Troubleshooting Drip/Micro For Avocados

Stuart Styles
itrc.org

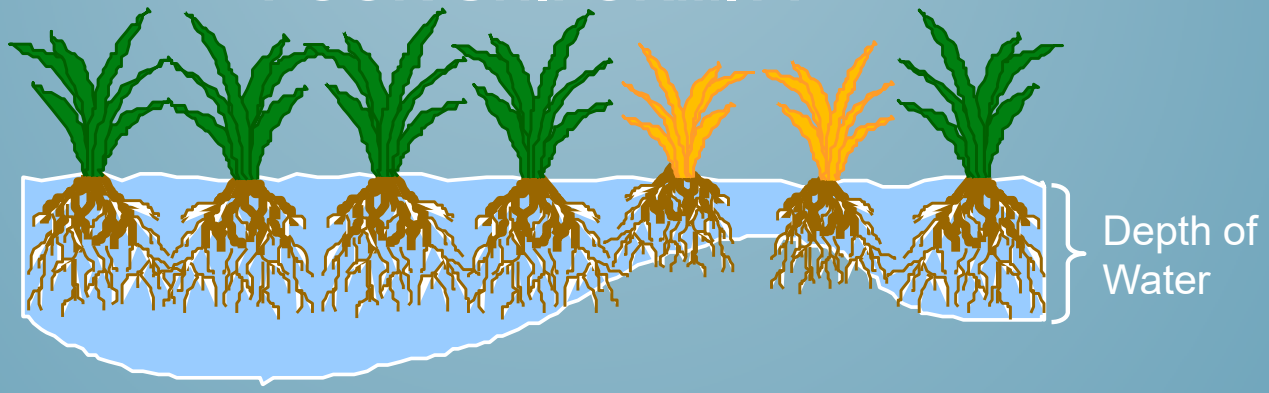
SUMMARY

1. *Irrigation Performance Assessment*
2. *Preventative Maintenance for Drip*
3. *Water Quality/Salinity Issues*
4. *Fertigation*

Uniformity of the Irrigation System

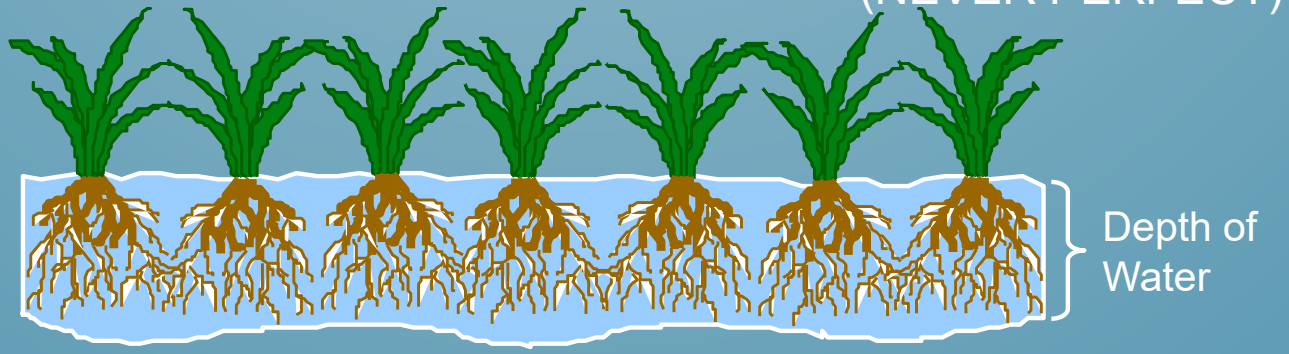
How evenly is water applied to individual plants throughout the field?

POOR UNIFORMITY



GOOD UNIFORMITY

(NEVER PERFECT)



Uniformity of the Irrigation System

By the way – where do you

- *Put soil moisture sensors?*
- *Measure fertility/take leaf samples?*

ET/Weather Stations

- Need at least one full station
- Need additional precipitation and temperature stations
- Current Companies (not complete):

Climate Minder: www.climateminder.com

Ranch Systems: http://www.ranchsystems.com/ssite/index.shtml

PureSense: http://www.puresense.com/ (Now, owned by Jain)

GroPoint: http://www.esica.com/products_gropoint_wireless.php

Hortau: http://www.hortau.com/en/home/

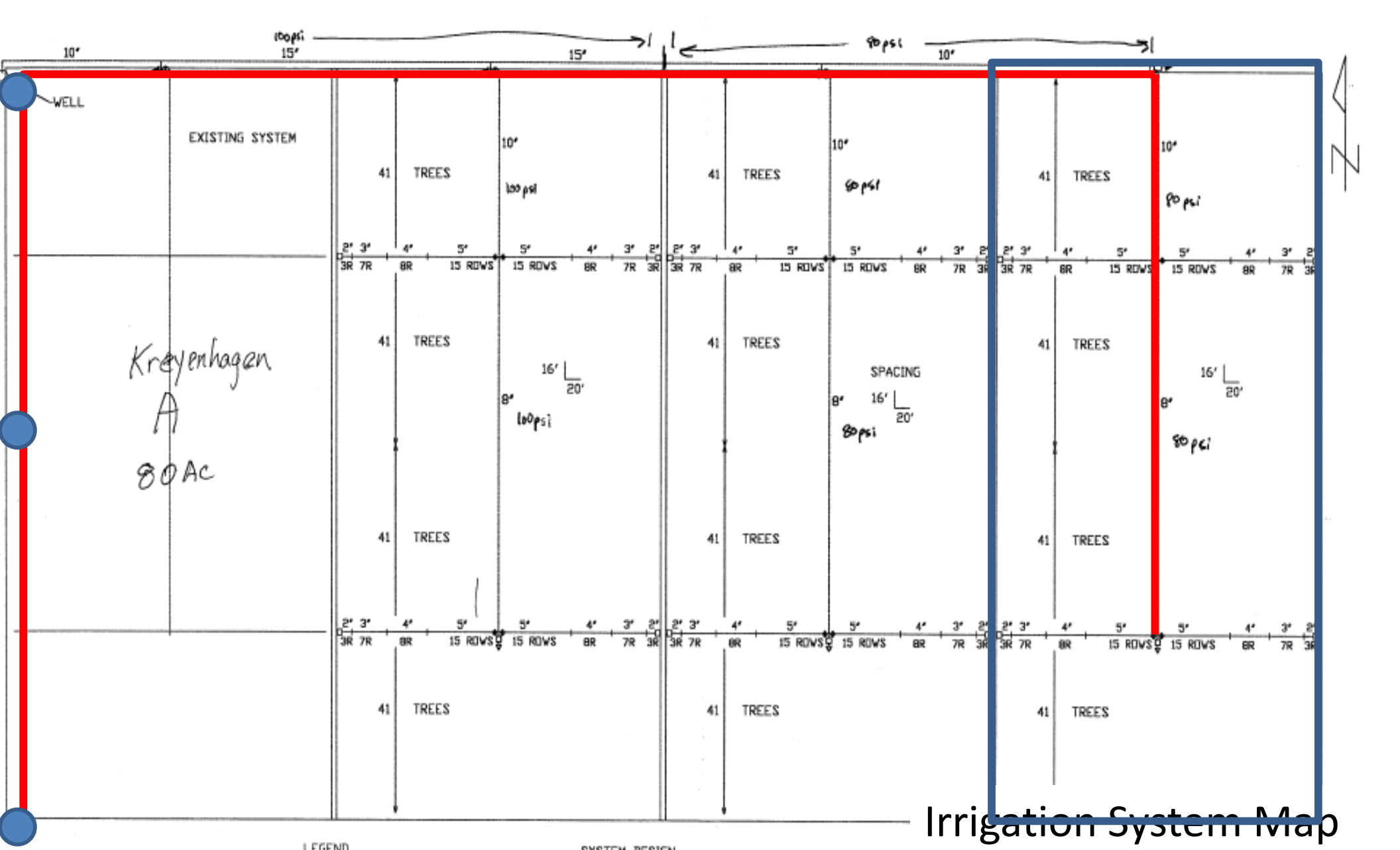
Adcon: http://www.mccrometer.com/products/product_mccrometerconnect.asp

ITRC

Irrigation System Evaluations Example

Nichols Farms

Johnny Starling/Joe Perez



Irrigation System Map

LEGEND

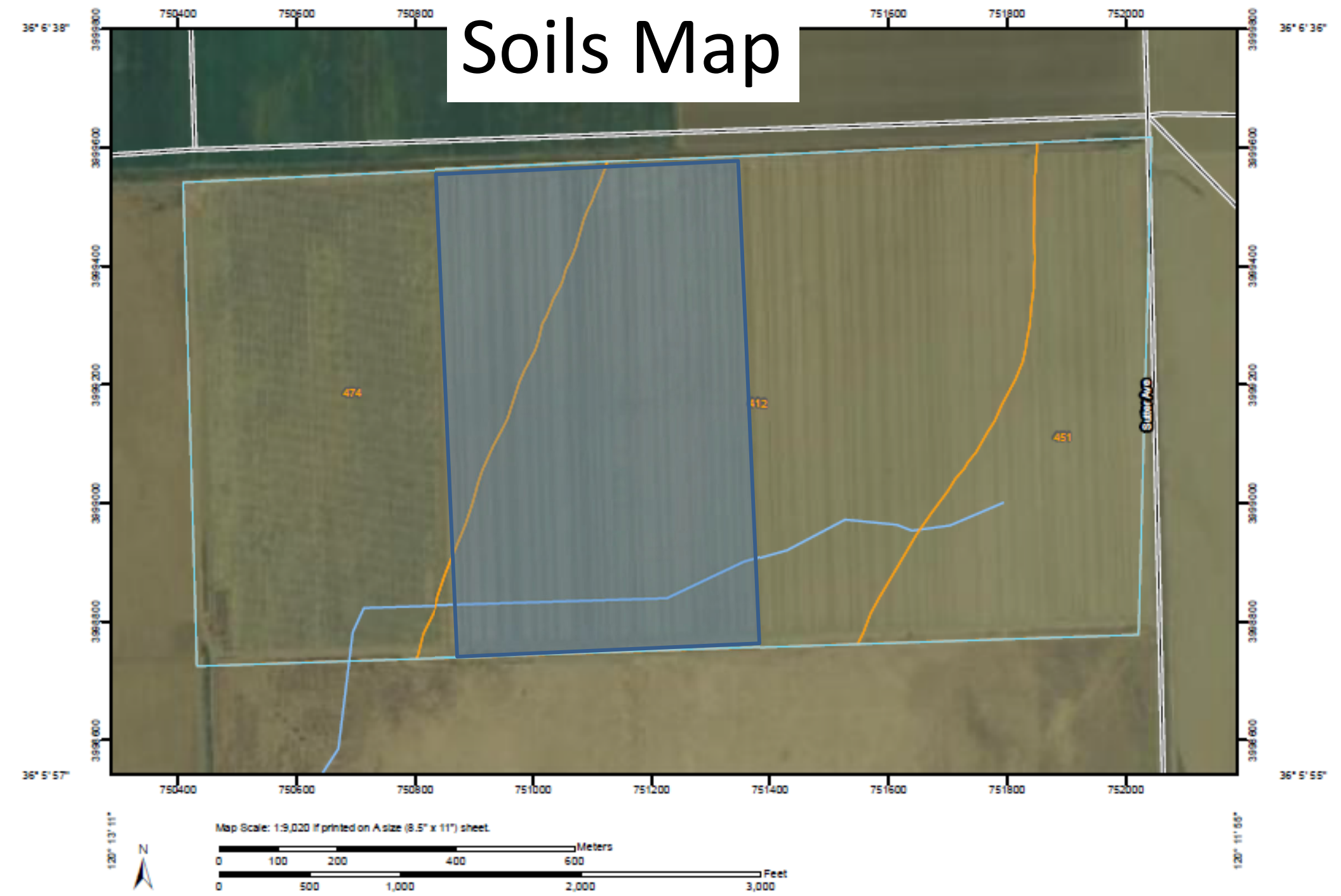
- △ AIR VENT
- □ FLUSHOUT
- ▲ C. A. AIR VENT
- ● CONTROL VALVE
- ○ BLOCK VALVE
- ← TUBING DIRECTION

SYSTEM DESIGN
TREE SPACING 16' X 20'
6 GPH PER TREE
APPLICATION RATE = .03"/HR
24 HR APPLICATION= .72" GROSS
80 ACRE WATER REQUIREMENT = 1138 GPM
PRESSURE REQUIRED = 66 PSI

3/8 mile	100psi	15"	1/8 mile	80psi	15"
1/8 mile	100 psi	10"	5/8 mile	80psi	10"
1/4 mile	100 psi	8"	4/8 mile	80 psi	8"

SELMA (559) 896-0200	BENNETT & BENNETT IRRIGATION SYSTEMS	ARMONA (559) 582-9336
SCALE 1"=340'	DRIP IRRIGATION SYSTEM	DRAWN BY JST
DATE 12/03		DRAWING # 3038
KREYENHAGEN DEVELOPMENT		

Soils Map


36° 6' 38"
36° 6' 36"
36° 5' 57"
36° 5' 55"
750400
750600
750800
751000
751200
751400
751600
751800
752000
3996800
3996600
3996400
3996200
3996000
3995800
3995600
474
412
451
Sutter Ave
120° 13' 11"
120° 11' 55"
N
Map Scale: 1:9,020 if printed on A size (8.5" x 11") sheet.
Meters
0
100
200
400
600
Feet
0
500
1,000
2,000
3,000

PC Emitter Evaluated

PC DRIPPER

ON-LINE PRESSURE-COMPENSATING, CONTINUOUSLY SELF-CLEANING DRIPPER

TECHNICAL INFORMATION

- Recommended filtration: 130 micron / 120 mesh.
  Filtration meth… ber.
  Wherever sand… er
  When sand/sil… s instructions.
- TurboNet™ lat…
- To be "inserted…
- Injected dripper, very low CV.
- UV resistant. Resistant to standard nutrients used in agricultural.
- PC on-line drippers meet ISO 9261 Standards with production certified by the Israel Standards Institute (SII).

Minimum pressure 7psi

DRIPPERS TECHNICAL DATA

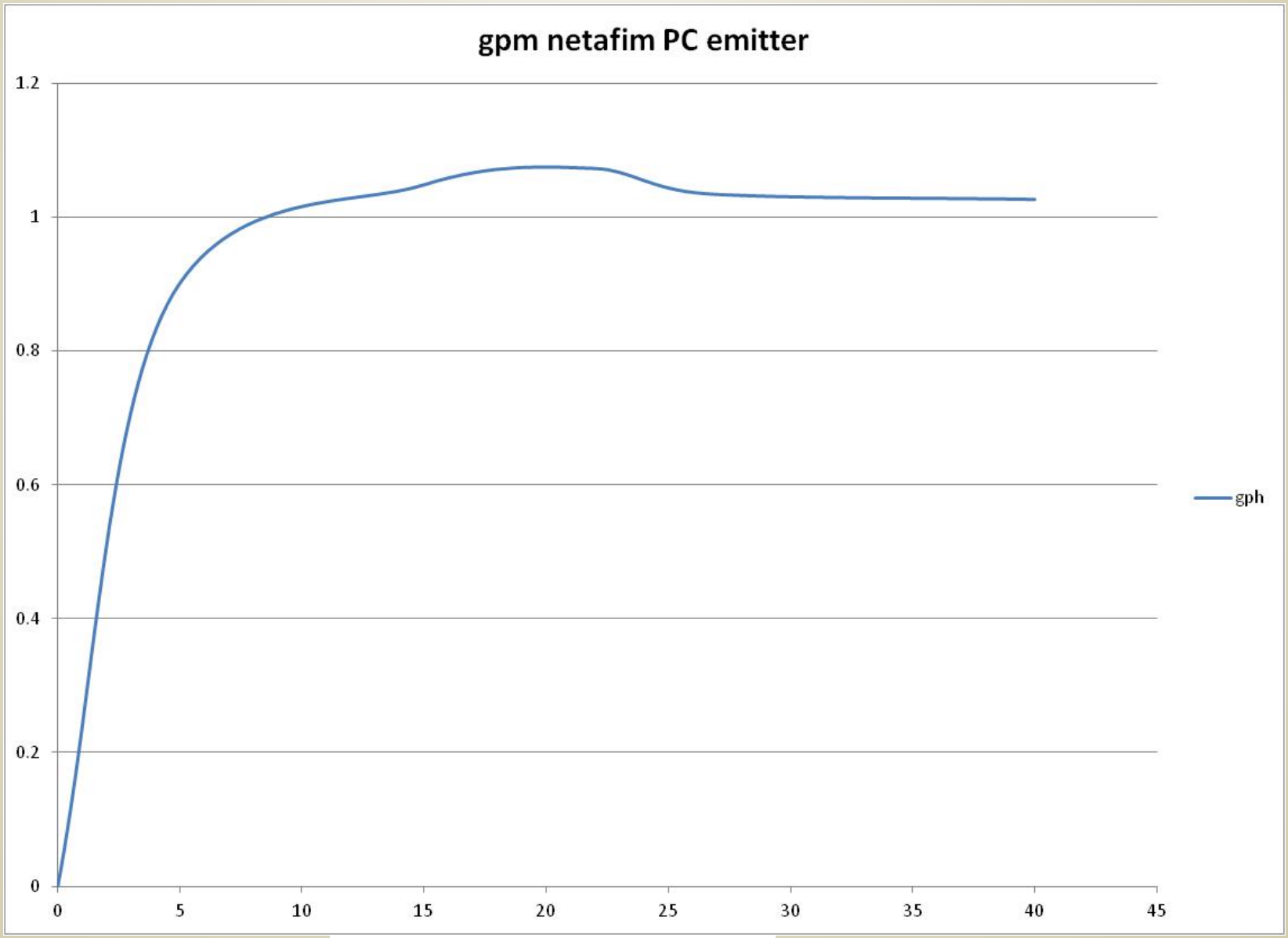
PC drippers

FLOW RATE (L/H)	WORKING PRESSURE RANGE (BAR)	WATER PASSAGES DIMENSIONS WIDTH-DEPTH-LENGTH (MM)	FILTRATION AREA (MM²)	CONSTANT K	EXPONENT* X	BASE CODE COLOR	CAP COLOR CODE
2.0	0.5 – 4.0	1.17 x 1.07 x 61	2.0	2.0	0	Red	Black
4.0	0.5 – 4.0	1.32 x 1.40 x 60	2.0	4.0	0	Black	Black
8.5	0.5 – 4.0	1.60 x 1.60 x 17	2.0	8.5	0	Green	Black

*Within working pressure range

PC Emitter Evaluated

Flow Rate (gph)



Pressure (PSI)

Results Year 1

DRIP/MICRO EVALUATION: RESULTS

GLOBAL SYSTEM DULQ 0.79

(Low Quarter Infiltrated / Average Infiltrated)

DISTRIBUTION UNIFORMITY PROBLEMS -

PERCENT OF TOTAL NON-UNIFORMITY DUE TO EACH PROBLEM:

Pressure differences 53%

Difference between manifold inlet pressures: 1 psi

Difference between hose inlet pressures: 2 psi

Maximum pressure difference within a hose: 13 psi

Other causes of flow variation 47%

Results – Year 2

DRIP/MICRO EVALUATION: RESULTS

GLOBAL SYSTEM DULQ 0.90
(Low Quarter Infiltrated / Average Infiltrated)

DISTRIBUTION UNIFORMITY PROBLEMS -
PERCENT OF TOTAL NON-UNIFORMITY DUE TO EACH PROBLEM:

Pressure differences 26%

Difference between hose inlet pressures: 17 psi
Maximum pressure difference within a hose: 20 psi

Other causes of flow variation 73%

Unequal Drainage 1%

Results – Year 3

DRIP/MICRO EVALUATION: RESULTS

GLOBAL SYSTEM DULQ 0.98
(Low Quarter Infiltrated / Average Infiltrated)

DISTRIBUTION UNIFORMITY PROBLEMS -
PERCENT OF TOTAL NON-UNIFORMITY DUE TO EACH PROBLEM:

Pressure differences 16%

Difference between hose inlet pressures across the field: 9 psi
Maximum pressure difference within a hose: 13 psi

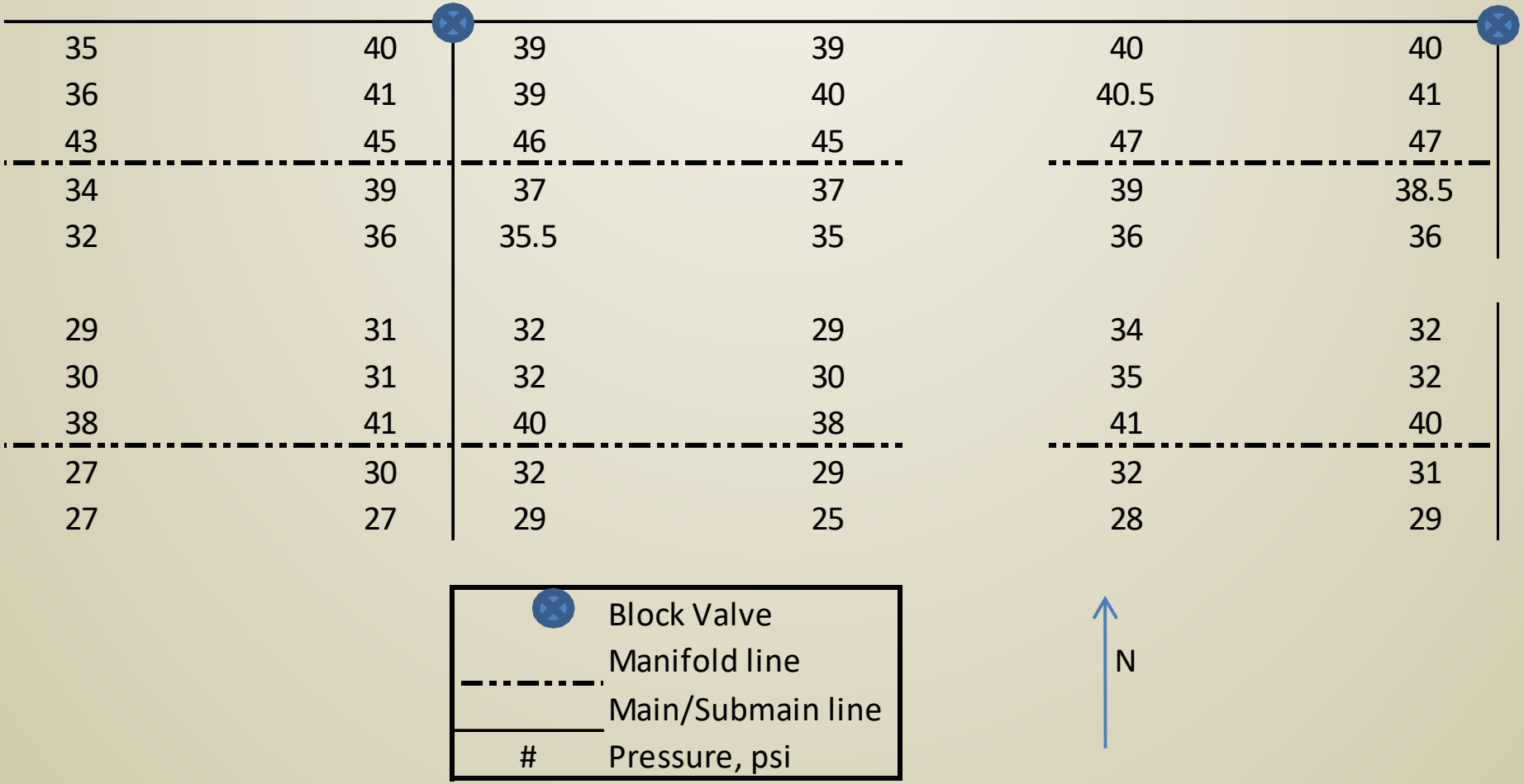
Other causes of flow variation 84%

Unequal Spacing 0%

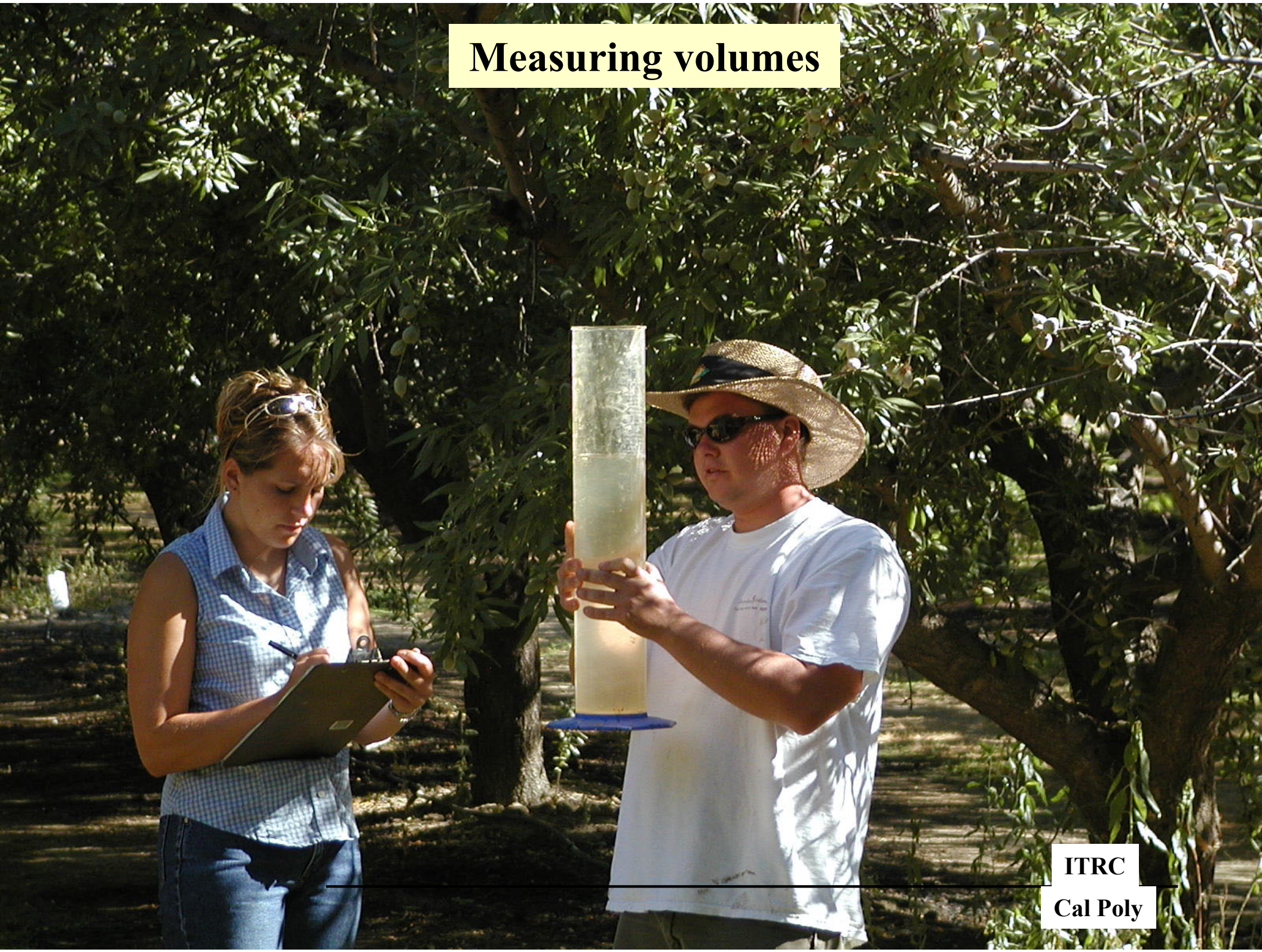
Unequal Drainage 0%

Pressure Distribution

Pressure (psi) Differences along Laterals



Measuring volumes



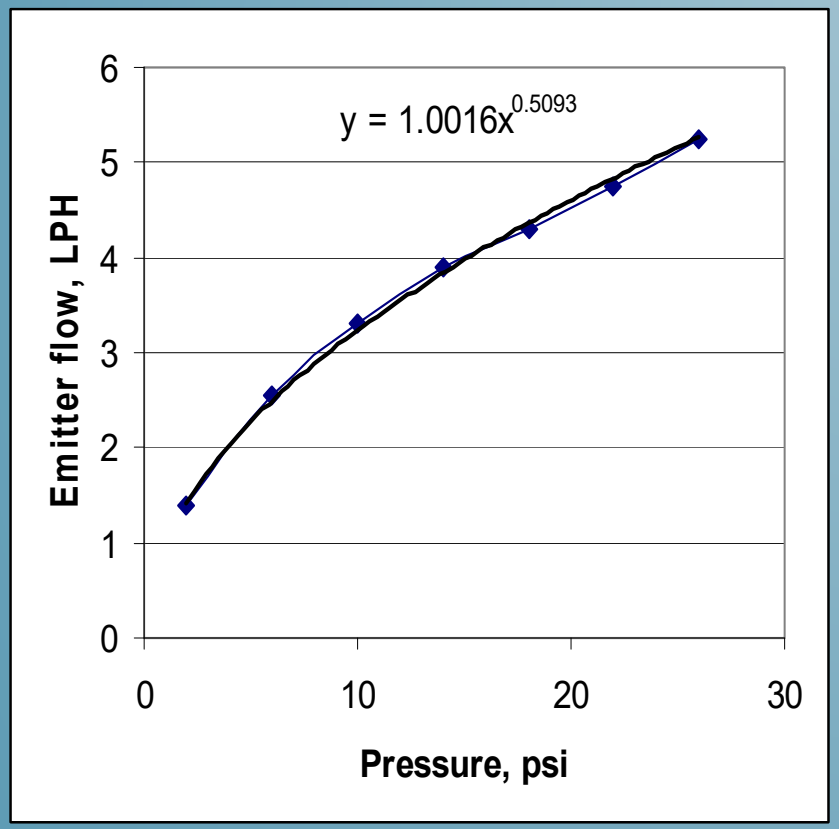
ITRC

Cal Poly

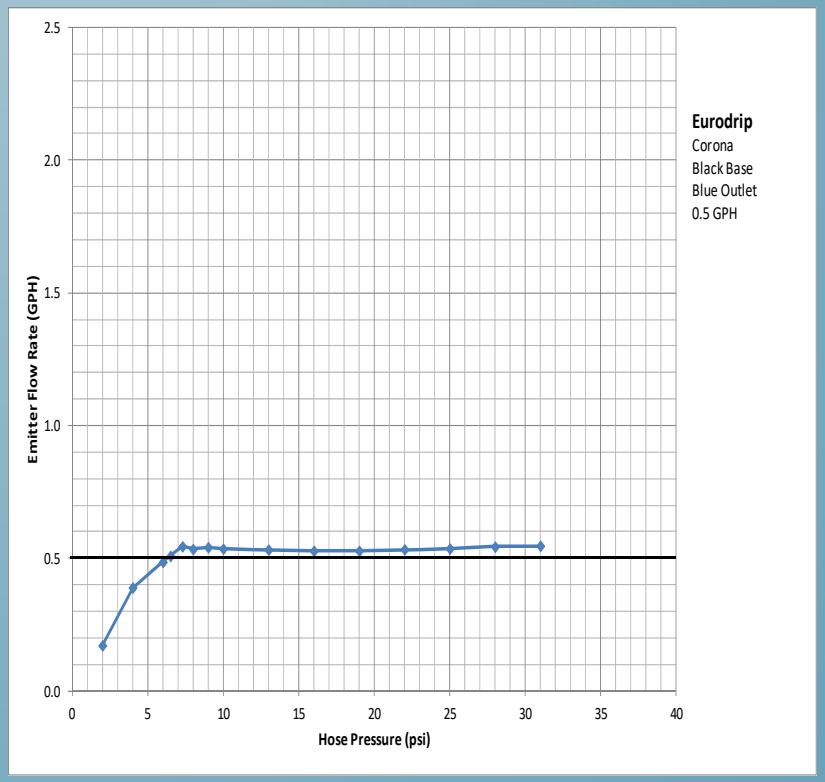
Components

Pressure Differences

Non-PC emitters



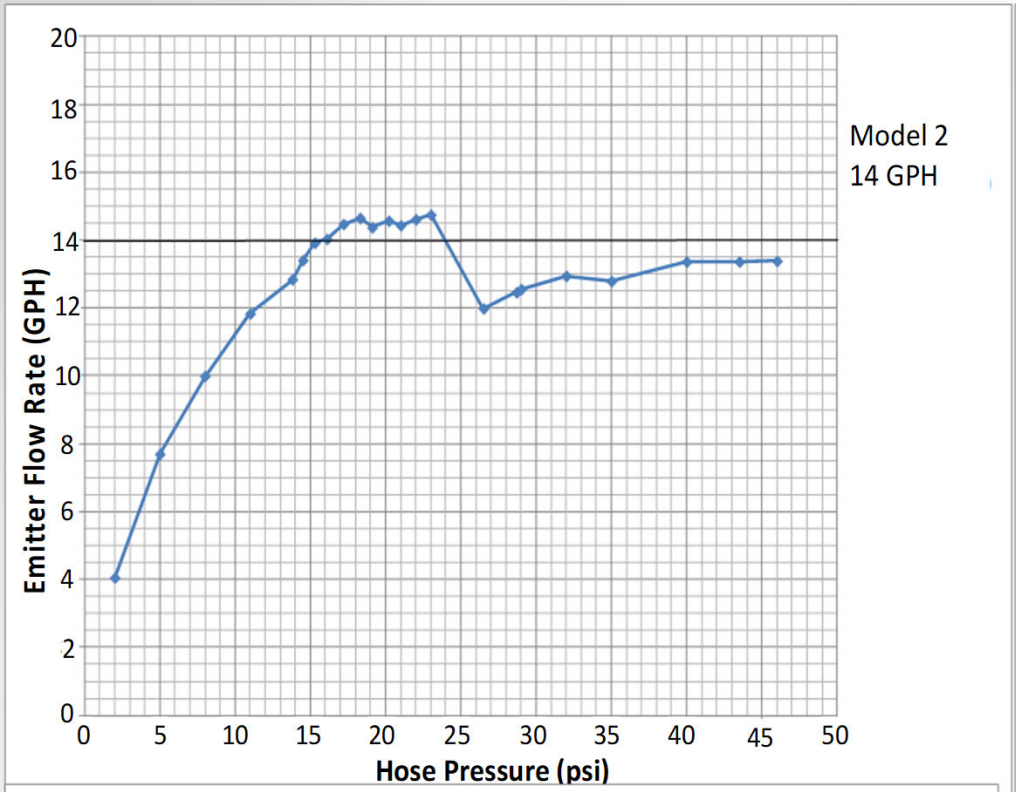
PC emitters

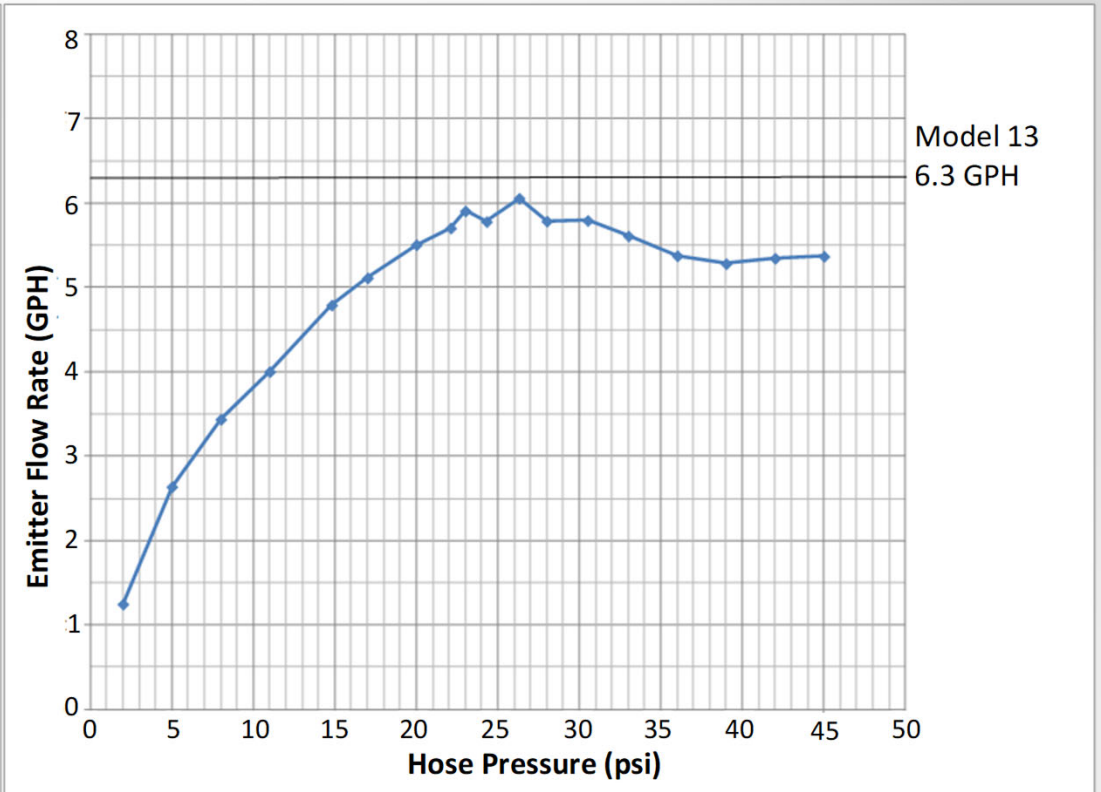


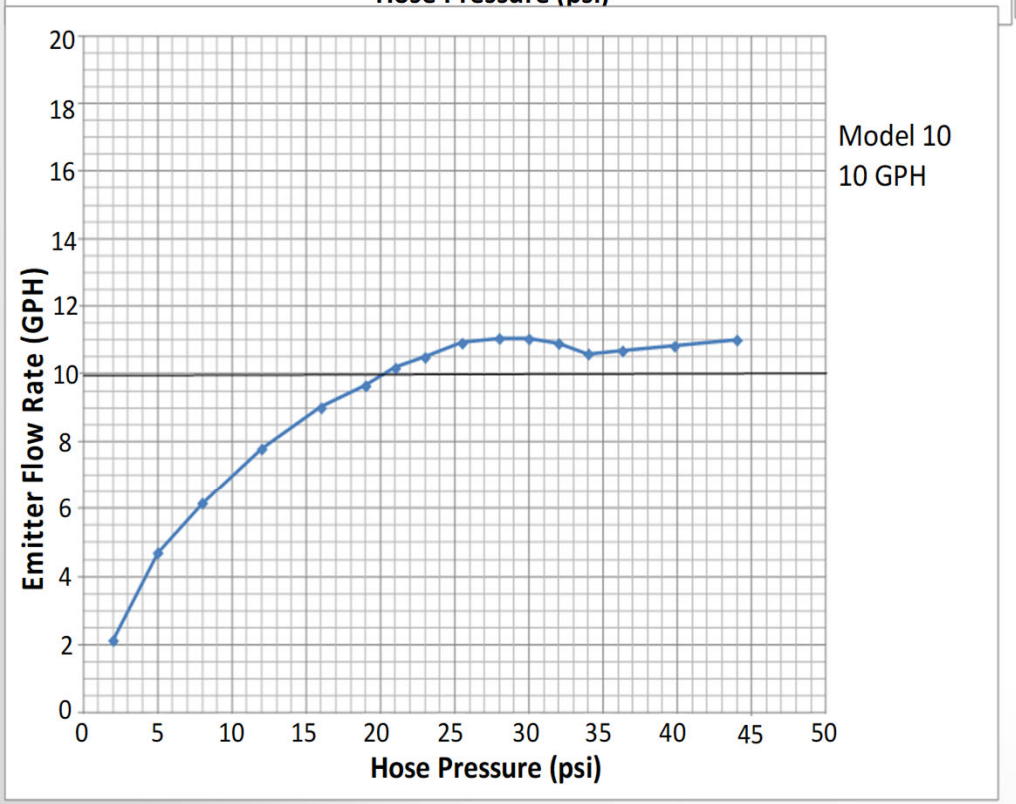
How about PC microsprayers?

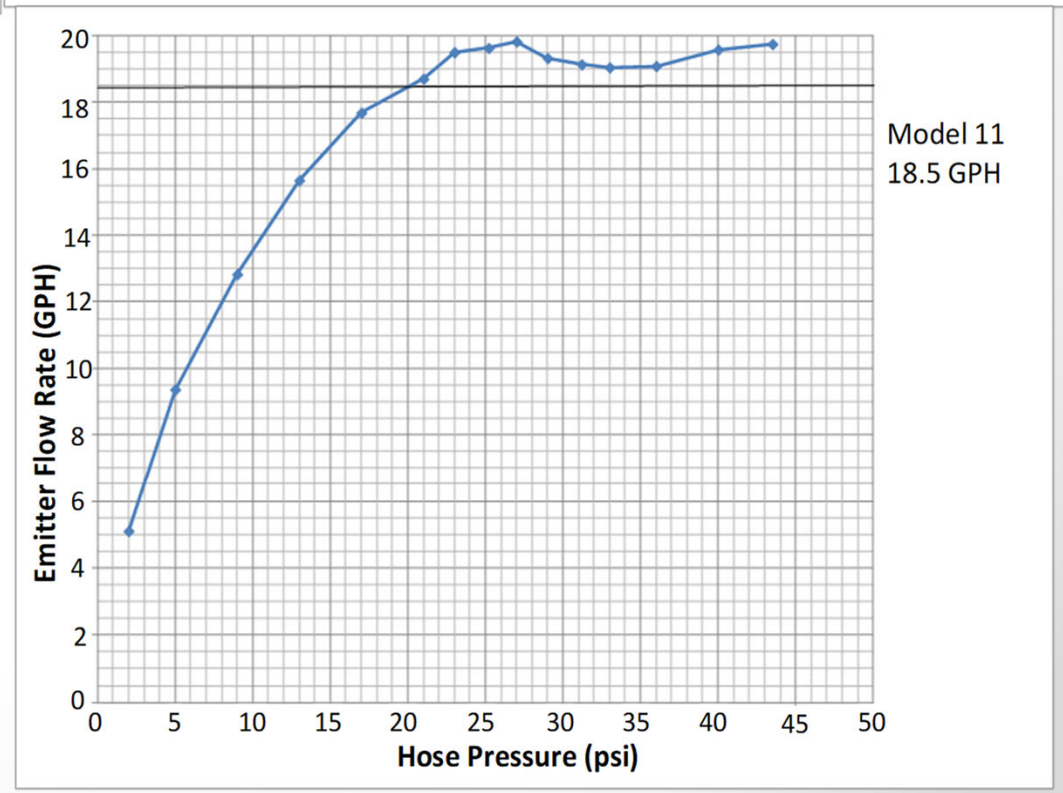
They aren't nearly as good as the low flow PC emitters.

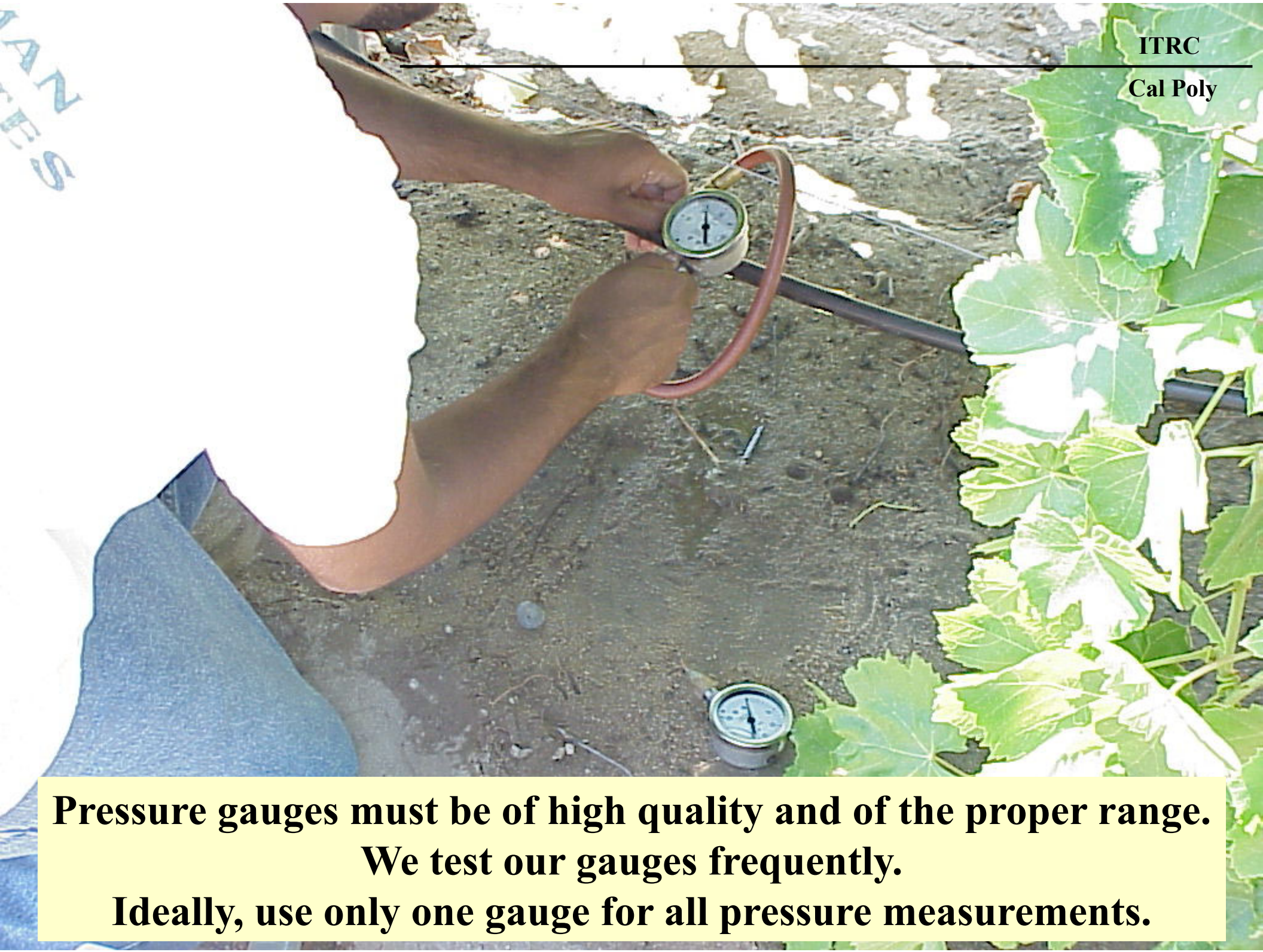
- High pressure requirements.
- Varying flows with pressure changes.
- Often the flow isn't the published – ***nominal*** - flow.


Model 2
14 GPH
Emitter Flow Rate (GPH)
Hose Pressure (psi)
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
30
35
40
45
50


Model 13
6.3 GPH
Emitter Flow Rate (GPH)
Hose Pressure (psi)
0
1
2
3
4
5
6
7
8
0
5
10
15
20
25
30
35
40
45
50


Model 10
10 GPH
Emitter Flow Rate (GPH)
Hose Pressure (psi)
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
30
35
40
45
50

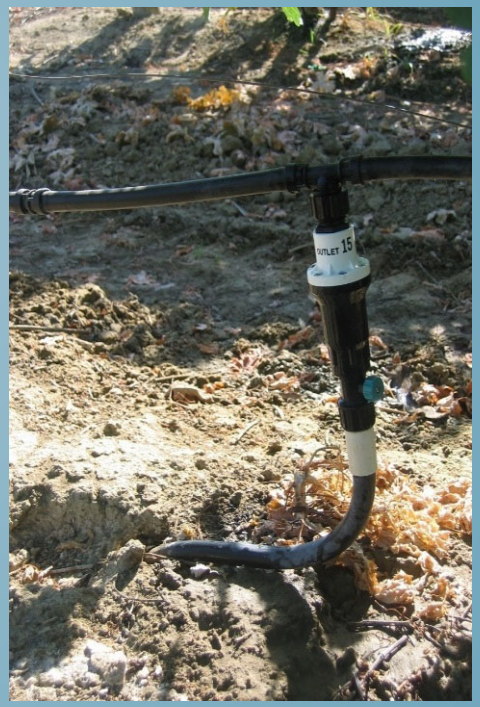

Model 11
18.5 GPH
Emitter Flow Rate (GPH)
Hose Pressure (psi)
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
30
35
40
45
50



Pressure gauges must be of high quality and of the proper range.
We test our gauges frequently.
Ideally, use only one gauge for all pressure measurements.

Solutions to Pressure Differences

- *Down a hose – Too late*
- *Between hoses*
  - *Pre-set pressure regulators*
  - *Remove hose screen washers*
- *Between blocks*
  - *Adjust pressure regulators*
  - *Install pressure regulators*



Preventative Maintenance

Preventative

#1 - FLUSH HOSES REGULARLY

Flushing minimizes the amount of chemical needed.

#2 - Chemical Injection

- *Dosages*
- *Frequency*
- *Location*
- *Other items*

Chemical Injection (Plugging)

Dosages

Avoid very large dosages – such as pulling up a trailer and dumping in 3 months of fertilizer - there can be plugging problems.

Chemical Injection

Frequency

- *At least once/week allows you to match demands.*
- *Proportional and continuous are nice, but sometimes become complicated.*

Plugging Prevention

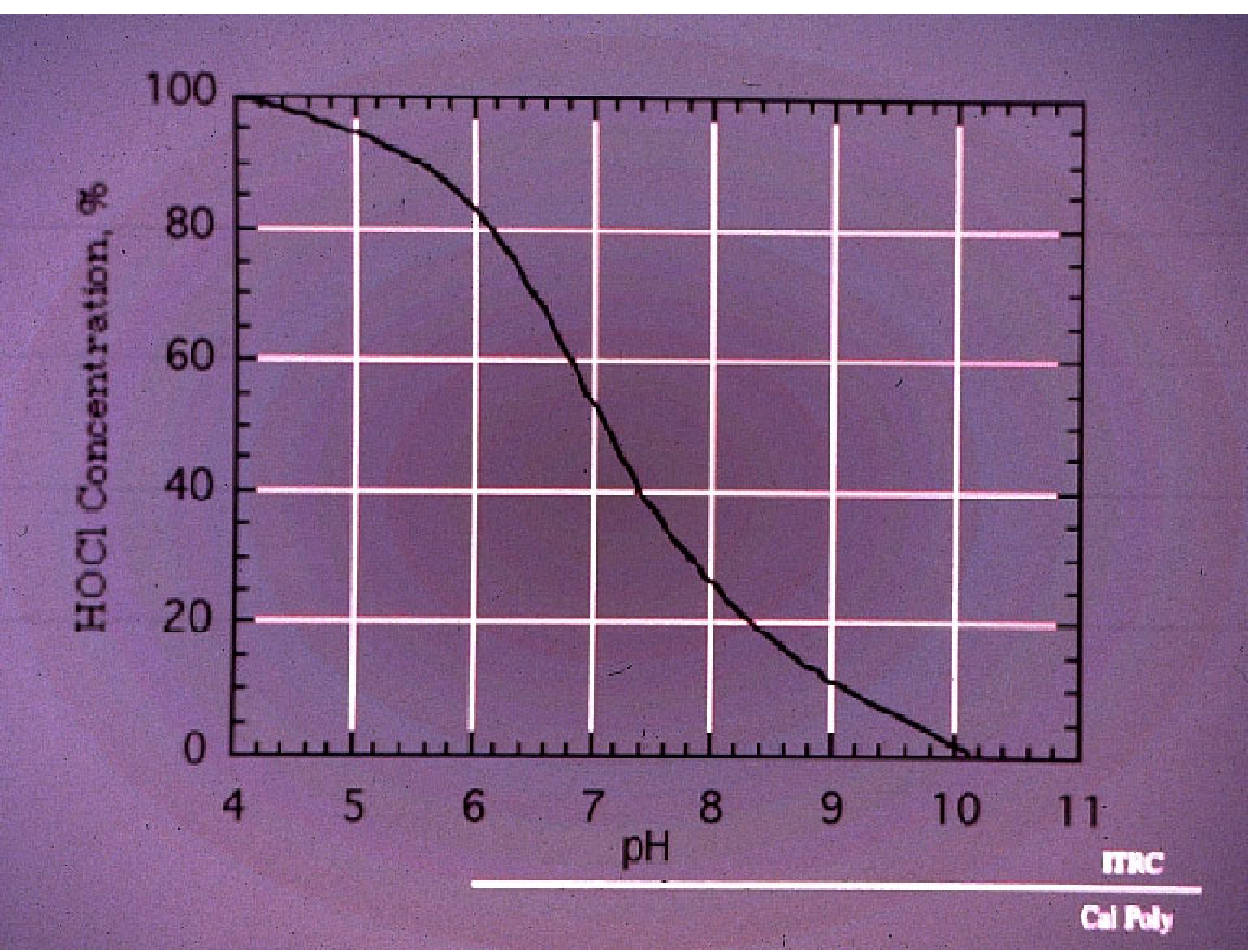
- *Chemicals*
  - *Chlorine (PLUS acid)*
  - *Various Polymers*
    - *For organics?*
    - *For iron, manganese?*
  - *Aeration*
  - *SO_2*
  - *Magnets????*
  - *Magic?????*

How often should chlorine be injected?

- As often as necessary.
  - In other words, it depends on the water quality. In some systems chlorine must be injected continuously. In other systems, once a week is fine.
  - *Check the ends of hoses to see if the maintenance program is fine.*

Chlorine

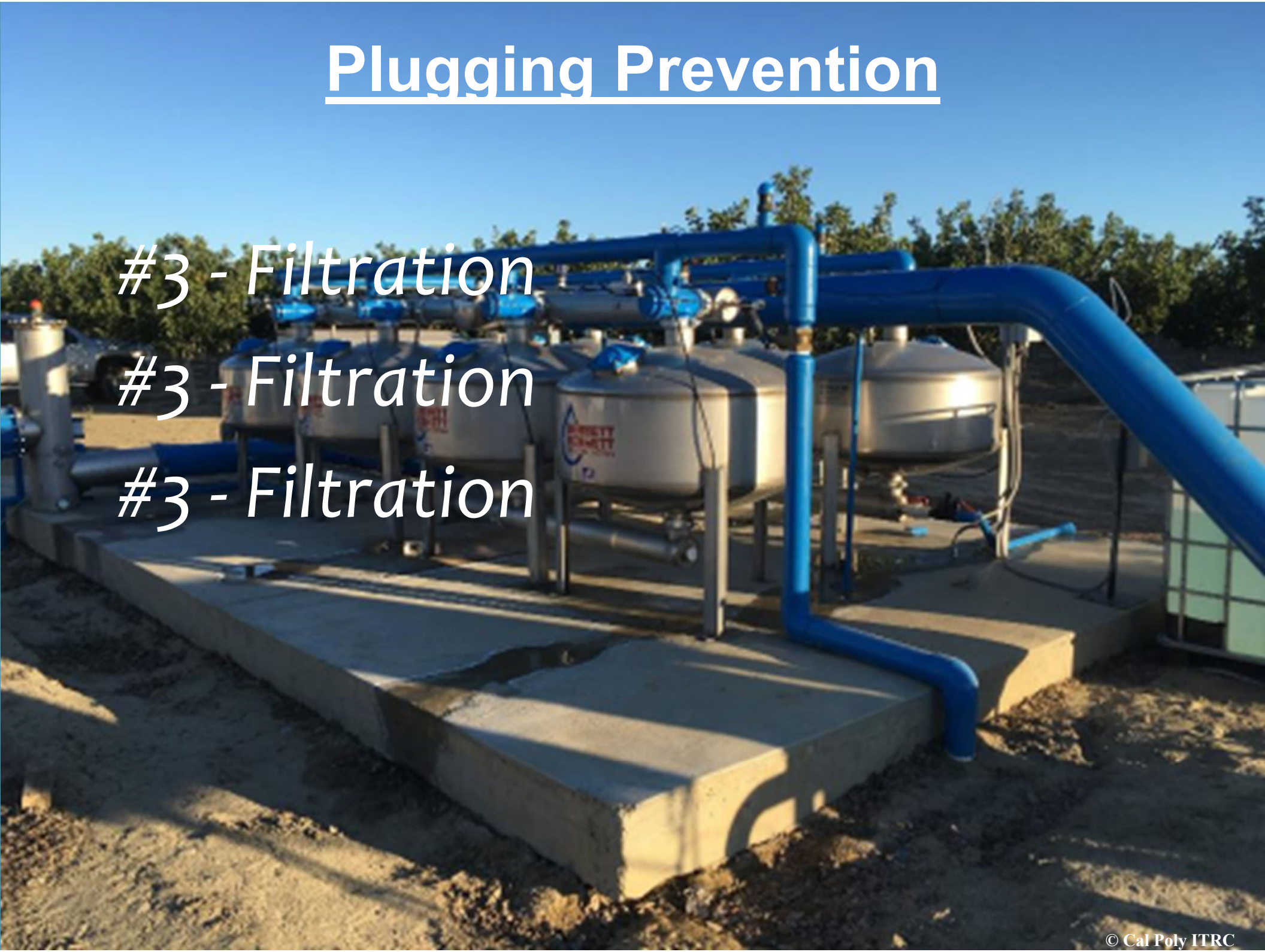
- 0.5 - 5 ppm
  - Bactericide
  - Oxidizer of iron
- 100 - 1000 ppm
  - Oxidizes organic materials
  - Kills plants

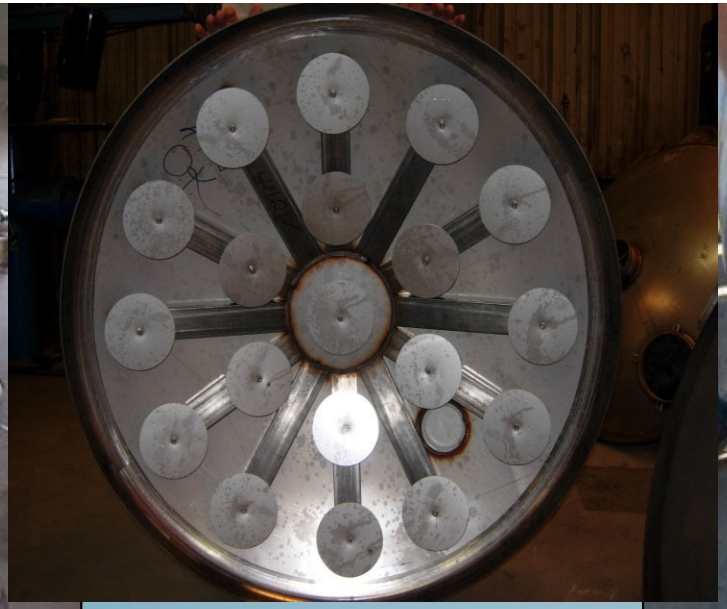

HOCl Concentration, %
100
80
60
40
20
0
4
5
6
7
8
9
10
11
pH
ITRC
Cal Poly

Lowering pH

Sulphuric Acid

Plugging Prevention





Media filter underdrains

<u>Good underdrain</u>: Little media goes out during large flow backflush.

Table 9. Characteristics of the media filter tanks

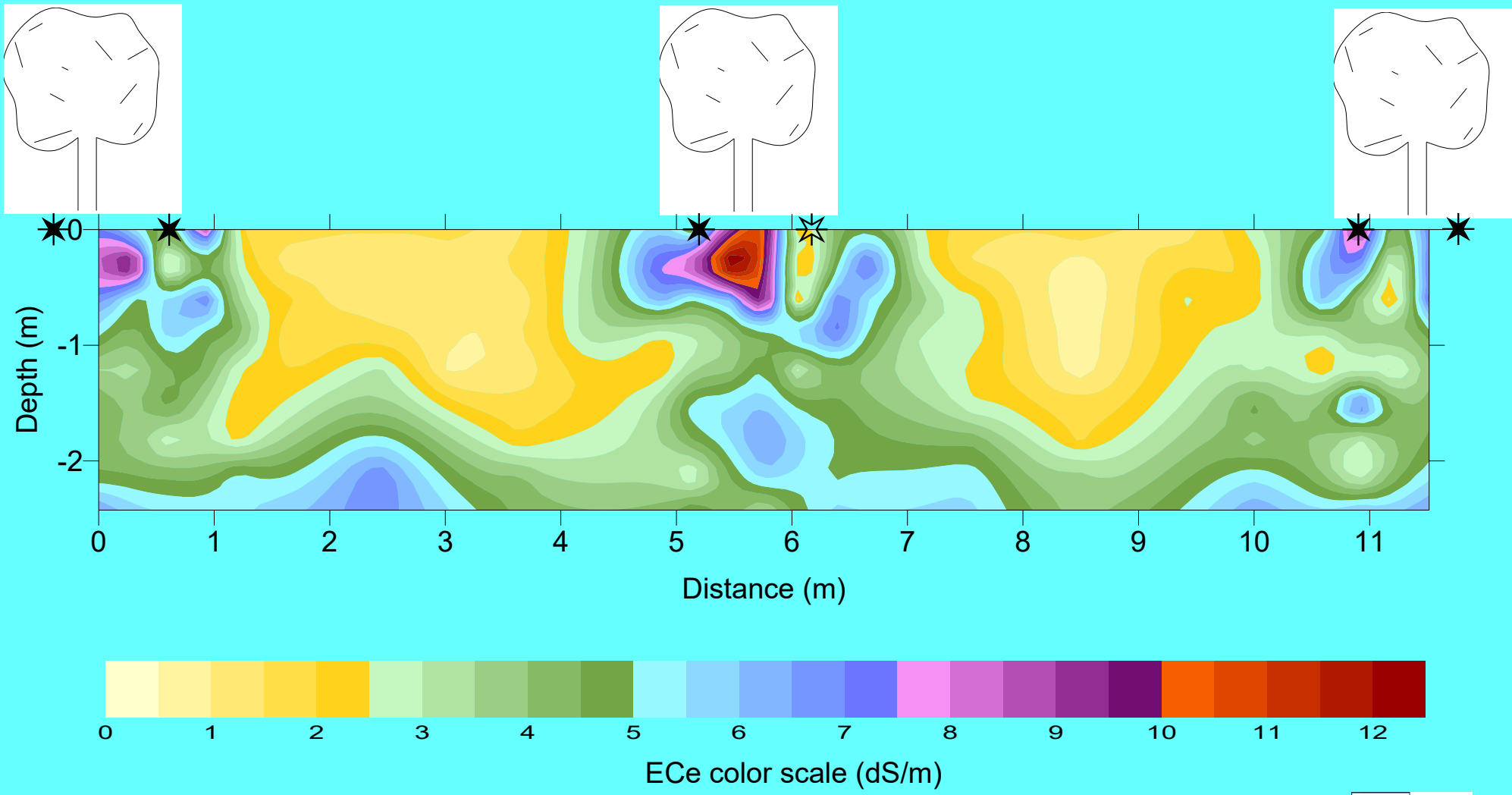
Feature	Characteristic	Measured Values for Different Tanks						Relative Importance*
		Arkal	Flow-Guard	Lakos	Lakos New	Waterman Wand	Waterman Dome	
Valve	Friction during filtration with #16 silica media @250 GPM, psi	2.3	0.8	0.9		2.2	2.1	2.5
	Friction during backflush with #16 silica media @200 GPM, psi	5.0	3.0	2.8		11.5	11.5	5
	Pressure required to open, psi	13.0	5.0	6.0		5.0	6.0	5
	Valve closure time at 22-25 psi, sec.	13.0	7.0	9.0		4.0	5.0	6
System	Total friction loss during filtration @250 GPM when clean	4.3	2.2	2.5			3.6	3
	Total friction loss during filtration @200 GPM when clean	6.0	3.5	3.0			13.0	5
Sand Removal	Mass of sand (grams) in 2 minutes @250 GPM	0.2	48.6		18.5	0.0	2.2	10
	Mass of sand (grams) in 2 minutes @200 GPM	0.0	0.7		0.7	0.0	0.1	
Underdrain	Horizontal area (sq. cm.) served by each pod or wand unit	214	613	446		117	214	6
	Coefficient of variation of the horizontal area served per pod/wand unit	0.24	0.14	0.31		0.75	0.17	8
	% of the horizontal area that is covered by pods or wands	9	3	7		32	12	8
	Mean slot width, mm.	0.33	0.23		0.27	0.19	0.29	
	Std. Deviation of slot widths, mm.	0.036	0.029		0.036	0.026	Not meas.	5
	Total slot open area, sq. Cm.	200	184		261	343	108	5
Summary	**Total best ratings**	1	7	5		8	4	
	Total worst ratings	6	3	1		3	4	

*The greater the Relative Importance value, the more important this characteristic is.

Challenges with Water Quality and Salinity

Research - Long term salinity buildup on the West Side of the San Joaquin Valley

DRIP irrigation



ITRC

Impact of Salinity with Different Salts

20 dS/m NaCl

20 dS/m KSO4

10 dS/m NaCl

10 dS/m KSO4

5 dS/m NaCl

5 dS/m KSO4

0 dS/m NaCl added

0 dS/m KSO4 added

Key Point:
Chloride salts are BAD

Reiter Brothers Matthews Ranch Well Water + Amendments – November 19, 2008

General Irrigation Suitability Analysis

Test Description	Result			Graphical Results Presentation				
Cations	mg/L	%	Lbs/AF	Good	Possible Problem	Moderate Problem	Increasing Problem	Severe Problem
Calcium	157	36	430	**				
Magnesium	44	16	120	**				
Potassium	9	1	24	**				
Sodium	238	47	650					
Anions								
Carbonate	< 10	0	0					
Bicarbonate	280	21	760	**				
Sulfate	500	48	1400	**				
Chloride	230	30	630					
Nitrate	< 0.4	0	0					
Fluoride	0.3	0	0.8					
Minor Elements								
Boron	0.60		1.6					
Copper	0.020		0.054					
Iron	0.26		0.71					
Manganese	0.020		0.054					
Zinc	< 0.02		0.00					
Other								
pH	7.2		units					
E. C.	1970		umhos/cm					
SAR	4.3		mg/L					
Crop Suitability								
No Amendments	Poor							
With Amendments	Poor							
Amendments								
Gypsum Requirement	0.4		Tons/AF	Do not apply if Sulfuric Acid amendment is applied.				
Sulfuric Acid (98%)	16		oz/1000Gal	Or 39 oz/1000Gal of urea Sulfuric Acid (15/49).				
Leaching Requirement	16		%					

Micro Irrigation System Plugging Hazard

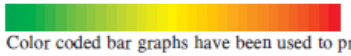
Test Description	Result		Graphical Results Presentation		
			Slight	Moderate	Severe
Chemical					
Manganese	0.02	mg/L			
Iron	0.26	mg/L			
TDS by Summation	1460	mg/L			
No Amendments					
pH	7.2	units			
Alkalinity	230	mg/L			
Total Hardness	573	mg/L			
With Amendments					
Alkalinity	230				
Total Hardness	573	mg/L			
pH	5.4 - 6.7	units			

Good — Problem Indicates physical conditions and/or phenological and amendment requirements.

Note: Color coded bar graphs have been used to provide you with 'AT-A-GLANCE' interpretations.

Avocado Irrigation Suitability Analysis

Test Description	Result				Graphical Results Presentation				
Cations	mg/L	Meq/L	% Meq	Lbs/AF	Good	Possible Problem	Moderate Problem	Increasing Problem	Severe Problem
Calcium	97	4.8	33	260	**				
Magnesium	40	3.3	22	110	**				
Potassium	6	0.15	1	16	**				
Sodium	146	6.4	43	400					
Anions									
Carbonate	< 10	0	0	0					
Bicarbonate	80	1.3	9	220	**				
Sulfate	478	10	68	1300	**				
Chloride	117	3.3	23	320					
Nitrate	1.2	0.019	0	3					
Nitrate Nitrogen	0.3			0.8					
Fluoride	0.7	0.037	0	2					
Minor Elements									
Boron	0.50			1.4					
Copper	0.080			220					
Iron	0.24			650					
Manganese	< 0.01			0.00					
Zinc	0.030			82					
TDS by Summation	966			2600					
Other									
pH	7.5			units					
E. C.	1.38			dS/m					
SAR	3.1								
Crop Suitability									
No Amendments	Fairly		Good						
With Amendments	Fairly		Good						
Amendments									
Gypsum Requirement	0.0			Tons/AF					
Sulfuric Acid (98%)	4.9			oz/1000Gal	Or 12 oz/1000Gal of urea Sulfuric Acid (15/49).				
Leaching Requirement	11			%					

Good  Problem

Note: Color coded bar graphs have been used to provide you with 'AT-A-GLANCE' interpretations.

Kerley

KTS

POTASSIUM THIOSULFATE FERTILIZER SOLUTION

0-0-25-17S

KTS® is a clear, chloride-free solution with the highest potassium and sulfur content available on the market.

Both potassium and sulfur can be supplied in one highly soluble form — KTS.

KTS boosts resistance to environmental stress.

Benefits of introducing KTS into your growing program:

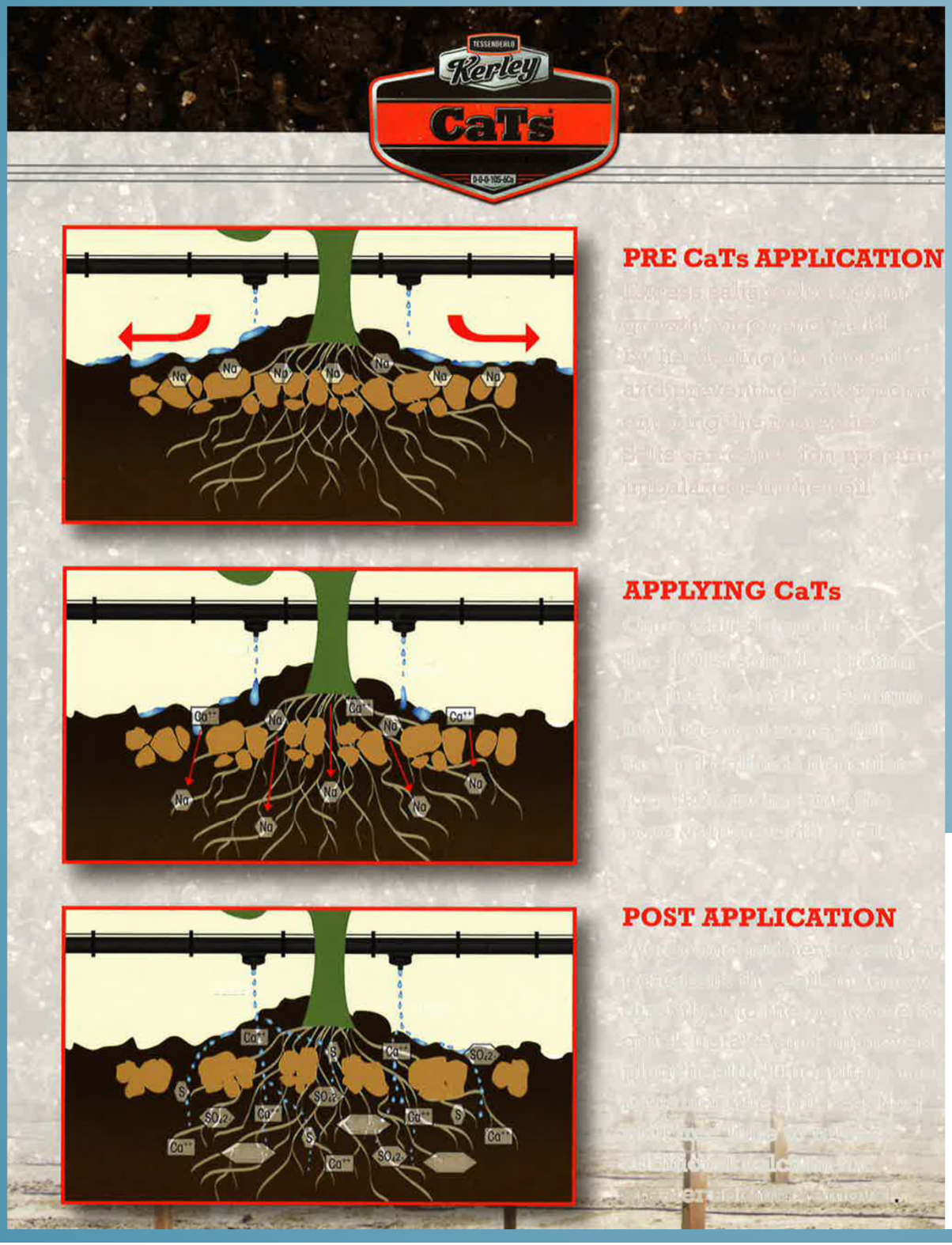
- KTS has proven to be a great addition to N and P starters, because it supplies both potassium and sulfur — nutrients that are often in short supply in cold soils where root growth is limited.
- KTS is an excellent source of potassium for chlorine sensitive crops.
- Sandy soils, where nutrient holding capacity is limited, may benefit from starter fertilizers containing KTS.
- KTS is a foliar fertilizer — an ideal product to supply potassium when crop demand is high.

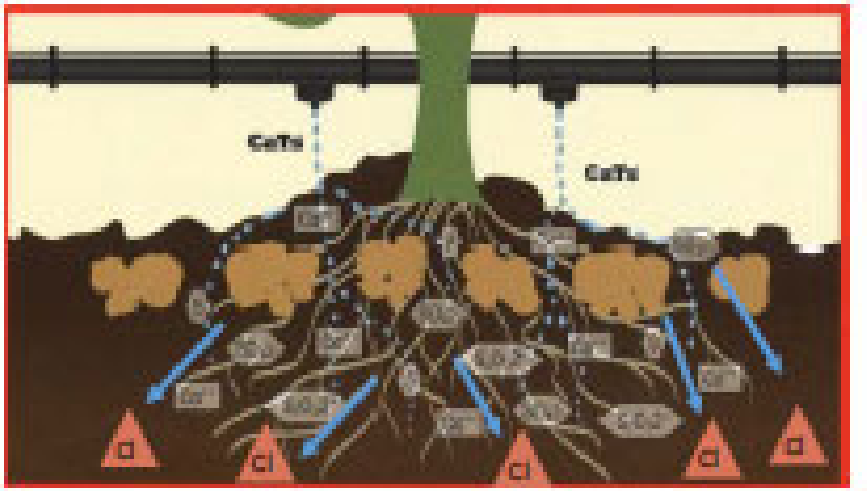
Adding Calcium Thiosulphate

Calcium exchanges with Sodium

Thiosulphate "counters" the negative effect of chlorides

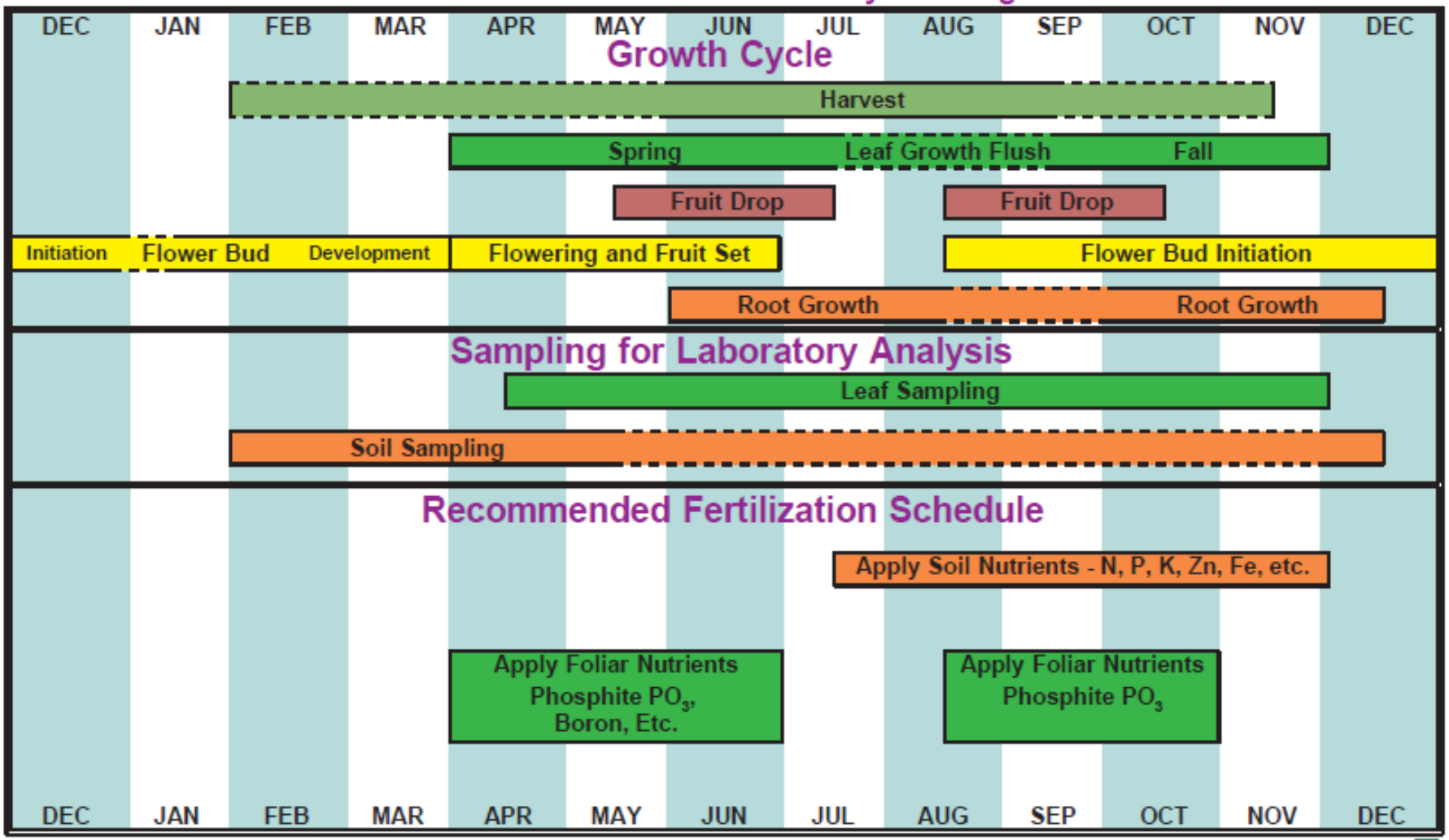
Note: Works well in gypsiverous soils. Will cause pH to drop if soil is low in Calcium





AVOCADO TREES

Ventura and Santa Barbara County Growing Area



— Indicates transition or less intensive periods.

Summary - Basic maintenance ideas for a good irrigation system:

1. Good DU
2. Good filtration and hose flushing.
3. Inject fertilizers upstream of filter.
4. Continuous water treatment for PREVENTION of many problems.
5. Occasional “reclamation” of salts if needed.
6. End of season “winterizing” of system.

End