

NOTES

Calypso Farm & Ecology Center
Drip Irrigation Workshop

2011



Our Workshops are Sponsored by:

**Cold Spot Feeds
Denali State Bank
HBRueter Engineering
Northland Wood
Sunshine Health Food**



**Calypso Farm and Ecology Center
PO Box 106,
Ester, AK 99725**

**www.calypsofarm.org
(907) 451-0691**



Drip Irrigation Workshop

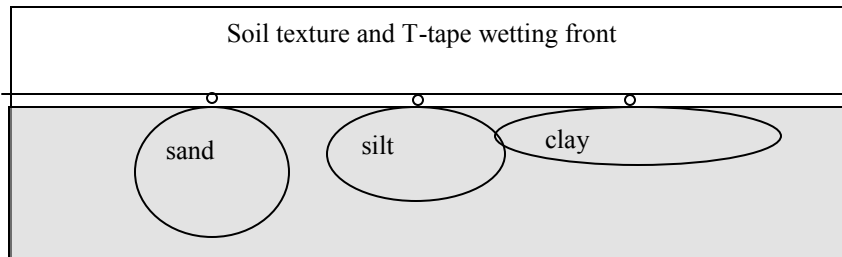
Introduction

This workshop introduces you to the basic principles of drip irrigation.



What is Drip Irrigation?

Drip irrigation is a method of watering your plants so the soil maintains an ample (but not surplus) amount of water readily available to your plants. The system delivers water slowly, efficiently and accurately to the plant root zone. Originally designed in Israel for extreme arid conditions, drip irrigation is now used all over the world. Drip irrigation saves water, reduces weeds, minimizes erosion and soil compaction, saves time, reduces plant stress, leaf burn and fungal diseases. Here in Alaska we get the added potential of increasing water temperature before watering.



Resources

Drip Irrigation Supply Companies

Dripworks: www.dripworks.com or 1-800-522-3747

Peaceful Valley Farm Supply: www.groworganics.com or 1-888-784-1722

Harmony Farm Supply: www.harmonyfarm.com or 1-707-823-9125

Local Drip Supply

Mike Brechan (cell 322-2036). Give Mike a call to see what is available locally. He has a variety of drip tape and emitters.

Web Resources

ATTRA - Appropriate Technology Transfer for Rural Areas (www.attra.org)

Inline Fertilizer injector



Inline Fertilizer Injector

System Setup -- Where to Start

1. Sketch your garden space
 - a. identify water source
 - b. bed layout
 - c. best line for manifolds and hoses
 - d. emitter type needed
 - e. indicate slopes, swells

2. Measure
 - a. faucet flow rate (gph)
 - b. water pressure (psi)
 - c. water quality - sediment, etc.
 - d. length of manifold run
 - e. number of emitters, length of t-tape

If your hose runs are very long measure flow rates and pressures at both ends and at any hose junctions. This will illustrate any system shortfalls.

3. Draw a simple garden map with accurate dimensions
4. Draw in the drip irrigation system - indicate needed components (e.g. filter, pressure regulator, emitters, etc.)

Other System Considerations

Frost protection
 Cleanout drains
 End of season care
 Trouble shooting



Some Basic Soil Principles and Definitions

Understanding the basic properties of your garden soil will help you understand how your drip system will work.

Permeability - the rate water moves through a soil (gravels are more permeable than clays)

Porosity - the amount of pore space between particles (Silts have a greater amount of pore space than an equal volume of coarse sands. Pores are smaller but more voluminous.)

Soil and Water Interaction- soils hold water by surface tension and in pore spaces (Aggregates have greater holding capacity due to the development of micro-pores and capillary tubes.)

Well Balanced Soil— 45% mineral, 25% air, 25% water, ~5% organic matter

Soil Texture - soil texture is a descriptive term for the overall composition of your soil. Soil texture is based on the relative proportion of sand, silt and clay and will determine how water moves through your soil. Sand Loam, Silty Sand and Loam are all examples of texture names. A loam indicates a good mixture of sands, silts and clays. The following Soil Property Table will help you understand how the different soil components affect characteristics of your garden soil.

Soil Property Table

<i>Texture</i>	<i>porosity</i>	<i>permeability</i>	<i>Nutrient holding</i>	<i>water holding</i>	<i>workability</i>
sand	low	rapid	lowest	low	easiest
silt	medium	medium	low	medium	medium
clay	high	slow	high	high	poor
organic matter	high	medium	high	high	easy

Soil Texture Test:

Obtain a representative soil sample from the top six inches of your garden beds by digging a hole six inches deep and then take a slice off the side of the hole and place in a small bucket. Stir the soil well in the bucket to break up any soil clumps.

Fill a quart jar 2/3 full with clean water. Add garden soil until the jar is nearly full (about 1 inch of head space). Add a few drops of dishwashing detergent. Cap and shake the jar. When it is thoroughly mixed, place on counter and leave undisturbed. After about 1 hour, mark the sediment layer. After another hour, mark the new sediment layer. After 24 hours, mark the next sediment layer. The water should be relatively clear. If not, let sit another day.

These marks give you an idea as to the relative proportions of fine material in your garden soil. The bottom is coarse sands grading up to very fine clays. Note: Organic matter may float on the top.

We do not have very much clay in our Alaskan soils so the final top layer will be mostly very fine silts.

Soil Water Content

Water is the nutrient transport system in your soil. Soil microbes and plant roots need moisture, but they also require good drainage so the soil does not become waterlogged. Soil water content is described in these general terms:

Saturated - waterlogged soil. All pore space is full, free water flows through the soil, leaching nutrients.

Field Capacity - evenly moist soil. Water is about 25% of the soil volume and is not flowing through the soil but is held by capillary action.

Permanent Wilting Plant - dry soil. Any water is bound to the surface of soil particles. Water is not available to plant roots.

Basic Drip Irrigation Components (listed from water source to plant)

1. Vacuum breaker - used to prevent back flow into a house system.
2. Filters - mesh device to clean particles out of the water as it flows into the system. Filters can greatly increase the life of t-tape and emitters. (a 200 mesh is recommended)
3. Timer/Controllers - automated device to turn system on and off at designated times. Timers are very useful to automate a system but reduces pressure greatly so they are usually not feasible on a gravity or low-pressure system.
4. Pressure regulator - a device to reduce the pressure at the water source. A pressure regulator is necessary to reduce pressure to accommodate a range of drip components. (for example, 20 to 30 psi is needed for emitters and less than 10 psi is required for t-tape)
5. Delivery hose/Manifold - the impermeable hose or tube used to distribute the system through your garden.
6. Emitters or t-tape - specific drip fittings that put the water where and how you want it.
7. Ground staples - staples to keep hose and tape in place. Tube can shift with changes in pressure due to turning system on and off.
8. Goof plugs - small plugs used to close up holes in the manifold when the system is modified.





Y-Filter in manifold line



Cleaning Y-Filter



Manifold with T joint and shut off valve



Manifold with T-tape branches



T-tape line in new garlic bed



Healthy stand of garlic in July with T-tape line

When to water ?

To conserve water and promote even plant growth it is important to water evenly and consistently. A simple check of the soil profile can be done by probing down 3 to 4 inches with your finger. The soil surface may be dry but the soil at a few inches should be moist; enough to moisten your finger. When this moisture is beyond 1 inches down you should think about watering (this is crop dependent, consider the crops particular rooting zone. shallow vs. deep rooted). It is also easier and better to water a moist soil than a dry soil as you have a developed wetting front that helps distribute the water evenly



Wetting Profile and Root Systems

Observation will show you how water infiltrates your garden soils. These pictures show you a T-Tape drip irrigation situation



Considerations for a Drip Irrigation System

Water Source - What is your source? Rain catchment, well, city water.

Water Quality - Do you have high iron or other minerals? Do you have water coming from a water softening system? Does your well have sediment? Is your tank or pond algae- or sediment-rich?



Storage - What is your water storage system? Is it inside or outside? What is its holding capacity?

To calculate storage volume in gallons:

Gallons = volume (in cubic feet) * 7.5 gallons/cu ft

Example - Tank is 7 feet high, 3 feet in diameter

Volume = ((pi)*radius*radius)*height
= 3.14159*1.5 feet*1.5 feet*7 feet = 49.5 cu ft

Gallons = 49.5 cu ft * 7.5 gal/cu ft
= 371.3 gallons

Temperature - What temperature difference can you obtain with a storage tank?

Approximate Maximum Flow Rates

1/2-inch I.D. polytubing = 240 gph
3/4-inch I.D. polytubing = 480 gph
1-inch I.D. polytubing = 900 gph
1/4-inch barb t-tape fitting = 80 gph @ 10 psi
200 mesh filter = 840 gph

Flow Rate (gallons per hour (gph)) - You should determine your flow rate. Low flow equals < 20 gph High flow equals >20 gph. This will allow you to size your drip system appropriately.

Pressure (pounds per square inch (psi)) - Static pressure is measured at a pipe with no flow past gauge. Rule of Thumb: 2.3 feet = 1 psi. Normal house pressure is approximately 40 to 50 psi.

Friction - Pipe walls can impede flow due to friction thus decreasing pressure. Measure pressures at the beginning and end of lines. It is important to allow for friction losses. If pressure is greatly reduced by friction, simply increase the manifold size.



A Word on Fittings

Pipe thread - a tight threading that is possible to cut onto a pipe with a die. Pipe threadings need Teflon tape or pipe dope to seal it water tight and often requires tools to tighten the fittings.

Hose thread - a wider angled thread that seals up against a rubber ring. Can be sealed by hand tightening. If it leaks, first check the rubber sealing ring! [Fire hose to garden hose also noted as NH or NPSH]

PVC joints - a simple plastic joint with a slip fitting. The fitting is usually glued. Under low pressure you can try 'dry' fitting. If you are gluing, use the primer and glue and flush the system before you use it.

Teflon tape - a thin flexible tape that is wrapped around a pipe fitting to help seal the fitting. Wrap in the direction of the thread (clockwise) and start on the end away from the pipe open end and work to the open end; pull tight as you wrap and lay a thin layer.

Pipe dope - functions like teflon tape. Use pipe dope on pipe thread when joining a male metal pipe to a female plastic/PVC pipe to avoid cracking the plastic.