

Orchard & Nutrient *Irrigation Complications*



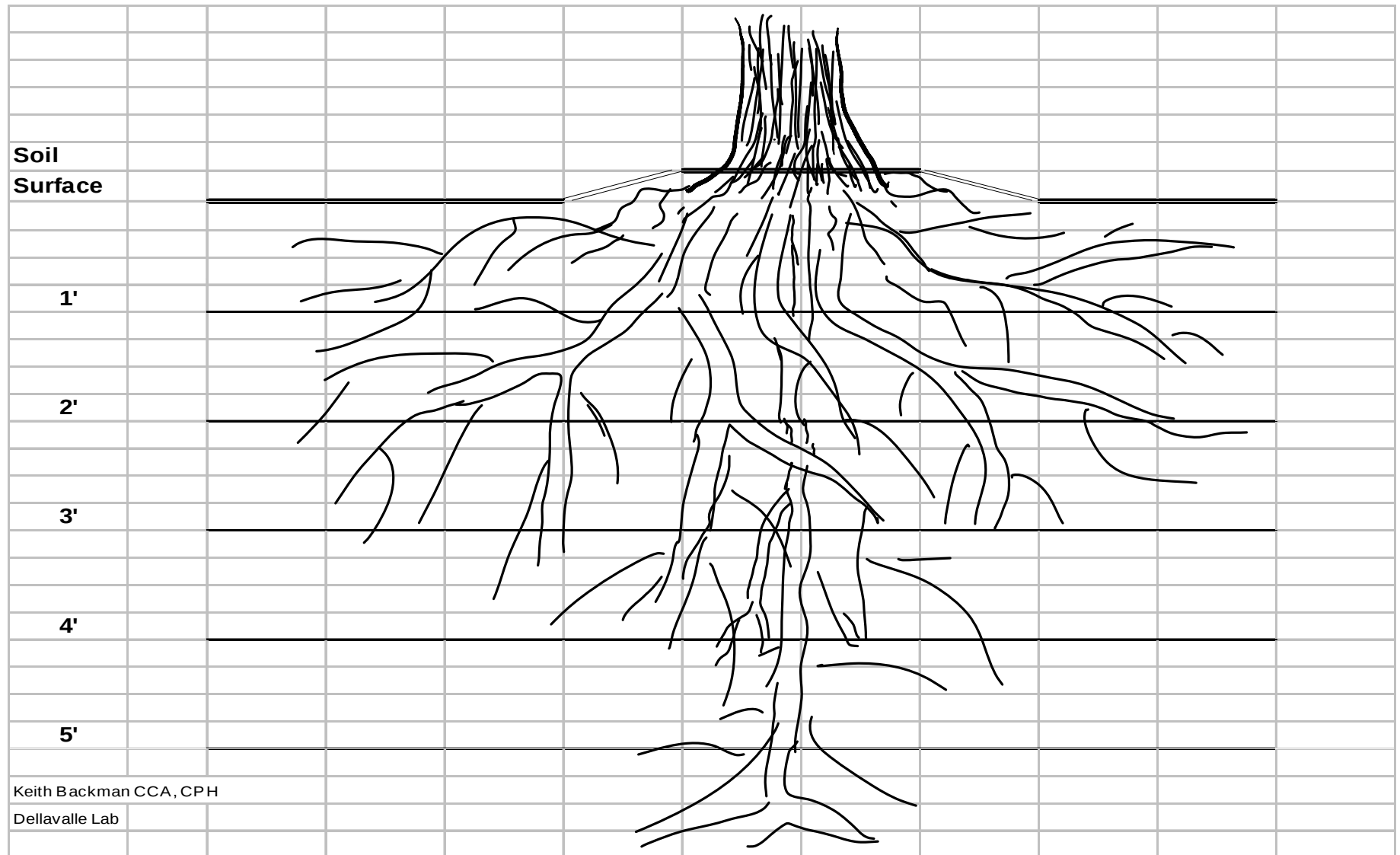
Keith M. Backman _ M.S. Pomology UCD

Certified Professional Horticulturist

Certified Crop Advisor _ California Board Member

Dellavalle Laboratory, Inc. – Consultant Manager

What does an orchard root system *really* want out of life?



Water Condition at Leafout in Spring

Fall Irrigation

Light Winter Rains

Nice !

Surface

1'

2'

3'

4'

5'

winter rain and
dormant irrigation



fall irrigation water



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Irrigation Complications

- Hardpan
- Compaction
- Soil Layering
- Sodium Buildup
- Low Salt Soil
- Low Salt Water
- Water “Recession” & Excess

Late Summer

Soil Interface:

could be: **Hardpan**
Sodium Layer
Textural Change
Timing?!

Surface

1'

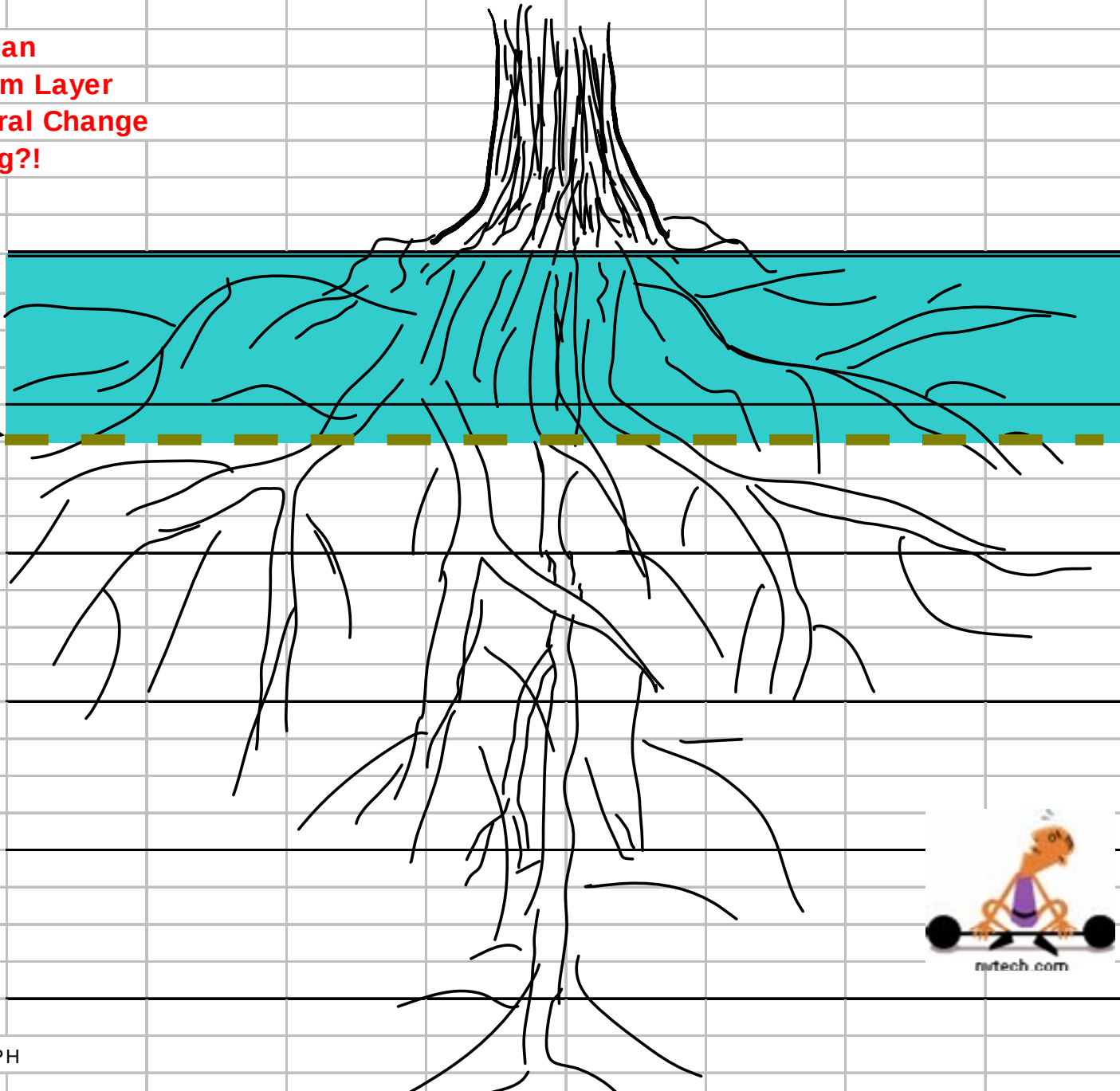
Barrier

2'

3'

4'

5'



What Lies Beneath?



Consider The Soil

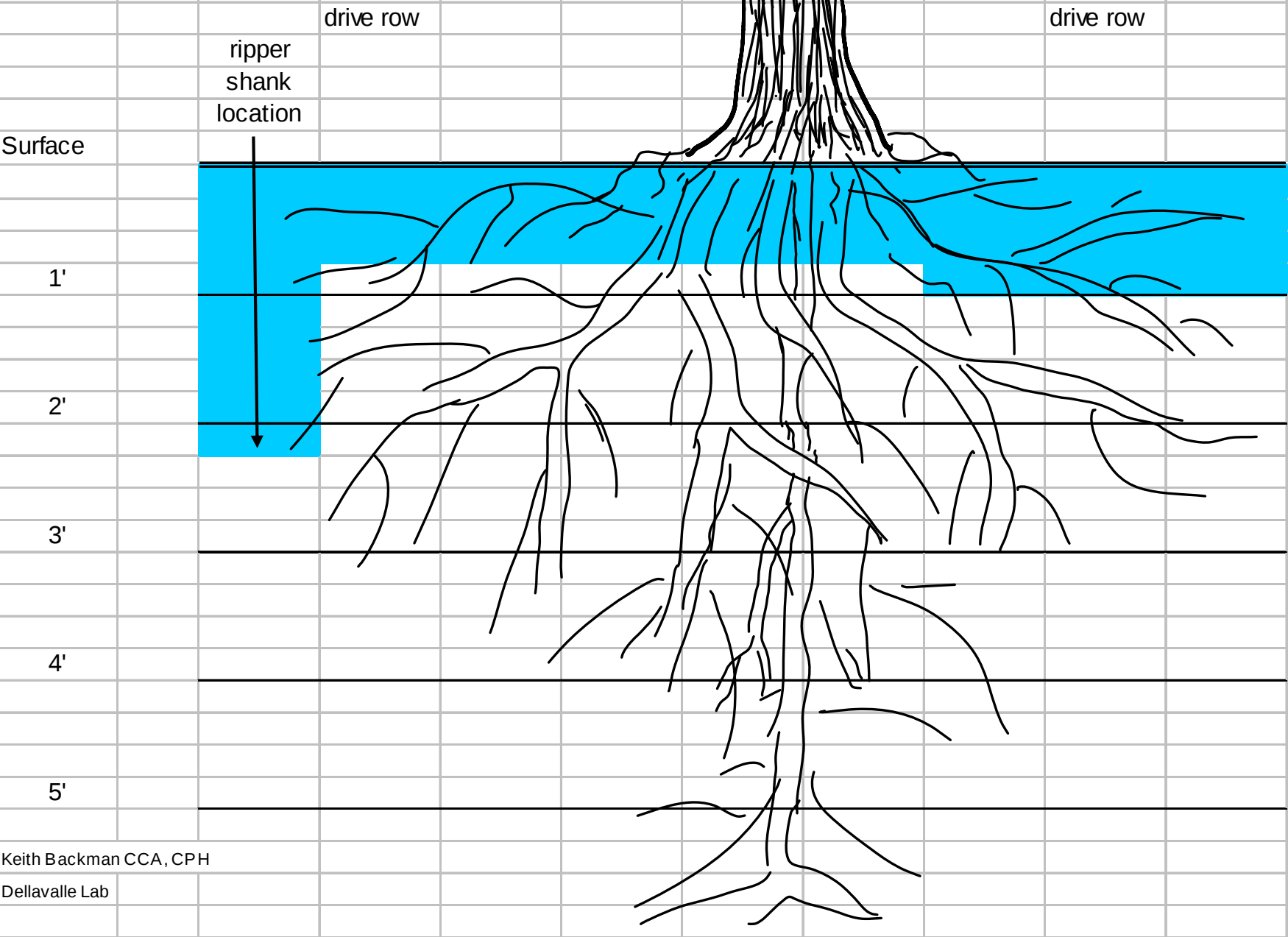


- Consider the Root Zone





Hard Pan Water Penetration Problem

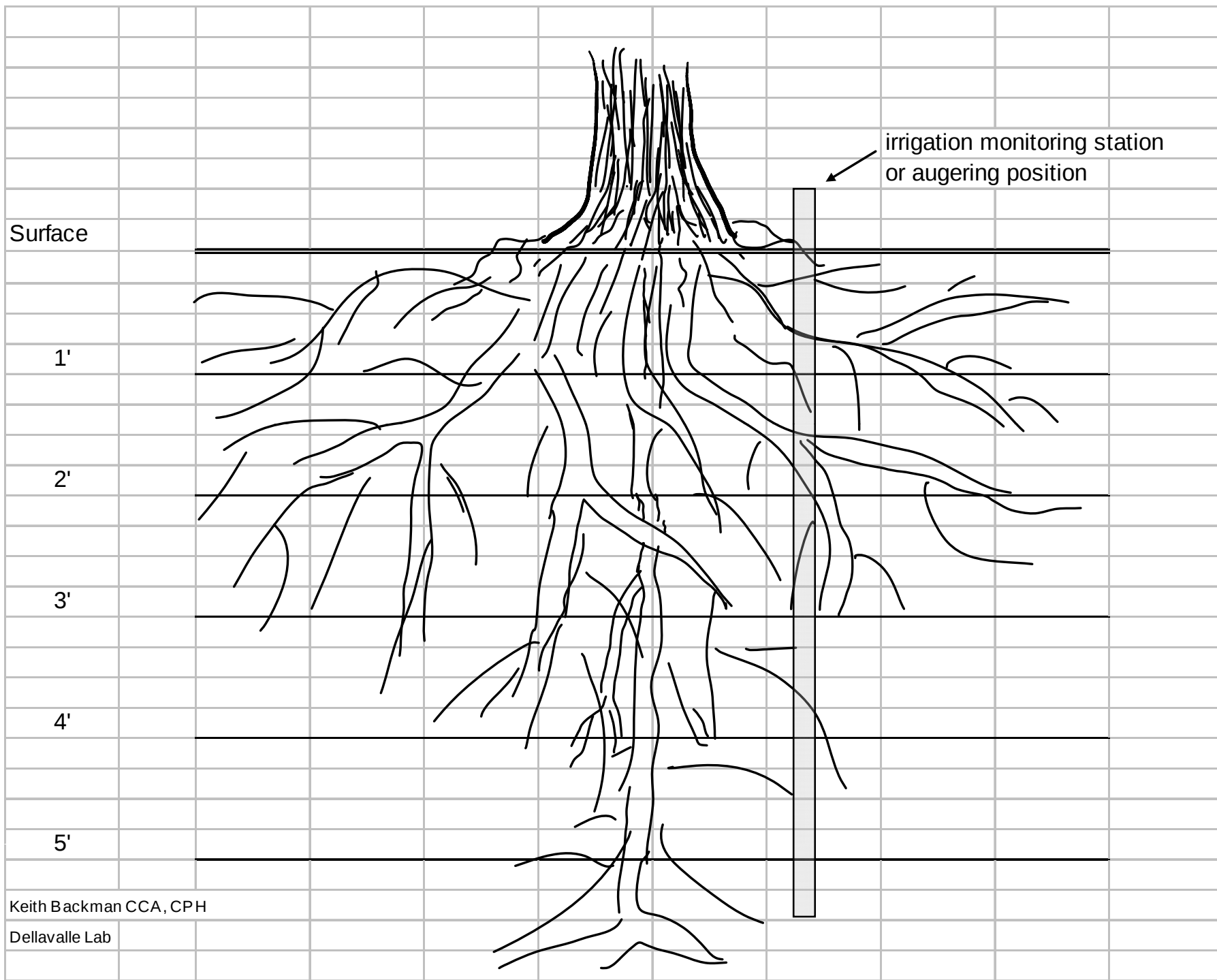


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Fix Prior to Planting

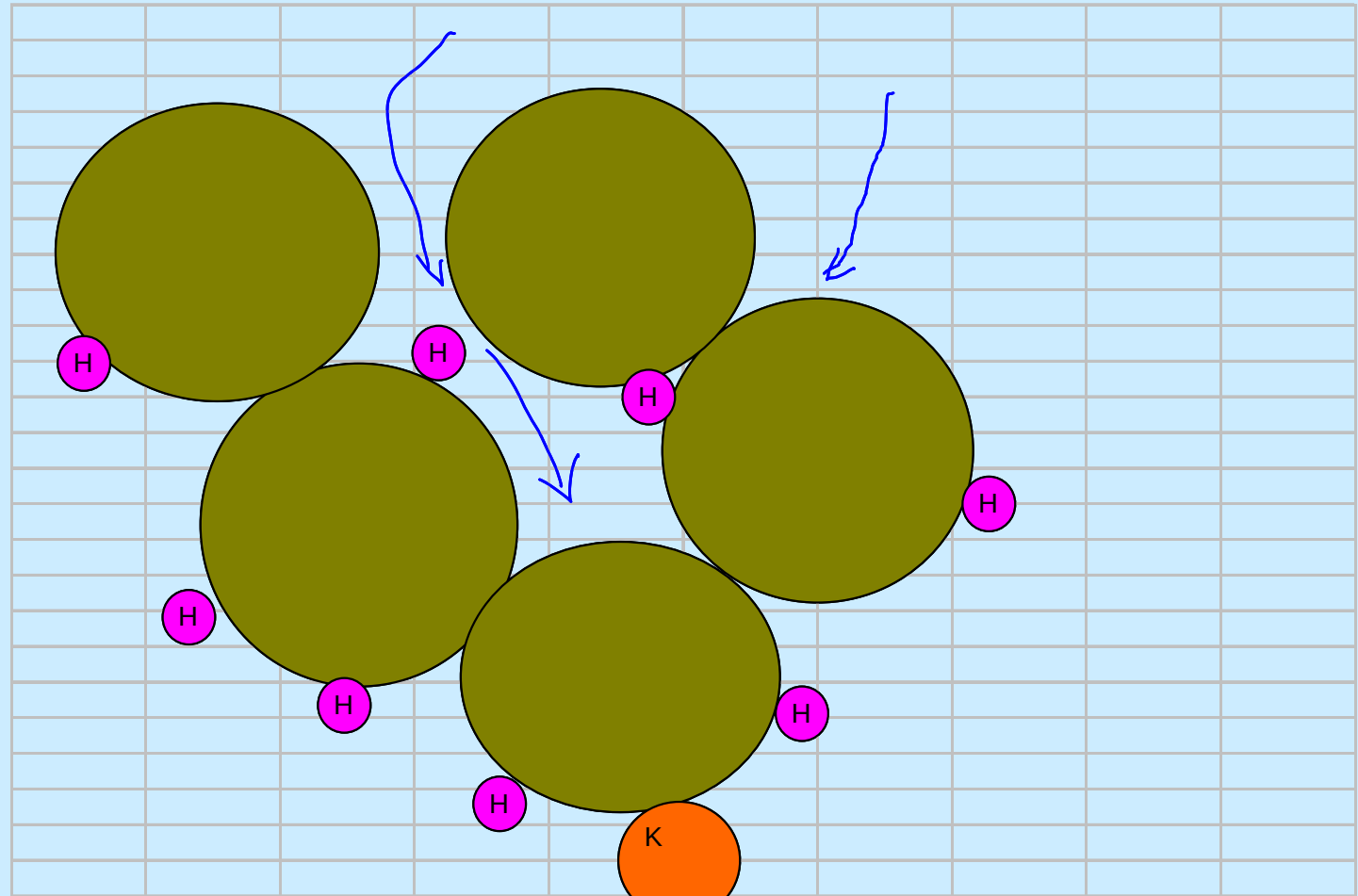




What does *Low Salt* mean?

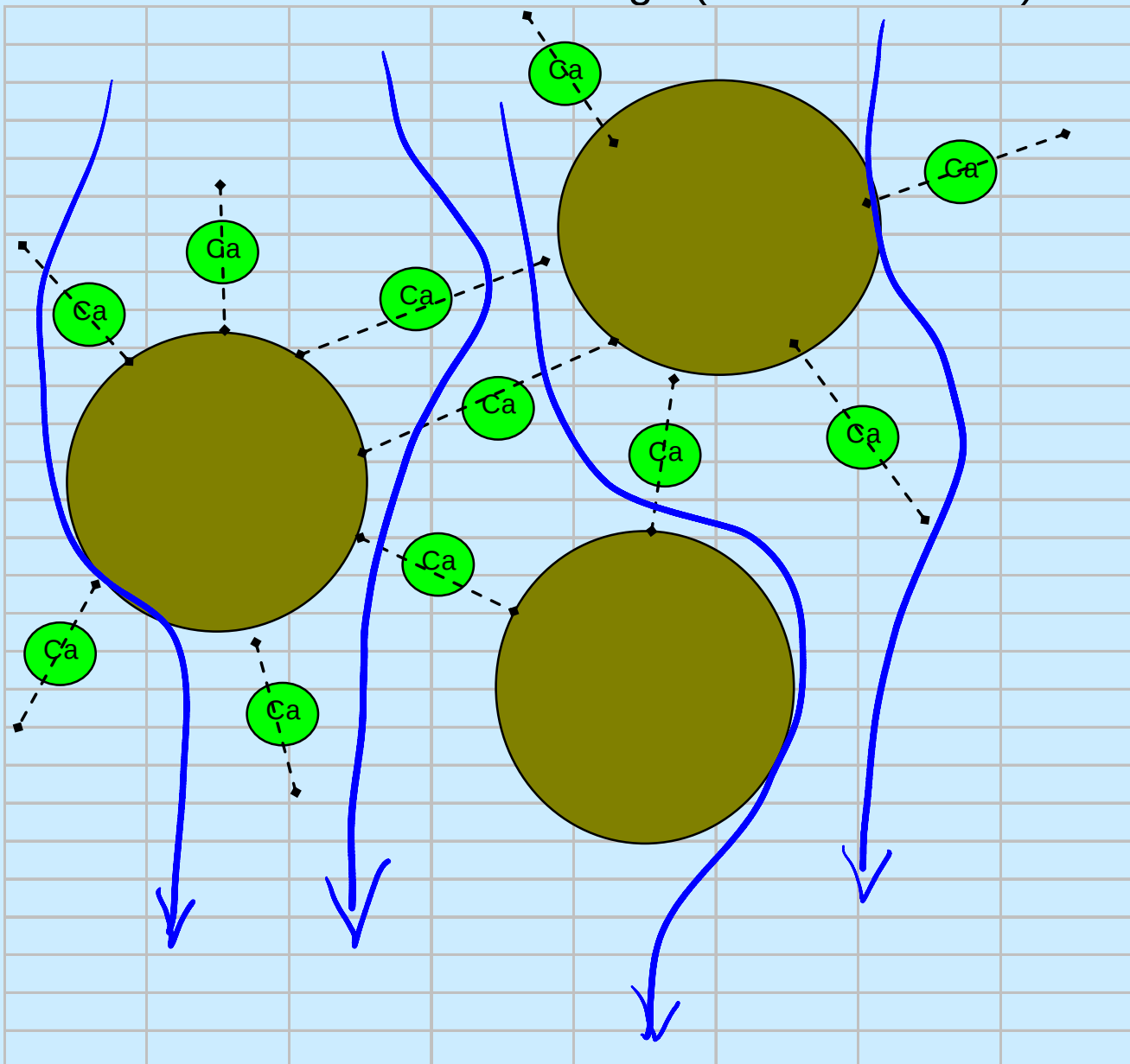
“Single Charge” Dominant Soil, (Low Salt)

Poor aeration, poor drainage (flocculated)



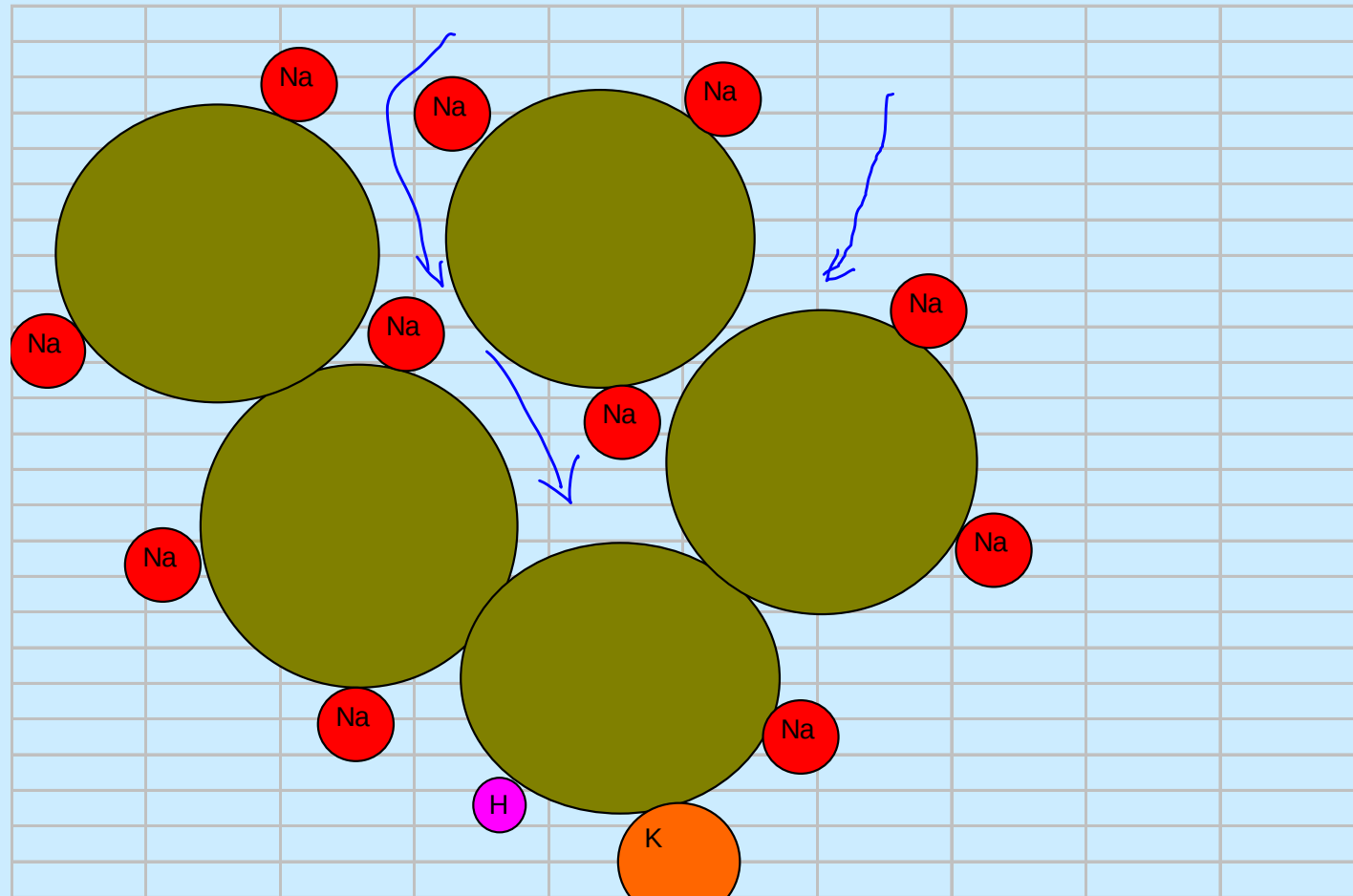
Calcium Dominant Soil

Good aeration and drainage (well flocculated)



“Single Charge” Dominant Soil

Poor aeration, poor drainage (deflocculated)



What is Sodic?

Sodium & Salinity



Salt Levels in the Soil

Sodium (AKA "Alkali")

Basic Description For Farmers

Salt Magnitude				Water Penetration	Situation	AKA	Resulting Condition		
Calcium		Sodium							
Ca	+	Na	=	Bad	Sodium Dominant	Sodic	Sick Tree		
Ca	+	Na	=	OK	High Salts	Saline	Sick & Dying Tree		
Ca	+	Na	=	Poor	High Salts, Sodium Dominant	Sodic - Saline	Dying Tree		

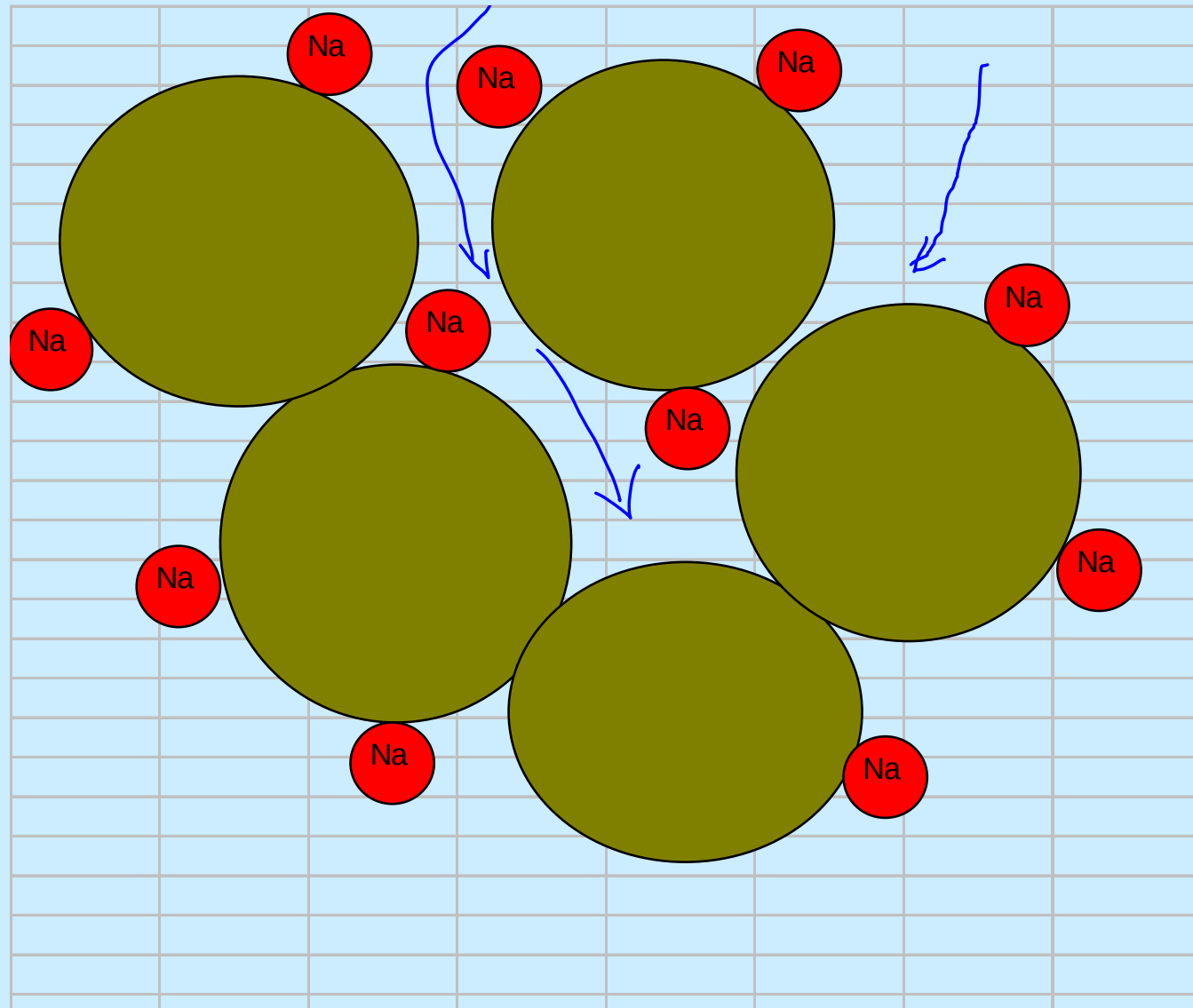
Compare salts from laboratory analyses, using water extraction (sat. paste) in meq./liter.

* = Providing other sub soil barriers are not present.

Dellavalle Laboratory, Inc. - Fresno, CA

Sodium Dominant Soil

Poor aeration, poor drainage (deflocculated)





DELLAVALLE®
Laboratory, Inc.
Chemists and Consultants

Report of Water Analysis

1910 W. McKinley, Suite 110, Fresno, CA 93728
FAX (559) 268-8174 - (800) 228-9896 - (559) 233-6129

Lab No. 178429

Sampler

Submitted Date 9/12/2012

Submitted by

Reported Date 9/24/2012

Location/Project

Copy To

Fax

e-mail

XXXXXX Vineyards

XXXXXX

San Miguel

CA

93451

10995

21

Crop: Winegrapes

					Total	Total	Total		Adj				Total		Total	Total				Nitrogen
					Ca	Mg	Na		SAR				B	NO ₃ -N	Fe	Mn	pH	L.I.	TDS	agricultural use
	Date	Time	EC		meq/L	meq/L	meq/L			meq/L	CO ₃ + HCO ₃	SO ₄	mg/L	mg/L	mg/L	mg/L	unit	Calc	mg/L	calculations
	Sampled	Sampled	dS/m								meq/L	meq/L								
RL-->			0.01	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.01	0.1	0.10	0.02	1.0 to 14.0	-2.0 to 2.0	10.0	
SM-->			2510 B					Calc	Calc		2320 B						4500H B	2330 B	2540 C	
EPA-->				200.7	200.7	200.7				300.0		300.0	200.7	300.0	200.7	200.7				
Analysis Date:	9/13/2012			9/18/2012	9/18/2012	9/18/2012	9/18/2012	9/20/2012	9/15/2012	9/17/2012	9/15/2012	9/18/2012	9/17/2012	9/18/2012	9/18/2012	9/13/2012	9/20/2012	9/19/2012		
Analysis Time:	14:54			15:15	15:15	15:15	15:15		8:11	13:53	8:11	15:15		15:15	15:15	14:54		3:30	calculated from nitrate-N	
																			lbs/AcFoot	lbs/AcInch

001	Ag Well	09/11/12	11:40	1.42	1.69	1.52	10.1	8.0	15.7	4.1	6.1	5.0	1.44	1.7	<0.10	<0.02	8.0	0.6	910	4.64	0.39
002	Domestic Well	09/11/12	11:30	1.42	2.07	1.99	10.2	7.2	14.7	3.8	6.0	5.8	1.37	1.9	<0.10	<0.02	8.1	0.7	927	5.19	0.43

Vineyard



Total				Sodium Abs. Ratio		Carbonates &							Langelier	
Salts	Calcium	agnesi	Sodium	SAR	Adjusted	Chloride	Bicarbonates	Sulfate	Boron	Nitrate	Iron	Manganese	pH	Index
<0.50	<4.00	-	-	-	-	-	-	-	-	-	-	-	<6.5	<-0.5
0-150.00-10.00	11-5.0	<4.0	0.1-4.0	0.1-4.0	0.1-15	0.1-2.5	0.1-5.0	0.01-0.40	0.1-5.0	<0.20	<0.20	6.8-7.9	-0.3 - 0.5	
>2.20	-	-	>7.0	>9.0	>9.0	>3.5	>3.5	-	>0.60	>7.0	>0.40*	>0.40*	>8.4	>0.9*

Many of the above parameters need specific adjustment for crops, uses, irrigation procedures, etc. Check report for specifics.

LI 0.4+ Problematic for drip system deposits. LI < -0.3 corrosive to plumbing

When sodium is greater than calcium (or high SAR), the water is considered sodic or "alkali".

Note: High & Low levels are based on consultant interpretation of the situation, including plant varieties, age, soil type, irrigation system, etc., when information is available.

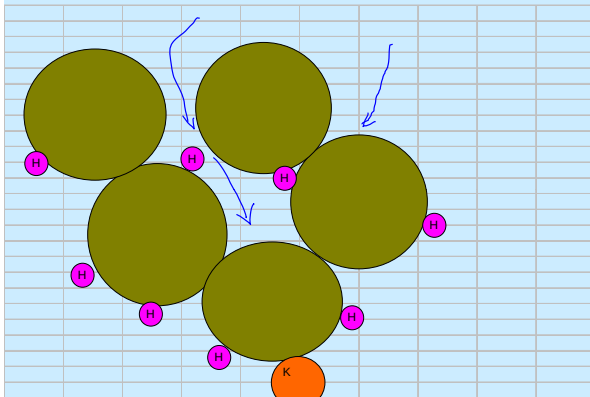
Notes: Black = Normal

Red = High Green = Sl. Low

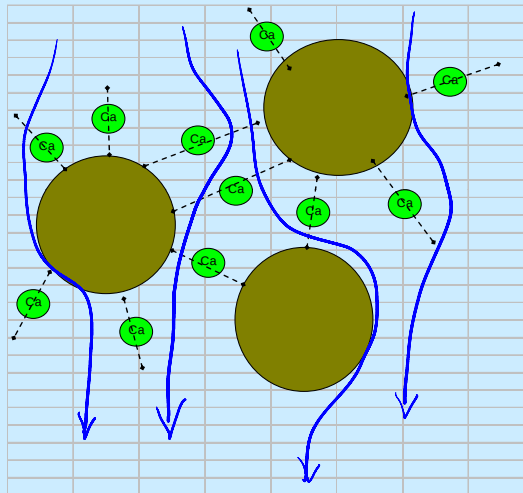
Orange = Sl. High Blue = Low

Review

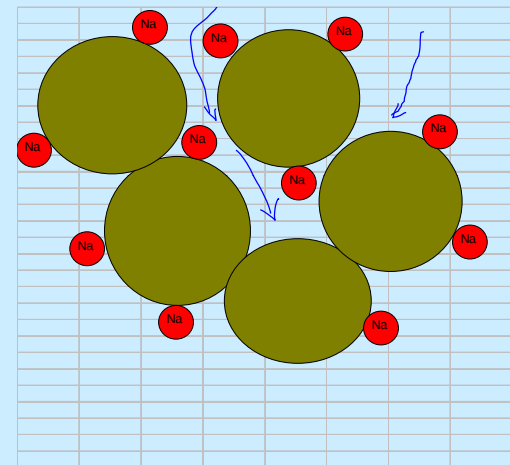
Low Salt
(deflocculated)



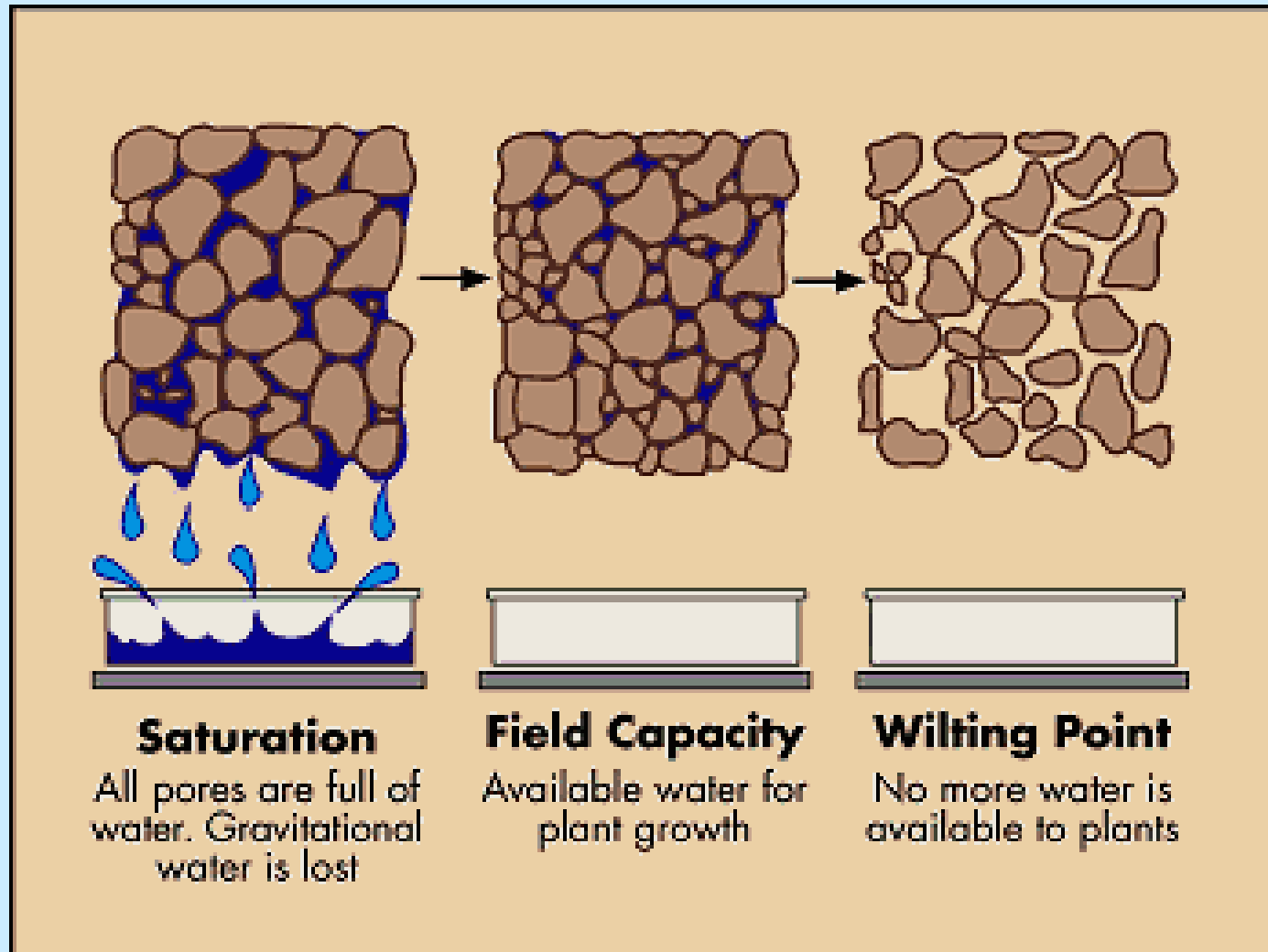
Nice Salt
(flocculated)

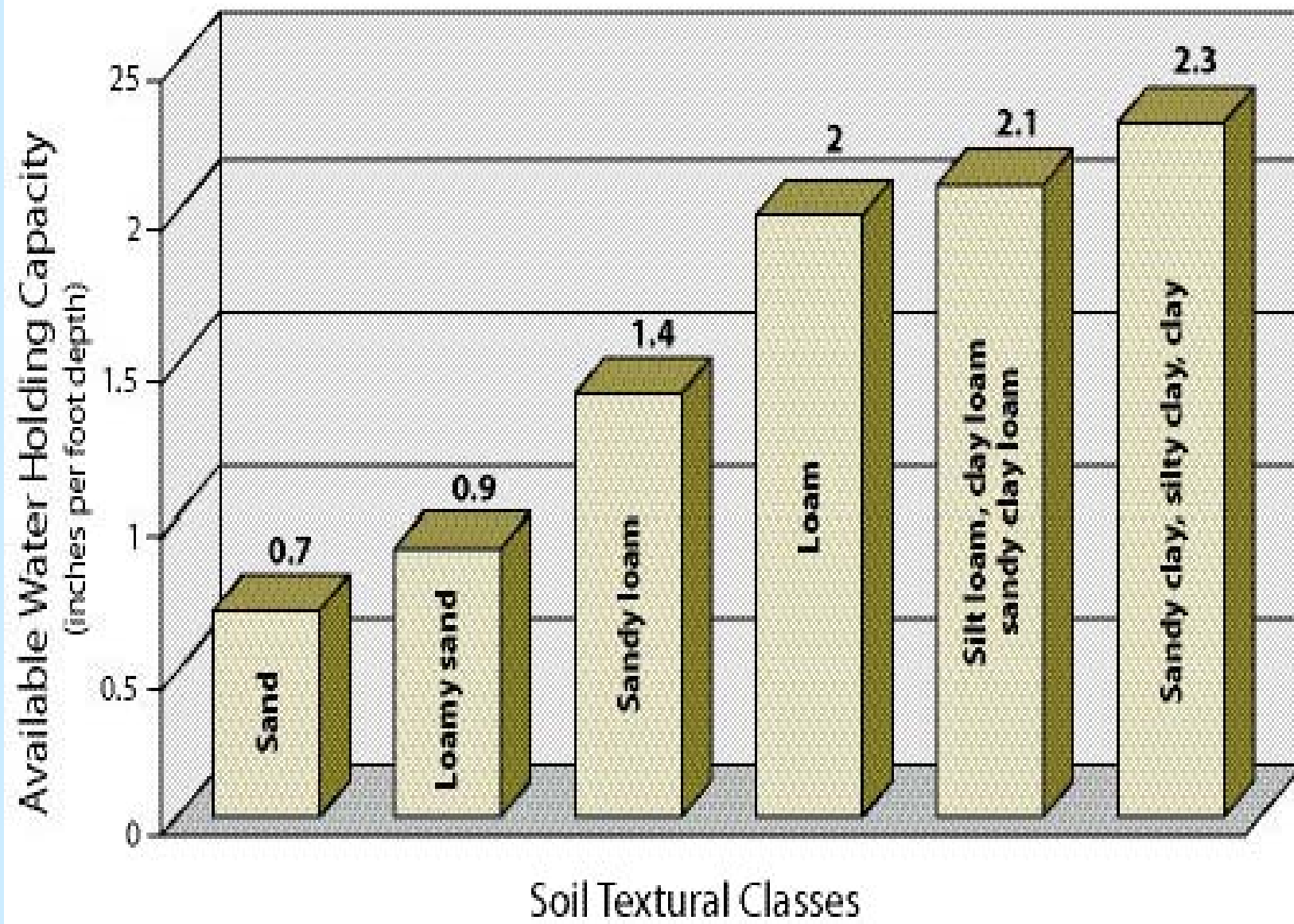


Sodium Salt
(deflocculated)



Water Holding Capacity



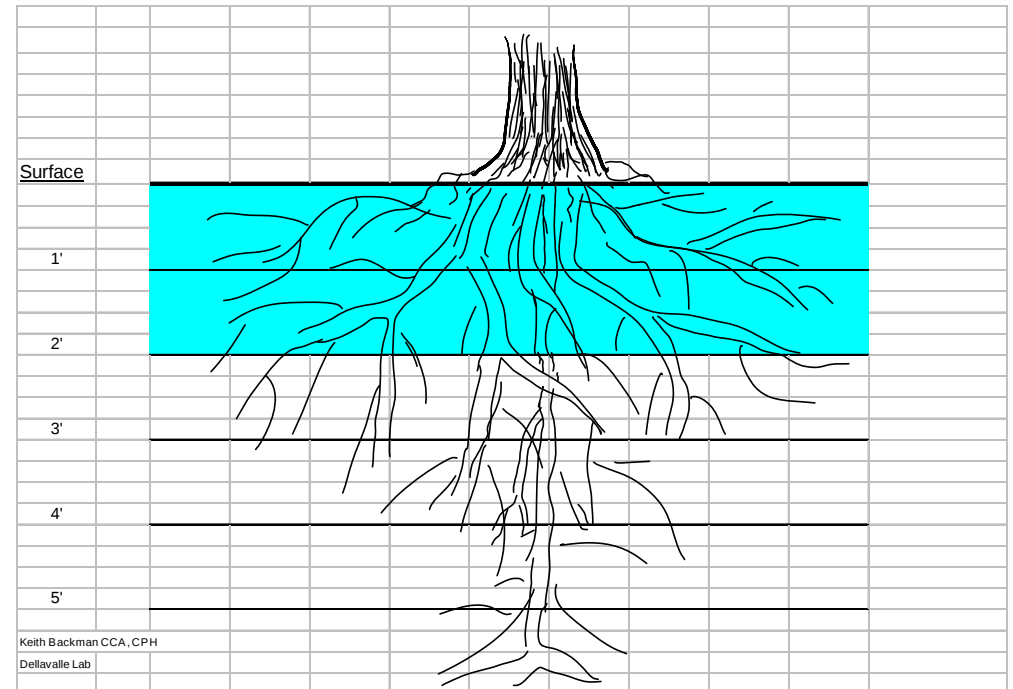
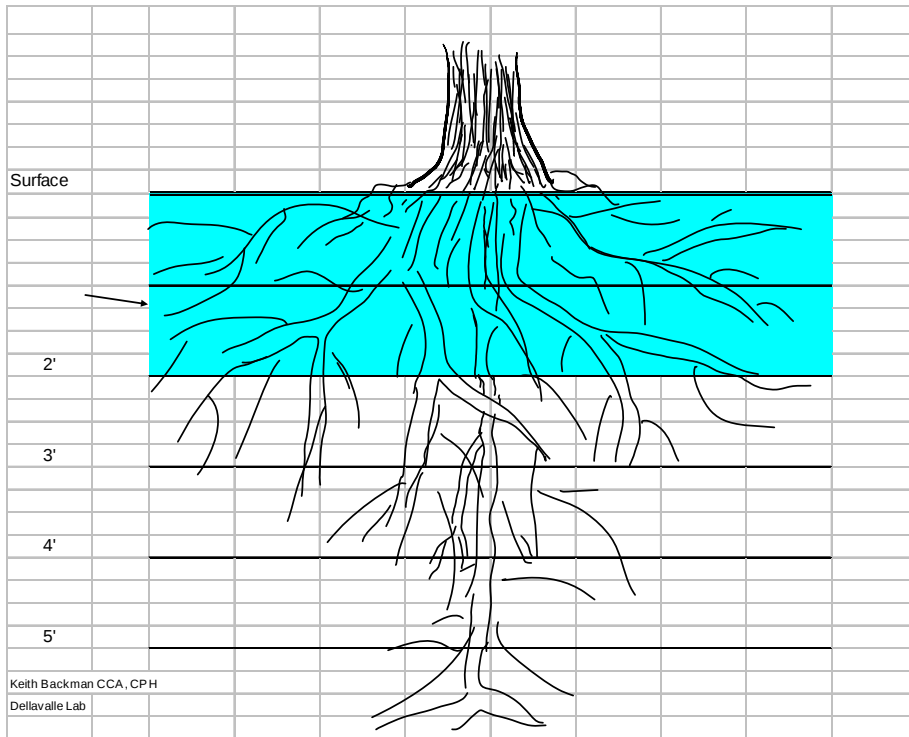


Water Availability

Days Worth of Water

Loamy Sand (WHC of 0.8"/ac ft)

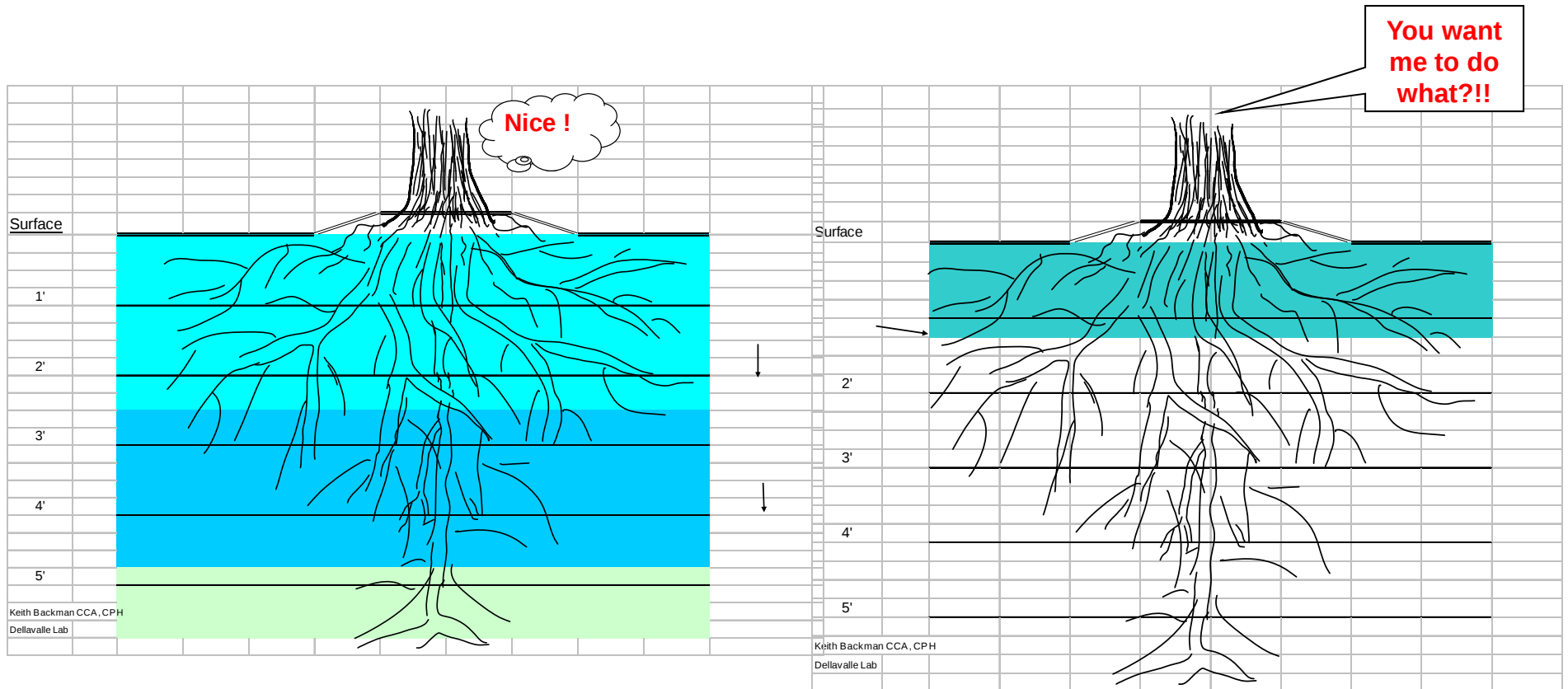
Clay (1.5"/ac ft)



These are clones of each other. Production numbers come from the construction materials and environment you supply!

Water Availability

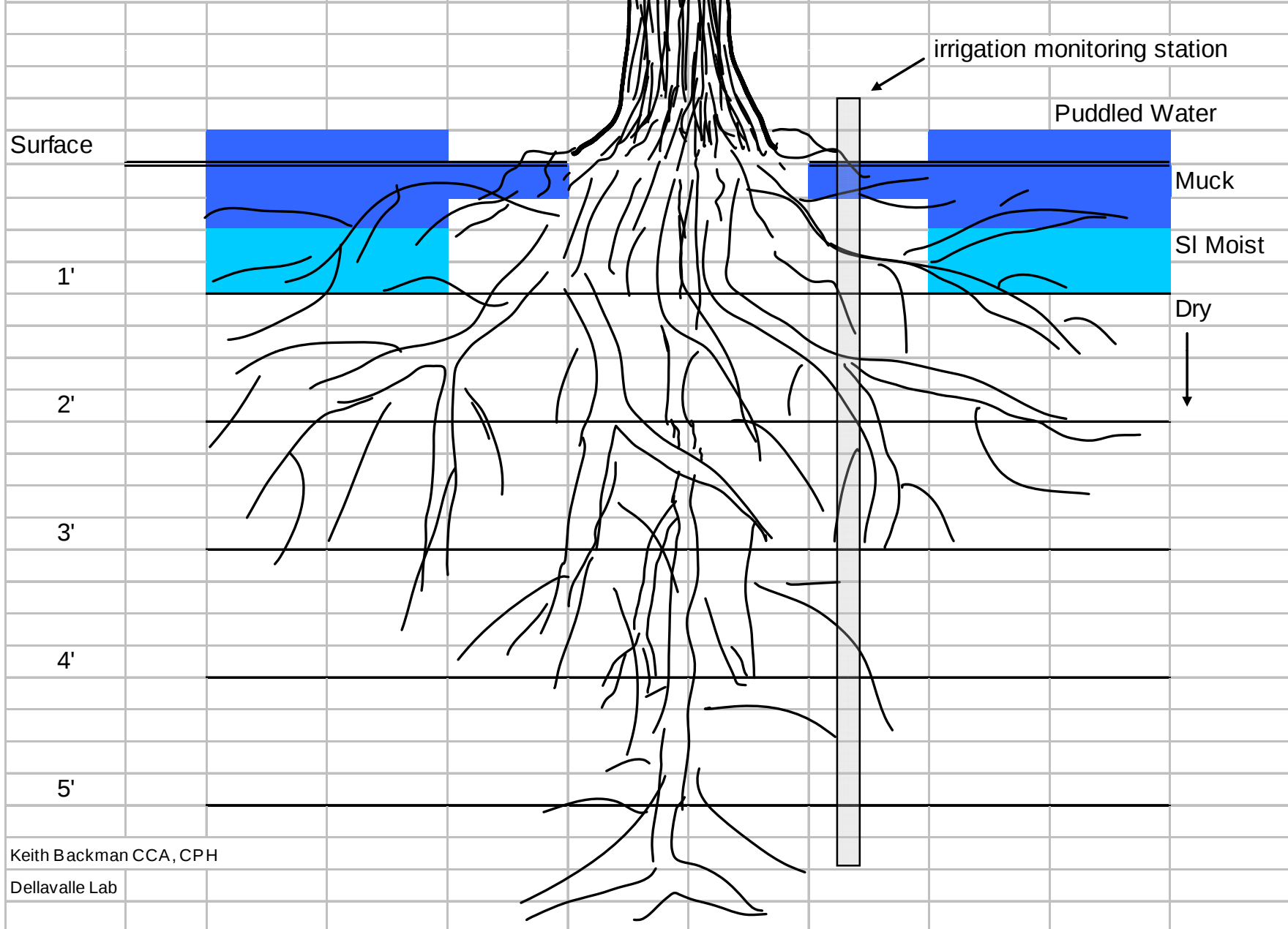
Days Worth of Water – Spring Conditions _0.10" of water needed per day



These are clones of each other. Production numbers come from the construction materials and environment you supply!

August 1

Low Salt Soil & Water



“Water Inflation”

- What happens when you routinely apply about 10 or 15% MORE water (per irrigation) than your crop routinely uses?
- Example: *apply 8 days worth of water every 7 days.*

Excess Irrigation Example

April 1

After applying about 15% MORE water than
than was really needed..

Surface

drip zone

drip zone

Depth to
Moist Soil



1'

Mar 1

2'

Apr 1

3'

May 1

4'

Jun 1

5'

Jul 1

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Dellavalle Lab



Excess Irrigation Example

July 1

After applying about 15% MORE water than
than was really needed..

Surface

drip zone

drip zone

**Depth to
Moist Soil**



1'

Mar 1

2'

Apr 1

3'

May 1

4'

Jun 1

5'

Jul 1

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-  = moist
-  =slightly moist
-  = dry all year

July 1

After applying about 10 or 15% MORE water than
than was really needed..

Surface

drip zone

drip zone

1'

2'

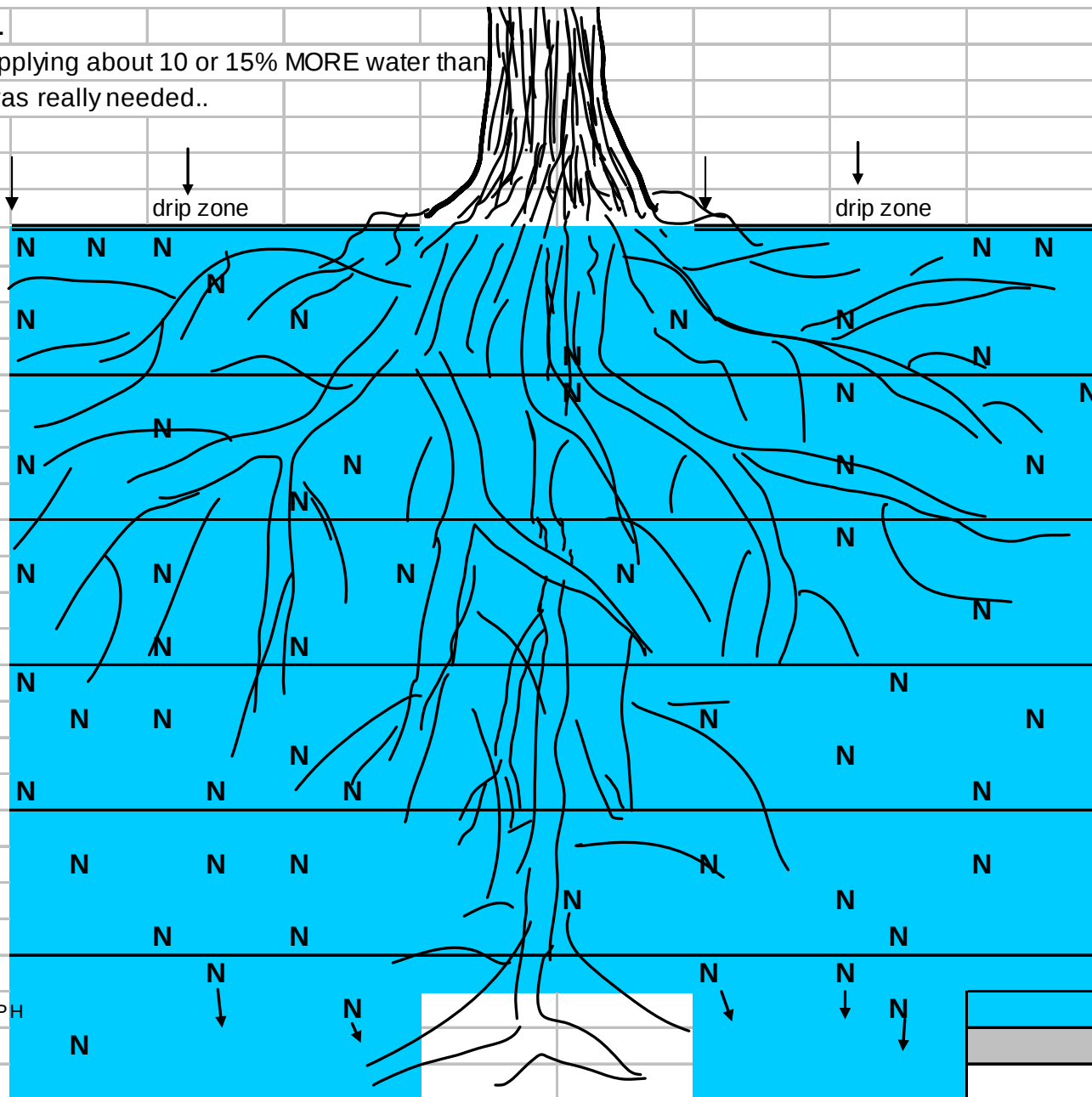
3'

4'

5'

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“Water Recession”

- What happens when you routinely apply about 10 or 15% less water (per irrigation) than your crop routinely uses?
- Example: *apply 6 days worth of water every 7 days.*

Deficit Irrigation Example

September 1

After applying about 10% less water than
than was really needed, for the whole season.
Typical for alm & pist

Depth to
Moist Soil

Surface

drip zone

drip zone

Jul 1

June 1

May 1

Apr 1

Mar 1

Feb 1

1'

2'

3'

4'

5'

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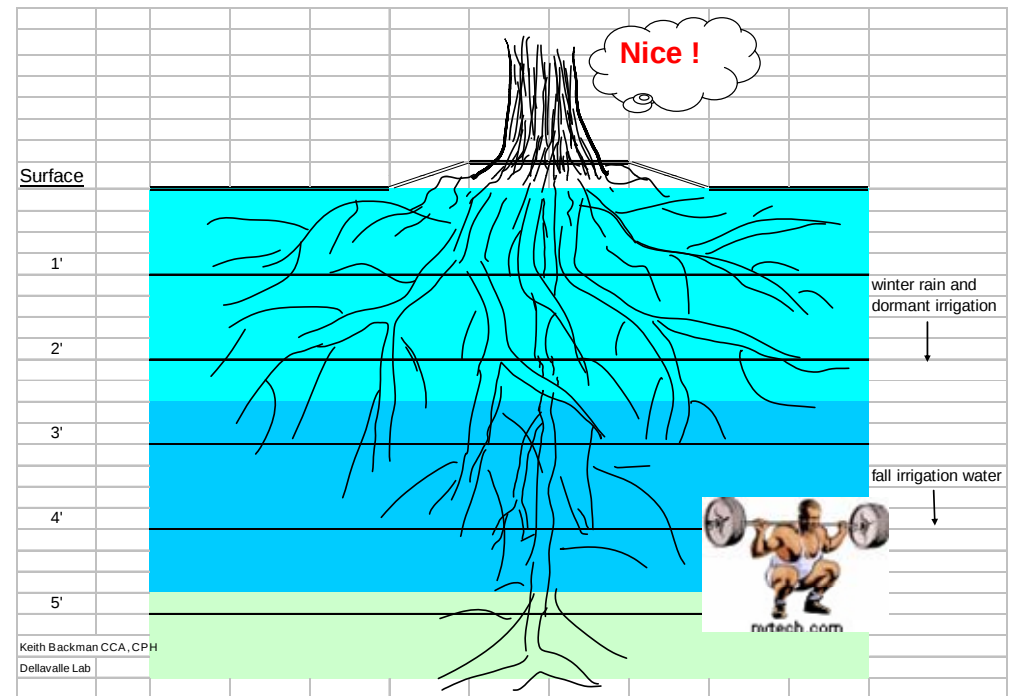
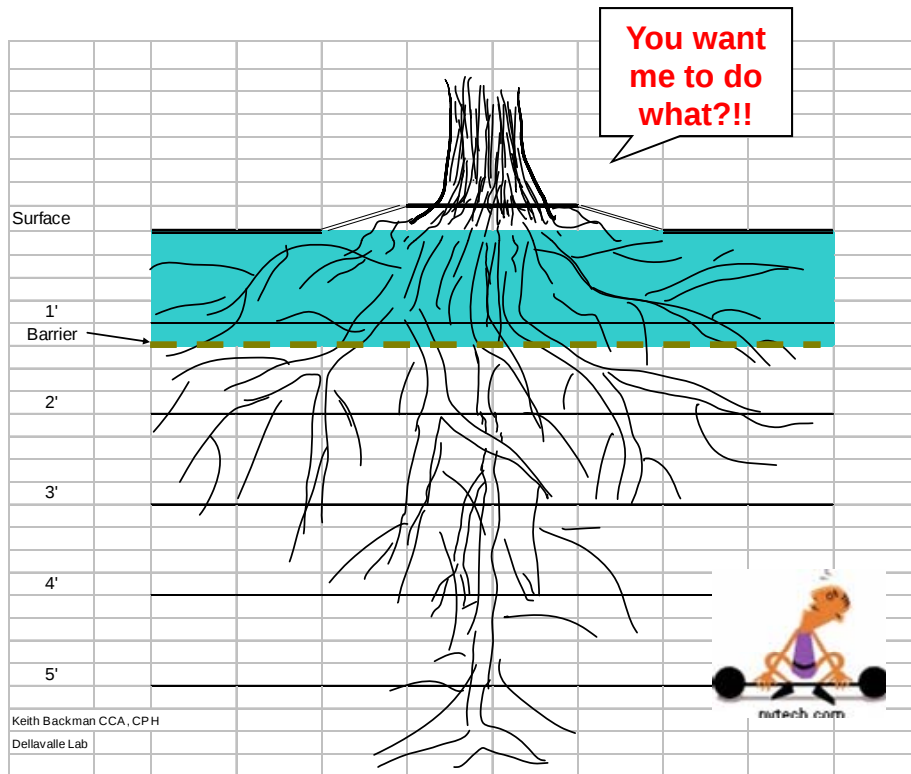
- = moist
- =was wet, now dry
- = dry all year

Are Your Roots “Pumping Iron”?

They Spend the Summer Producing Your Crop

“Weak Crop”

“Strong Crop”



These trees are clones of each other. Production numbers come from the construction materials and environment you supply!

Deficit Irrigation Example

September 1

Surface

drip zone

drip zone

Depth to Moist Soil

Jul 1

June 1

May 1

Apr 1

Mar 1

Feb 1

1'

2'

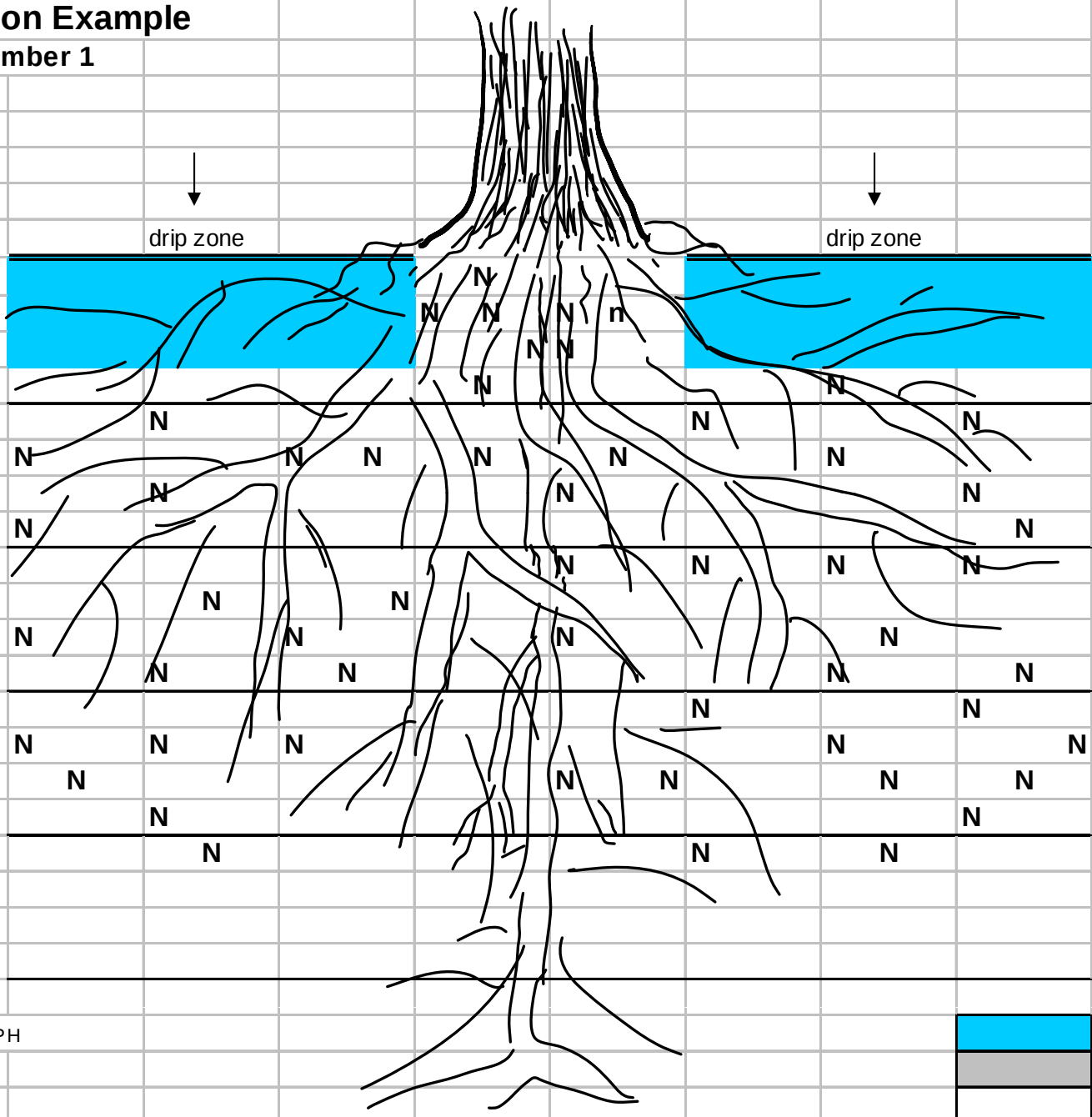
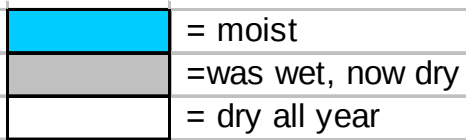
3'

4'

5'

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Excess Irrigation Example

November 1

Post Harvest
Irrigation
to Leach
Salts
and Invigorate
the Roots

Surface

drip zone

drip zone

1'

2'

3'

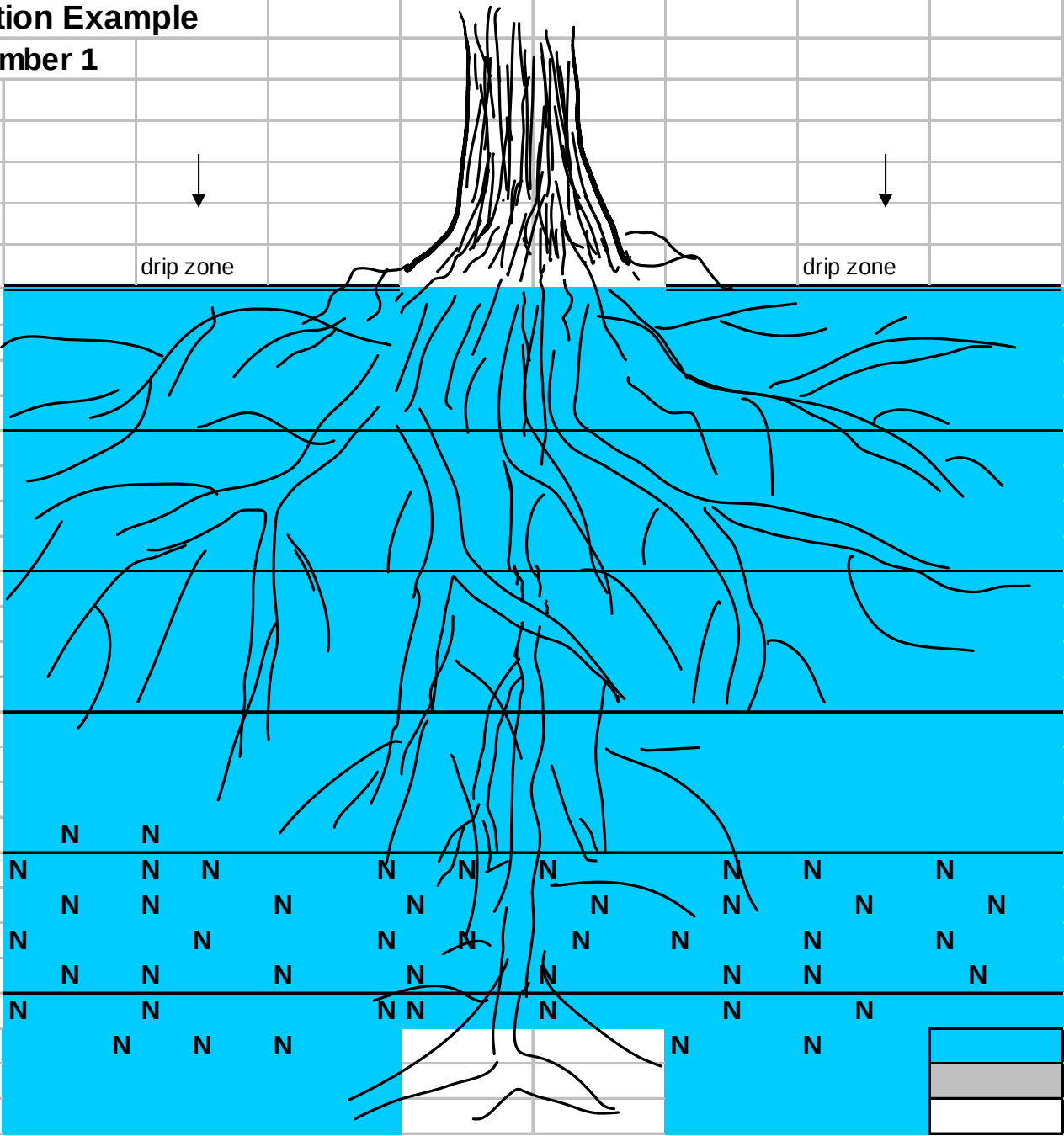
4'

5'



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- = moist
- =slightly moist
- = dry all year

Know your System

BOWSMITH

Fan-Jet[®]

Microsprinklers

SPRAY PATTERNS

Spray Trajectories

Arrows shown are for reference only.

Filtration	Nozzle Size	Pressure (PSI)	Flow (GPM)	Approx. Diameter ¹ (ft)	Approx. Diameter ¹ (in)	Approx. Diameter ¹ (ft)	Approx. Diameter ¹ (in)	Approx. Diameter ¹ (ft)	Approx. Diameter ¹ (in)	Approx. Diameter ¹ (ft)	Approx. Diameter ¹ (in)	Approx. Diameter ¹ (ft)	Approx. Diameter ¹ (in)
150-mesh filtration recommended	30 (BLACK)	10	8.4	10	9	12	12	10	10	9	10	11	7
		15	9.2	12	10	14	14	12	12	11	12	13	8
		20	10.0	14	10	16	16	14	14	12	14	15	9
		25	10.7	16	11	18	18	16	16	14	16	17	10
	35 (ORANGE)	10	7.8	9	8	11	11	9	9	8	9	10	6
		15	8.6	11	9	13	13	11	11	10	11	12	7
		20	9.4	13	10	15	15	13	13	11	13	14	8
		25	10.1	15	11	17	17	15	15	13	15	16	9
	40 (BLUE)	10	7.0	8	7	10	10	8	8	7	8	9	5
		15	7.8	10	9	12	12	10	10	9	10	11	6
		20	8.6	12	10	14	14	12	12	11	12	13	7
		25	9.4	14	11	16	16	14	14	12	14	15	8
	45 (VIOLET)	10	6.0	7	6	9	9	7	7	6	7	8	4
		15	6.8	9	8	11	11	9	9	8	9	10	5
		20	7.6	11	10	13	13	11	11	10	11	12	6
		25	8.4	13	11	15	15	13	13	11	13	14	7
100-mesh filtration recommended	50 (GREEN)	10	5.0	6	5	8	8	6	6	5	6	7	3
		15	5.8	8	7	10	10	8	8	7	8	9	4
		20	6.6	10	9	12	12	10	10	9	10	11	5
		25	7.4	12	10	14	14	12	12	11	12	13	6
	55 (YELLOW)	10	4.0	5	4	7	7	5	5	4	5	6	2
		15	4.8	7	6	9	9	7	7	6	7	8	3
		20	5.6	9	8	11	11	9	9	8	9	10	4
		25	6.4	11	9	13	13	11	11	10	11	12	5
	60 (RED)	10	3.0	4	3	6	6	4	4	3	4	5	1
		15	3.8	6	5	8	8	6	6	5	6	7	2
		20	4.6	8	7	10	10	8	8	7	8	9	3
		25	5.4	10	9	12	12	10	10	9	10	11	4

Flow of complete Fan-Jet sprinkler models may vary slightly from those shown. We do not guarantee flow of these head models used in all applications not manufactured by BowSmith.

Flowhead recommendations for BowSmith Fan-Jet are intended as a guide only. Do not use for any other application. Do not use for any other application. Do not use for any other application.

Flow of complete Fan-Jet microsprinkler assemblies may vary please consult factory.
We warrant, guarantee flow of these heads when used with complete Fan-Jet microsprinkler manufactured by BowSmith.

Filtration recommendations for BowSmith Fan-Jet are intended as a guide for only use.
Clipping or excessive wear may result from poor water quality or sources with high pH.
This product should be maintained for compatibility.

Tools for Proper Water Evaluation

- Soil Probe
- Calculator
- Computer Satellite Maps
- Tensiometer
- Neutron Probe
- Gypsum Block
- Pressure Bomb
- Real Time Systems _ (capacitance, Gypsum Block)

A Must Have!



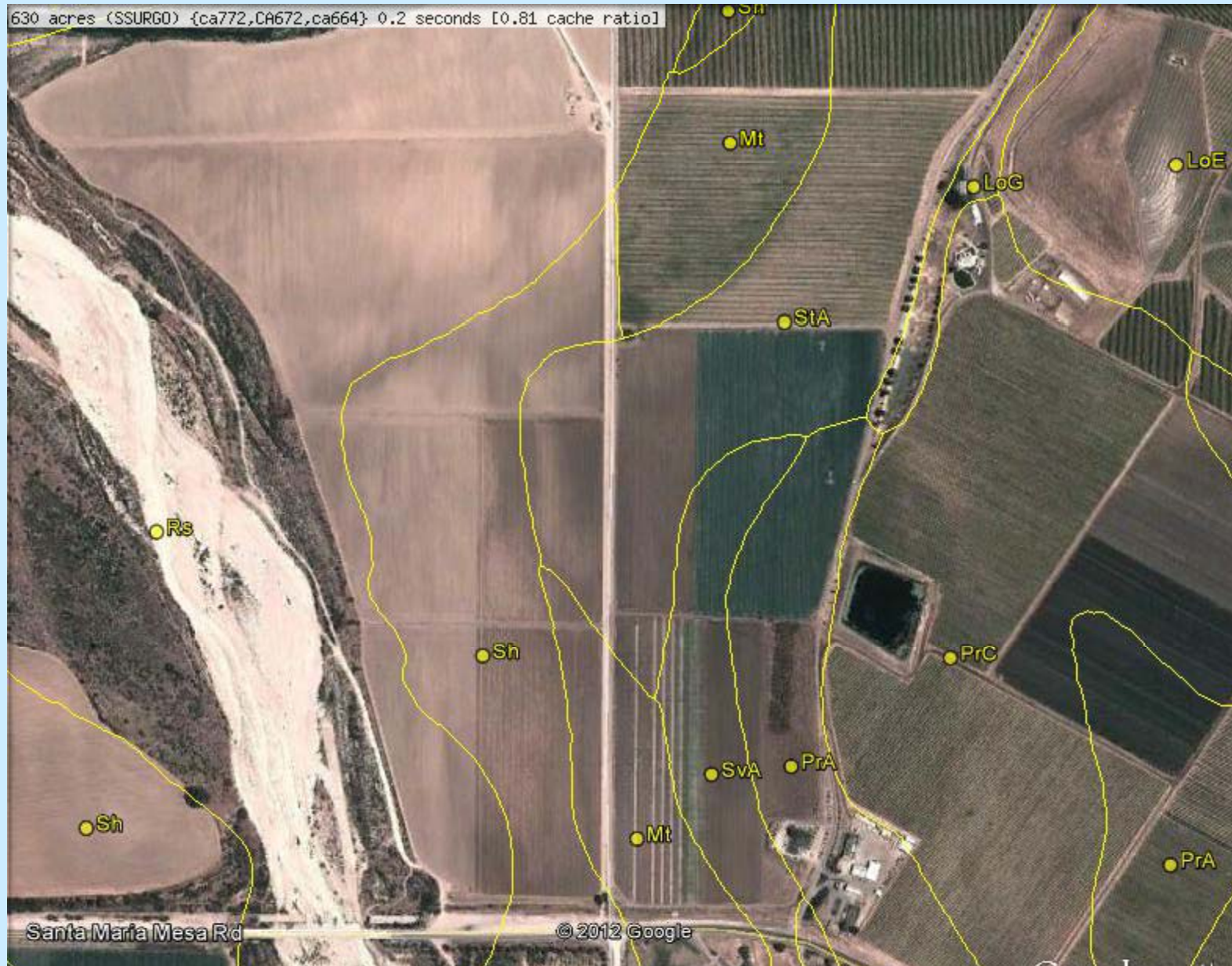
Google Map



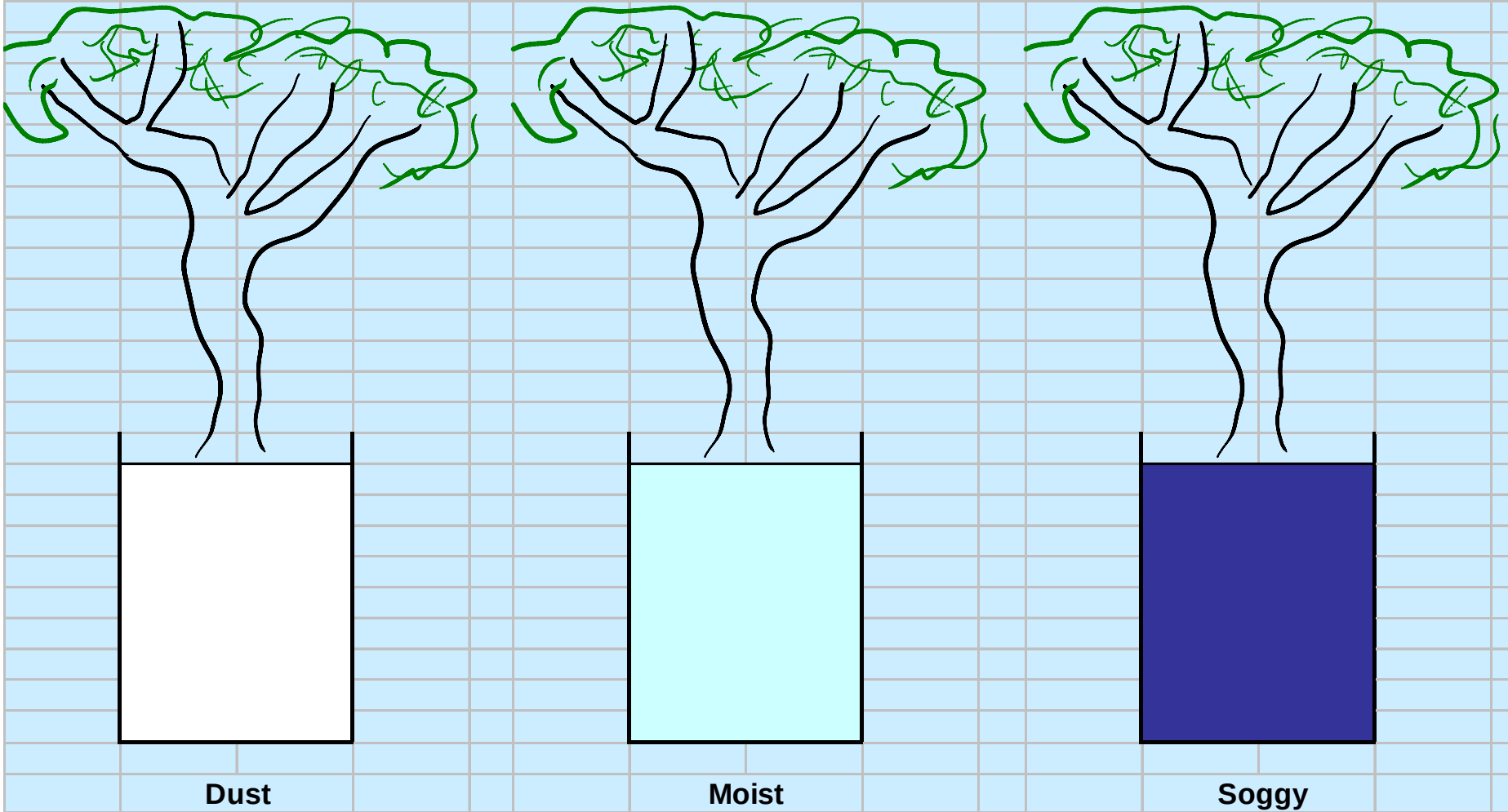
Santa Maria Mesa Rd

© 2012 Google

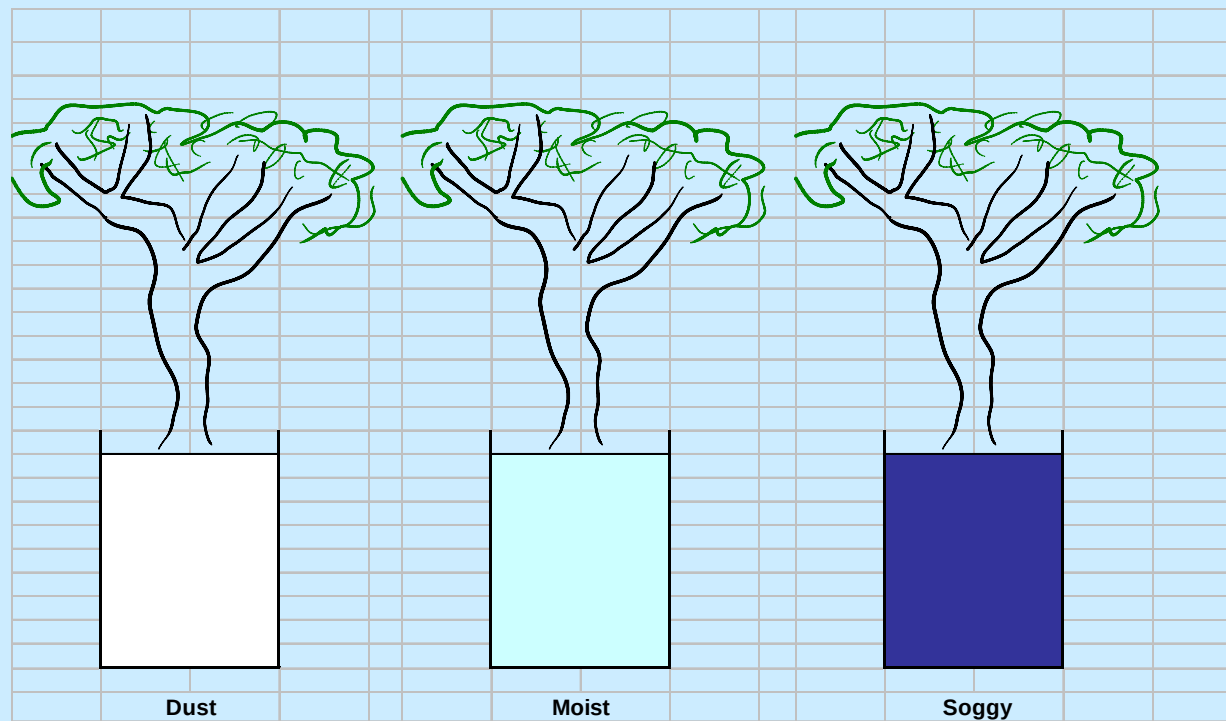
Google Map with “SoilWeb”



Question: If each plant in these pots consumes 5 gallons per day and we add 5 gallons per day to each container, then everything is perfect, right?!?



Root Zone Moisture Observation is Required !



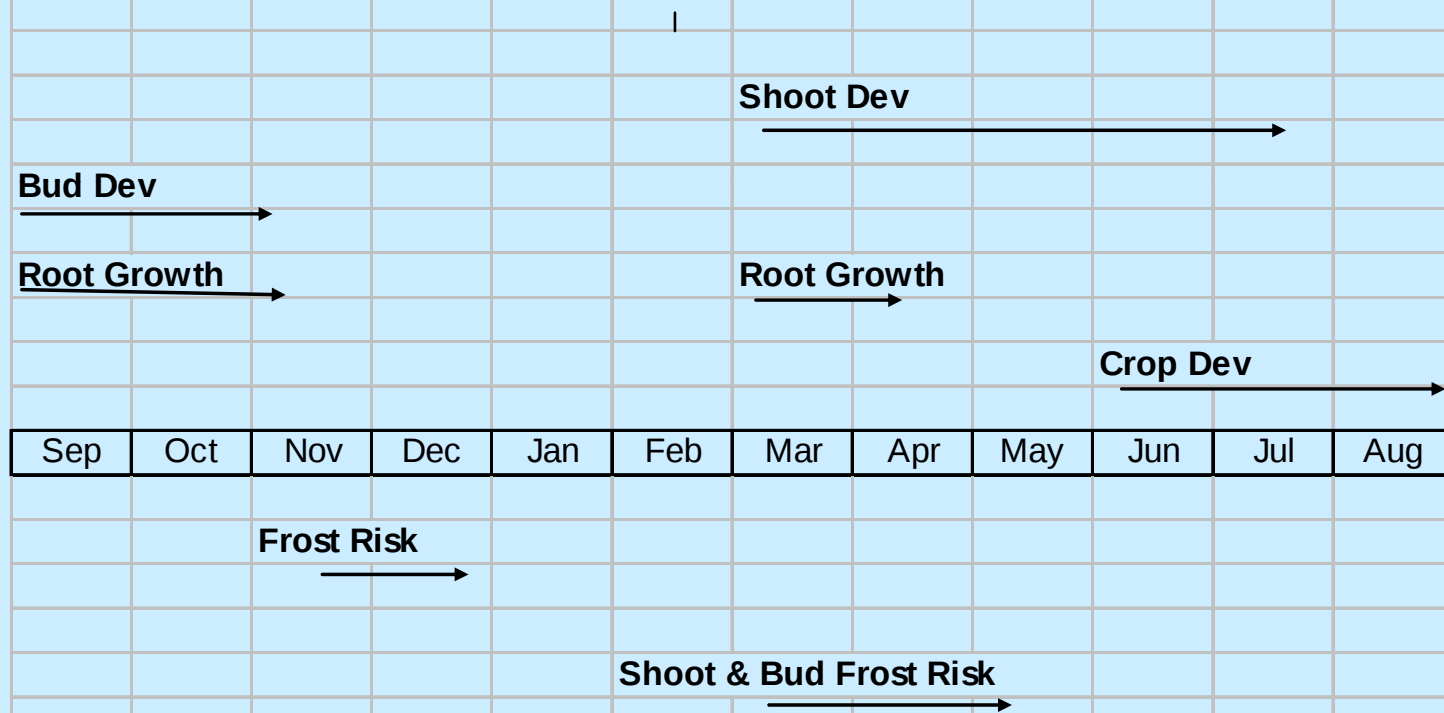
Review

Ways to Wreck a N Management Program via Irrigation *unless you adapt*

- Using Sodic or Low Salt Water
- Applying just a *little* more water than the tree uses
- Applying just a *little* less water than the tree uses
- Too Short or Too Long an Interval
- Making Sudden Changes (IE: 12 set to a 24, just because)
- Not understanding the Delivery Rate
- Misjudging the Water Holding Capacity
- Not Knowing How Much Water Remains in
the Root System BEFORE you Irrigate



Orchard Status



All of the above vary widely depending on climate and seasonal variation

Problems

- Nitrogen Waste
- Damaged Roots
- Leaf Scorch
- Damaged Wood & Conductive Tissue
- Small Crop
- Damaged Crop
- (just to name a few categories)

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