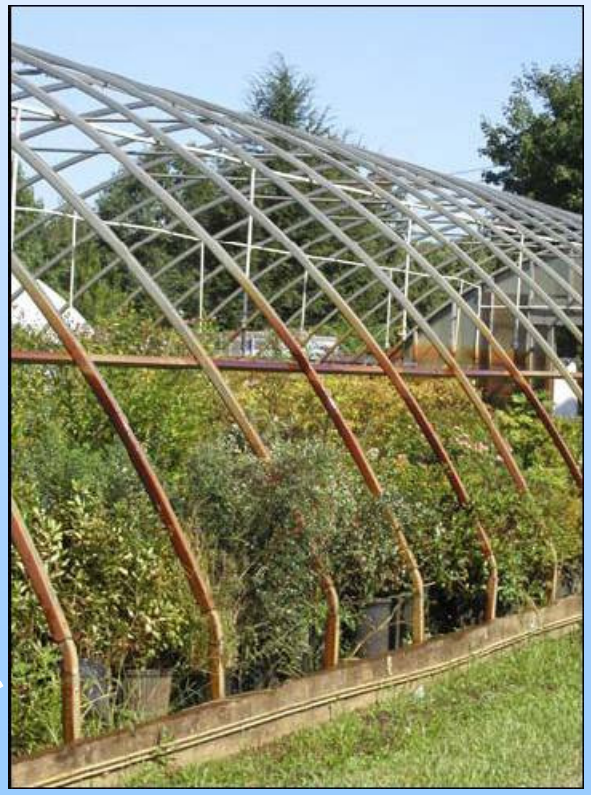
WASHINGTON STATE UNIVERSITY

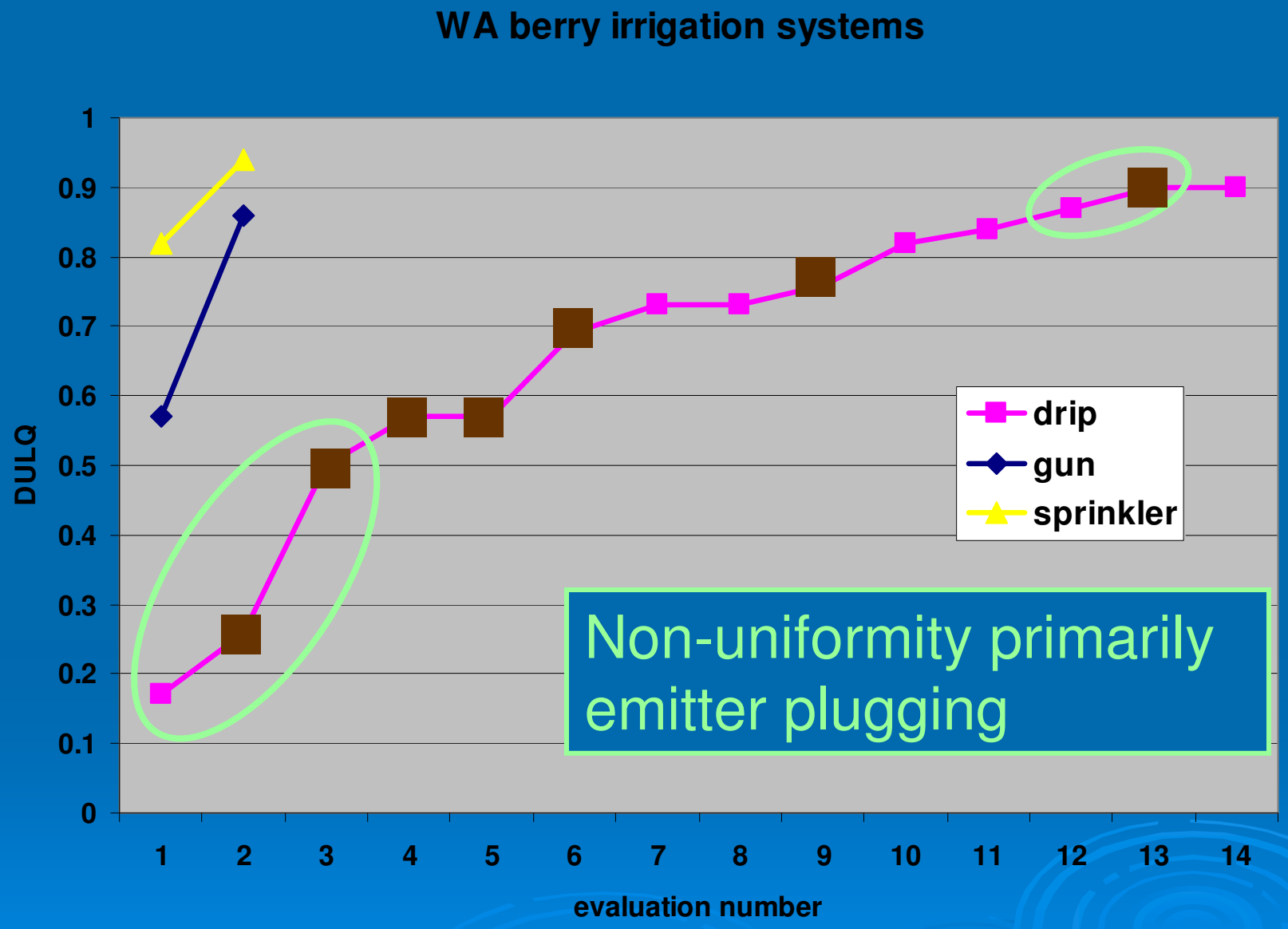
World Class. Face to Face.

Irrigation and Water Workshop Series

Rust Never Sleeps

Ways to deal with iron in drip irrigation water





■ Observed or probable iron bacteria present

Iron Bacteria

- Common in nature (extreme example on right).
- “Feed” on soluble (ferrous) iron in well water.

Iron Bacteria

- Excrete insoluble (ferric) iron and slime.
- Can plug emitters when soluble iron levels are as low as 0.1 ppm

Drip Water Quality guidelines
(from Kansas State extension bulletin MF-2178)

Table 1. Criteria for Plugging Potential of Drip Irrigation System Water Sources

Factor	Plugging Hazard		
	Slight	Moderate	Severe
	[in parts per million (ppm)* except pH]		
Physical			
Suspended Solids (filterable)	<50	50–100	>100
Chemical			
pH	<7.0	7.0–7.5	>7.5
Manganese	<0.1	0.1–1.5	>1.5
Iron	<0.1	0.1–1.5	>1.5
Hardness	<150	150–300	>300
Hydrogen sulfide	<0.5	0.5–2.0	>2.0

*Some water reports list results as milligrams per liter, mg/L, which is equal to parts per million, ppm

Testing for Iron (DIY)

•**Ferrous** Iron test, sometimes called **Dissolved** iron test: reacts with soluble (ferrous) iron to form a colored compound. More iron=more color

•**Total** Iron test: first acidifies the water to make all the iron soluble, then undergoes a similar reaction to the one above.

Both types of test are available from Hach (www.hach.com)

Testing for Iron (outside labs)

- **Local labs** for iron testing (that I know of):
  - Wm. F. Black Soil testing & Analysis: 360-757-6112
  - Edge Analytical: 360-757-1400
  - Exact Scientific Services: 360-733-1205

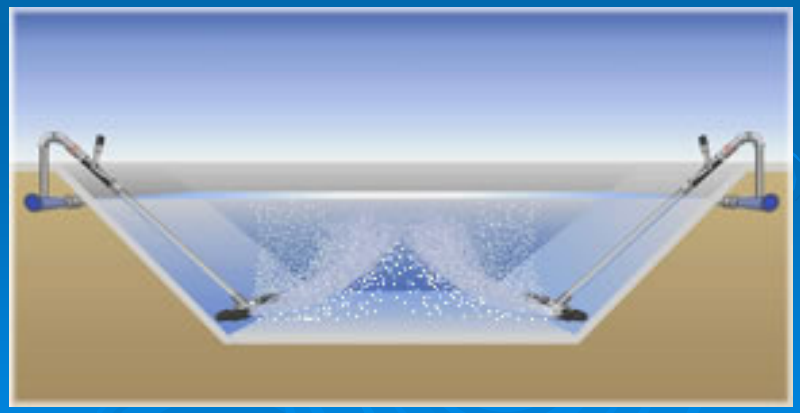
- For a more **complete list** of labs in the Pacific Northwest, see EB1578E “Analytical Laboratories and Consultants serving Agriculture in the Pacific Northwest”, http://wsprs.wsu.edu/AnalyticalLabsEB1578E.pdf

Controlling Iron and Iron Bacteria

- **Oxidize** the ferrous iron, then **Precipitate** and **Filter**
  - Aeration
  - Chlorine
  - Ozone
  - Other oxidizing agents
- Oxidize, then sequester

Aeration

- Oxygen in air used to oxidize
  - Waterfalls
  - Cascading towers
  - Water Spray/pond
  - Venturi devices
- ↑ Air is free, effective. No chemical usage.
- ↓ Takes time for iron to precipitate, so large settling ponds often used



Chlorine

- Commonly used method to manage iron in irrigation water.
- Relatively easy to meter accurately, and easy to monitor appropriate levels.
- Oxidation time depends upon water pH, temperature.

Metering Chlorine

- Add 0.6 ppm Cl for each ppm ferrous iron
  - Liquid sodium hypochlorite solutions are usually 5.25, 10 or 15% chlorine.
  - Chlorine gas is 100% chlorine
- Often, additional chlorine will be needed to oxidize organic compounds, etc in the water.
- Goal is to have about 1 ppm residual free chlorine at the end of the system (emitters furthest from the pump. Use a D.P.D. test.
- Allowed for organic production.

Hazards of Chlorine

- Chlorine gas can be FATAL after a few breaths at 1000 ppm.
- If using chlorine gas, exercise EXTREME CAUTION!
- Liquid hypochlorite + acid = Chlorine gas, so do NOT mix chlorine and acid solutions! Always inject chlorine before filters, and inject acid after filters.

Is Chlorine bad for my plants?

- Some plants, particularly woody perennials such as blueberries, are sensitive to chloride.
- Irrigation water with <105 ppm Chloride is generally thought to be unlikely to cause toxicity.
- Using the 0.6 ppm Cl / 1 ppm Fe rule, treat water with 15 ppm soluble iron with 9 ppm

Is Chlorine bad for my plants?

- It is smart to look at other sources of chlorine, though.
  - Irrigation water.
  - Some fertilizers have high amounts of chlorine – check with your fertilizer dealer
  - Consider checking Cl^- in your soil
    - check soil EC
    - Include Cl^- in your soil test
    - Soil salinity analysis

Ozone

- Often injected with venturi devices
- Commonly used in Aquariums, Water Treatment plants
- ↑ Very rapid oxidation, no residual chemicals
- ↓ Many systems lack effective metering ability, no residual activity

Other oxidizing agents

- Other oxidizing agents
  - Chlorine dioxide (very rapid oxidization)
  - Hydrogen Peroxide
  - Peracetic acid (ex: LineBlaster)

- Sequestration agents – bind iron so that it won't precipitate in the system
  - Polyphosphates
  - Phosphonic acid (ex: CH20's Sure Flow DS)
  - Sodium silicate

Don’t forget maintenance!

- Flush lines regularly
  - Start by flushing once a month.
  - If it takes more than 5 sec for the line most distant from the pump to run clear, you need to flush more frequently
- Backflush filters frequently
- Check Pressures and flows regularly
- Consider an Irrigation System Evaluation

Want more info?

- http://mtvernon.wsu.edu/Small_Fruit_Hort/SFberrylinks.html

Thank You!

- Funding
  - Washington Red Raspberry Commission
  - Washington Blueberry Commission
  - Washington Strawberry Commission
  - Washington State Commission on Pesticide Registration