I Don’t Know Why She swallowed a fly

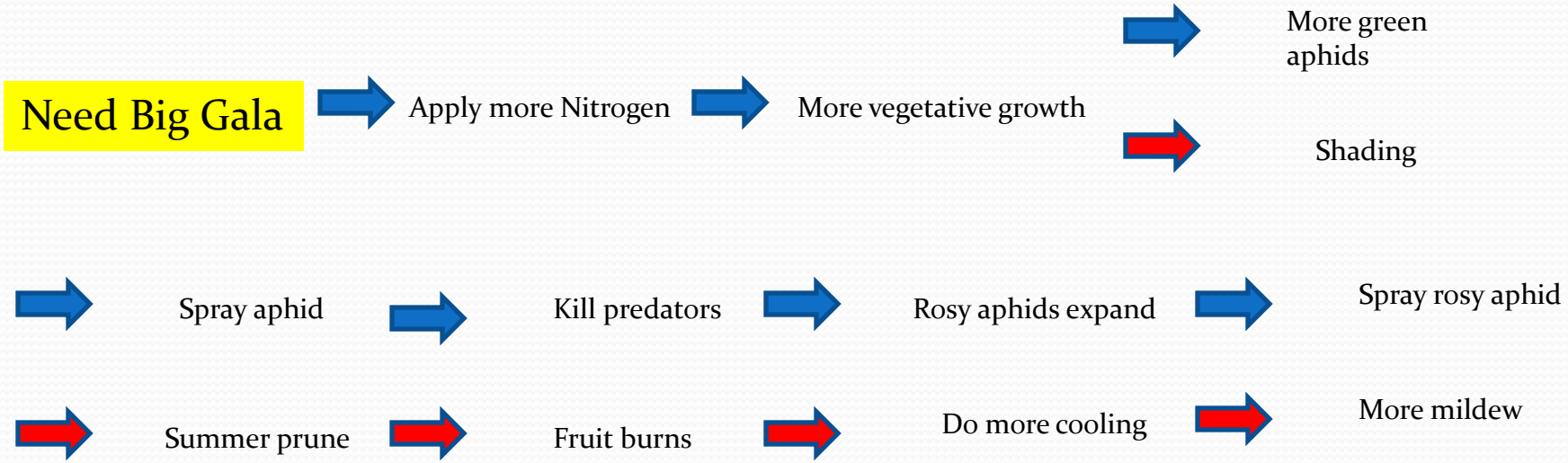
Orchard system integration from the front line: True life experiences

Mike Robinson , Double Diamond Fruit

Notes on slides can be viewed by holding the cursor over the icon in the upper left corner.

She swallowed the spider to catch the fly , I don’t know why she swallowed the fly, perhaps she’ll die

Linear Decision Making



The old lady eventually swallows a dog to catch the cat ……

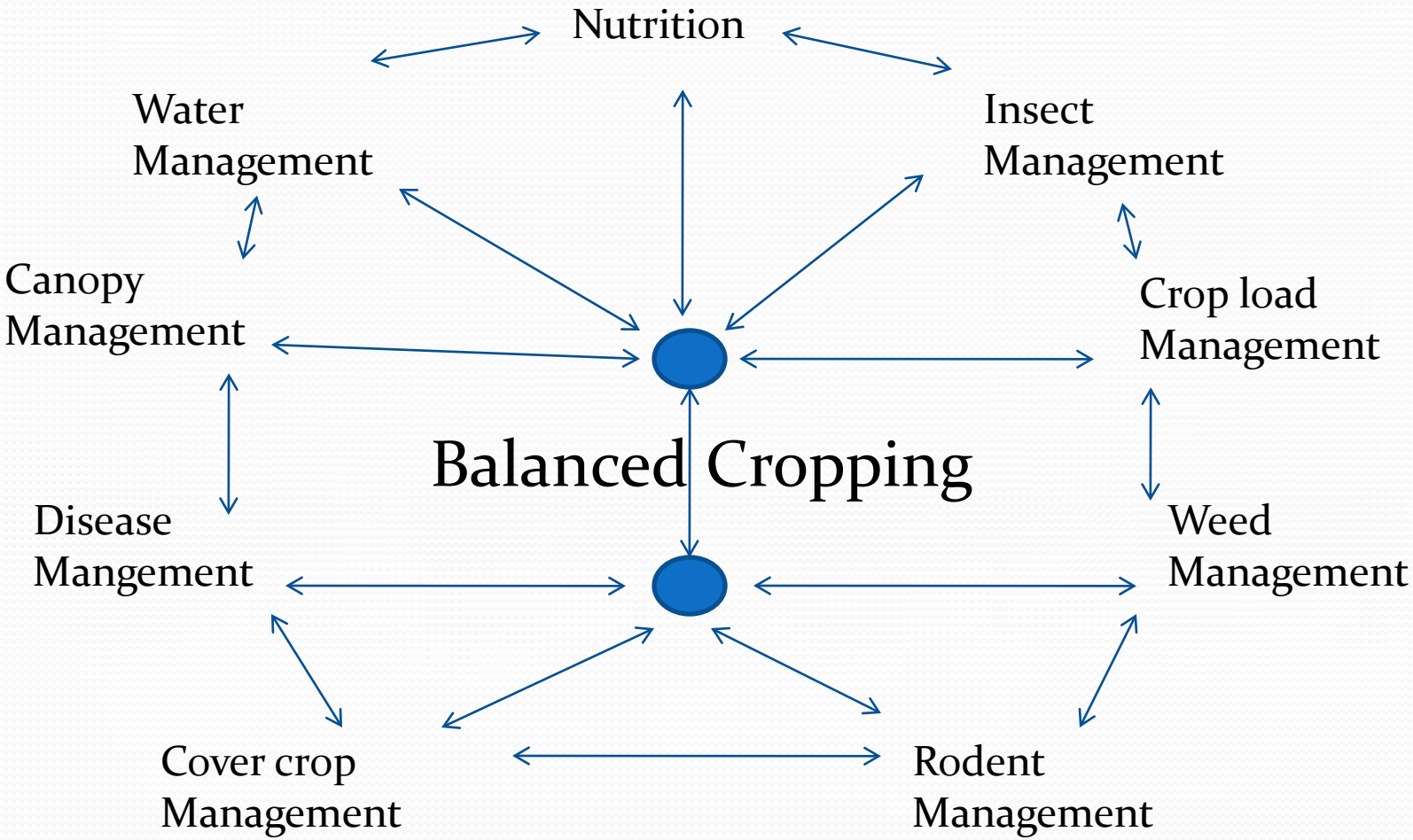
Systems integration = Not swallowing flies

Systems integration

- Melding science with on farm experience
- Leaving checks
- Following up on observations
- Looking for unintended consequences, good and bad

Maintaining Balance

- Trees fill the space
- Moderate vigor
- Annual cropping
- Limited pest and disease control
- Minimize production costs


Nutrition
Water Management
Insect Management
Canopy Management
Crop load Management
Balanced Cropping
Disease Mangement
Weed Management
Cover crop Management
Rodent Management

Canopy Management

- Long pruning
- Avoiding heading cuts in vegetative wood
- Only heading flat wood in a bearing habit
- Need for summer pruning indicates an out of balance condition

Insect Management

- We have the tools from research to manage apple pests organically
- Most of the most useful organic tools are prophylactic

Codling Moth Pheromones

- Repeated scientific trials show good response
- Adoption by most of the industry , both conventional and organic
- Personal experience has been excellent

Mature codling moth larva

Codling moth adult (J. Brunner)

Oils

- Delayed dormant, 2.5% superior oil NW 200 gpa
- 20% bloom, 2% Crockers fish oil, 200 gpa
- 80% bloom, 2% Crockers fish oil, 200 gpa
- 200 degree days , 1% superior oil NW 200 gpa
- 400 degree days , 1% superior oil NW 200 gpa
- 600 degree days , 1% superior oil NW 200 gpa.

Brunner and Willet showed good results for pest control, 10 years of use show no horticultural problems. We mix with Calcium chloride

Predator release

- No scientific work supports efficacy
- I use lacewing cards every year, its cheap and I have seen some positive results in a couple of farms.
- No good checks in my trials
- This practice is hard to Justify based on my usual standards

DAS The Decision Aid System

- Developed By Vince Jones
- Models for most major pests, diseases, sunburn
- Scientific timing recommendations for pest control
- Can be set to give organic recommendations
- Specific for AWN sites or my farm
- Can be accessed via iPhone
- I use it most days in season,

AG Weather Net

- The source of raw data for DAS
- Historical Data can be searched in many ways
- Real time temp and weather info available
- Very useful during frost and cooling
- Good for comparing years
- I use it with chemical thinning and spray records to get a complete picture

LS & FO

- Lime Sulfur + Fish oil has been shown to provide some control of leafrollers at the Wenatchee TFRC.
- Neither component alone was effective
- My leafroller pressure is very light where I have used it
- Harold Ostenson may soon find someone to prove it is a cure for AIDS

Entrust

Wooly aphid sprays

Natural enemy studies

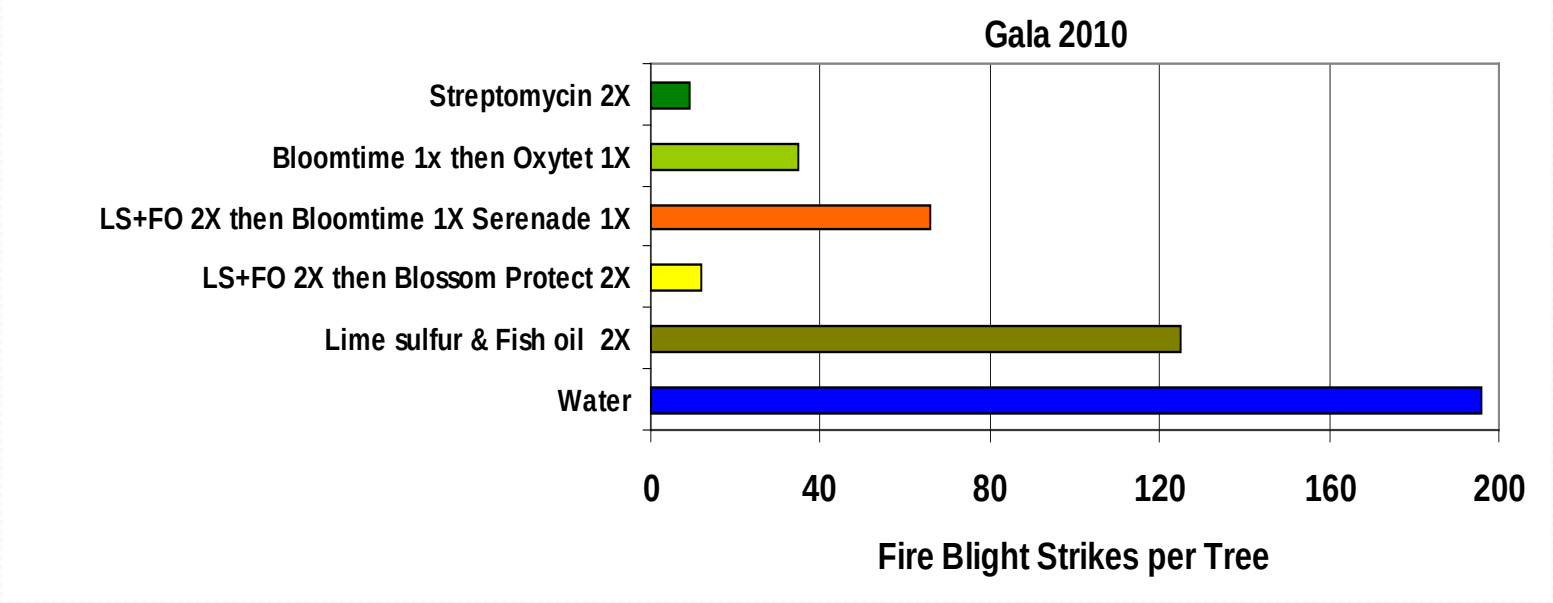
- As a part of the Area wide 2 projects, Entomologists are looking at both acute and sub lethal effects of pest control materials on beneficial's
- There is a chart in the Spray guide. Take a look at Success another spinosad like Entrust.

Disease Management

- LS + FO appears to provide some control of fire blight , Work of Ken Johnson, OSU
- Lime Sulphur controls Mildew
- Managing humidity and overwintering infections is important with most diseases

Not enough to go around at bloom

Science based options



Dr. ken Johnson OSU

Rodent Management

- Mulch and not till create great mouse habitat

Rodent Damage

Organic no till mouse control

- 50 traps per acre
- $0.30 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 $$$$$$

Weed Management

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

Mulch

Haul it in

Mow and blow

David Granatstien

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 trials in Canada and WA
  Denise and Gerry Neilsen, Gene Hogue, et al.

Mulch provides several positive effects

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

Quincy PRD trial Mulch

- In early spring of 2002, five tree subplots were established in the Deficit and control plots with three inches of composted yard waste. The results were dramatic. The unanswered question: Did the mulch provide better soil moisture relations or nutrition?
- The vigor of the mulched trees seem to be increasing. How long will the organic amendment affect the trees in the mulch plots?
- Fruit color and leaf nitrogen are known to be inversely related; more nitrogen=less fruit color. The fruit and nitrogen levels of the mulched plots clearly support this relationship.
- Leaf calcium and magnesium also trend higher in the mulch plots but the calcium / magnesium ratio move in a favorable direction

Jim McFerson, Horst Caspari, Tom Auvil

Grow your own N

Year 3 after planting,
Alfalfa supplies 47# N

David Granatstein

Mulch

Moo and blow

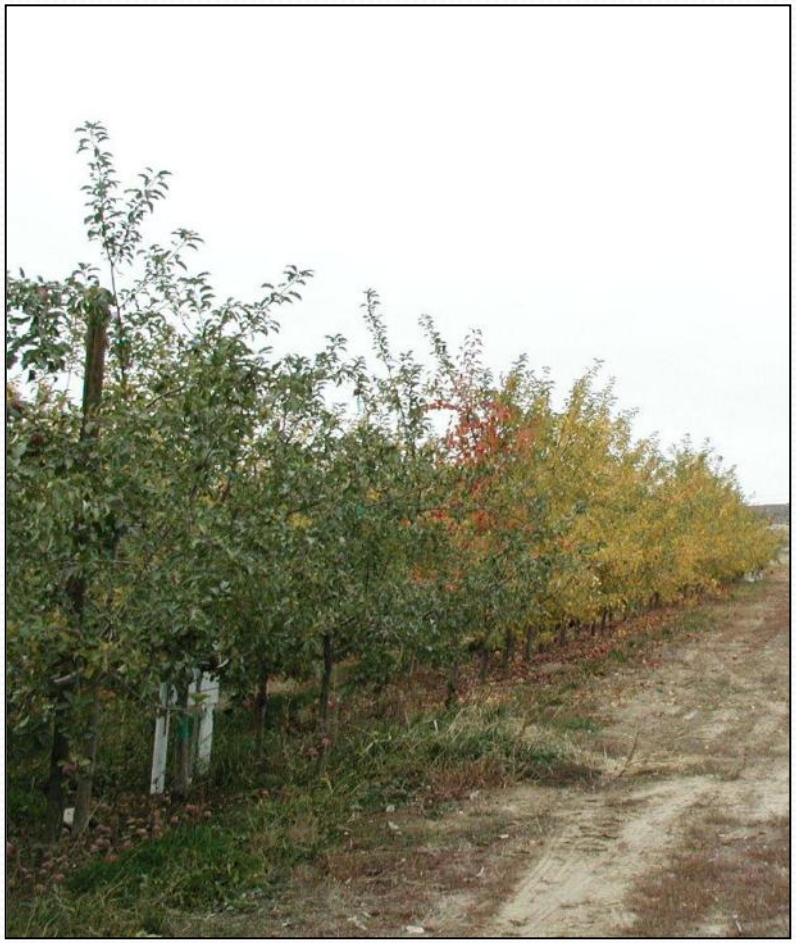
Deficit irrigation

- 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

Quincy PRD Deficit Irrigation

- Three year significant findings:
- Very uniform applications of water allows water stress to be manipulated to improve fruit color while maintaining yield and minimizing fruit size reduction.
- The irrigation practices in this trial did not induce typical water stress symptoms such as off fruit color, sunburn, leaf wilt or drought mark on the fruit.
- Mulches can have big impacts on the soil moisture and nutritional relationship.
- Two lines of buried drip per row may allow the successful completion of a quality crop with less than 20 inches of water.
- Thorough, regular monitoring of deficit irrigated blocks can minimize the risk of crop/and or tree damage due to excessive water stress.
- The 2003 crop did not have the fruit appearance of the prior two seasons. The soil moisture levels at the end of July are very different for the two seasons. Is this a critical time to stress trees for improved color in Fuji?

Jim McFerson, Horst Caspari, Tom Auvil,



- The yellow leaves indicate the result of less water. The trees have the same appearance as low nitrogen trees. This is an example of the intricate relationship of soil moisture, root health, nutritional status and tree vigor.

McFerson, Caspari, Auvil

Standard Fuji

- Fruit color is enhanced with less tree vigor. Below are Fuji where less water is applied and the appearance is excellent. Significantly more water was applied in 2003 due to the heat, and fruit appearance was not as good. 2003 crop load was heavy, further challenging the ability of fruit to color.

Jim McFerson, Horst Caspari, Tom Auvil,

- Over irrigating early in the year leads to excess vegetative growth and nutrient leaching
- Over irrigation late in the year delays development of background color
- Under irrigating in periods of temp stress can lead to drought injury
- Watch the second and third feet of the profile

09/28/10

STEWART IRRIGATION 760-2622

WEEKLY IRRIGATION SCHEDULING REPORT

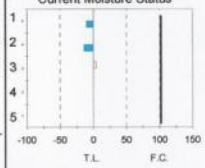
Page : 1

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	1.61
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

Current Moisture Status



Season To Date Moisture Status

Comments :

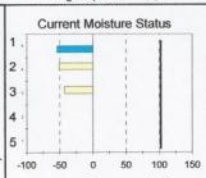
Gala 5

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

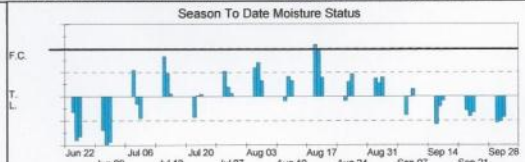
Root Depth : 1 Avg Dep %: 70 Proj. ET : 0.11 Days to Next: 0 Irr Interval : 9.00 Set Hours: 12.0

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

Current Moisture Status



Season To Date Moisture Status



Comments :

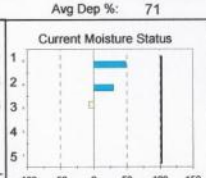
Fuji

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

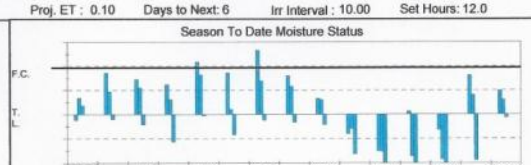
Root Depth : 2 Avg Dep %: 71 Proj. ET : 0.10 Days to Next: 6 Irr Interval : 10.00 Set Hours: 12.0

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	1.65
4		0.00	
5		0.00	
	7.50	5.41	5.99

Current Moisture Status



Season To Date Moisture Status



Comments :

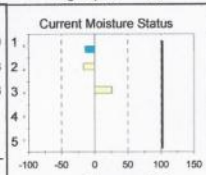
Goldens

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

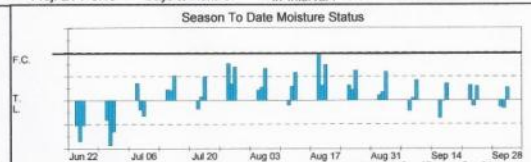
Root Depth : 1 Avg Dep %: 70 Proj. ET : 0.10 Days to Next: 0 Irr Interval : 10.00 Set Hours: 12.0

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

Current Moisture Status



Season To Date Moisture Status



Comments :

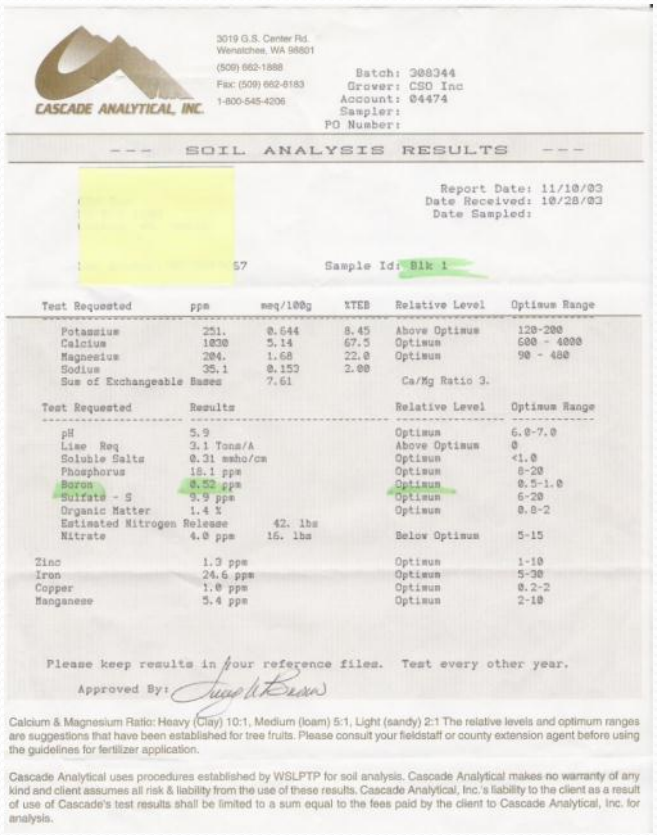
Gala 3

Overhead Cooling

- Burn is affected by temperature, UV radiation, wind , size of fruit, and humidity . Larry Schrader et al.
- Model on DAS
- I don't cool below 90 degrees, before 12pm, or after 5 pm
- Lots of days 85 to 90 , few days above 90.
- Negative effects of cooling include splits in Gala and poor fruit finish in Goldens and Fuji
- Fruit at a 90^{0} angle to the sun and directly exposed may burn regardless of what you do. More downgrades

Fertility = Blind Men Describing an Elephant

Samples don’t correlate



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: CSO Inc
Account: 04474
Sampler:
PO Number:

--- SOIL ANALYSIS RESULTS ---

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

[redacted] 57 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.

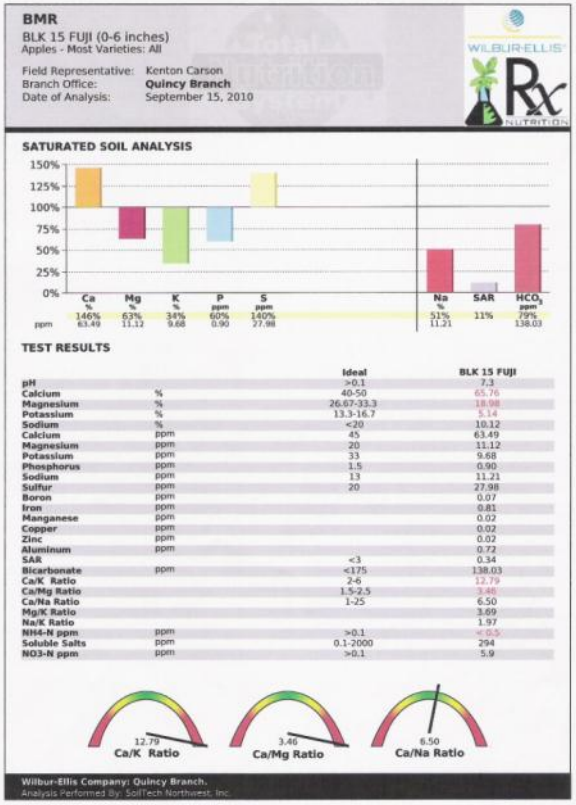
Approved By:

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 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?



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

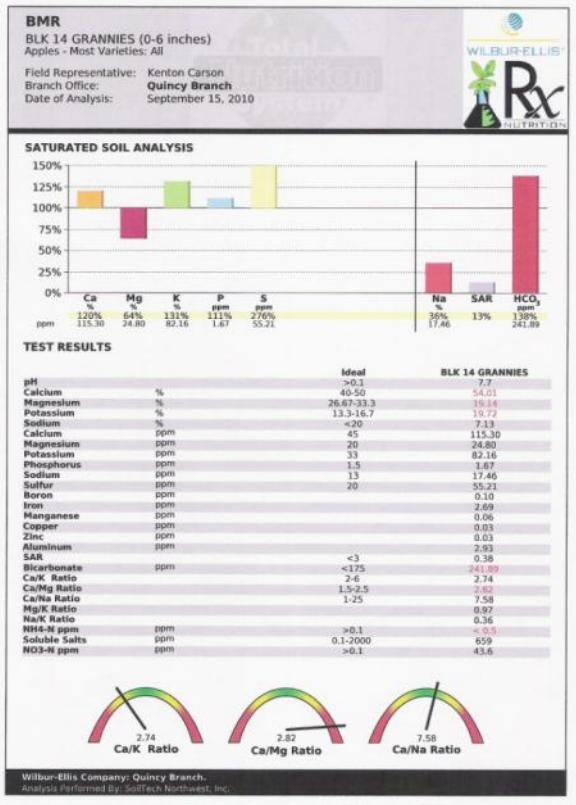
WILBUR-ELLIS Rx NUTRITION

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.



BMR
BLK 14 GRANNIES (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 14 GRANNIES
pH		>0.1	7.7
Calcium	%	40-50	54.01
Magnesium	%	26.67-33.3	19.14
Potassium	%	13.3-16.7	19.72
Sodium	%	<20	7.13
Calcium	ppm	45	115.30
Magnesium	ppm	20	24.80
Potassium	ppm	33	82.16
Phosphorus	ppm	1.5	1.67
Sodium	ppm	13	17.46
Sulfur	ppm	20	55.21
Boron	ppm		0.10
Iron	ppm		2.69
Manganese	ppm		0.06
Copper	ppm		0.03
Zinc	ppm		0.03
Aluminum	ppm		2.93
SAR		<3	0.38
Bicarbonate	ppm	<175	241.89
Ca/K Ratio		2-6	2.74
Ca/Mg Ratio		1.5-2.5	2.82
Ca/Na Ratio		1-25	7.58
Mg/K Ratio			0.97
Na/K Ratio			0.36
NH4-N ppm	ppm	>0.1	< 0.5
Soluble Salts	ppm	0.1-2000	659
NO3-N ppm	ppm	>0.1	43.6

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

70 BPA Moderate Fuji

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

Fertility

- How much P and K are too much?
- How do we get enough N without P and K?
- What correlation is there between soil OM levels and fruit quality or production?
- How many smart guys like Mark Mazzola will it take to figure this out before I die?

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

- Government agencies require use of sampling even though there is no correlation with any test. NRCS equip
- NOP requires proof of deficiency through testing to use nutrients

Crop load Management

- Annual cropping is the biggest challenge I face organically
- The earlier we thin , the bigger the crop we can carry and have return bloom. Batjer
- I suspect that leaf N levels directly affect response to sulfur thinners
- We don't know the mode of action for LS&FO

Table 6. Incidence and percentage of results significantly superior (p=.05) to untreated control.

Apple chemical bloom thinning trials WTFRC 1999-2004.

Treatment	Fruitlets/100 blossom clusters	Harvested fruit diam	Return bloom[1,2]	
Ammonium thiosulfate	13 / 41 (32%)	9 / 44 (20%)	2 / 33 (6%)	
NC99 (Mg^{++}/Ca^{++} Cl^{-} brine)	14 / 26 (54%)	7 / 28 (25%)	2 / 22 (9%)	
Lime sulfur	25 / 48 (52%)	12 / 42 (29%)	9 / 36 (25%)	
Crocker's Fish Oil + lime sulfur	50 / 68 (74%)	24 / 63 (38%)	12 / 45 (27%)	
JMS Stylet Oil + lime sulfur	14 / 23 (61%)	8 / 22 (36%)	4 / 20 (20%)	
Wilbur-Ellis Supreme Oil + lime sulfur	14 / 22 (64%)	4 / 21 (19%)	3 / 16 (19%)	
Vegetable Oil Emulsion	13 / 18 (72%)	4 / 17 (24%)	2 / 15 (13%)	

[1]Does not include data from 2004 trials.

[2] (no. blossom clusters year 2/sample area) / (no. blossom clusters year 1/sample area)

- "This big picture view of more than 100 trials shows clearly that oil and lime sulfur mixes have yielded positive results more consistently than have desiccating salts such as ATS or NC99, especially with respect to return bloom"

- <u>Fruit finish</u>
  While some have adopted a number of the thinning programs we have evaluated, many growers express concern over fruit finish issues. We continue to carefully evaluate fruit sampled from every trial for russet on fruit flanks, shoulders, and in stem bowls. Despite rigorous application of conservative grading standards (e.g. all fruit with any visible russet is graded as "russeted," regardless of degree) **we have been unable to discern that any of our treatments have had a consistent effect, positive or negative, on fruit finish.** We have observed isolated cases of fruit marking in sprayer blast zones, which may offer some new research directions. At any rate, attention to fruit finish will continue to be a high priority in our programs.

Chemical alternatives for cost effective apple crop load management. (2005) Dr Jim McFerson

Integration

- Moderate vigor
- Deficit early and late
- Avoid cooling below 90 and after 5 pm
- Mulch
- Limited tillage
- Trap for mice
- Minimize heading cuts on vegetative wood
- Avoid summer pruning
- Use predators
- Minimize spray , tolerate some pests, think about the effect on predators
- Maintain annual cropping, take risks with thinning
- Plan for the long term

Don’t swallow flies