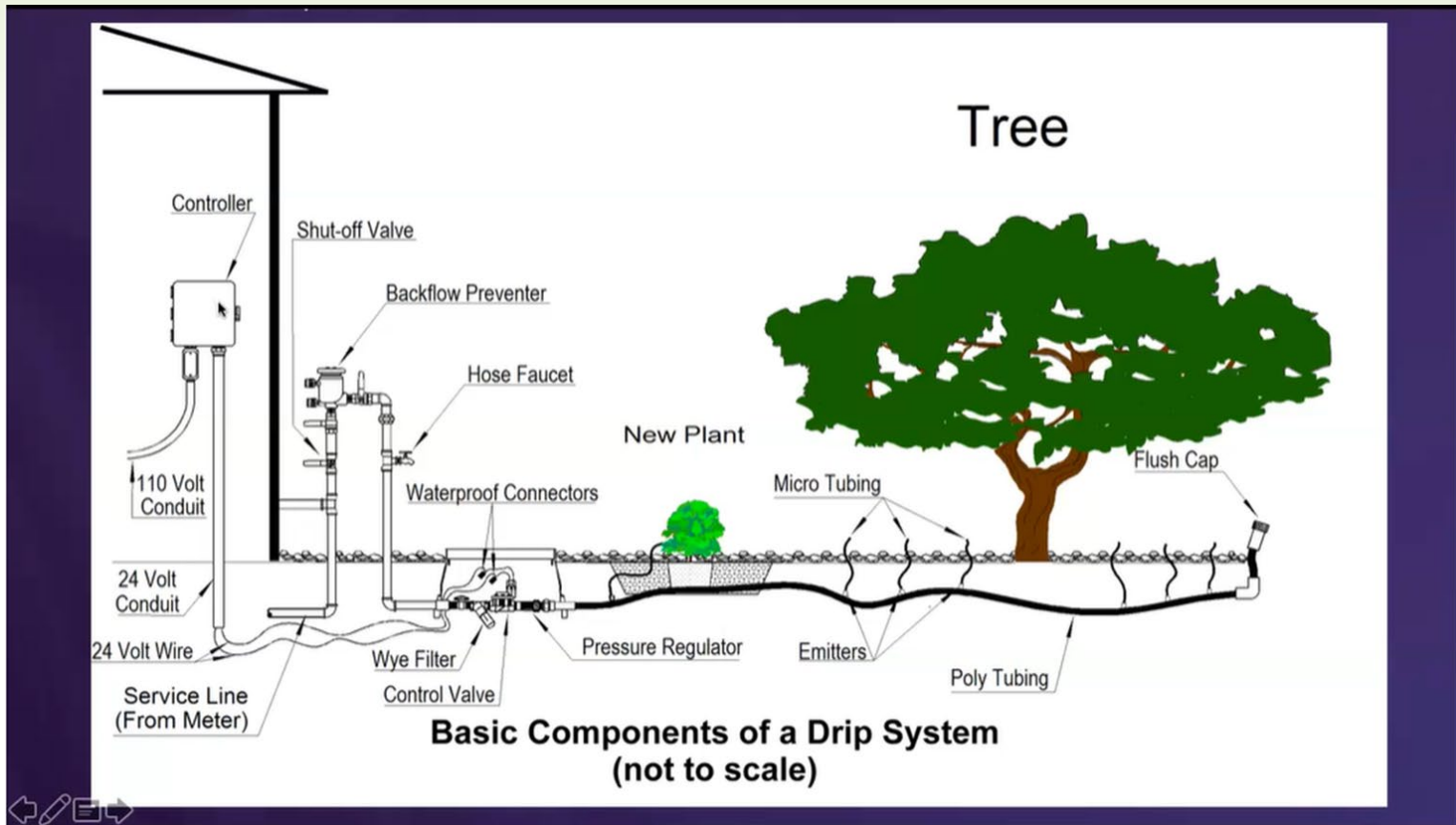


Image - University of Arizona Cooperative Extension

Parts for a DIY drip irrigation system

- ▶ Controllers (not necessary on the simplest systems)
- ▶ DIY kits (come with all the parts for your size garden)
- ▶ Typical parts (available at nurseries and home improvement centers and online)
- ▶ **Remember to get extra parts (all the same brand)**
- ▶ Help and advice on choosing kits and parts is available at Johnny's Seeds and Cooperative Extension sites online from across the country



Maintaining your drip irrigation system

- ▶ Drip and other irrigation systems are no better than their management
- ▶ Inspect and make sure any water filters are clean on supply hoses and poly tubing before operation
- ▶ Inspecting your system regularly during its operation can uncover possible problems
- ▶ Emitters can become clogged by algae, sand, salt, or debris and not perform well
- ▶ Repair any leaks or damage to hoses, gaskets or tubing



Troubleshooting irrigation problems

- ▶ Problems common to all irrigation systems:
 - ▶ Plants are not getting enough water
 - ▶ Plants wilt during the day and don't recover by morning
 - ▶ Leaves yellow or curl
 - ▶ New leaves are smaller
 - ▶ Plants are stunted



Troubleshooting irrigation problems

- ▶ Problems common to all irrigation systems:
 - ▶ Plants that are getting too much water can have similar symptoms to under-watering but usually don't dry out
 - ▶ Water is pooling in areas of your garden and wetting non-plant areas



Summary/Key Points

- ▶ Choose an irrigation method that suits your personality and your budget
- ▶ Don't water too much or too little
- ▶ Monitor the operation and effect of your irrigation system
- ▶ Explore drip irrigation and experiment on a small scale if you plan to DIY
- ▶ Take advantage of the resources online if you want to try drip irrigation



Questions?



**For more information about our programs,
visit our website at
extension.arizona.edu/yavapai**

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**Learn more at:
<https://extension.arizona.edu/legal-disclaimer>**



Cooperative Extension
Yavapai County

Website resources:

The University of Arizona Cooperative Extension Service and Arizona State University offer several publications related to home irrigation that you may find useful. Here are a few examples:

“Ten Steps to a Successful Vegetable Garden”

<https://extension.arizona.edu/pubs/ten-steps-successful-vegetable-garden>

“Drip Irrigation: The Basics” By: Ursula K. Schuch Robert E. Call Cado Daily

<https://extension.arizona.edu/pubs/drip-irrigation-basics>

“Maricopa County Smartscape”

<https://extension.arizona.edu/maricopa-county-smartscape-0>

“Guidelines for Landscape Drip Irrigation Systems” ASU

<https://prism.lib.asu.edu/items/42041>

“Designing a Basic PVC Home Garden Drip Irrigation System”

https://extension.usu.edu/juab/files/Fact_Sheet_12DF5-1o.pdf

Water Use it Wisely Website

<https://wateruseitwisely.com/about-us/>

U of A County Extension YouTube channel (search irrigation)

<https://www.youtube.com/@azcoopextension/videos>

Online video resources:

Choosing Your Irrigation Tubing

<https://www.youtube.com/@universityofarizonacoopera6971>

Build An Irrigation System With Jim U of A Pinal county

<https://www.youtube.com/watch?v=8peCtH00vKQ>

How to Install a Drip Tape Irrigation System

<https://www.youtube.com/@usuextension>

How to Build a PVC Drip Irrigation System

<https://www.youtube.com/watch?v=NOpvLFwjS1g&t=6s>

Video • Irrigation Systems & Methods • Johnny's Educational Webinar Series

<https://www.youtube.com/watch?v=M4ReuyLnMoo&t=2s>

