Getting the Most From Your Irrigation System

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- **Not a lot can be done to improve them, but here are two ideas:**

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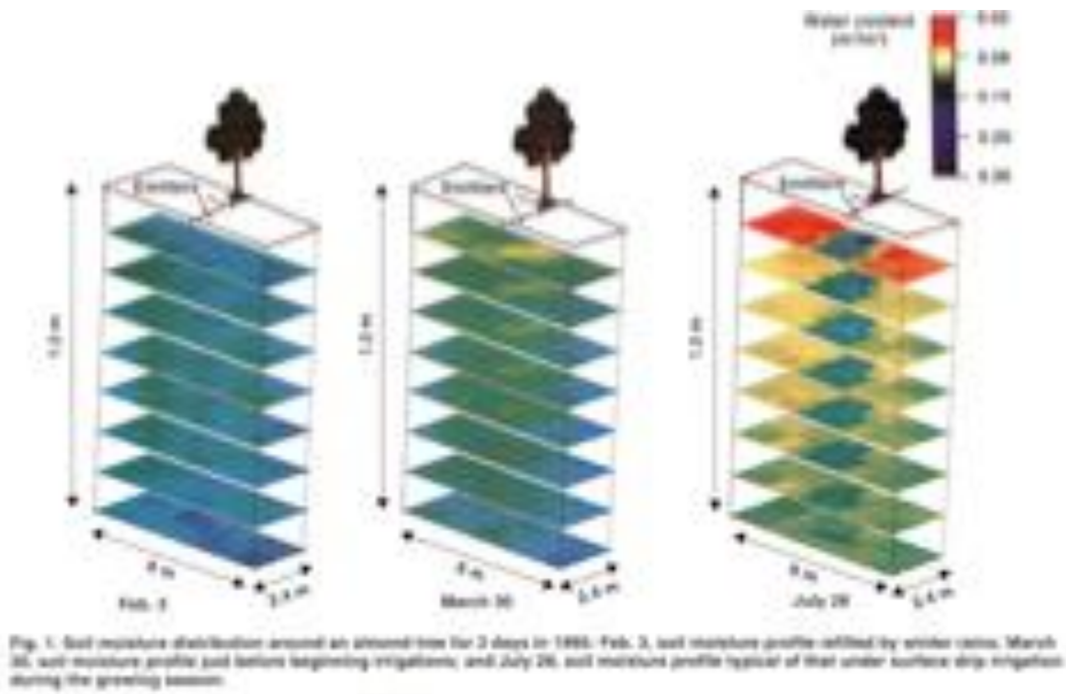

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  - **Don't flood the entire middles. Use furrows pulled along the tree rows.**

Sprinkler Irrigation Systems:

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Sprinkler Irrigation Systems:

- How can we improve their performance?
  - **Know the application rate.**
    - **We provide water use information in units of “inches of water use per day (or per week……..)”.**
    - **Need to know the system application rate (in/hr) in order to know how long to run the system.**

Sprinkler Irrigation Systems:

- **How can we improve their performance?**
  - **Know the application rate.**

$$Application\ Rate\ \left(\frac{in}{hr}\right) = \frac{96.3\ x\ (nozzle\ discharge\ in\ gpm)}{Spacing\ along\ lateral\ (ft)\ x\ \ Spacing\ between\ laterals\ (ft)}$$

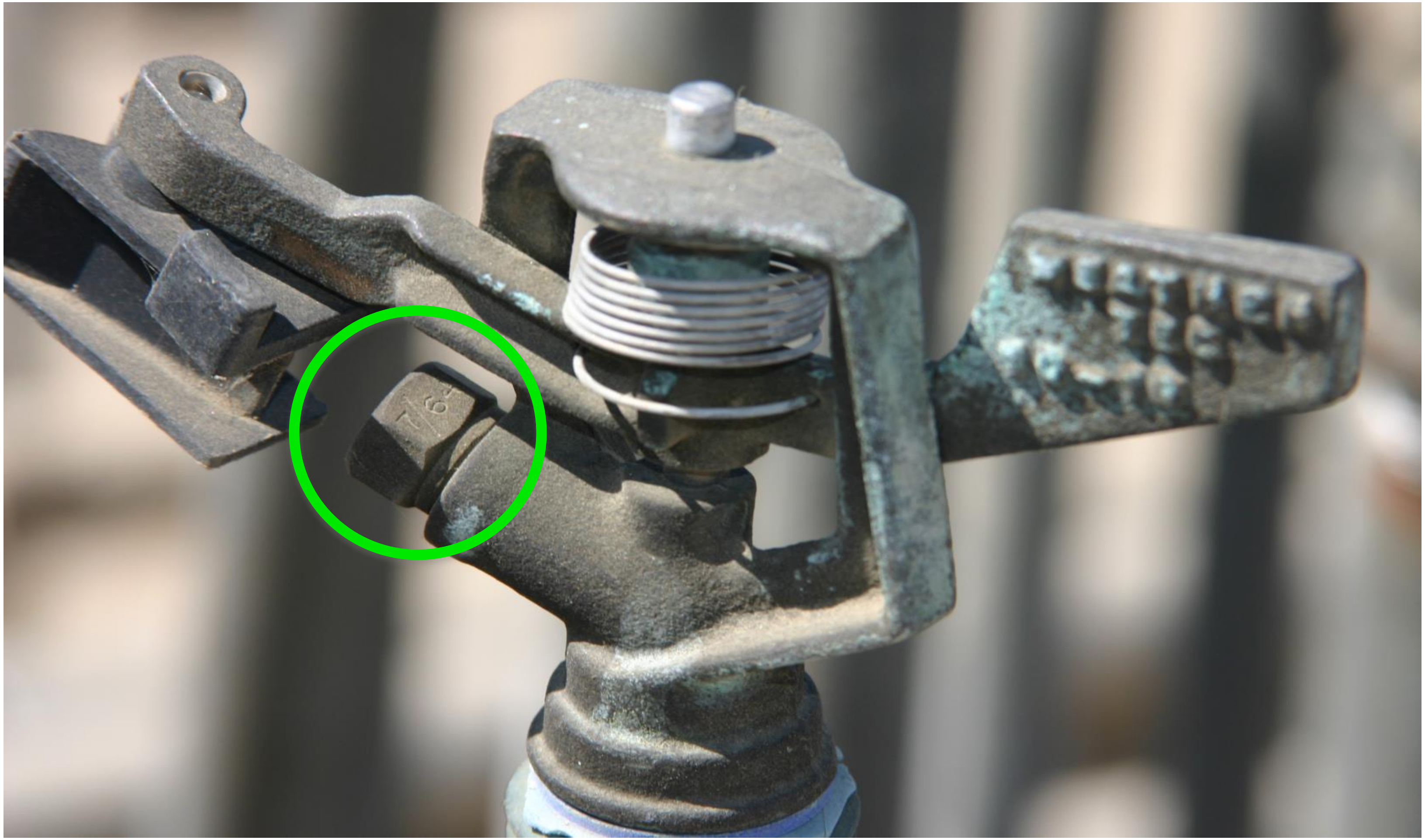
Sprinkler Application Rate:

Table 2. Sprinkler discharge rates (gpm) for various nozzle sizes (in) and pressures (psi)

Pressure (psi)	Nozzle size (in)										
	3/32	7/64	1/8	9/64	5/32	11/64	3/16	13/64	7/32	15/64	1/4
20	1.17	1.60	2.09	2.65	3.26	3.92	4.69	5.51	6.37	7.32	8.34
25	1.31	1.78	2.34	2.96	3.64	4.38	5.25	6.16	7.13	8.19	9.32
30	1.44	1.95	2.56	3.26	4.01	4.83	5.75	6.80	7.86	8.97	10.21
35	1.55	2.11	2.77	3.50	4.31	5.18	6.21	7.30	8.43	9.69	11.03
40	1.66	2.26	2.96	3.74	4.61	5.54	6.64	7.80	9.02	10.35	11.79
45	1.76	2.39	3.13	3.99	4.91	5.91	7.03	8.30	9.60	10.99	12.50
50	1.85	2.52	3.30	4.18	5.15	6.19	7.41	8.71	10.10	11.58	13.18
55	1.94	2.64	3.46	4.37	5.39	6.48	7.77	9.12	10.50	12.15	13.82
60	2.03	2.76	3.62	4.50	5.65	6.80	8.12	9.56	11.05	12.68	14.44
65	2.11	2.88	3.77	4.76	5.87	7.06	8.45	9.92	11.45	13.21	15.03
70	2.19	2.99	3.91	4.96	6.10	7.34	8.78	10.32	11.95	13.70	15.59
75	2.27	3.09	4.05	5.12	6.30	7.58	9.08	10.66	12.32	14.19	16.14

Note: Metric conversions: 1 gal = 3.785 l; 1 in = 2.54 cm; 1 psi = 6.89 kPa

Sprinkler Nozzle Size:



Sprinkler Application Rate

Pitot Tube &
Pressure Gauge

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Sprinkler Application Rate:

R10 Plate/Nozzle Options and Flow Performance in GPM and LPH

Plate Series	Plate Options	Recommended Nozzles	PSI						BAR						
			25	30	35	40	45	50	1.75	2	2.25	2.5	2.75	3	3.25
P2	P2 9° Red Radius 18-20′ (5.5-6.1 m) Stream Ht.14-23″ (36-58 cm)	Lt. Blue #40	—	—	.28	.30	.32	.34	—	—	61.4	64.7	68.0	71.3	74.6
		Lt. Purple #45	.29	.32	.35	.37	.39	.42	66.4	71.3	76.3	80.6	83.9	87.2	91.5
		Dk. Green #50	.36	.39	.43	.46	.48	.51	82.3	87.2	93.4	99.4	104	108	112
		.35 10FC	Within the recommended pressure range of 25-50 PSI (1.75-3.25 BAR), the .35 10 FC flow control nozzle is flow regulating within a flow range of no more than 0% greater and 10% less than the nominal flow of .35 GPM (79.5 LPH).												
P4	P4 9° White Radius 18-22′ (5.5-6.7 m) Stream Ht. 14-24″ (36-61 cm)	Dk. Green #50	—	—	.43	.46	.48	.51	—	—	93.4	99.4	104	108	112
		Lt. Yellow #55	.44	.48	.52	.55	.59	.62	101	107	114	120	125	131	137
		Lt. Red #60	.51	.56	.61	.65	.69	.73	117	125	133	141	147	154	161
	P4 15° Orange Radius: 23-25′ (7.0-7.6 m) Stream Ht. 40-50″ (102-127 cm)	.50 10FC	Within the recommended pressure range of pressure range of 25-50 PSI (1.75-3.25 BAR), the .5 10 FC flow control nozzle is flow regulating within a flow range of no more than 0% greater and 10% less than the nominal flow of .5 GPM (114 LPH).												

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Sprinkler Irrigation Systems:

- How can we improve their performance?
  - Know the application rate.
  - Determine and improve (if needed) the application uniformity.

Sprinkler Irrigation Systems:

- **Measuring sprinkler application uniformity**
  - ***Tells you how evenly the water is applied.***

Sprinkler Irrigation Systems:

- Measuring sprinkler application uniformity

Hire Someone to Do It For You.

Sprinkler Irrigation Systems:

REDUCING RUNOFF FROM IRRIGATED LANDS PUBLICATION 8216

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Soil Intake Rates and Application Rates in Sprinkler-Irrigated Orchards

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UNIVERSITY OF CALIFORNIA
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INTRODUCTION

The California State Water Code requires anyone discharging waste that could affect the waters of the state to obtain a permit or coverage under a waiver. Agricultural runoff, whether from irrigation or rainfall, that leaves a property has been determined to likely contain waste (sediment, nutrients, chemicals, etc.)

Microirrigation Systems

- **How can we improve them?**

Microirrigation Systems

- How can we improve them?
  - **Know the application rate and application uniformity.**

UCCE-Schwankl

Orchard Irrigation

Determining the Application Rate & Uniformity of a Microirrigation System

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Determining the application rate of microirrigation systems can be confusing because irrigation scheduling and tree water use information is usually presented in inches per day (in/day), while discharge from microirrigation emitters is measured in gallons per hour (gph). The following may be helpful in determining required operating times for microirrigation systems.

Available at http://ucanr.edu/schwankl along with the Powerpoint presentation

Microirrigation Systems

- **Irrigation uniformity can be a problem with microirrigation systems too.**

  That means all the drippers or microsprinklers aren't discharging the same amount of water.

Microirrigation Systems

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- Why wouldn't it be uniform?
  - Not a good irrigation system design – pressure differences too great.

Microirrigation Systems

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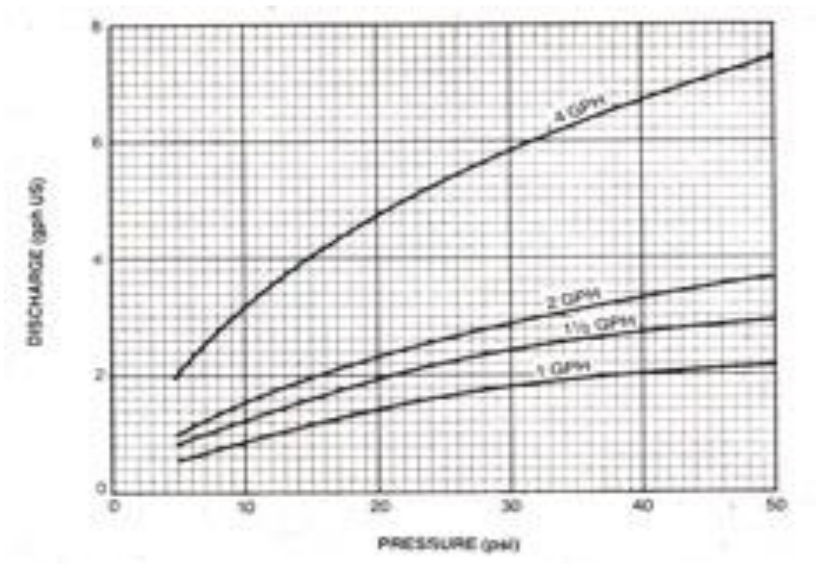
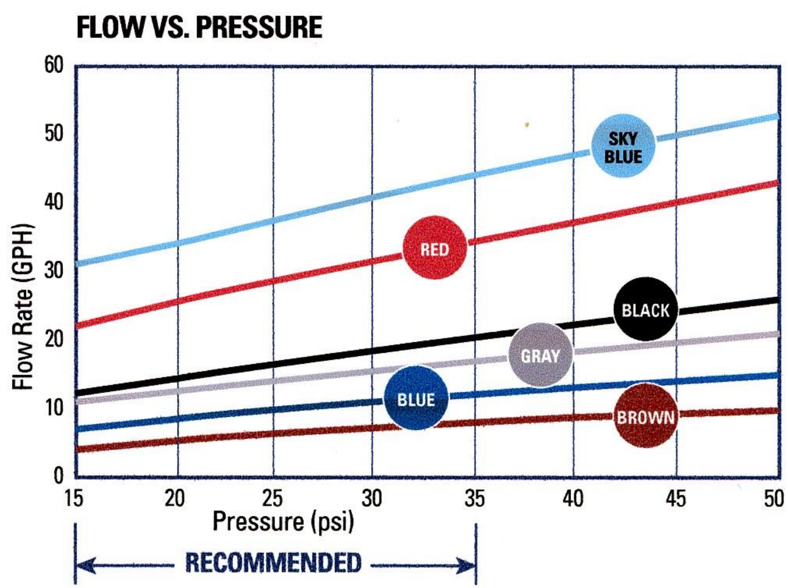
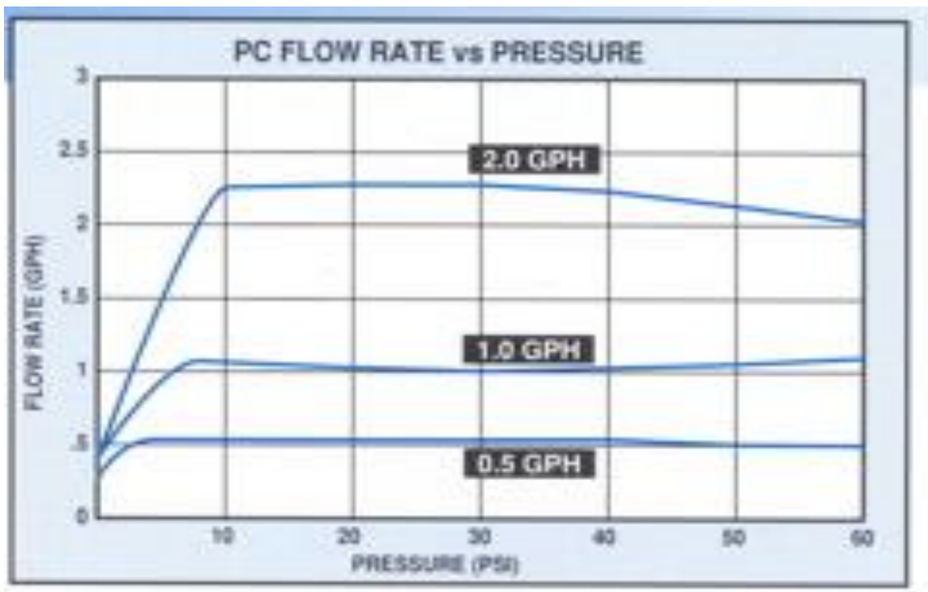
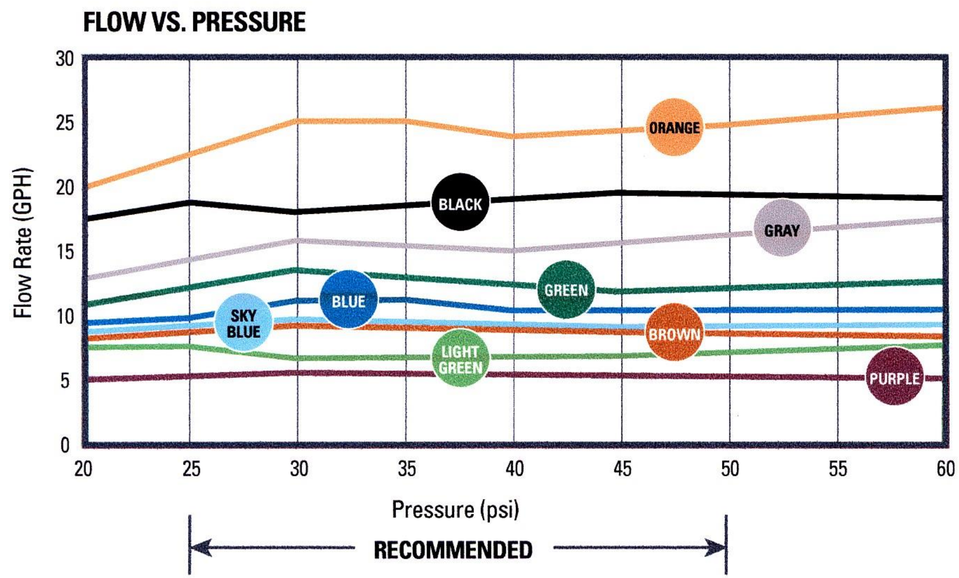




Microirrigation Systems

- Irrigation uniformity can be a problem with microirrigation systems too.
- Why wouldn't it be uniform?
  - Not a good irrigation system design – pressure differences too great. **PC drippers or PC micros can help.**





Microirrigation Systems

- Irrigation uniformity can be a problem with microirrigation systems too.
- Why wouldn’t it be uniform?
  - Not a good irrigation system design – pressure differences too great.
  - Maintenance problems.
    - Clogging problems can lead to serious non-uniformity problems. Almost all clogging problems can be solved or prevented.

Clogging of Microirrigation Systems

Source: Physical Clogging

Clogging of Microirrigation Systems

Source: Physical Clogging - Particulates

Solution: Filtration

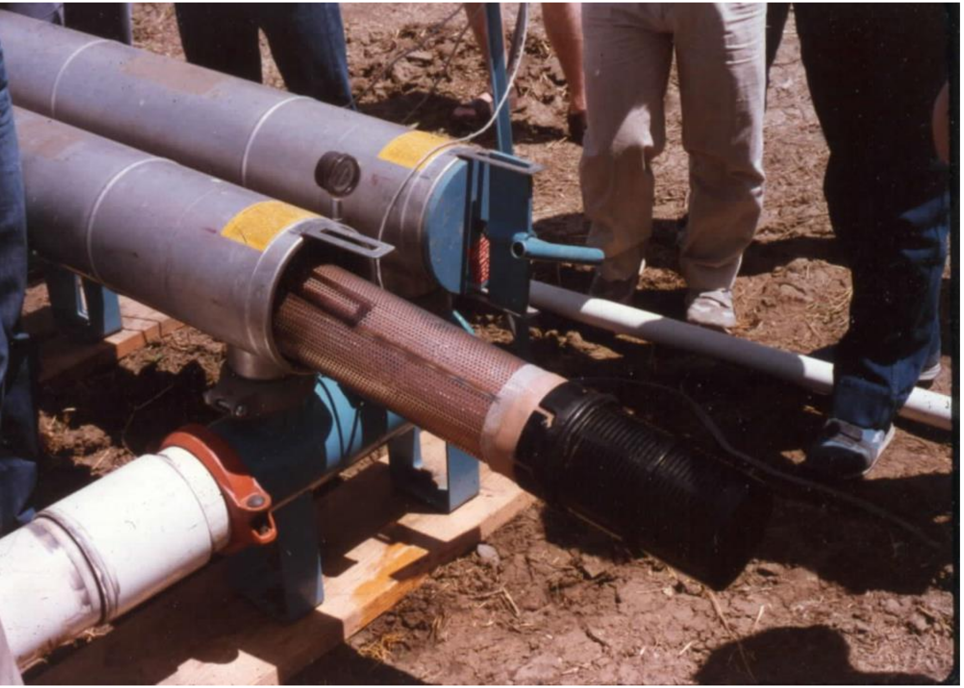
Filters:

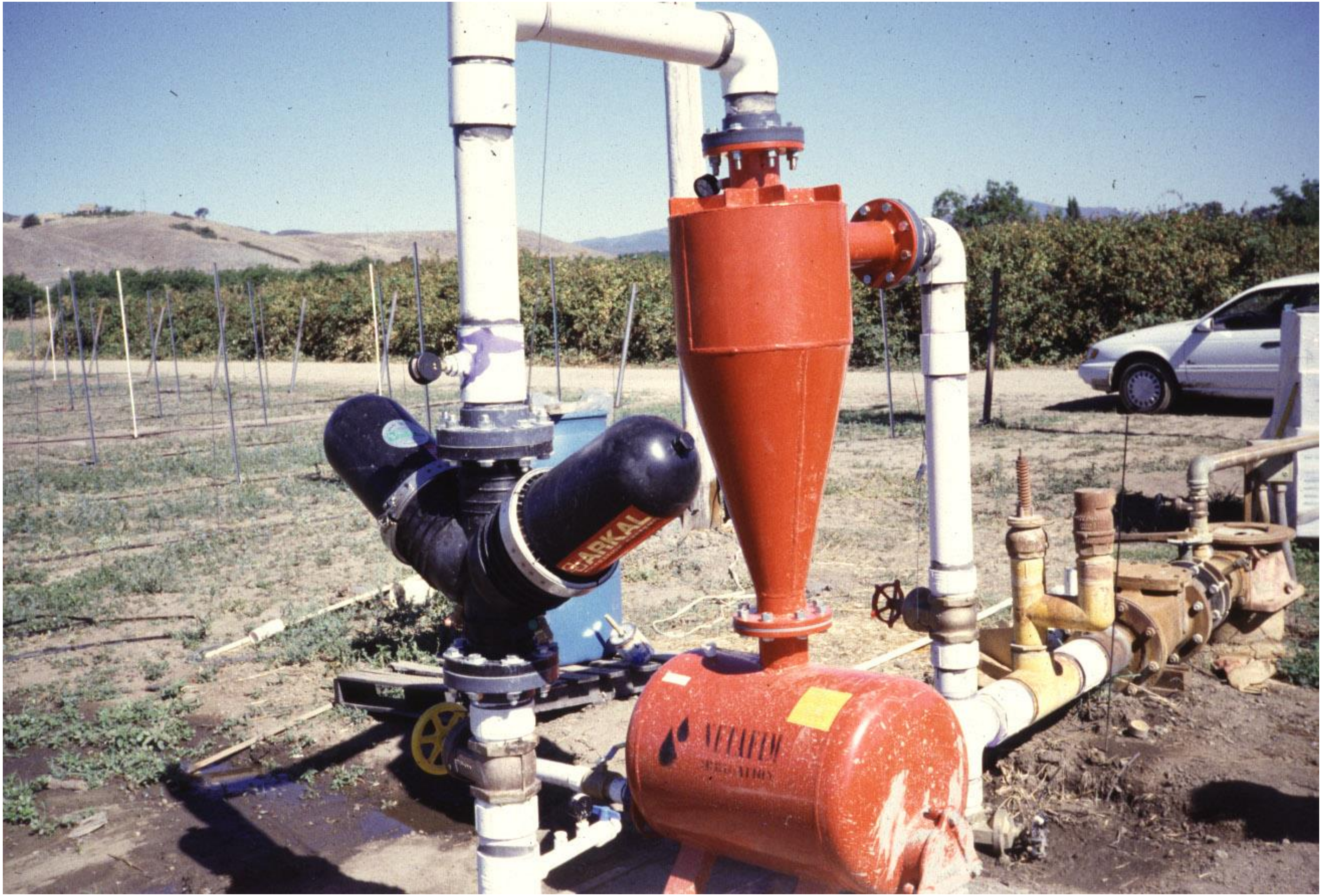
- Screen, disk, and sand media filters are all available.

- They can all filter to the same degree

BUT

they req. different frequency of cleaning

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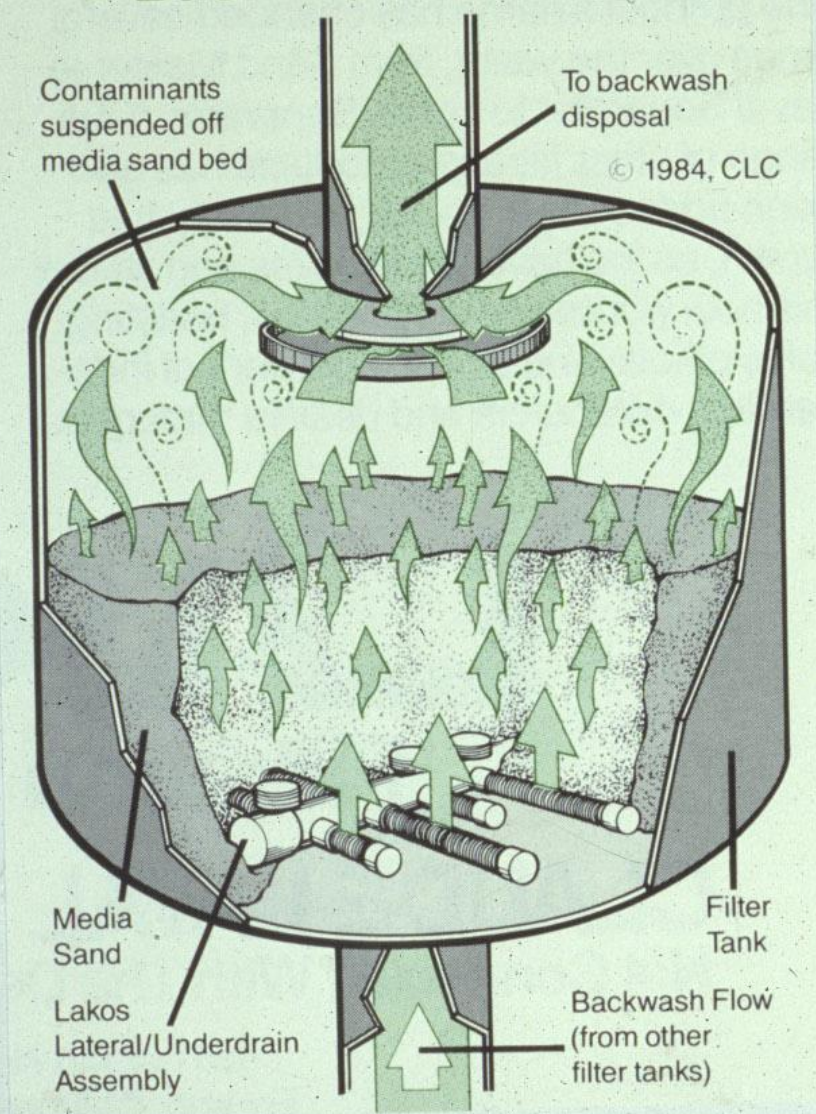
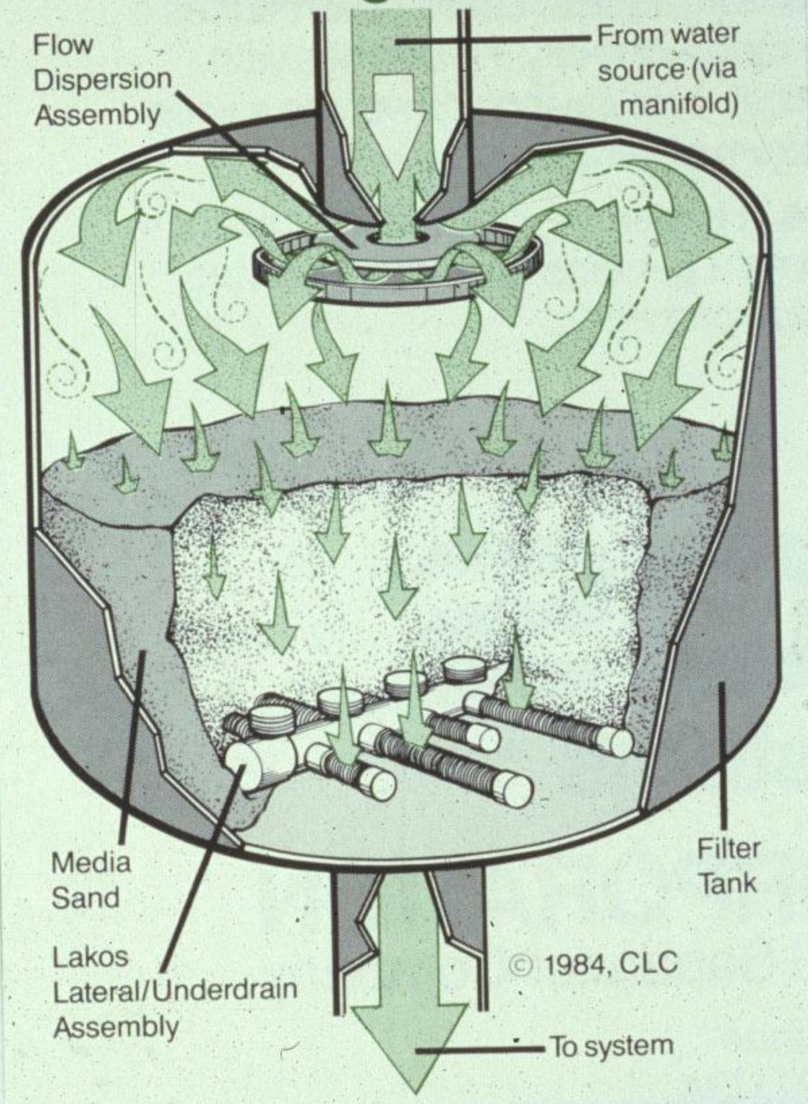
Backwash Process



Filtering Process




FLOW – GUARD
IRRIGATION PRODUCTS
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FLOW – GUARD

Clogging of Microirrigation Systems

Source: Chemical Precipitates

- Lime (calcium carbonate) and iron are the most common problems.

Chemical Precipitate Clogging of Microirrigation Systems

Water quality levels of concern:

- **Calcium: pH > 7.5 and 2.0 meq/l (120 ppm) of bicarbonate**

- **Iron: pH > 4.0 and 0.5 ppm iron**

Clogging of Microirrigation Systems

Source: Lime

Solution: pH Control (Acidification)

+

filtration

Dealing with Iron Precipitation:

1. Precipitate iron in a pond / reservoir

Dealing with Iron Precipitation:

1. Precipitate iron in a pond / reservoir

2. Chemicals (e.g. phosphonic acid, phosphonate) may keep iron in solution

Clogging of Microirrigation Systems

Source: Biological Sources

Clogging of Microirrigation Systems

Source: Biological Sources

Solution: Filtration (usually media filters)

+

Biocide

Biolgical Clogging

Acid may deter
but not eliminate

biocide

chlorine copper

Chlorine

- Sources:
  - Liquid - sodium hypochlorite.
  - Solid - calcium hypochlorite.
  - Gas chlorine.

Chlorine as a Biocide

	Free Chlorine
Prevent growth	1-2 ppm
Periodic treatment	10-20 ppm
Serious clogging cleanup	

Test for chlorine using a pool / spa test kit

Chlorine: Injection Rates

- Sodium hypochlorite (liquid)
  - Example: household bleach w/ 5.25% active chorine.

$$\text{Chlorine injection rate (gal/hr)} = \text{System flow rate (gpm)} \times \text{Desired Cl Conc. (ppm)} \times 0.006 \div \text{Strength of Cl soln (\%)}$$

- Calcium hypochlorite (solid)
  - 65-70% available chlorine.
  - 12.8 lbs. of calcium hypochlorite added to 100 gallons of water forms a 1% solution.
  - Use above formula.

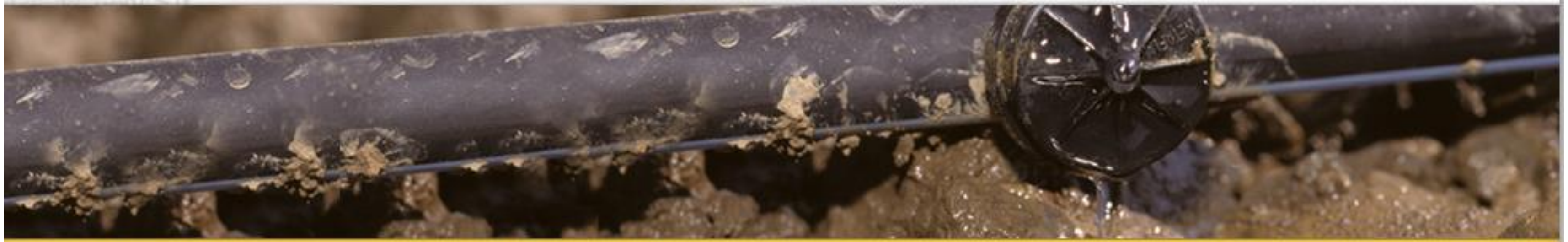
Flushing of Microirrigation Systems:

Flushing

- **Silts and clay particles pass through even the best filters.**

Flushing

- Silts and clay particles pass through even the best filters.
- Need to flush the system - mainlines, submains, and laterals (in that order). Flush by hand or can use self-flushing end caps.



Maintenance of Microirrigation Systems

Predicting Clogging Problems

"What should I watch for?"

Solutions to Existing Clogging Problems

"I Have a Clogging Problem and I Want to Solve It"

System evaluation for emission device clogging

"How do I determine if I have a clogging problem?"

Routine Maintenance Tasks

"What should I do to keep my microirrigation system running well?"

Microirrigation systems include microsprinklers for tree crops, drip emitters for trees, vines, and some row crops, and drip tape for row and field crops. Microirrigation systems apply water to the soil through emitters that are installed along drip lines and contain very small flow passages. Microirrigation systems can apply water and fertilizers more uniformly than other irrigation methods. This uniformity results in potentially higher yields, higher revenue, and reduced irrigation operating costs.

Uniformity, a performance characteristic of irrigation systems, is a measure of the evenness of the applied water throughout the irrigation system. Distribution uniformity (DU), sometimes called emission uniformity (EU), is an index that describes how evenly or uniformly water is applied throughout the field. A uniformity of 100% means the same amount of water was applied everywhere. Unfortunately, all irrigation systems apply water at a uniformity of less than 100%, and thus some parts of a field receive more water than others. Field evaluations have shown that microirrigation systems have the potential for higher uniformity than other irrigation methods. However, clogging reduces the uniformity of applied water in microirrigation systems, thus increasing the relative differences in applied water throughout a field.

The small flow passages in the emitters and microsprinklers make microirrigation systems highly susceptible to clogging. Clogging reduces the uniformity of the applied water and decreases the amount of applied water. Clogging also decreases the amount of salt leaching around the lateral line in saline soils.

http://micromaintain.ucanr.edu

Available at:

http://anrcatalog.ucdavis.edu

Maintaining Microirrigation Systems

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Blaine Hanson
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University of California
Agriculture and Natural Resources
Publication 21637

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Water Resources Center

Stay on Top of Your Maintenance

Questions???

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Presentation available at: http://ucanr.edu/schwankl

Maintenance website: http://micromaintain.ucanr.edu