

Drip Tape Application Rate and Drip System Maintenance

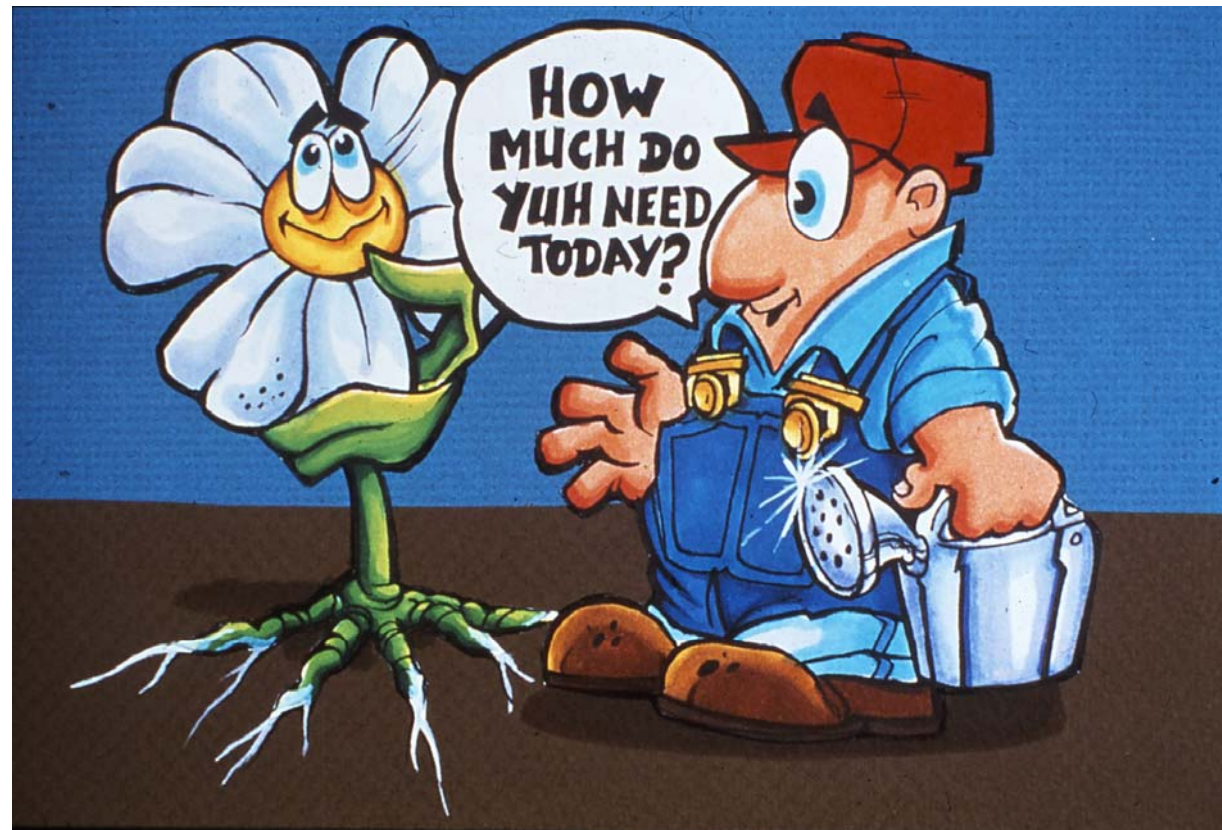
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Irrigation Scheduling with Drip Tape

- Water use (ET) info. usually provided in “inches” (e.g. in/day, in/week).



Irrigation Scheduling with Drip Tape

- Water use (ET) info. usually provided in “inches” (e.g. in/day, in/week).
- Drip tape discharge given as:
 - gpm/100 ft.



Product Summary Chart

Series	Emitter Spacing	Flow Rate	Operating
500 (5/8")			
	Inch	Gpm/ 100 Ft	Pressure (PSI)
4 mil	8, 12, 16	.170, .220, .340, .450, .670, 1.0	8
5 mil	4, 6, 8, 9, 12, 16	.110, .15, .170, .220, .340, .450, .510, .670, 1.0	8
6 mil	4, 6, 8, 12, 16	.110, .170, .220, .250, .340, .450, .510, 1.00, 1.340	8
8 mil	4, 6, 8, 12, 16, 24	.170, .220, .250, .300, .340, .403, .440	8
10 mil	4, 8, 12, 16, 18	.170, .220, .300, .340, .450, .670	
15 mil	8, 12, 16, 18, 20	.220, .250, .280, .340, .450, .510, .536, .670	8
700 (7/8")			
6 mil	6, 8, 12, 16, 18, 24	.170, .220, .270, .300, .340, .450, .510, .670	
8 mil	6, 8, 12, 16, 18, 24	.220, .250, .340, .403, .450, .510, .670, 1.0	8
10 mil	6, 8, 12, 16, 18, 24	.220, .250, .280, .300, .340, .450, .510, .670	8
15 mil	8, 12, 16, 24	0.220, .250, .280, .340, .422, .450, 0.536, .670, 1.1	8

Application Rate of Drip Tape

Drip tape discharge (in/hr)

Drip Tape Discharge (gpm/100')	Drip Tape Spacing in Field (in.)														
	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
0.10	0.12	0.08	0.06	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01
0.12	0.14	0.09	0.07	0.06	0.05	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
0.14	0.16	0.11	0.08	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02
0.16	0.18	0.12	0.09	0.07	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02
0.18	0.21	0.14	0.10	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.03
0.20	0.23	0.15	0.12	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03
0.22	0.25	0.17	0.13	0.10	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03
0.24	0.28	0.18	0.14	0.11	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03
0.26	0.30	0.20	0.15	0.12	0.10	0.09	0.08	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04
0.28	0.32	0.22	0.16	0.13	0.11	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04
0.30	0.35	0.23	0.17	0.14	0.12	0.10	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.04
0.32	0.37	0.25	0.18	0.15	0.12	0.11	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05
0.34	0.39	0.26	0.20	0.16	0.13	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05
0.36	0.42	0.28	0.21	0.17	0.14	0.12	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.06	0.05
0.38	0.44	0.29	0.22	0.18	0.15	0.13	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05
0.40	0.46	0.31	0.23	0.18	0.15	0.13	0.12	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06
0.42	0.49	0.32	0.24	0.19	0.16	0.14	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06
0.44	0.51	0.34	0.25	0.20	0.17	0.15	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06
0.46	0.53	0.35	0.27	0.21	0.18	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.07

$$\text{Tape Discharge rate (in/hr)} = \frac{\text{gpm}}{100 \text{ ft.}} \div \text{tape spacing (in.)} \times 11.55$$

Application Rate of Drip Tape

Drip Tape Discharge Rate Tables

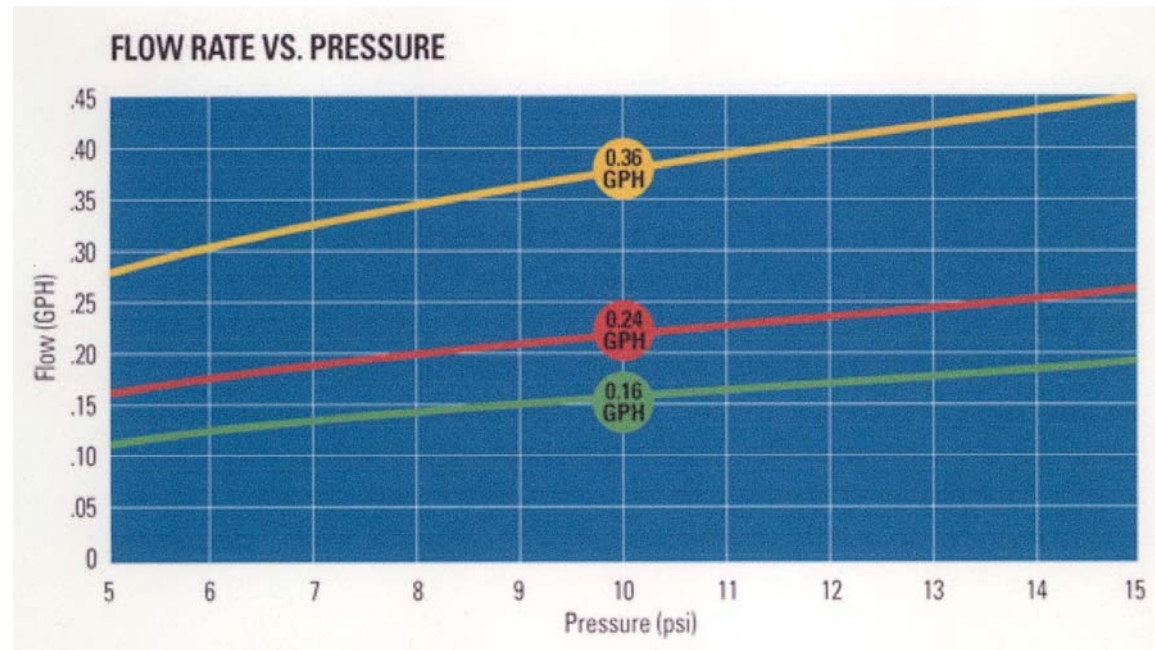
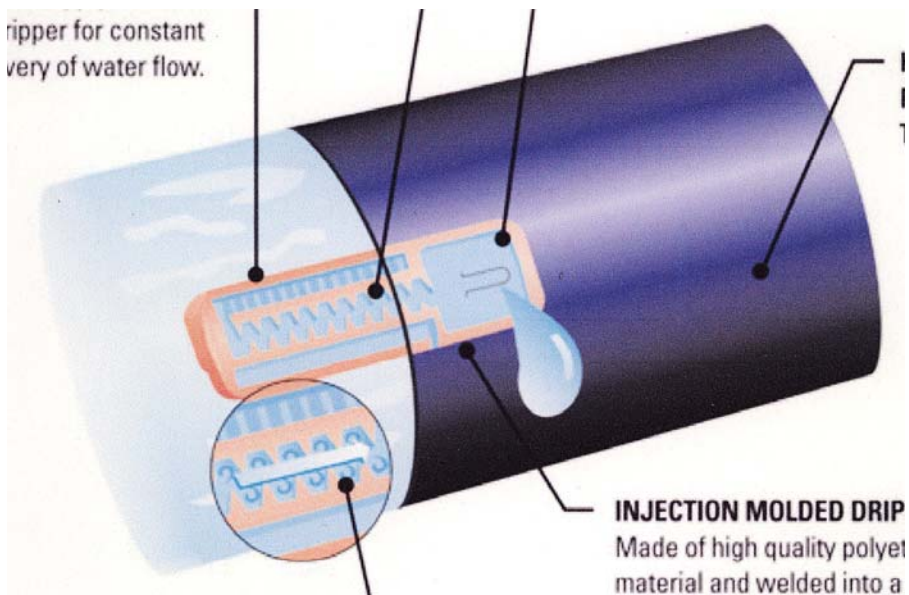
Converting tape discharge in gpm/100 ft. to in/hr

Converting discharge from tape with built-in emitters (gph) to a discharge rate in in/hr

Available at <http://ucanr.org/schwankl>

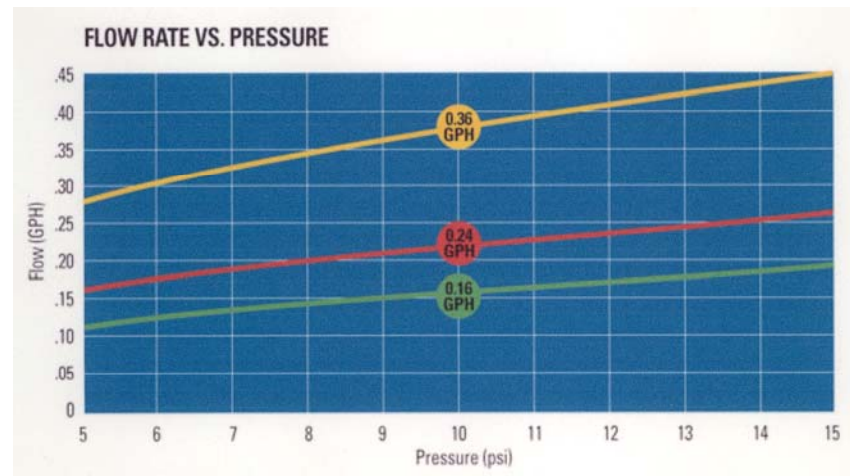
Irrigation Scheduling with Drip Tape

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$$\text{Tape Discharge rate (in/hr)} = \frac{\text{Emitter discharge (gph)}}{\text{Tape spacing (in)} \times \text{Emitter spacing (in)}} \times 231$$

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- Drip tape discharge given as:
 - gpm/100ft.
 - Emitter discharge (gph)

$$\text{Tape Discharge rate (in/hr)} = \frac{\text{Emitter discharge (gph)}}{\text{Tape spacing (in)} \times \text{Emitter spacing (in)}} \times 231$$

Emitter Discharge (gph)	Drip Tape Spacing in Field (in.)														
	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
0.10	0.19	0.13	0.10	0.08	0.06	0.06	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02
0.12	0.23	0.15	0.12	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03
0.14	0.27	0.18	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03
0.16	0.31	0.21	0.15	0.12	0.10	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04
0.18	0.35	0.23	0.17	0.14	0.12	0.10	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.04
0.20	0.39	0.26	0.19	0.15	0.13	0.11	0.10	0.09	0.08	0.07	0.06	0.06	0.06	0.05	0.05
0.22	0.42	0.28	0.21	0.17	0.14	0.12	0.11	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05
0.24	0.46	0.31	0.23	0.18	0.15	0.13	0.12	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06
0.26	0.50	0.33	0.25	0.20	0.17	0.14	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06
0.28	0.54	0.36	0.27	0.22	0.18	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.07
0.30	0.58	0.39	0.29	0.23	0.19	0.17	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07
0.32	0.62	0.41	0.31	0.25	0.21	0.18	0.15	0.14	0.12	0.11	0.10	0.09	0.09	0.08	0.08
0.34	0.65	0.44	0.33	0.26	0.22	0.19	0.16	0.15	0.13	0.12	0.11	0.10	0.09	0.09	0.08
0.36	0.69	0.46	0.35	0.28	0.23	0.20	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.09
0.38	0.73	0.49	0.37	0.29	0.24	0.21	0.18	0.16	0.15	0.13	0.12	0.11	0.10	0.10	0.09
0.40	0.77	0.51	0.39	0.31	0.26	0.22	0.19	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.10
0.42	0.81	0.54	0.40	0.32	0.27	0.23	0.20	0.18	0.16	0.15	0.13	0.12	0.12	0.11	0.10
0.44	0.85	0.56	0.42	0.34	0.28	0.24	0.21	0.19	0.17	0.15	0.14	0.13	0.12	0.11	0.11
0.46	0.89	0.59	0.44	0.35	0.30	0.25	0.22	0.20	0.18	0.16	0.15	0.14	0.13	0.12	0.11

Drip tape discharge (in/hr) for drip tape with emitters every 12 inches

Tables available at:
<http://ucanr.org/schwankl>

Microirrigation Systems

What do you want from a well-designed drip system?



Microirrigation Systems

What do you want from a well-designed drip system?

Good Uniformity:

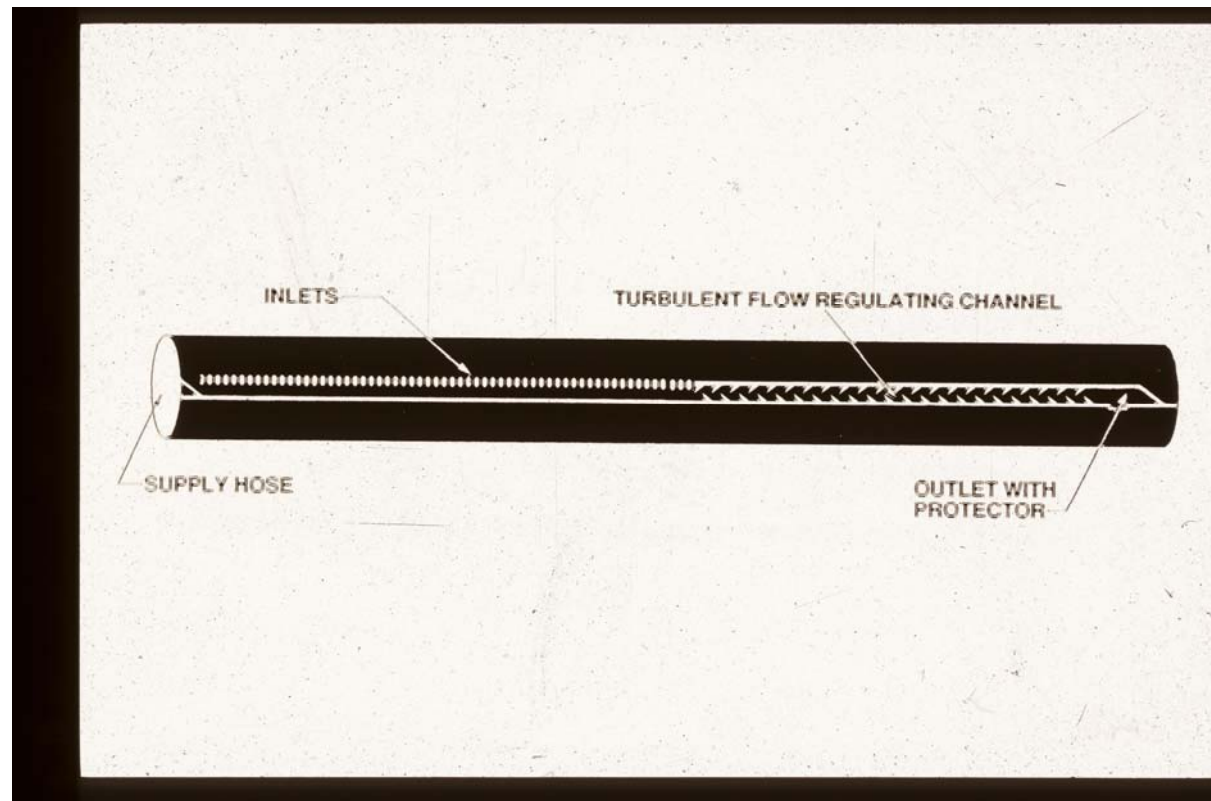
All areas of the field receive nearly the same amount of water.



Microirrigation Systems

Why would there be non-uniformity?

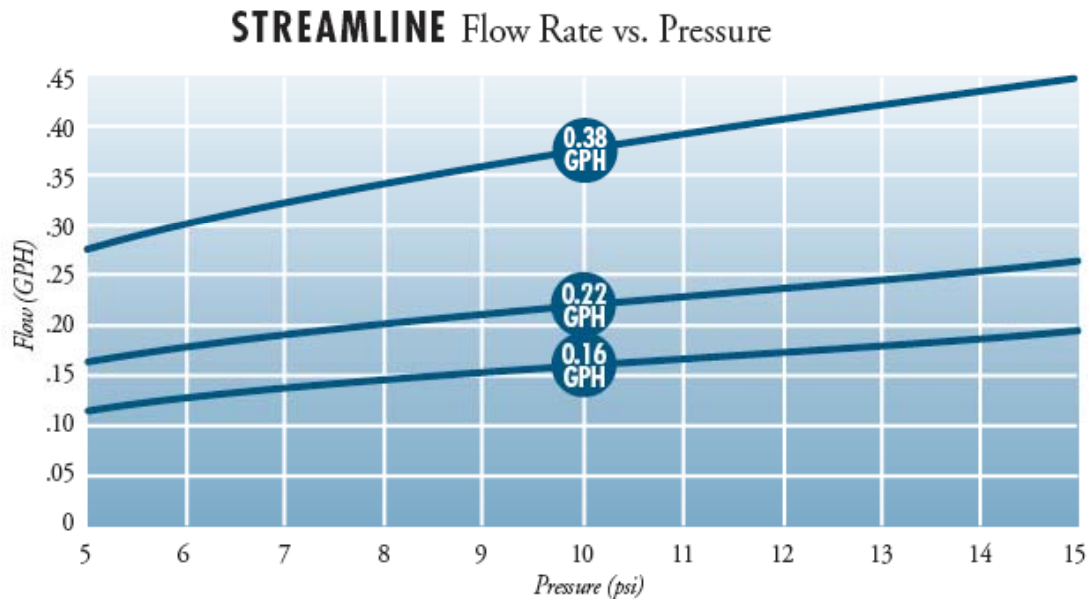
- 1. Manufacturing variation - minor with good microirrigation products.**



Microirrigation Systems

Why would there be non-uniformity?

1. Manufacturing variation - minor with good microirrigation products.
2. Pressure differences - due to elevation changes and pressure losses.



Microirrigation Systems

Why would there be non-uniformity?

1. Manufacturing variation - minor with good microirrigation products.
2. Pressure differences - due to elevation changes and pressure losses.

LENGTH OF RUN @ 0% Slope
0.16 GPH Dripper (0.16 @ 10 psi)

Dripper Spacing	GPM per 100 ft.	Emission Uniformity (EU)		
		94%	92%	90%
8"	0.398	391	472	538
12"	0.267	535	650	743
16"	0.201	670	813	929
18"	0.177	731	888	1001
24"	0.134	902	1093	1243

Can minimize pressure differences
with good design

Microirrigation Systems

Why would there be non-uniformity?

1. Manufacturing variation - minor with good microirrigation products.
2. Pressure differences - due to elevation changes and pressure losses.
3. Clogging problems.

Maintenance of Micro Systems:

Maintaining Microirrigation Systems



Larry Schwankl
Blaine Hanson
Terry Prichard

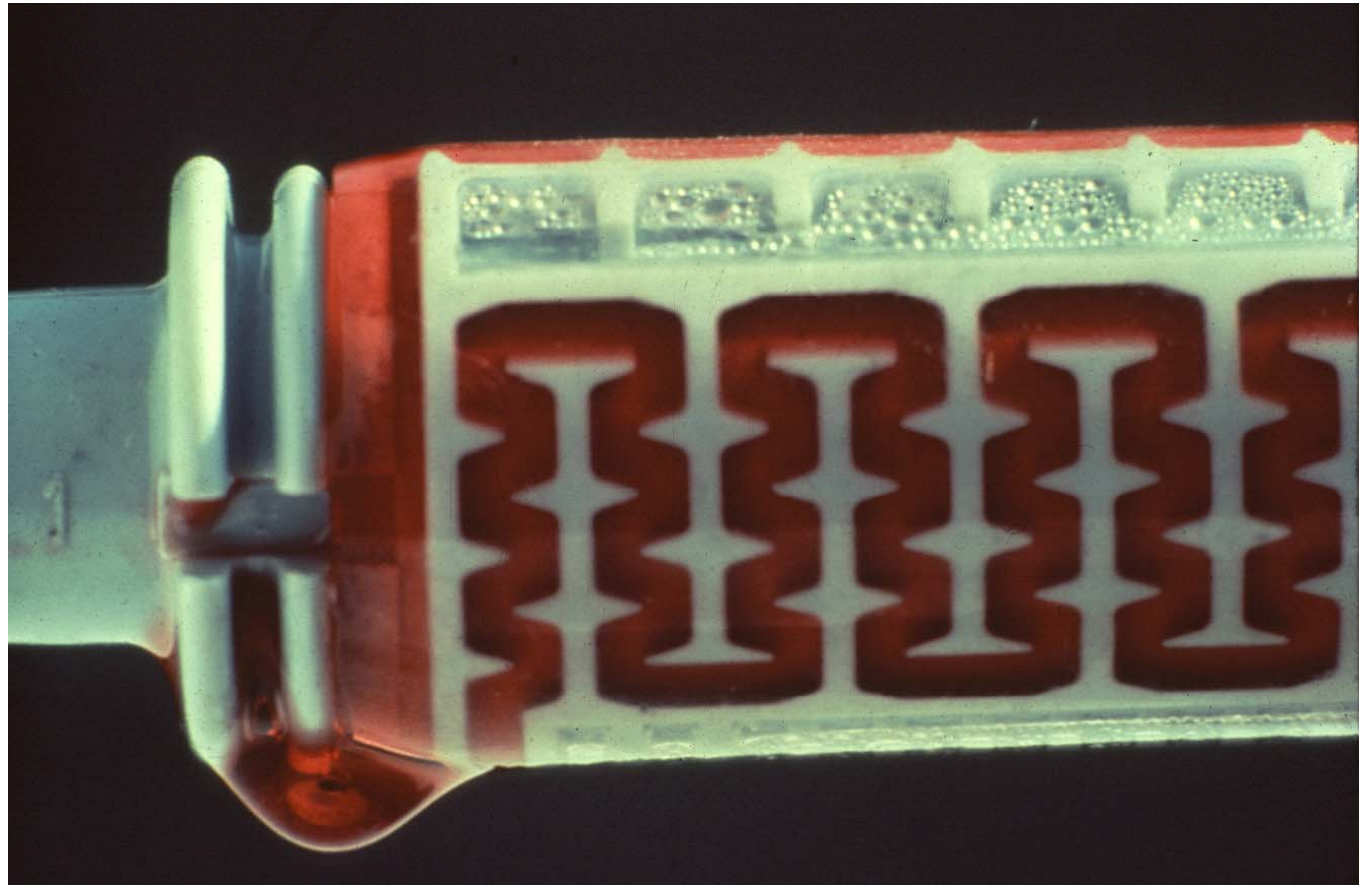


University of California
Agriculture and Natural Resources
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Administered by the University of California
Water Resources Center

Emitters:

Clogging is the greatest “threat” to emitters.



Clogging of Microirrigation Systems

Source: Physical Clogging - Particulates

Clogging of Microirrigation Systems

Source: Physical Clogging - Particulates

Solution: Filtration



Filters:

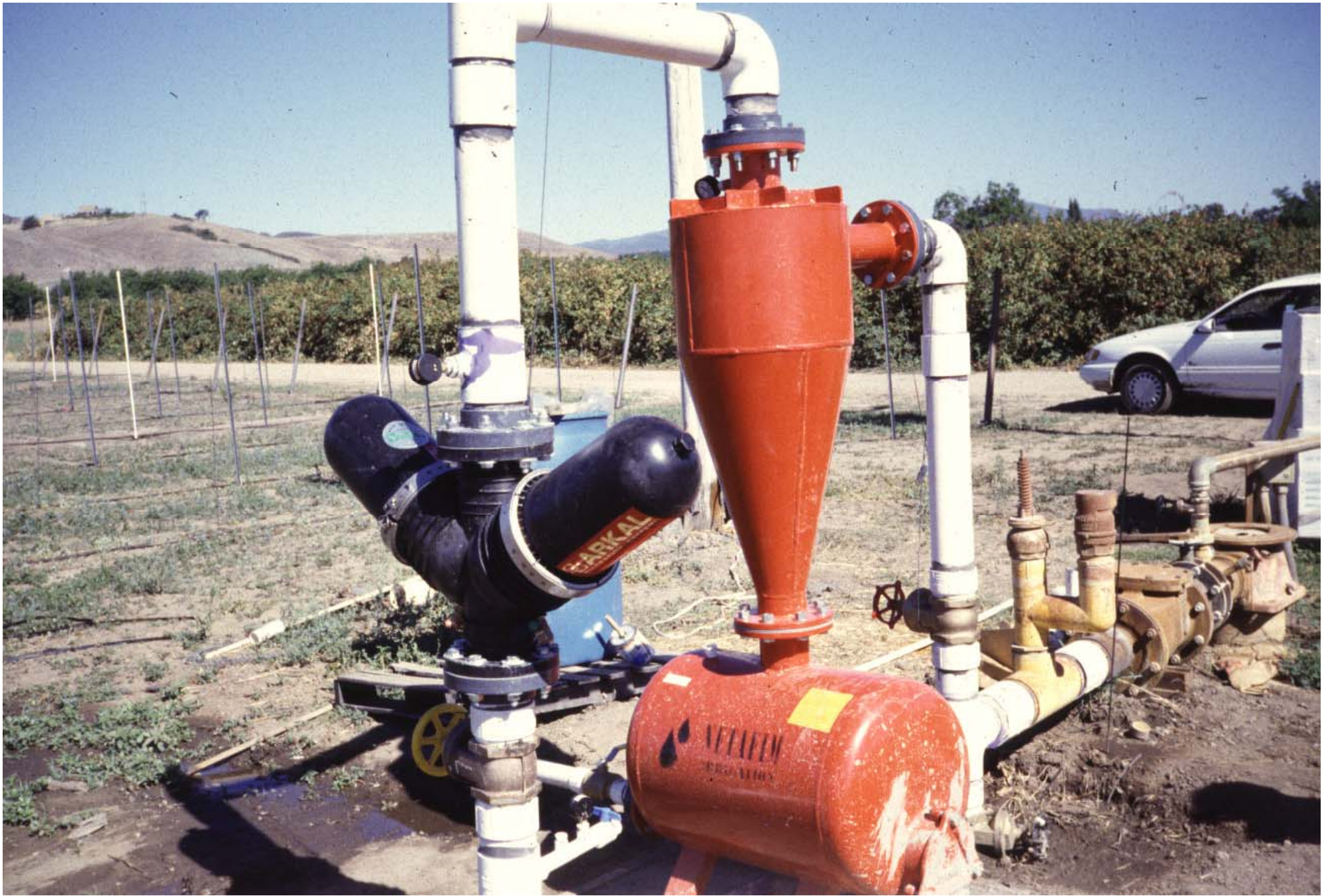
- **Screen, disk, and sand media filters are all available.**

- **They can all filter to the same degree**

BUT

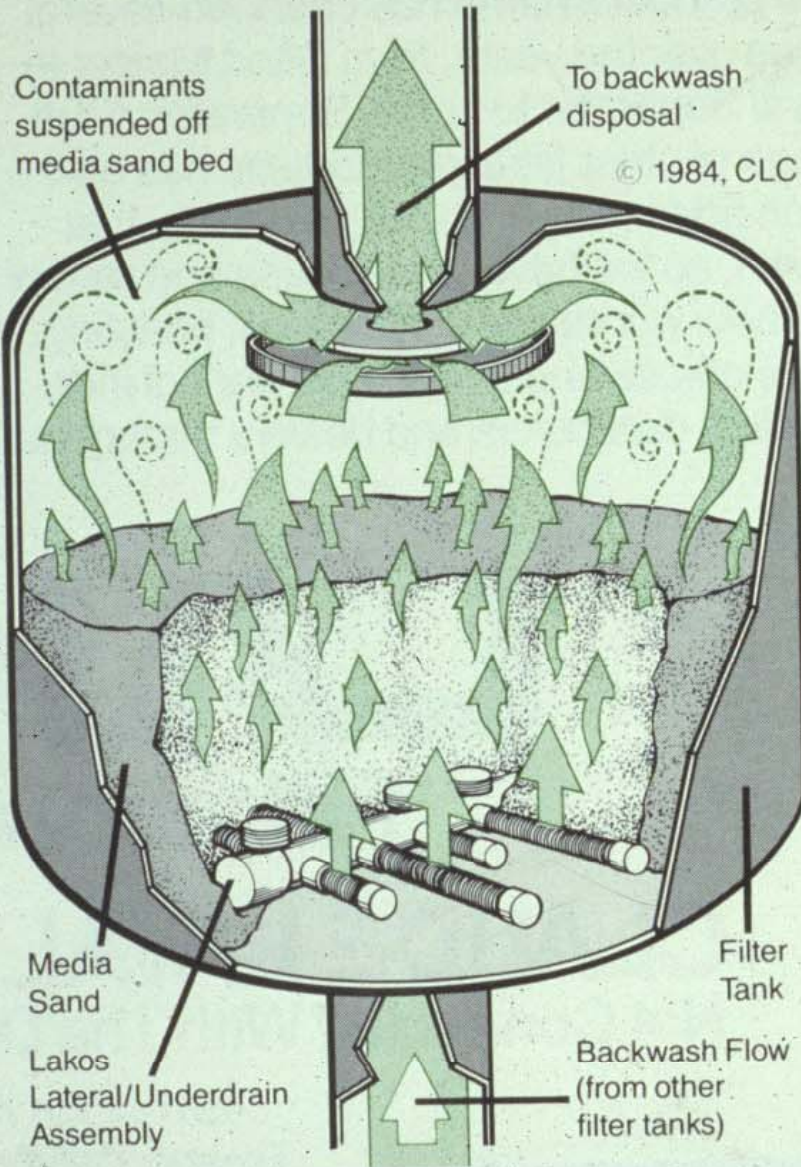
they req. different frequency of cleaning.



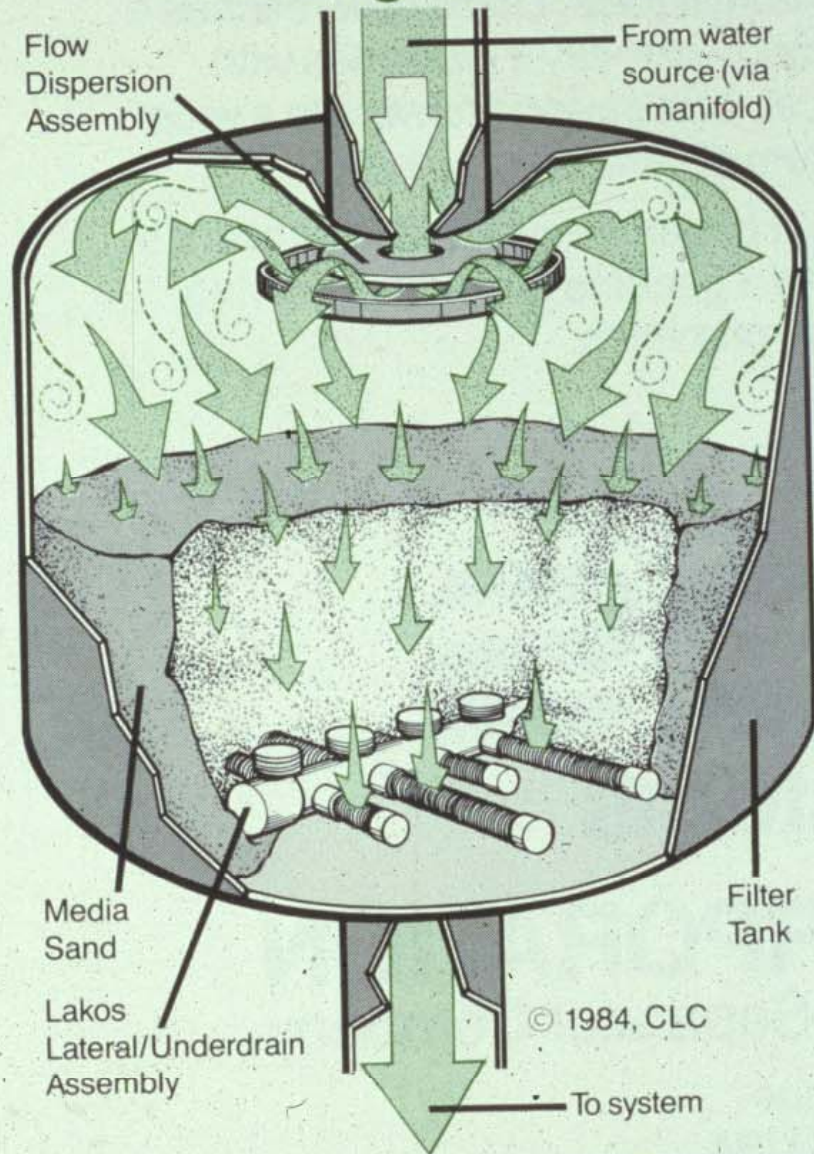




Backwash Process



Filtering Process



FLOW-GUARD
IRRIGATION PRODUCTS
— FRESNO VALVES & CASTINGS, INC. —
HELMA, CA 95724-8512

Control panel for the Flow-Guard irrigation system, featuring:

- Two rotary switches at the top.
- A large central pressure gauge.
- A flow indicator light (red) at the bottom right.
- Labels for "FLOW-GUARD" and "IRRIGATION PRODUCTS".

Two pressure gauges mounted on the right side of the tank, with black hoses connected to them.

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:** $\text{pH} > 7.5$ and 2.0 meq/l (120 ppm) of bicarbonate
- **Iron:** $\text{pH} > 4.0$ 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

Biological Clogging

Acid may deter
but not eliminate

biocide

chlorine copper

Chlorine

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



Chlorine:

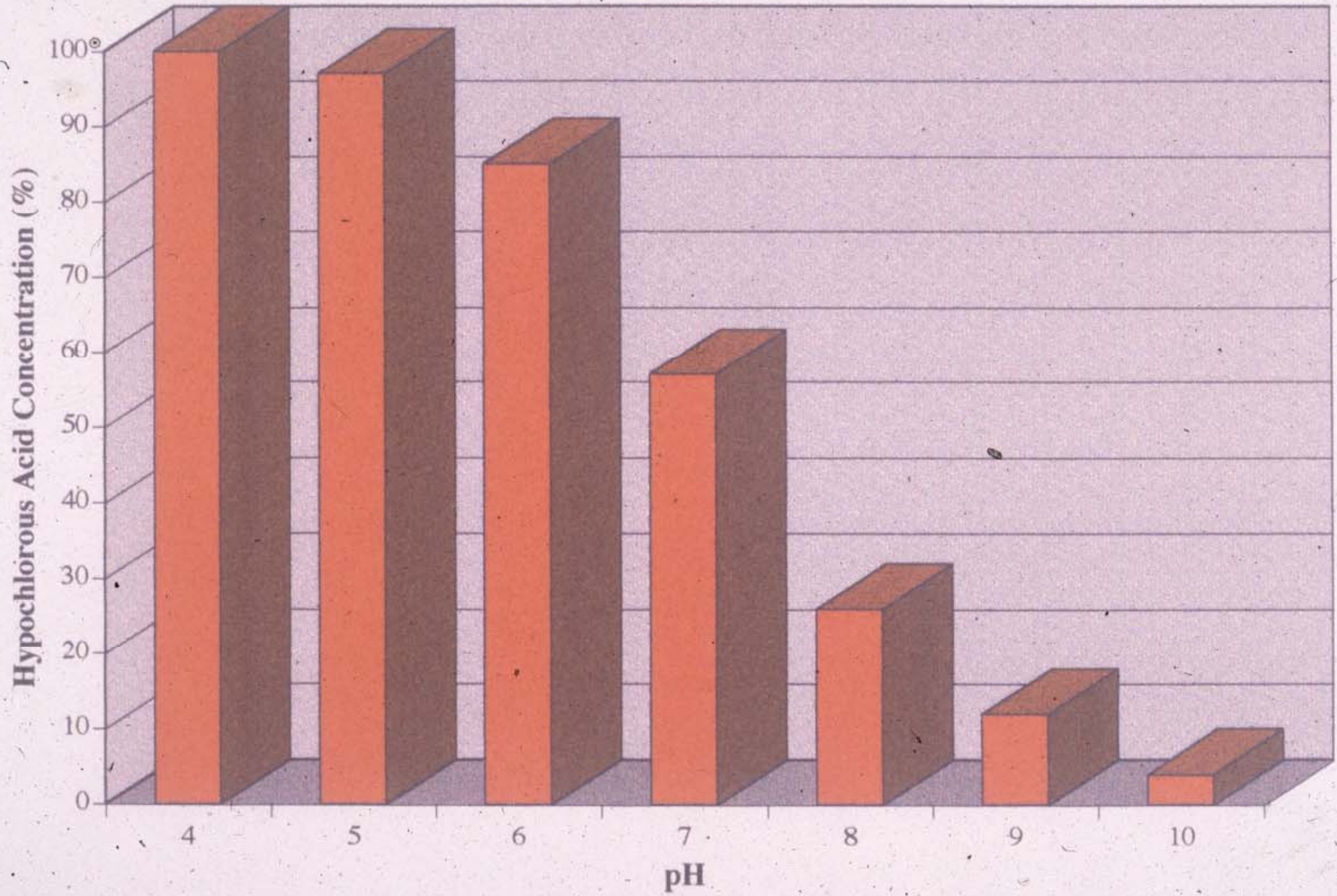
■ Sources:

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

■ When add chlorine source to water:

- Forms hypochlorous acid + hypochlorite.
- Hypochlorous acid is more powerful biocide.
- If pH is lower (acidic), more hypochlorous acid is present - better biocide.

pH Effect on Hypochlorous Acid Concentration



Chlorine as a Biocide

	Free Chlorine
prevent growth	1 - 2 ppm
periodic injection	10 - 20
super chlorination (reclamation)	500 - 1000

Test for chlorine using a pool / spa test kit

Chlorine: Injection Rates

■ Sodium hypochlorite (liquid)

- Example: household bleach w/ 5.25% active chlorine.

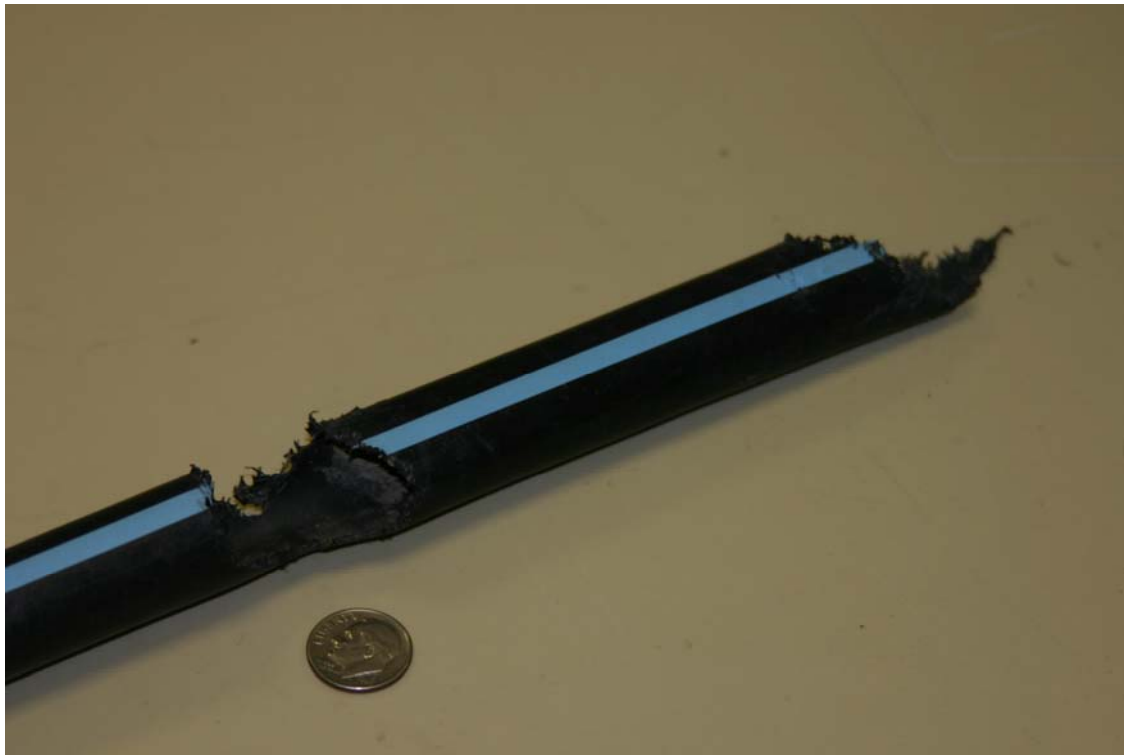
$$\text{Chlorine injection rate (gal/hr)} = \text{System flow rate (gpm)} \times \text{Desired Cl Conc. (ppm)} \times 0.006 \div \text{Strength of Cl soln (\%)}$$

■ 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.

Leaks in Microirrigation Systems

Source: Rodents



Leaks in Microirrigation Systems

Source: Rodents

Solution: Get rid of them.



Flushing of microirrigation systems:

- **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).**

Flushing

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





**Stay on Top of
Your Maintenance**



Questions?

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For this Powerpoint presentation, go to:

<http://ucanr.org/schwankl>