Inches to Hours: Turning ET info. Into Irrigation System Run Times

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Powerpoint at: http://ucanr.edu/schwankl

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How do we make these work together?

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- **We need the vine spacing and some conversion factors.**

Inches to Hours:

Converting ET (in/day) to ET (gal/day)

$$\text{Vine Water Use (gal/day)} = \text{Vine Spacing (ft}^2\text{)} \times \text{Vine Water Use (in/day)} \times 0.623$$

Most important equation you'll see from me today!

Inches to Hours:

Example: Vine spacing = 8’ x 10’ = 80 ft^2

ET = 0.15 in/day

$$\text{Vine Water Use (gal/day)} = \text{Vine Spacing } (ft^2) \times \text{Vine Water Use (in/day)} \times 0.623$$

$$\text{Vine Water Use (in/day)} = 80\ ft^2 \times 0.15\ \text{in/day} \times 0.623$$

$$= 7.5\ \text{gal/day}$$

Plus some extra water for irrigation inefficiency

Drip Irrigation Application Rate

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Drip Irrigation Application Rate

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1. **How do we determine what the drip system application rate is?**

We'll get to that

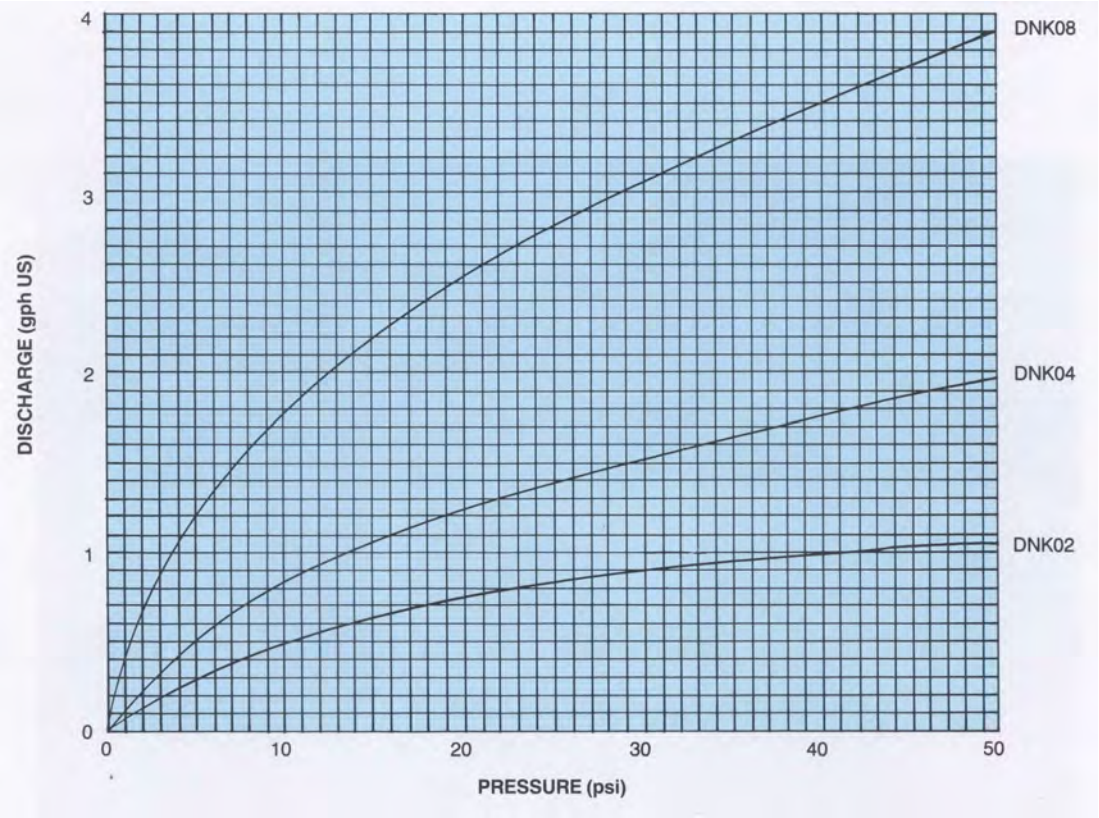
Drip Irrigation Application Rate

- We now know how much we want to apply but we need the drip system's Application Rate and an estimate of its Irrigation Efficiency.

1. How do we determine what the application rate is?
2. **We have to factor in some additional irrigation to account for irrigation inefficiencies.**
   - **How do we figure out what the Irrigation Efficiency is?**

Drip Irrigation Application Rate

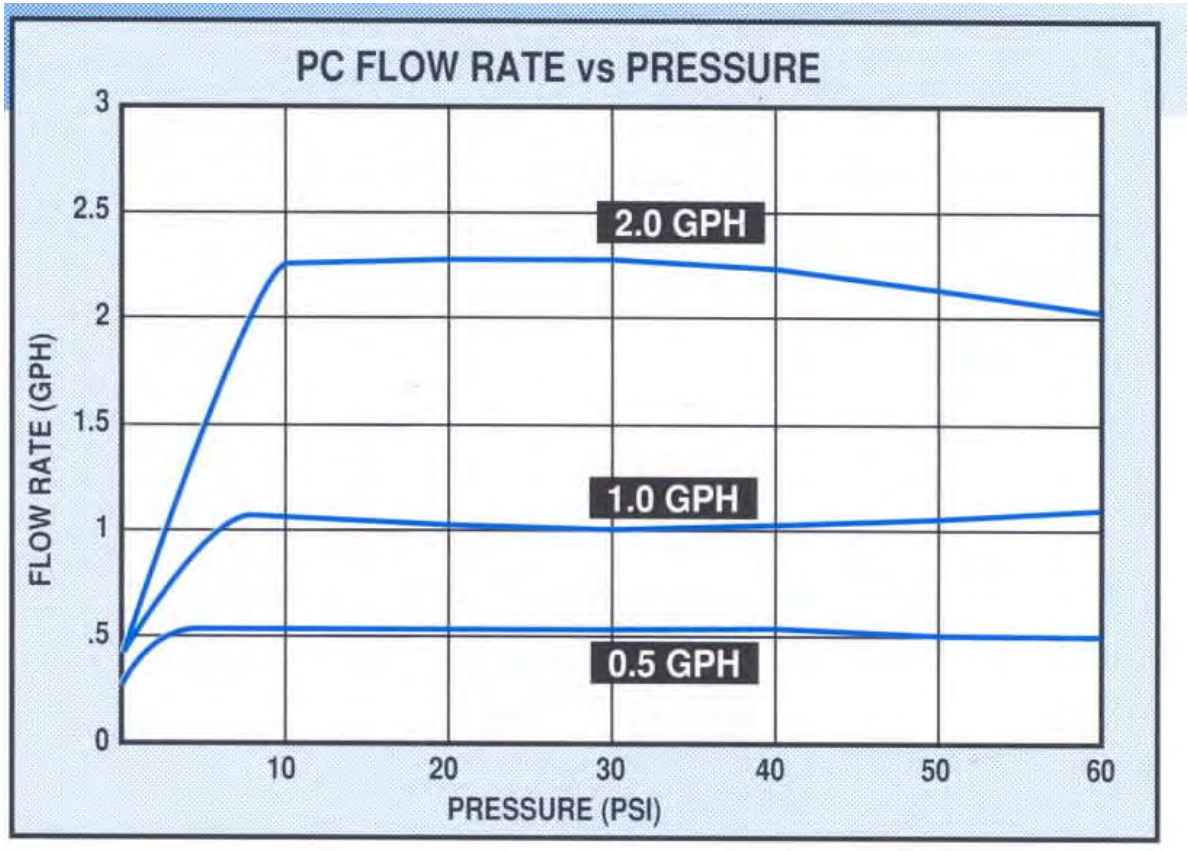
- **Can you just use manufacturer's info. and estimate?**



Drip Irrigation Application Rate

- **Can you just use manufacturer's info. and estimate?**

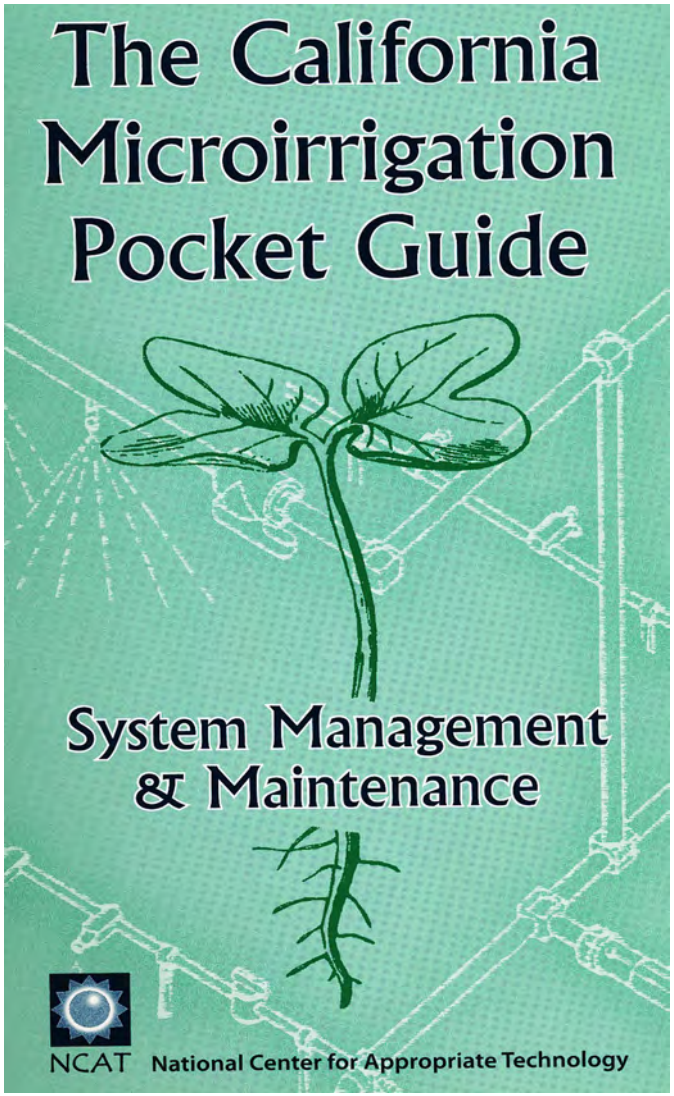
PC = Pressure Compensating

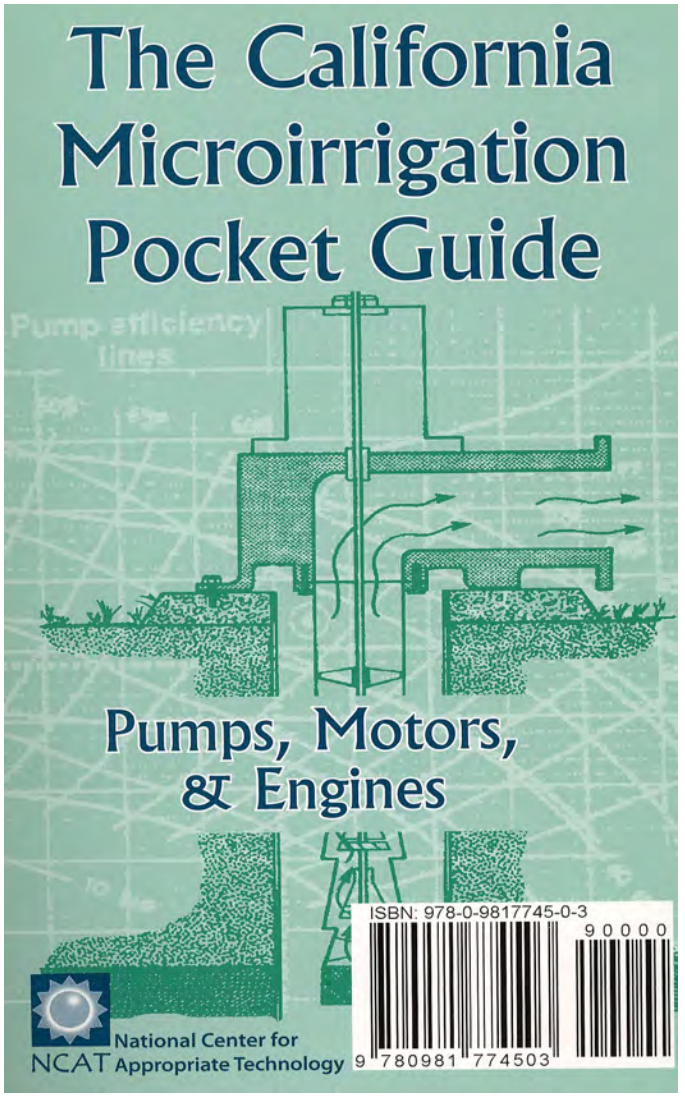


Drip Irrigation Application Rate

- Can you just use manufacturer's info. and estimate?
  - **Best way is to do some field measurements.**
    - **Even with PC emitters, there may be some clogging occurring. *We'll talk more about clogging.***

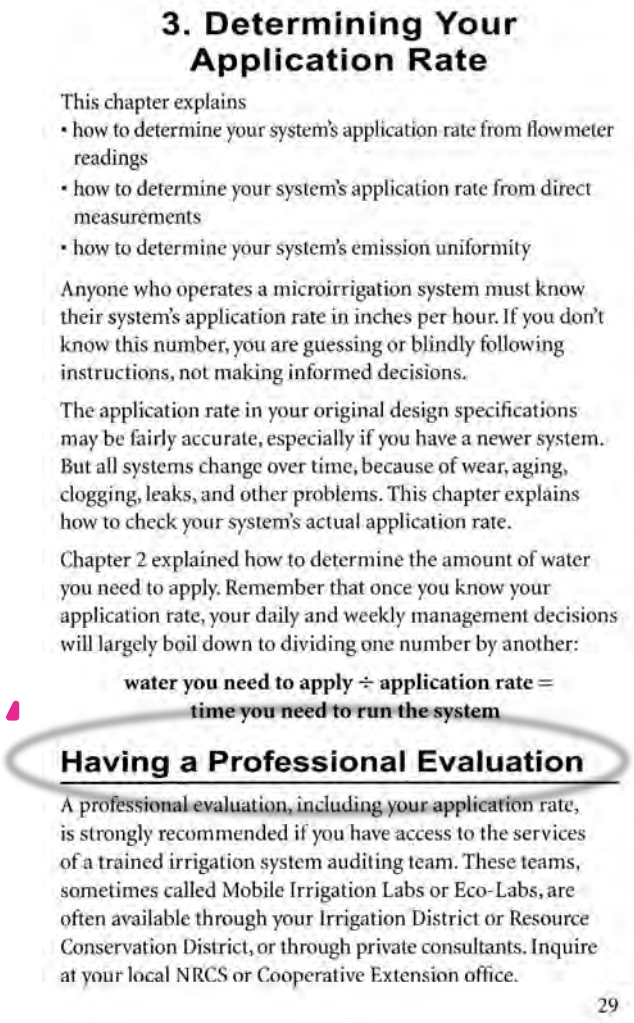
Managing Your Drip System





Drip Application Rate

- Use professional evaluation



3. Determining Your Application Rate

This chapter explains

- how to determine your system's application rate from flowmeter readings
- how to determine your system's application rate from direct measurements
- how to determine your system's emission uniformity

Anyone who operates a microirrigation system must know their system's application rate in inches per hour. If you don't know this number, you are guessing or blindly following instructions, not making informed decisions.

The application rate in your original design specifications may be fairly accurate, especially if you have a newer system. But all systems change over time, because of wear, aging, clogging, leaks, and other problems. This chapter explains how to check your system's actual application rate.

Chapter 2 explained how to determine the amount of water you need to apply. Remember that once you know your application rate, your daily and weekly management decisions will largely boil down to dividing one number by another:

water you need to apply ÷ application rate = time you need to run the system

Having a Professional Evaluation

A professional evaluation, including your application rate, is strongly recommended if you have access to the services of a trained irrigation system auditing team. These teams, sometimes called Mobile Irrigation Labs or Eco-Labs, are often available through your Irrigation District or Resource Conservation District, or through private consultants. Inquire at your local NRCS or Cooperative Extension office.

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Drip Application Rate

- Use professional evaluation
- **Use flow meter**
  - **Head of system**

Using Flowmeters to Find Your Application Rate

Every properly designed microirrigation system includes at least one flowmeter. Most often, this is a propeller flowmeter installed at the head of the system, in the main supply line—after the filters and on a straight section of pipe. Small flowmeters may also be installed on individual lateral lines.

Larry Schwankl photo

Figure 5. Saddle-type propeller flowmeter

Flowmeter at the Head of the System

If your flowmeter gives instantaneous readings in gallons per minute (gpm) or cubic feet per second (cfs), simply convert these readings into inches per hour as follows:

_____ gpm ÷ _____ irrigated area (acres) × 0.0022 =
_____ application rate (inches per hour)

_____ cfs ÷ _____ irrigated area (acres) × 0.992 =
_____ application rate (inches per hour)

If (unfortunately) there is no flowmeter on the system, you can still use the formulas above if you've recently had a pump test.

Instead of giving instantaneous readings, your flowmeter may record "totalized" flow in gallons, acre-feet, or acre-inches. To find your application rate, record the meter reading and time

Drip Application Rate

- Use professional evaluation
- Use flow meter
  - Head of system
  - **On laterals**

Flowmeters on Lateral Lines

Your system may have small totalizing flowmeters installed on individual lateral lines throughout the system. While not very common in California, these flowmeters do have advantages. They normally cost less than $100 apiece and provide good information about emission uniformity. On the other hand, they may be less convenient to install and maintain than a single flowmeter at the head of the system.

To determine the application rate on the lateral line, record the meter reading and time at the beginning and end of your irrigation set. Then follow the three steps below to find your application rate in inches per hour:

Step 1: Divide acre-inches by the number of hours, to determine application rate in acre-inches per hour.

If meter readings are in gallons or acre-feet, use one of the conversion formulas on the previous page.

Step 2: Determine irrigated area of the lateral line in acres, using the following formula.

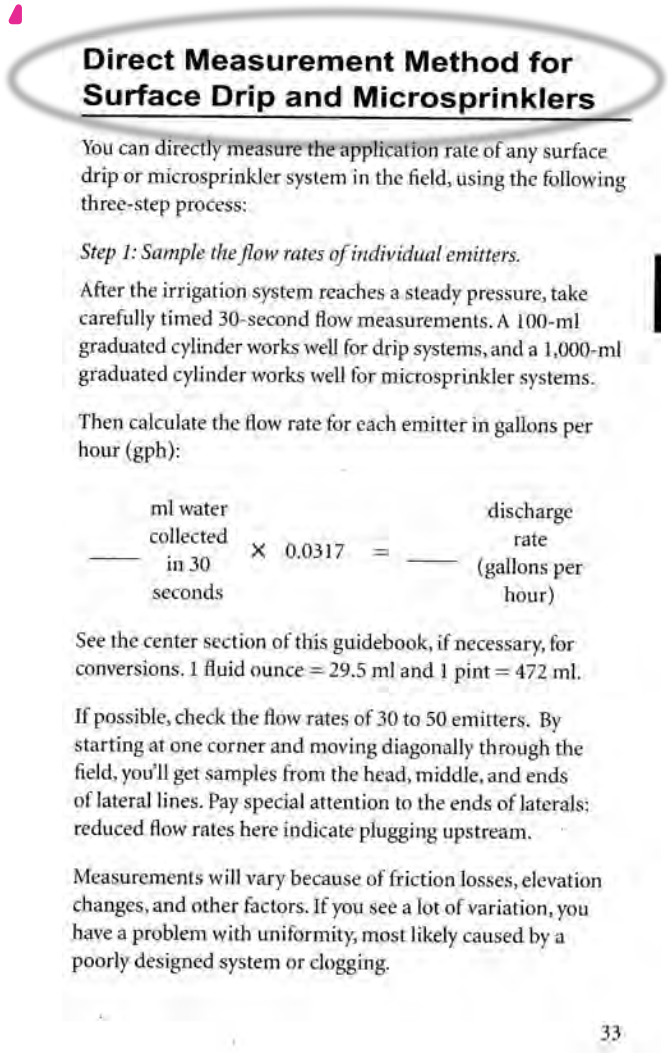
____ lateral length (feet) × ____ lateral spacing (feet) ÷ 43,560 = ____ irrigated area (acres)

Step 3: Divide applied water (Step 1) by irrigated area (Step 2) to find application rate.

____ applied water (ac-in/hr) ÷ ____ irrigated area (acres) = ____ application rate (in/hr)

Drip Application Rate

- Use professional evaluation
- Use flow meter
  - Head of system
  - On laterals
- **Sample the Drippers**



Direct Measurement Method for Surface Drip and Microsprinklers

You can directly measure the application rate of any surface drip or microsprinkler system in the field, using the following three-step process:

Step 1: Sample the flow rates of individual emitters.

After the irrigation system reaches a steady pressure, take carefully timed 30-second flow measurements. A 100-ml graduated cylinder works well for drip systems, and a 1,000-ml graduated cylinder works well for microsprinkler systems.

Then calculate the flow rate for each emitter in gallons per hour (gph):

$$\frac{\text{ml water collected in 30 seconds}}{} \times 0.0317 = \frac{}{\text{discharge rate (gallons per hour)}}$$

See the center section of this guidebook, if necessary, for conversions. 1 fluid ounce = 29.5 ml and 1 pint = 472 ml.

If possible, check the flow rates of 30 to 50 emitters. By starting at one corner and moving diagonally through the field, you'll get samples from the head, middle, and ends of lateral lines. Pay special attention to the ends of laterals: reduced flow rates here indicate plugging upstream.

Measurements will vary because of friction losses, elevation changes, and other factors. If you see a lot of variation, you have a problem with uniformity, most likely caused by a poorly designed system or clogging.

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Drip Application Rate and Uniformity

Determining the Irrigation Amount

How to calculate the number of hours to run your drip system in order to apply a net amount of gallons per vine

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Step 1: Determine how much water you want to apply to the vineyard.

Step 2: Determine the application rate and application uniformity of the drip system.

Step 3: Determine the number of hours to irrigate.

Evaluating Drip Irrigation Systems

- **Irrigation Uniformity. How big a deal is this?**
  - **When we irrigate, no matter what strategy you use, you want the entire vineyard to benefit from that strategy.**

Evaluating Drip Irrigation Systems

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  - When we irrigate, no matter what strategy you use, you want the entire vineyard to benefit from that strategy.
    - **That means that each vine in the block gets treated the same. That is Uniform Irrigation.**

Evaluating Drip Irrigation Systems

- Irrigation Uniformity. How big a deal is this?
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    - That means that each vine in the block gets treated the same. That is Uniform Irrigation.
    - **With Non-Uniform Irrigation, some vines get more water and some vines get less.**

Evaluating Drip Irrigation Systems

- How big a deal is this?
  - When we irrigate, no matter what strategy you use, you want the entire orchard to benefit from that strategy.
    - That means that each tree in the block gets treated the same. That is Uniform Irrigation.
    - With Non-Uniform Irrigation, some trees get more water and some trees get less.
    - **We usually want to make sure all the vines get enough water, so with a non-uniform system we end up over-irrigating some of the vines. This leads over-irrigation on some of the vines. INEFFICIENT**

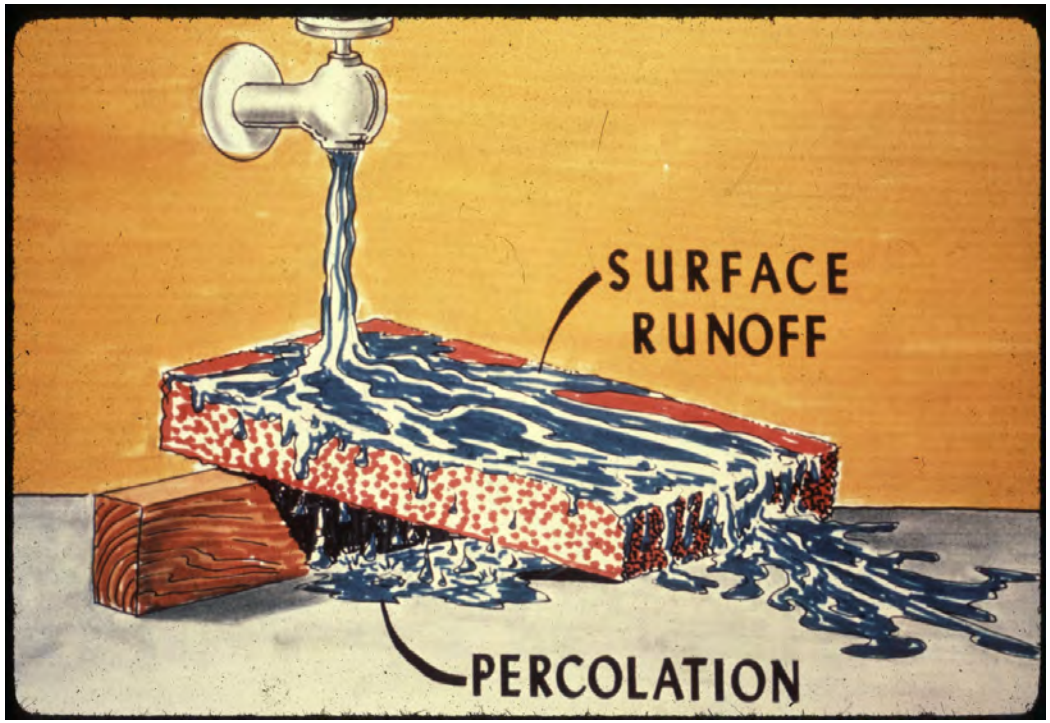
Evaluating Drip Irrigation Systems

- **What do we do with the Uniformity measurement?**

Evaluating Drip Irrigation Systems

- What do we do with the Uniformity measurement?
  - **We use it as an estimate of Irrigation Efficiency.**

Good Irrigation Uniformity + good Irrigation Scheduling leads to good Irrigation Efficiency.



Efficient Irrigation Management

- **Example: ET = 7.5 gal/day (gpd) per vine (from before). Measured Uniformity and it was 85%. Assume Efficiency is 85%. Have a single 1 gph dripper per vine.**

Irrigation Req. = 7.5 gpd ÷ 0.85 = 8.8 gal/day

Run time = 8.8 gpd ÷ 1 gph = 8.8 hrs/day

Questions???

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