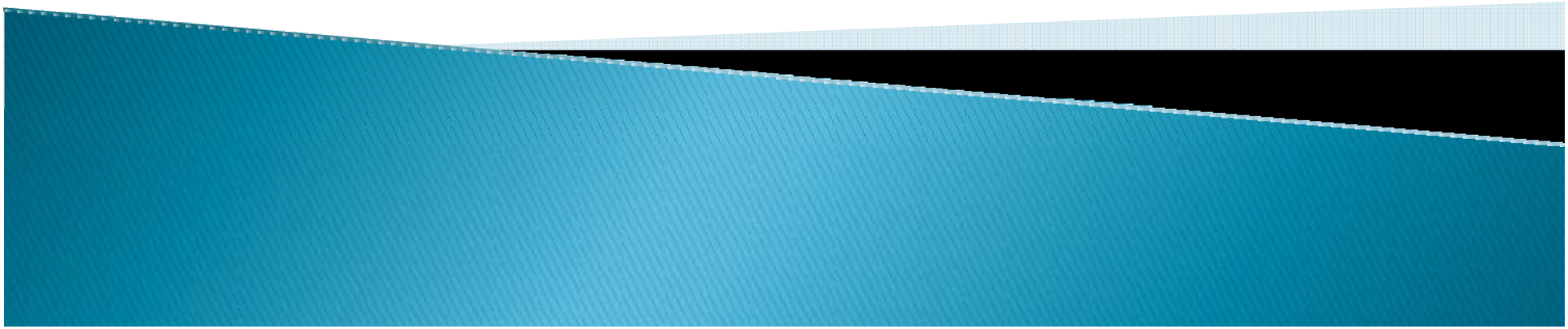
Fertility and Soil Health

Mike Robinson

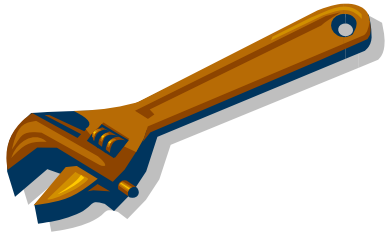
Wenatchee, WA



What is the Goal?

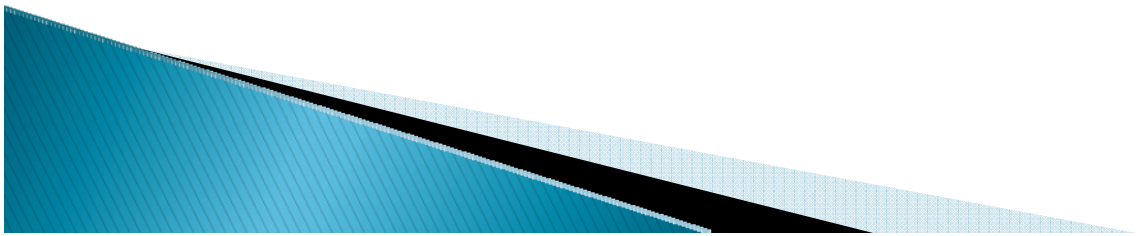
- To produce maximum crops on an annual basis, of commercially preferred sizes and grades
- Leave the Soil better than I found it
- Provide tasty and nutritious food
- Contain the nutrients I use to the property I farm.
- MAKE A PROFIT (The key to sustainability)

What Tools do I have to accomplish my goals

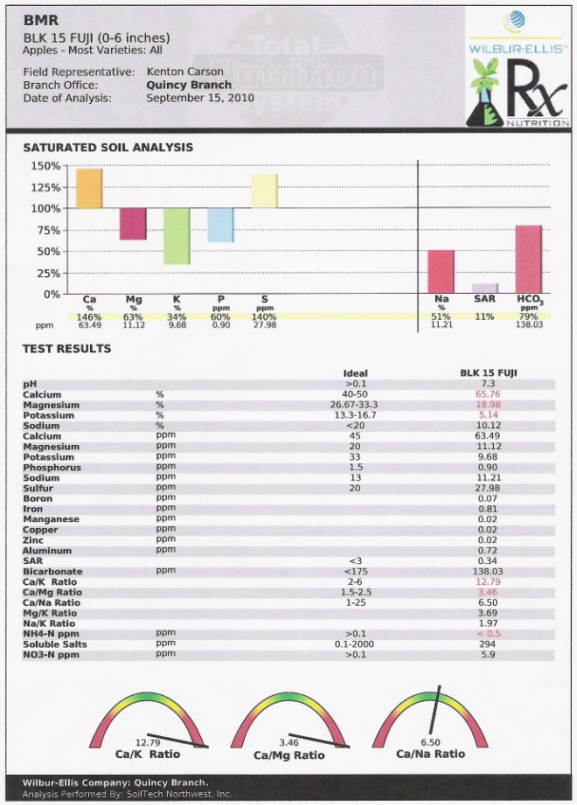


Soil Analysis

- The cornerstone of modern fertility management
- Referred to in most extension publications and farm magazines as the basis for decisions on fertility.
- Its use is taught in classrooms across the US
- Required by the NOP and some GAP programs



A couple of common soil testing and fertility management systems



BMR
BLK 15 FUJI (0-6 inches)
Apples - Most Varieties: All

Field Representative: Kenton Carson
Branch Office: **Quincy Branch**
Date of Analysis: September 15, 2010

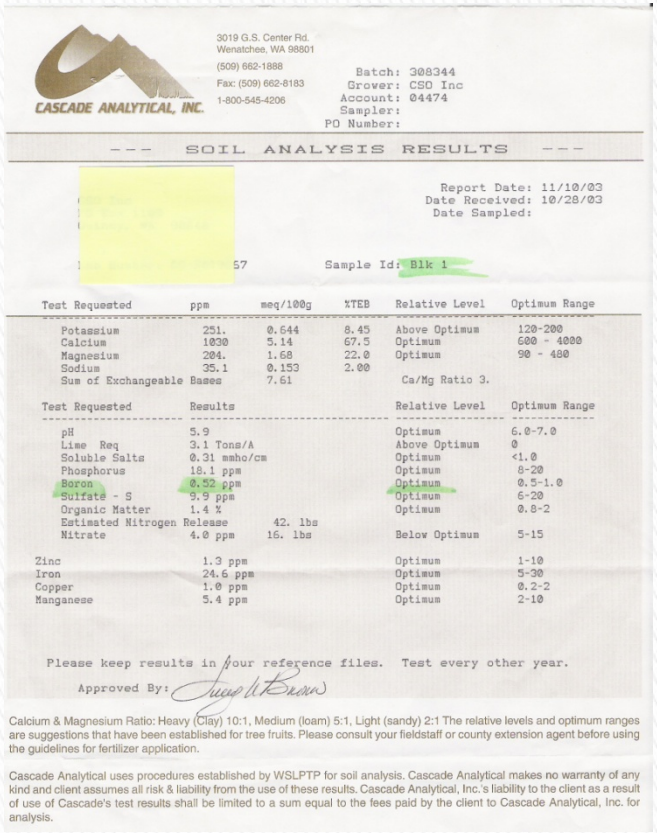
WILBUR-ELLIS Rx NUTRITION

SATURATED SOIL ANALYSIS

TEST RESULTS

		Ideal	BLK 15 FUJI
pH		>0.1	7.3
Calcium	%	40-50	65.76
Magnesium	%	26.67-33.3	18.98
Potassium	%	13.3-16.7	5.14
Sodium	%	<20	10.12
Calcium	ppm	45	63.49
Magnesium	ppm	20	11.12
Potassium	ppm	33	9.68
Phosphorus	ppm	1.5	0.90
Sodium	ppm	13	11.21
Sulfur	ppm	20	27.98
Boron	ppm		0.07
Iron	ppm		0.81
Manganese	ppm		0.02
Copper	ppm		0.02
Zinc	ppm		0.02
Aluminum	ppm		0.72
SAR		<3	0.34
Bicarbonate	ppm	<175	138.03
Ca/K Ratio		2-6	12.79
Ca/Mg Ratio		1.5-2.5	3.46
Ca/Na Ratio		1-25	6.50
Mg/K Ratio			3.69
Na/K Ratio			1.97
NH4-N ppm	ppm	>0.1	< 0.5
Soluble Salts	ppm	0.1-2000	294
NO3-N ppm	ppm	>0.1	5.9

Wilbur-Ellis Company: Quincy Branch.
Analysis Performed By: SoilTech Northwest, Inc.



CASCADE ANALYTICAL, INC.
3019 G.S. Center Rd.
Wenatchee, WA 98801
(509) 662-1888
Fax: (509) 662-8183
1-800-545-4206

Batch: 308344
Grower: CSD Inc
Account: 04474
Sampler:
PO Number:

--- SOIL ANALYSIS RESULTS ---

Report Date: 11/10/03
Date Received: 10/28/03
Date Sampled:

Sample Id: Blk 1

Test Requested	ppm	meq/100g	%TEB	Relative Level	Optimum Range
Potassium	251.	0.644	8.45	Above Optimum	120-200
Calcium	1030	5.14	67.5	Optimum	600 - 4000
Magnesium	204.	1.68	22.0	Optimum	90 - 480
Sodium	35.1	0.153	2.00		
Sum of Exchangeable Bases		7.61		Ca/Mg Ratio 3.	

Test Requested	Results		Relative Level	Optimum Range
pH	5.9		Optimum	6.0-7.0
Lime Req	3.1 Tons/A		Above Optimum	0
Soluble Salts	0.31 mmho/cm		Optimum	<1.0
Phosphorus	18.1 ppm		Optimum	8-20
Boron	0.52 ppm		Optimum	0.5-1.0
Sulfate - S	9.9 ppm		Optimum	6-20
Organic Matter	1.4 %		Optimum	0.8-2
Estimated Nitrogen Release		42. lbs		
Nitrate	4.0 ppm	16. lbs	Below Optimum	5-15
Zinc	1.3 ppm		Optimum	1-10
Iron	24.6 ppm		Optimum	5-30
Copper	1.0 ppm		Optimum	0.2-2
Manganese	5.4 ppm		Optimum	2-10

Please keep results in your reference files. Test every other year.

Approved By:

Calcium & Magnesium Ratio: Heavy (Clay) 10:1, Medium (loam) 5:1, Light (sandy) 2:1 The relative levels and optimum ranges are suggestions that have been established for tree fruits. Please consult your fieldstaff or county extension agent before using the guidelines for fertilizer application.

Cascade Analytical uses procedures established by WSLPTP for soil analysis. Cascade Analytical makes no warranty of any kind and client assumes all risk & liability from the use of these results. Cascade Analytical, Inc.'s liability to the client as a result of use of Cascade's test results shall be limited to a sum equal to the fees paid by the client to Cascade Analytical, Inc. for analysis.

Soil Balancing approach

Nutrient target approach

Where did the target levels come from?

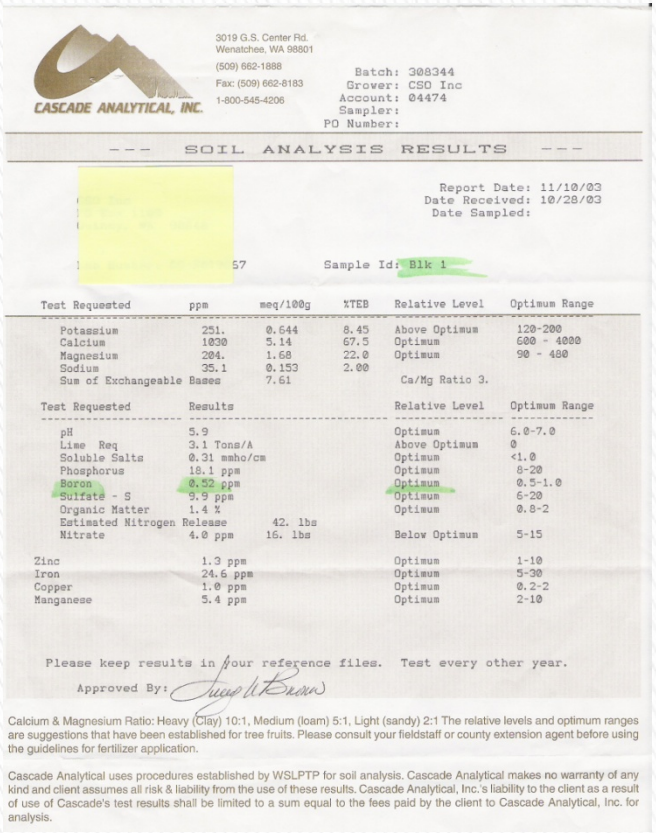
- The soil balancing approach started with a researcher named Albrecht in Missouri
- It has been modified to fit our climate and soils through substantial trial and error
- No scientific trials link test results to a result in the tree

Soil Balancing approach

- The WSU Fertilizer guide from many years ago
- The levels may have been derived from target levels developed for alfalfa
- No scientific trials link test results to a result in the tree

Nutrient target approach

Samples don't correlate



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Magnesium	204.	1.68	22.0	Optimum	90 - 480
Sodium	35.1	0.153	2.00		
Sum of Exchangeable Bases		7.61		Ca/Mg Ratio 3.	

Test Requested	Results		Relative Level	Optimum Range
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Lime Req	3.1 Tons/A		Above Optimum	0
Soluble Salts	0.31 mmho/cm		Optimum	<1.0
Phosphorus	18.1 ppm		Optimum	8-20
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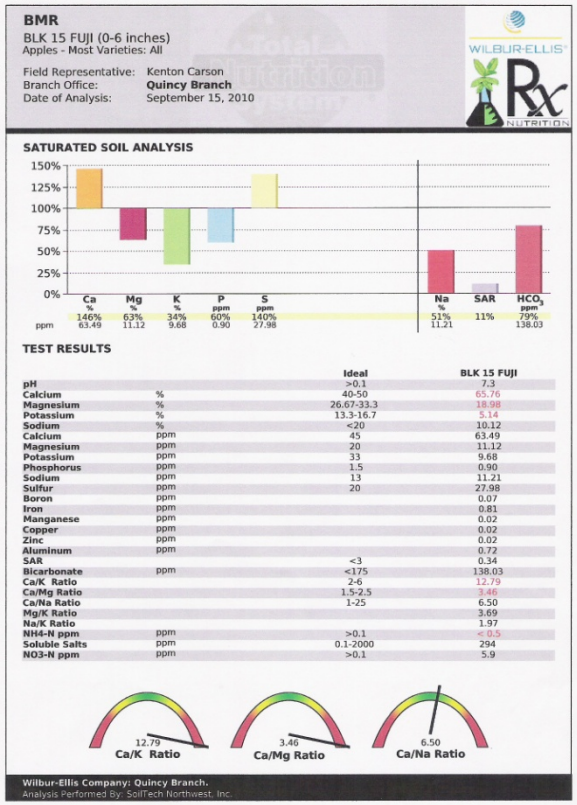
- Soil samples don't correlate to the quality of the block
- The best producing / highest quality blocks should have numbers closest to optimum levels
- The results are often the opposite

Eliminate the block numbers , can you tell which block is which?



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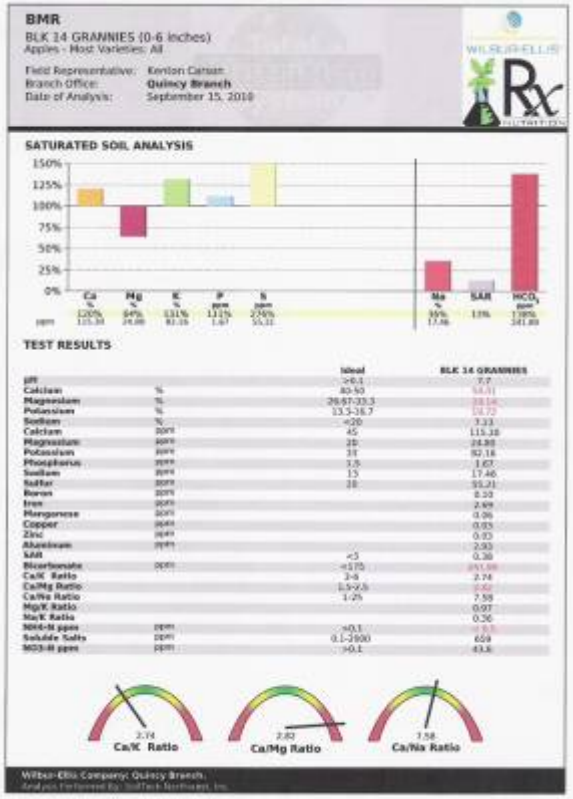
70 BPA Moderate Fuji



BMR

BLK 14 GRANNIES (0-6 inches)
Apples - Most Varieties: All

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Branch Office: **Quincy Branch**
Date of Analysis: September 15, 2010

SATURATED SOIL ANALYSIS

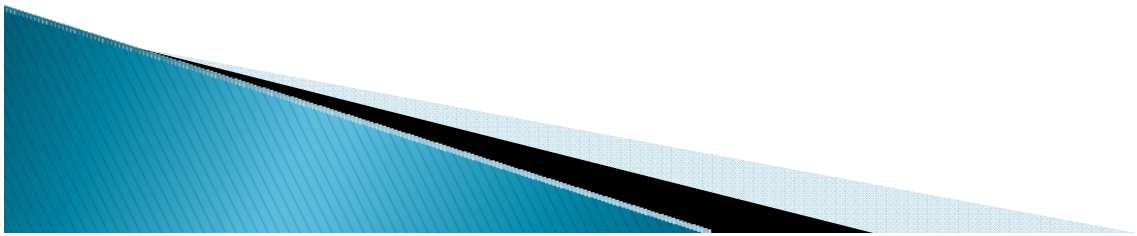
TEST RESULTS

Wilbur-Ellis Company: Quincy Branch.

40 BPA Weak Granny

Why might this be?

- We are only looking at one piece of a complex problem.
- Treating living soil like a chemistry experiment
- Soil Biology plays a large role in nutrient availability and plant response
- Water can move the nutrients in the soil and plant



Blind men describing the elephant

We need a test, or tests, that can predict a response in the tree

- Research leadership
- Money
- Time

- The highest new research priority in horticulture for the WTFRC.
- We need a plan or roadmap before we start

What system do you use mike?

- Trial and
- Error with
- Snippets of
- Science

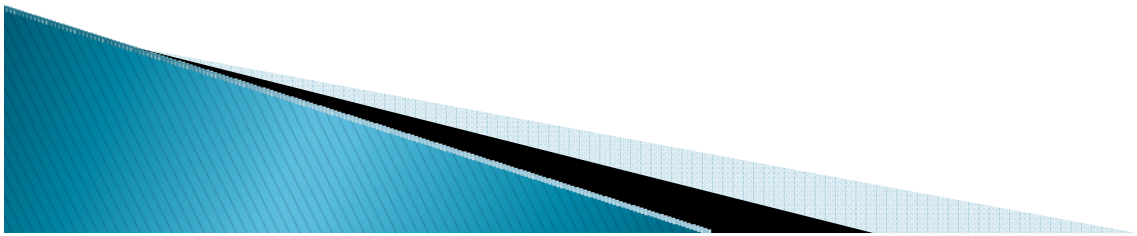
Vegetative Balance

Small fruit, low yields

Poor quality , low yields

The tools I use

- Nitrogen
- Mulch
- Lots of foliar calcium
- Foliar Phosphate and micronutrients
- Deficit irrigation
- Minimized cultivation



Nitrogen

- The Results are visible
- I can often see the difference between 25 and 75 pounds of actual N on a moderate vigor block
- Timing of N application has been shown by Righetti and Denise and Gerry Neilsen to make a big difference in how N is used by the tree.
- Growing season applications have the most effect. Early fall or spring

Mulch

Haul it in

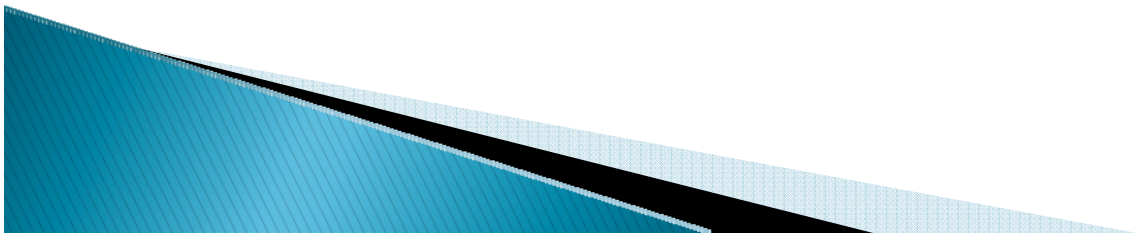
Mow and blow

Mulch

Moo and blow

Extensive research

- Seven year mulch trial at Summerland PARC
  Denise and Gerry Neilsen, Gene Hogue, Tom Forge
- Mulch Subplots in the PRD trial block at Quincy
- David Granatstein trials near Orondo, and Wenatchee
- Grow your own N trials, David Granatstein and Joan Davenport
- Multi year on farm trial in Canada and WA
  Denise and Gerry Neilsen, Gene Hogue, et al



Grow your own N

Year 3 after planting,
Alfalfa supplies 47# N

David Granatstein

Mow and Blow

Legume residue in tree row after mow and blow

Mulch provides several positive effects

- Improved water use efficiency
- Better vegetative growth
- Larger Fruit
- Weed suppression

Balancing the checkbook

	Nutrient pounds Removed 20 ton crop	Nutrient pounds Added 1 ton mint compost
Nitrogen	16.20	38.8
Phosphorous	12.96	11.8
Potassium	48.60	48
Calcium	1.90	25.8
Magnesium	2.14	8.8
Micronutrients	1.14	

Excessive potassium

- Mint mulch may oversupply K and Mg when used at rates required for N fertilization
- Wood chips or municipal compost may supply fewer Nutrients

Very active soil

Compost 1 to 2 inches deep

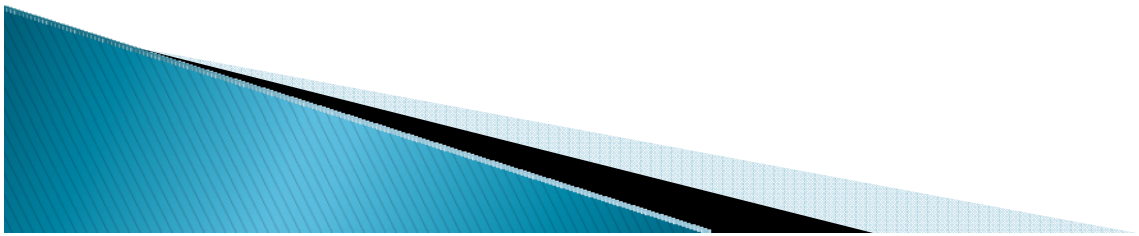
Frequent Calcium applications

Frequent foliar calcium

- Early season pro natural calcium. A complexed calcium
- Mid June Calcium Chloride 94% , 5 pounds per acre
- 7 or 8 applications on varieties less prone to bitter pit
- 10 to 12 applications on young trees, Goldens
- 15 to 20 on Honeycrisp, Watch overspray and Temps

Foliar Micronutrients

- Tree shield. Contains a lot of Phosphate like Alliete
- Pro Natural Zinc
- Pro natural Iron
- Mora leaf P&K
- Weak trees get a little urea mixed in



Deficit irrigation

- Sets terminals
- Improves fruit color
- Helps control effect of excessive vigor
- Improves spur density
- Improves sugar levels
- Reduces harvest bruising
- May reduce fruit size if done incorrectly

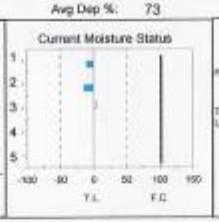
STEWART IRRIGATION 760-2622

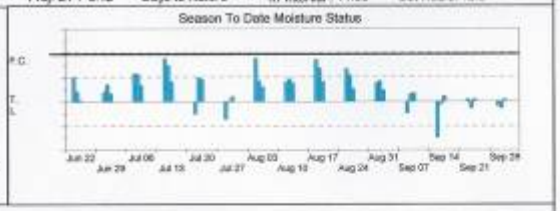
WEEKLY IRRIGATION SCHEDULING REPORT

Farm: BAIRD EAST **Block:** BLOCK 5 **Tube:** ROW 20 # 1 Sample Date 09/28/2010

Root Depth : 2 Avg Dep %: 73 Proj. ET : 0.12 Days to Next: 0 Irr Interval : 11.00 Set Hours: 12.0

in/ft	F.C.	T.L.	M
1	2.40	1.68	1.81
2	2.35	1.76	1.68
3	2.70	2.03	2.05
4		0.00	
5		0.00	
	7.45	5.47	5.34



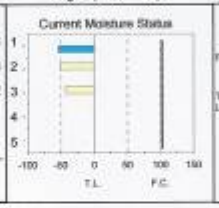


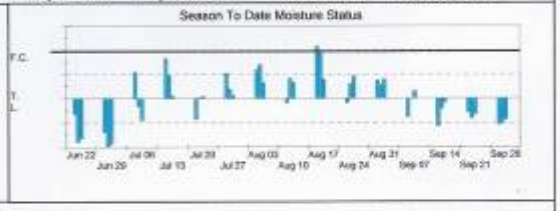
Comments :

Farm: BAIRD EAST **Block:** BLOCK 4 **Tube:** ROW 24 # 2 Sample Date 09/28/2010

Root Depth : 1 Avg Dep %: 70 Proj. ET : 0.11 Days to Next: 0 Irr Interval : 9.00 Set Hours: 12.0

in/ft	F.C.	T.L.	M
1	2.90	2.03	1.56
2	2.70	2.03	1.68
3	3.45	2.59	2.22
4		0.00	
5		0.00	
	9.05	6.64	5.46



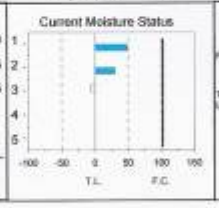


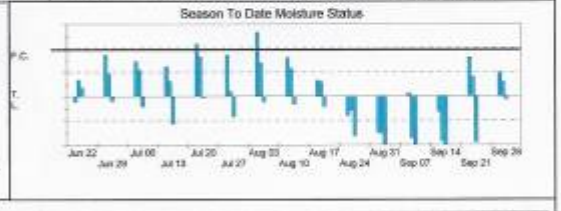
Comments :

Farm: BAIRD EAST **Block:** GOLDENS **Tube:** # 3 Sample Date 09/28/2010

Root Depth : 2 Avg Dep %: 71 Proj. ET : 0.10 Days to Next: 6 Irr Interval : 10.00 Set Hours: 12.0

in/ft	F.C.	T.L.	M
1	2.70	1.89	2.29
2	2.55	1.84	2.05
3	2.25	1.69	1.85
4		0.00	
5		0.00	
	7.50	5.41	5.99



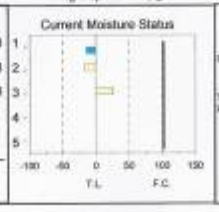


Comments :

Farm: BAIRD EAST **Block:** BLOCK 3 **Tube:** ROW 71 # 4 Sample Date 09/28/2010

Root Depth : 1 Avg Dep %: 70 Proj. ET : 0.10 Days to Next: 0 Irr Interval : 10.00 Set Hours: 12.0

in/ft	F.C.	T.L.	M
1	3.35	2.35	2.20
2	3.50	2.63	2.48
3	3.78	2.84	3.08
4		0.00	
5		0.00	
	10.63	7.80	7.76



Comments :

Quincy partial root zone drying

Deficit

Deficit + Mulch

Minimize tillage

- Bark damage to trunk
- Damage to the roots in the most productive soil horizon on a regular basis
- Soil compaction from frequent travel
- Reduces soil OM

Rodent Damage

Organic no till mouse control

- 50 traps per acre
- $.30 each
- Traps last 3 years
- Check 5 times at 1 hour per acre
- Round labor cost to $50 per year
- Traps are $5 per acre per year
- Organic peanut butter for bait $$$$$$

I can describe the tail, do I understand the Elephant?