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Ag Rx Annual Spring Avocado/Citrus Meeting

February 28, 2017

David Holden

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What we Will Look at Today

- Data Specific to Citrus and Avocados
  - Snail Baits
  - Nematodes
  - Burn Down Herbicides
  - Long term herbicides
  - Phytophthora Control in Avocados
  - Plant health and Headline
  - N-P-K levels for both leaf and soil in citrus and avocados
  - Biostimulants – When to use and why
    - Seaweed
    - HYTA
    - H2H
  - Zinc and Grozyme

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Spring 2015 Snail Bait Trials

- Caged feeding trials with and without rain weathering of bait.
- All treatments went on at 20 pounds per acre equivalent

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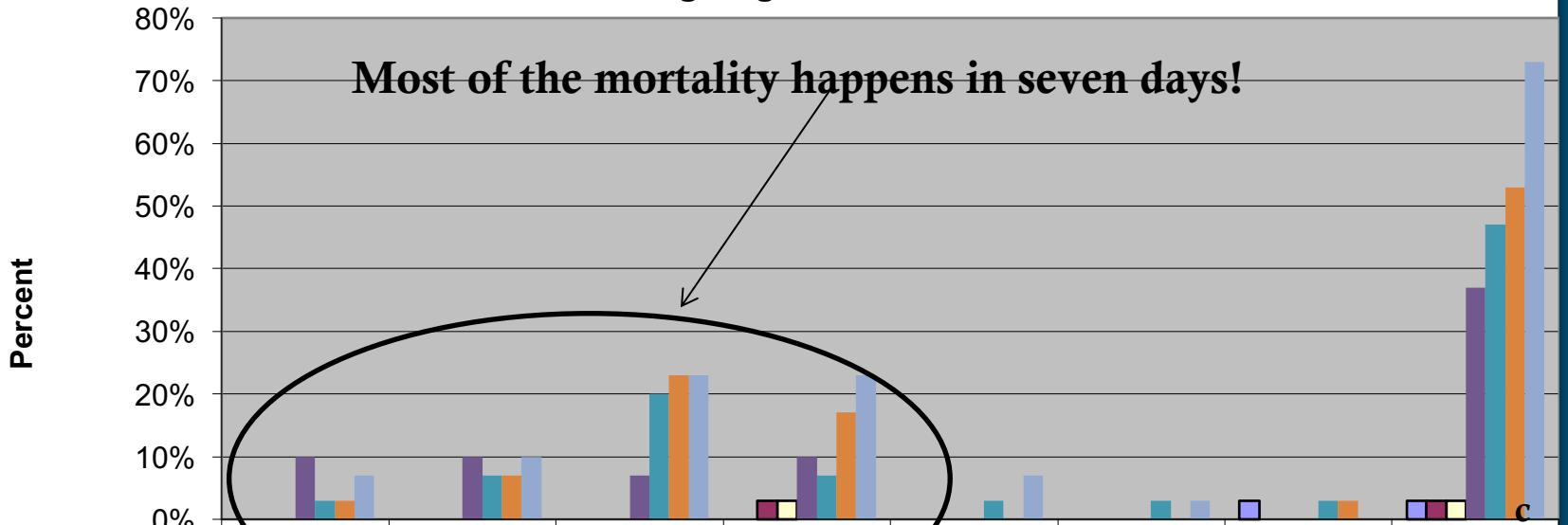
Snail Bait Trial Spring 2015

Chart 1: Holden Research Trial for Snail Control with Various Baits on Lemons, Ventura County, Spring 2015- Percent Dead Snails per Set of Feeding Cages



	3 DAT	4 DAT	5 DAT	7 DAT	9 DAT	12 DAT	16 DAT	Cumulative
UTC	0%	0%	0%	0%	0%	0%	3%	3%
BioSul 1% S- Rain	0%	0%	0%	3%	0%	0%	0%	3%
Bio Sul 1% S - No Rain	0%	0%	0%	3%	0%	0%	0%	3%
Slugger 4% - Rain	10%	10%	7%	10%	0%	0%	0%	37%
Deadline 3% - Rain	3%	7%	20%	7%	3%	3%	3%	47%
Deadline 3% - No Rain	3%	7%	23%	17%	0%	0%	3%	53%
Slugger 4% - No Rain	7%	10%	23%	23%	7%	3%	0%	73%

c
c
b
b
ab
a

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Which Bait is Best?

- Deadline SP
- Ferroxx
- Slugger
- I would rotate between a metaldehyde (Deadline) and iron phosphate (Ferroxx) based baits
- They both control equally well, just remember that with the Deadline you see snails dying, with the Ferroxx they usually make it back to the leaf litter before dying.

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Melocon for Citrus Nematode Control

- Melocon WG
- 2-4 lb/ac
- Twice per year
- Significant reductions in trials and real world.
- Four years of development testing in citrus.
- Registered in California on multiple crops including but not limited to most vegetables, tree, vine, and nut crops, berries, etc. Check the label.

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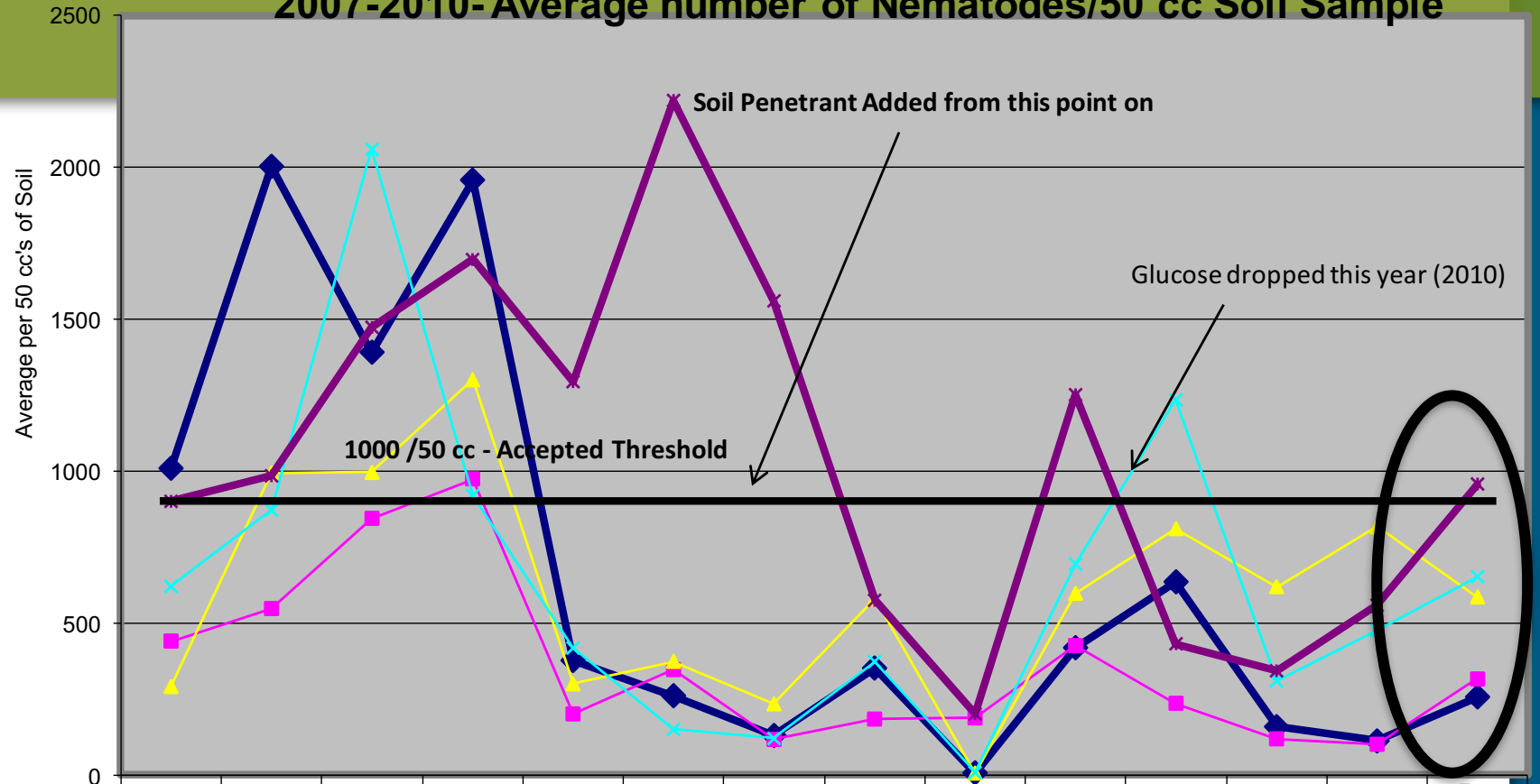
Chart 1: Prophyta Efficacy Trial for the Control of Citrus Nematode- 2007-2010- Average number of Nematodes/50 cc Soil Sample



	Pre-Treat 6-7-07	37 DAT-A 7/25/07	48 DAT-B 10/2/07	Pre-Treat 5/26/08	49 DAT-C 7/31/08	55 DAT-D 10/6/08	Pre-Treat 6/3/09	42 DAT-E 7/28/09	52DAT-F 10/2/09	Post Treat Ave - 3 Yr	Pre-Treat 6/7/10	40 DAT-G 8/2/10	51 DAT-H 10/13/10	Four Year Post Treat Ave	
Meloncon - Middle	1010	2004	1392	1959	377	261	130	352	7	419	636	159	112	257	
Vydate Standard	441	548	845	975	201	347	117	184	188	426	236	119	101	316	c
Meloncon - low	291	995	996	1301	300	374	234	580	6	598	811	620	817	586	bc
Meloncon - High	621	872	2060	920	418	150	120	373	8	694	1235	310	475	653	bc
UTC	901	985	1474	1697	1295	2221	1561	575	201	1252	432	343	559	958	ab a

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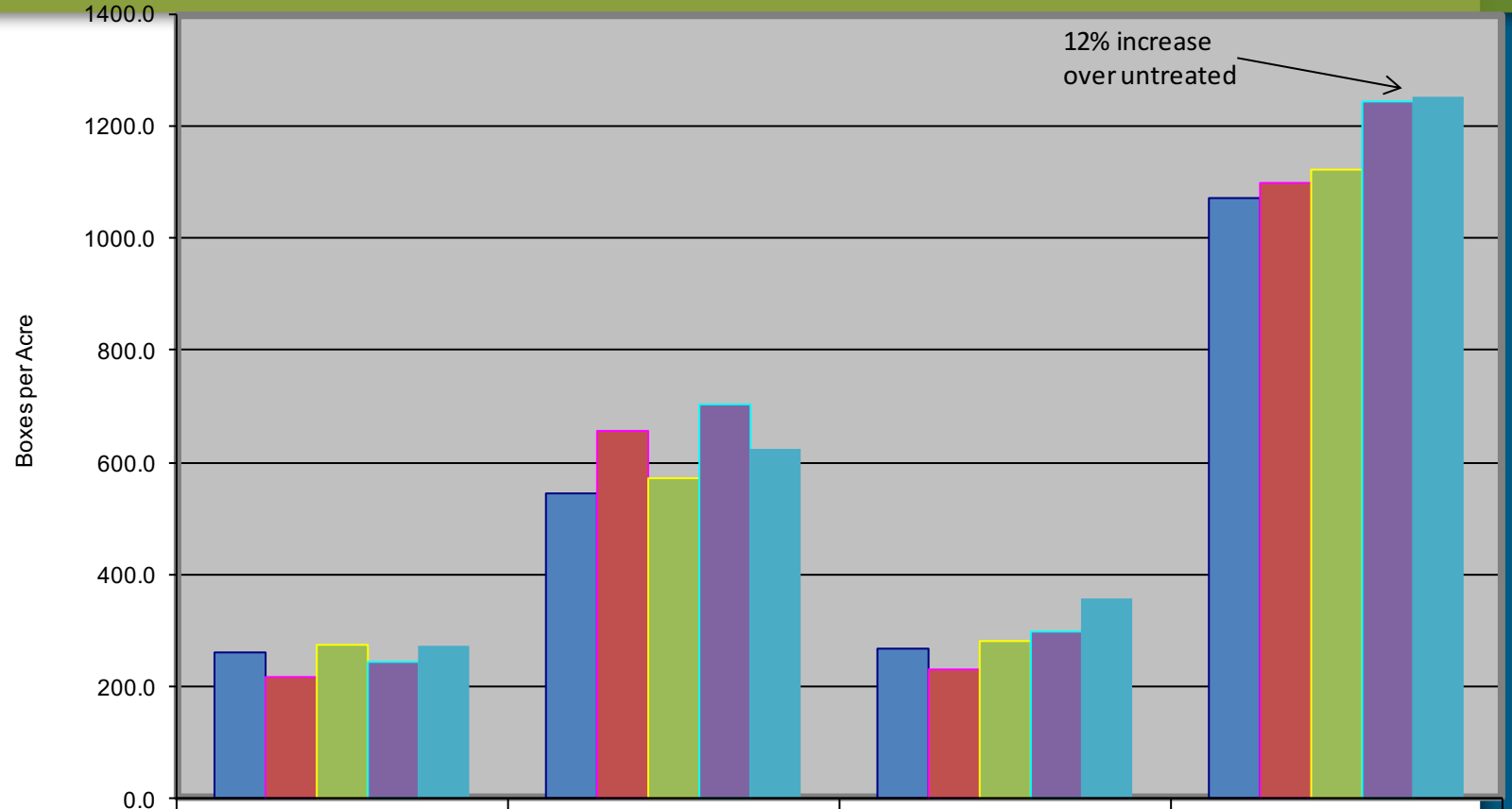
Chart 2: Prophyta Efficacy Trial for the Control of Citrus Nematode - 2007-2010- Extrapolated Yield per Acre for 2008



	Feb-08	May-08	Jul-08	Total for Year
Meloncon - low	261.0	544.0	266.0	1071.0
Vydate Standard	215.0	655.0	230.0	1099.0
UTC	272.0	570.0	281.0	1122.0
Meloncon - High	244.0	703.0	298.0	1245.0
Meloncon - Middle	272.0	625.0	357.0	1254.0

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Actual Applied Field Results

- Single spring applications – 2010
- Populations listed are per 50 cc, threshold is 1000/50 cc.
  - Client A Client B
  - Pre Treat 3800 Pre Treat 3500
  - Post Treat 360 Post Treat 900
- Suggest two applications, one in spring and one in fall for the first year if populations high like these clients.

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Effectiveness

- "Any product that shows a 50% reduction in the nematode population 6 months after application is doing the job."
  - Dr. Mike McHenry, University of California nematologist.

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Factors to Consider with Melocon

- Soil Type
  - Lighter soils will require application later in the irrigation cycle
  - Heavier soils will require application earlier in the irrigation cycle. Also the use of a soil adjuvant to help with percolation may be necessary.
- Other?
  - Soil Moisture
  - Soil Temperature
- Results may not be immediate, Melocon is made up of the spores of a soil fungus that parasitizes many species of plant parasitic nematodes. Recheck populations four to six weeks after initial treatment in the same general vicinity that the original samples were taken from. Make sure you have roots in both the original and subsequent samples.

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Conventional Contact Herbicides

- You have choices
- Citrus
  - Glufosinate such as Lifeline and Rely
  - Glyphosate such as Roundup, Honcho
  - Paraquat dichloride (Gramoxone)
- Avocados
  - Glyphosate
  - Paraquat dichloride (Gramoxone)

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Hairy Fleabane 7 days post Treat - Glyphosate

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Hairy Fleabane 7 days post Treat - Glufonsinate

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Hairy Fleabane 7 days post Treat - Paraquat

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Residual or Long Term Herbicides

- Trial instigated prior to first rain in November.
- Photos as of last week, February 22, 2017
- 18.5 inches of rain to date on these trials
- All applied with paraquat as burn down two days prior to first significant rain (.35 inches) to set in place
- Berm and sides treated, not the middles.

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No Residual Herbicide

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Alion/Matrix Tank Mix

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Alion Alone

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Matrix Alone

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Broadworks Alone (Grass coming through)

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Prowl H2O/Matrix

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Phytophthora in Avocados - 2016

- Multiple in season applications to the soil
  - Ridomil Gold SL – Spring and Fall
  - Soilgard – Single spring application
  - Soilgard- Single spring application plus Double Nickel LC applied three more times
  - Double Nickel LC applied four times
- Products are available that work

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Phytophthora Ratings

Treatment	Vigor rating in spring (0-5, 0 best)	Vigor rating in fall	Average fruit size in fall - diameter
Untreated Check	3.0	2.9 a	48.4 a
Ridomil	2.8	1.8 **b**	48.6 a
SoilGard - Single	1.8	2.3 ab	54.3 ab
SoilGard-Single Double Nickel -3	2.9	1.9 **b**	55.9 **b**
Double Nickel - 4	2.8	1.6 **b**	56.9 **b**

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Plant Health Trial in Citrus with Headline

- Multiple Foliar Applications to Lemons in the spring of 2016. Trees approximately 15 years old.
- May-June, compared to June-July timing
- Yield increases seen in other citrus districts.
- Jury is still out on lemons here, just now collecting data.
- First pick
  - Untreated check – 1.74 boxes per tree
  - May-June App – 1.97 boxes per tree
  - June-July app – 1.99 boxes per tree

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Nitrogen-Phosphorus-Potassium for Lemons and Avocados

- Recommended Leaf Levels *

Element	Avocados	Lemons
Nitrogen	2.2-2.4%	2.3-2.6 %
Phosphorus	.08-.44%	.12-.21 %
Potassium	1.0-3.0%	.7-3.3%

- *C/O Fruit Grower's Labs reports

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Are these levels valid today

- Based on data from 40-60 years ago, are they still valid?
- Yes, may want to raise the nitrogen a bit if you are fighting boron in the water.
- Recent report commissioned by the California Avocado Commission. "Decision Support Tools for Management of Avocado Nutrition and Chloride Toxicity"

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Time for a Break

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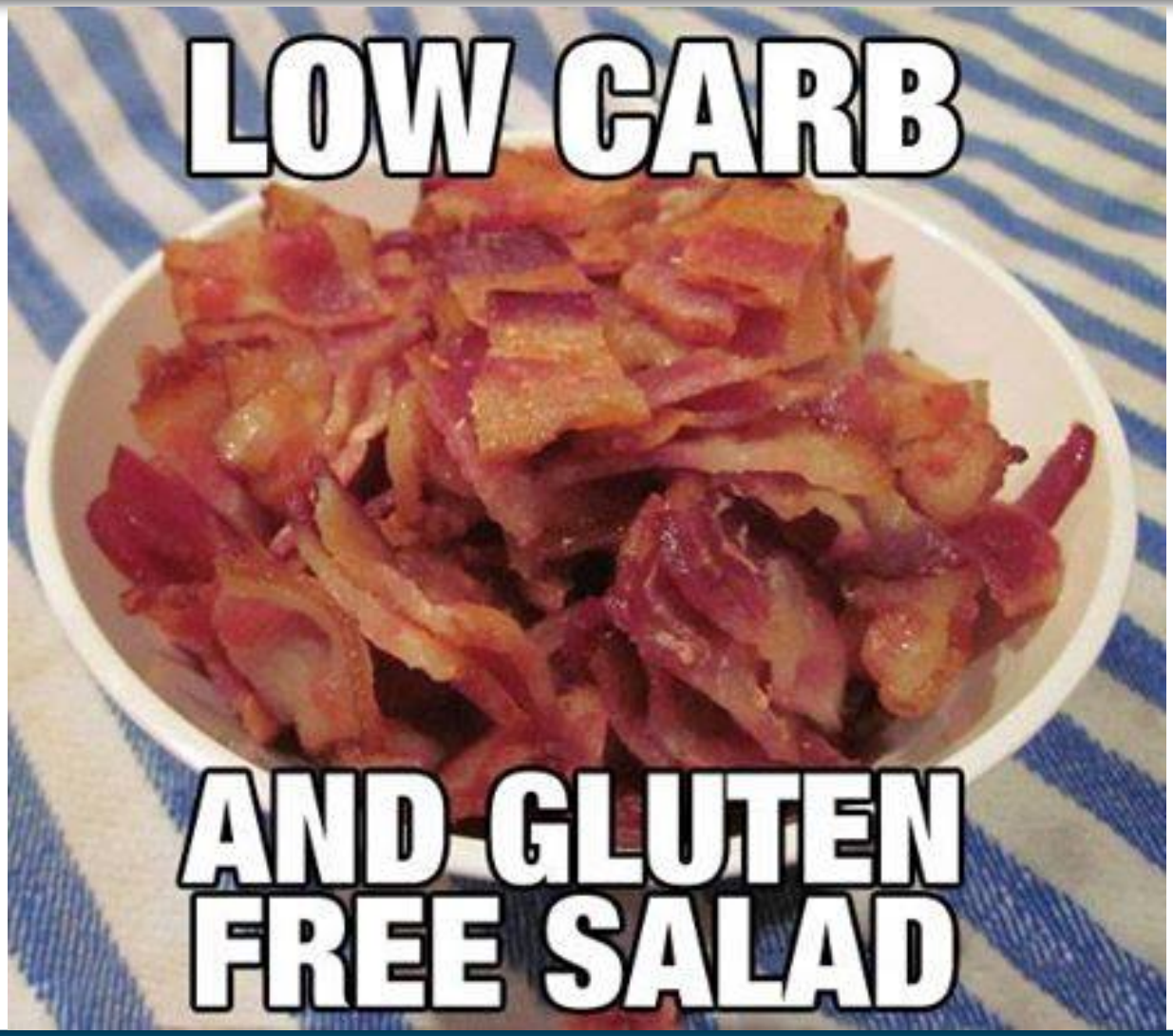

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I wasn't planning on going for a run today, but those cops came out of nowhere!

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Biostimulants Use for Avocados and Citrus – A Practical Persective.

- What are they and why am I talking about them
- Applied Science behind them
- Practical reasons to use them

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Biostimulants – What they are?

- From "The Biostimulant Coalition.
- **"Biostimulant (n.) – A material that, when applied to a plant, seed, soil or growing media - in conjunction with established fertilization plans, enhances the plant's nutrient use efficiency,** ***or provides other direct or indirect benefits to plant development or stress response.***

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What They Look Like?

- Seaweeds
- Humic-Fulvic Acids
- Plant based Extracts
- Phosphites?
- Amino acids
- Bacterial/Fungal Biologicals
- Fermentation process metabolites?
- Mixes of the above
- Algaes
- Reprocessed vegetative matter
- Others?

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What are they?

- Currently may be categorized three ways:
  - Abiotic or Biotic Stress mitigators
  - Biome Influencers
  - Primers
- Competitive inhibition of pathogens in the rhizosphere
- Stimulation of plant's natural defense mechanisms.
- Supplemental in nature, that is they are not a replacement for the seventeen essential elements, but they can help alongside fertilization and pest control.

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Further Explanation of How they might Work

- They influence plant genes to “up regulate” and “down regulate” in the presence of abiotic and biotic stress
  - Abiotic = non living, that is drought, salt, frost, ect.
  - Biotic = living such as insects, disease, etc.
- They may impact plants by being “biome influencers.” Generally bilogicals or metabolites of biologicals.
- They may be “primers”, that is they may change how a plant responds to its environment with a single exposer to the plant(s).

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Example of Abiotic Stress

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What they are not?

- Some would say they are:

- But I agree with Dr. Patrick Brown at UC, Davis, they are more likely:

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For Further Reading

- Biostimulants in Plant Science: A Global Perspective, *Frontiers in Plant Sciences, January 26, 2017*, http://journal.frontiersin.org/article/10.3389/fpls.2016.02049/full

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Seaweed in Avocados/Mandarins

- 2006-07 Sizing Study with Acadian
- Three Year Study with Acadian
- Mandarin Study with Algamin

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2007 Acadian Sizing Study

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Fruit Sizing February 1, 2007, Acadian on left

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Fruit Sizing April 5, 2007, Acadian on left

2010-2012 Avocado Acadian Study

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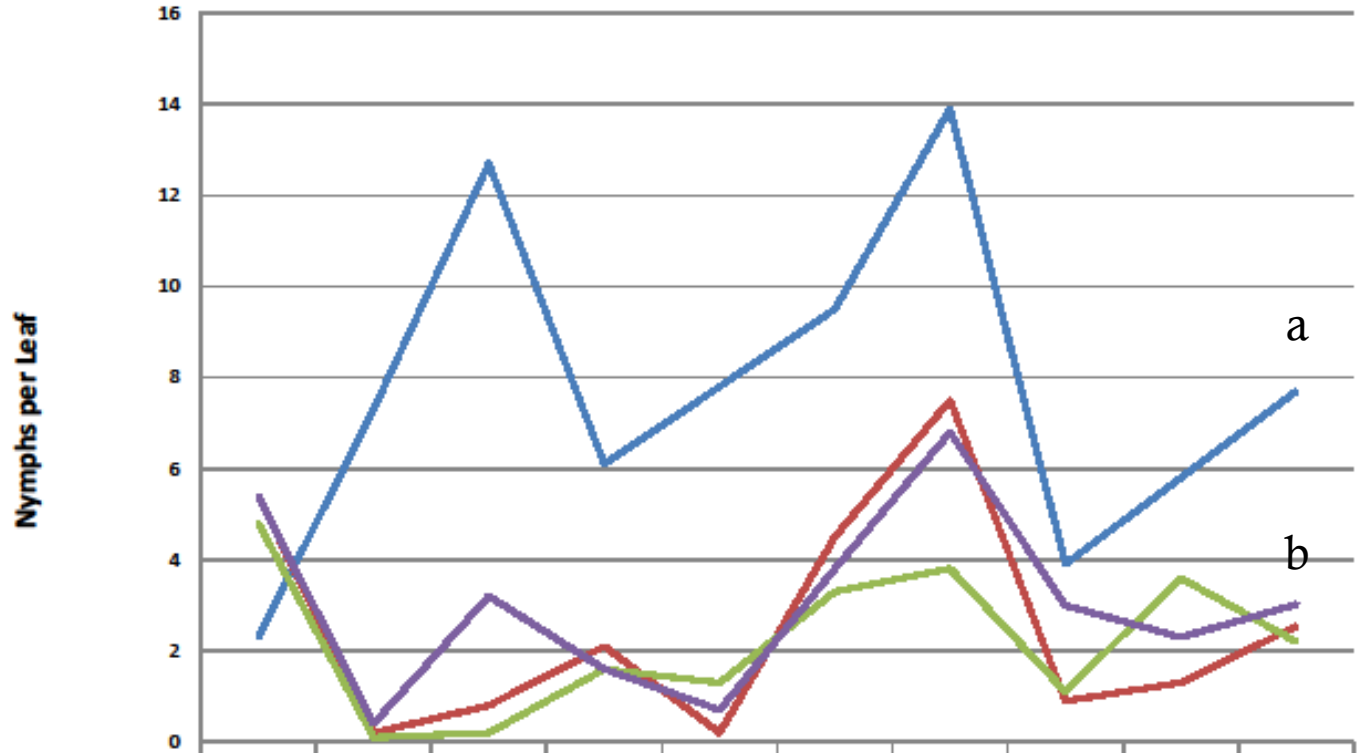
Chart 1: Acadian SSEP as an Enhancement to Pesticide Efficacy - Spring 2010 - Avocado Thrips Control in Avocados - Counts per Leaf



	Pre-Treat	6 DAT	11 DAT	20 DAT	26 DAT	34 DAT	40 DAT	46 DAT	53 DAT	Post Treat Average
UTC	2.3	7.3	12.7	6.1	7.8	9.5	13.9	3.9	5.8	7.7
Agrimek/Oil	5.4	0.2	0.8	2.1	0.2	4.5	7.5	0.9	1.3	2.5
Agrimek/Oil/Acadian SSEP	4.8	0.1	0.2	1.6	1.3	3.3	3.8	1.1	3.6	2.2
Acadian SSEP	5.4	0.4	3.2	1.6	0.7	3.8	6.8	3.0	2.3	3.0

Thrip counts based on 5 newly emerged leaves sampled per replicate and total number of immature thrips counted from the underside of the leaves.

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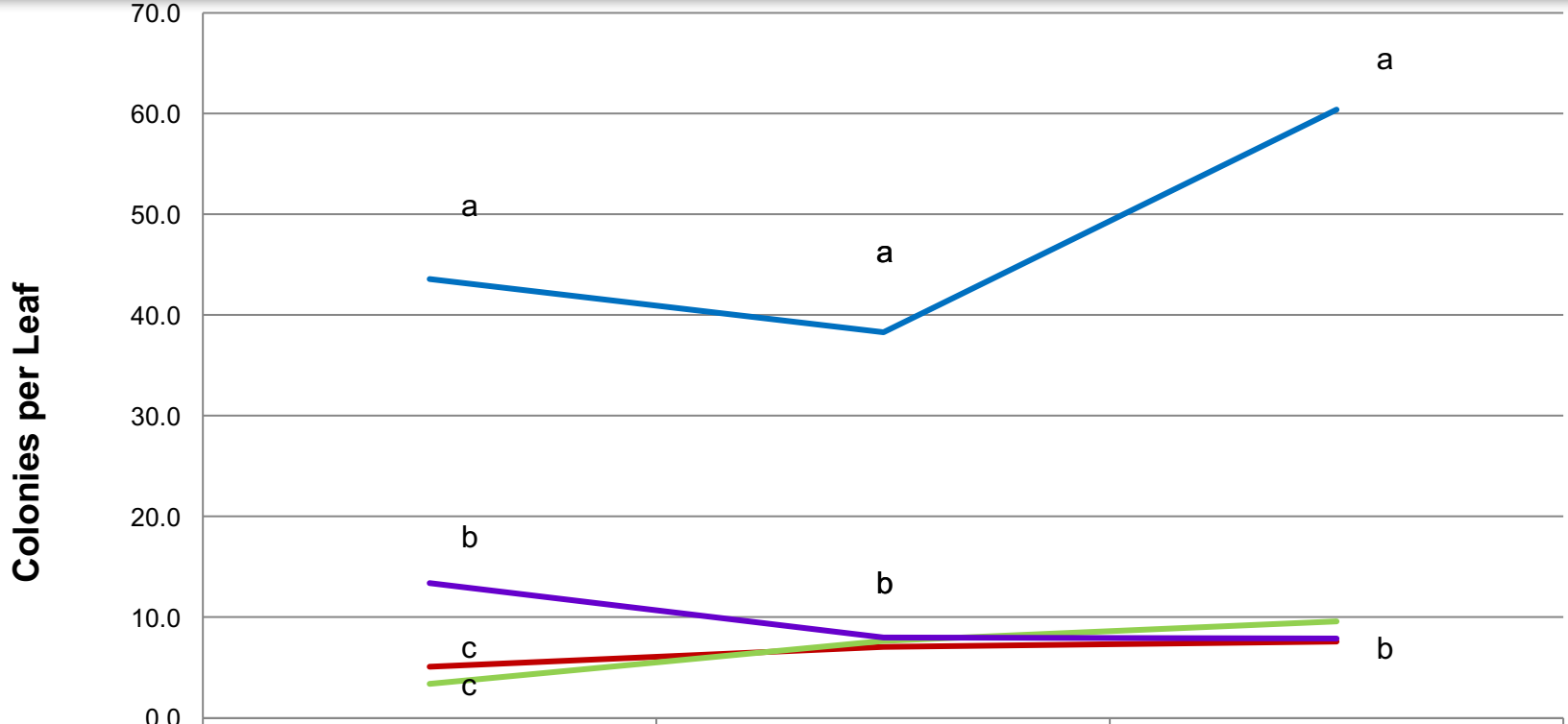
Chart 2: Acadian Seaweed Extract as an Enhancement to Pesticide Efficacy - Spring 2010 - Avocado Persea Mite Control in Avocados - Colony Counts per Leaf



	11 DAT-B	18 DAT-B	28 DAT-B
UTC	43.6	38.3	60.4
Agrimek/Oil	5.1	7.1	7.6
Agrimek/Oil/Acadian	3.4	7.7	9.6
Acadian	13.4	8.0	7.9

Mite counts based on 5 newly emerged leaves sampled per replicate. Counts were taken from the underside of the leaves. Colonies generally house 1-4 mites per colony and 5-10 eggs.

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2008-09 Algamin Mandarin Sizing Study

- Foliar applications in the spring
- Sized and extrapolated to production per acre in 2009

Treatment	Average Fruit Weight, grams	Yield per acre, cartons
Grower Standard	80.9 a	491
G.S./Algamin 1 qt/a	90.5 b	599
G.S./Acadian 2 qt/a	89.5 b	513

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2015 Tree Establishment

- Agrinos Products utilized in tape post lemon tree planting
- Allen on Macropylla planted in April 2015, followed by three spring applications of HYTA and HYTB

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Lemon trees- Camarillo, CA.

UNTREATED

June 17,2015

TREATED

June 17, 2015

Transplanted April 20, 2015
Application: 32 oz. HYT A® & + 32 oz. HYT B® per acre thru drip on May 11, 2015

BRINGING PROSPERITY TO THE GROWER, THE CROP AND THE SOIL™

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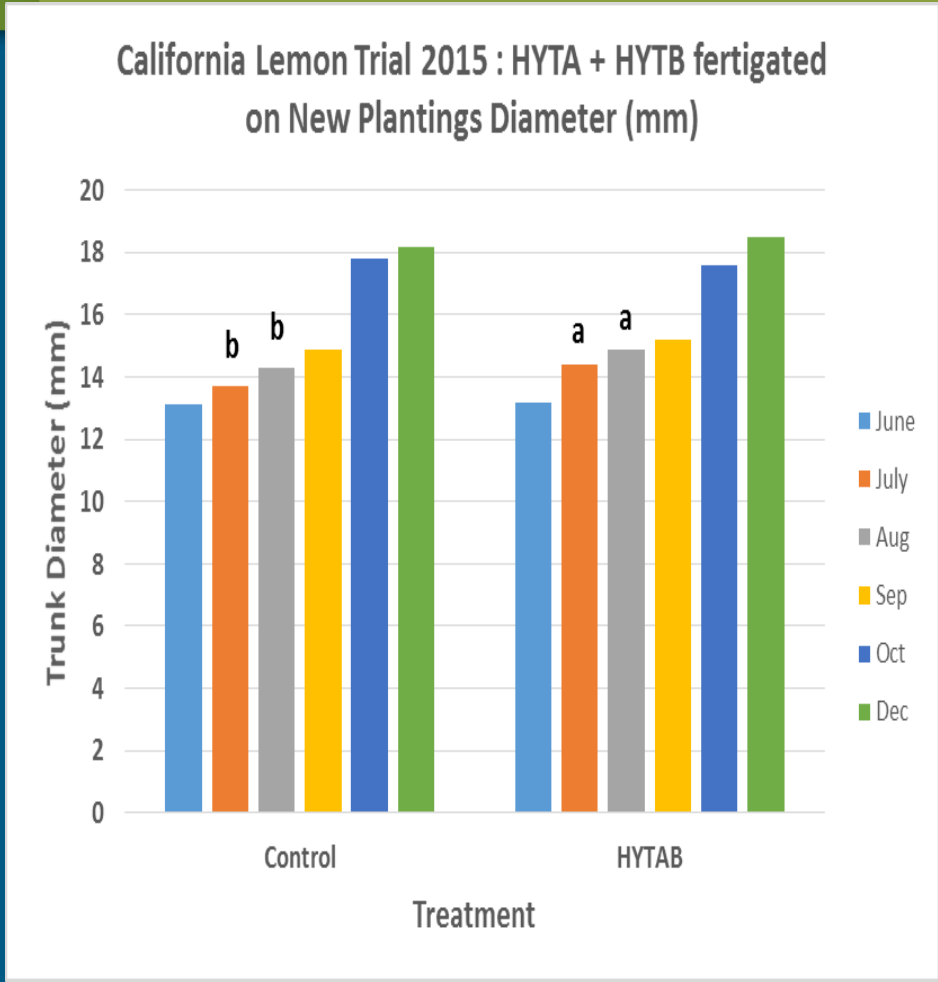
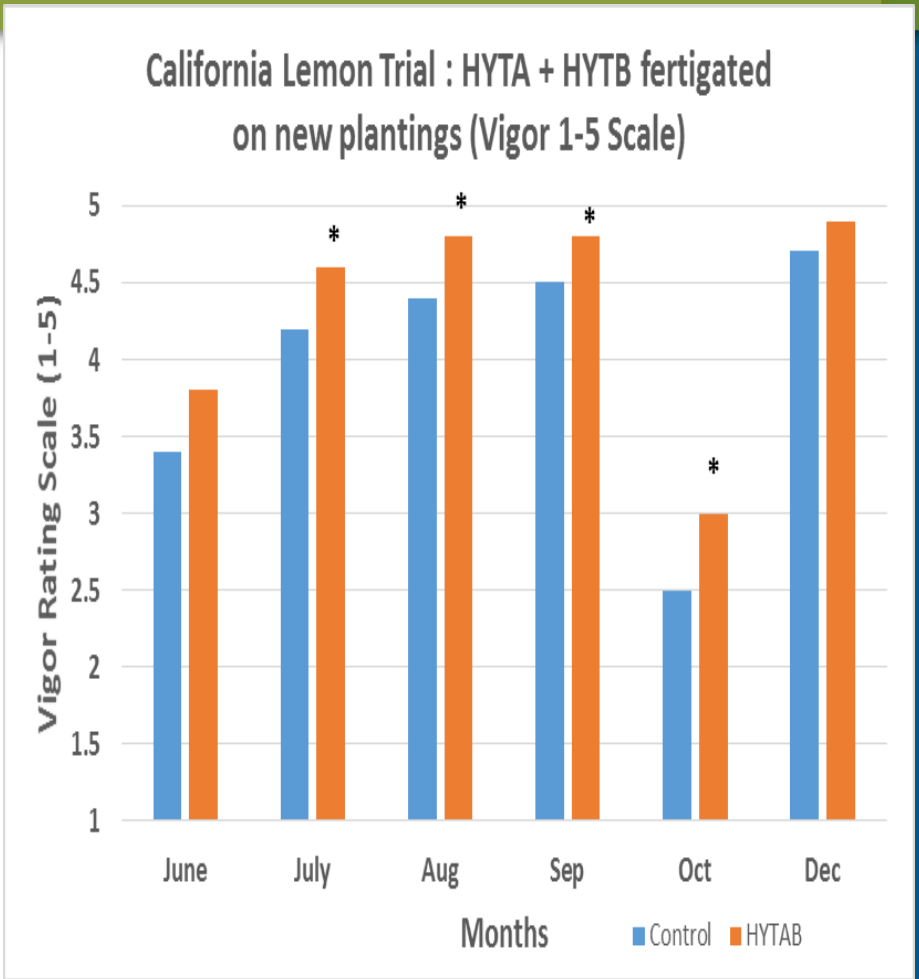
Lemons California

Plant Date: 2015
Harvest Date: First app May 2015
Crop: Lemons,
Location: California

Rates/Application: 1 qt /acre HYT A thru Drip mixed with 1qt/acre HYT B thru Drip
Method: Drip Irrigation Lemons on 3 separate occasions 30 days apart
Field size: 6 reps





20-24 tree diameters per treatment measured

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Biostimulants for Stress Relief and Production Enhancement

- CalSafeSoil H2H utilized on strawberries grown in elevated sodium chloride environment.
- Abiotic Stress Effects from the fall of 2015

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Strawberries Grown with Salt and H2H from CaliforniaSafeSoils-2015

- Treatments
  - Grower Standard
  - G.S. plus 100 ppm NaCl
  - G.S. plus 100 ppm NaCl/H2H weekly at 5 gal/ac equivalent rate
  - G.S. plus 100 ppm NaCl/H2H every two weeks at 10 gal/ac equivalent rate.
- Harvest for 30 pick days.

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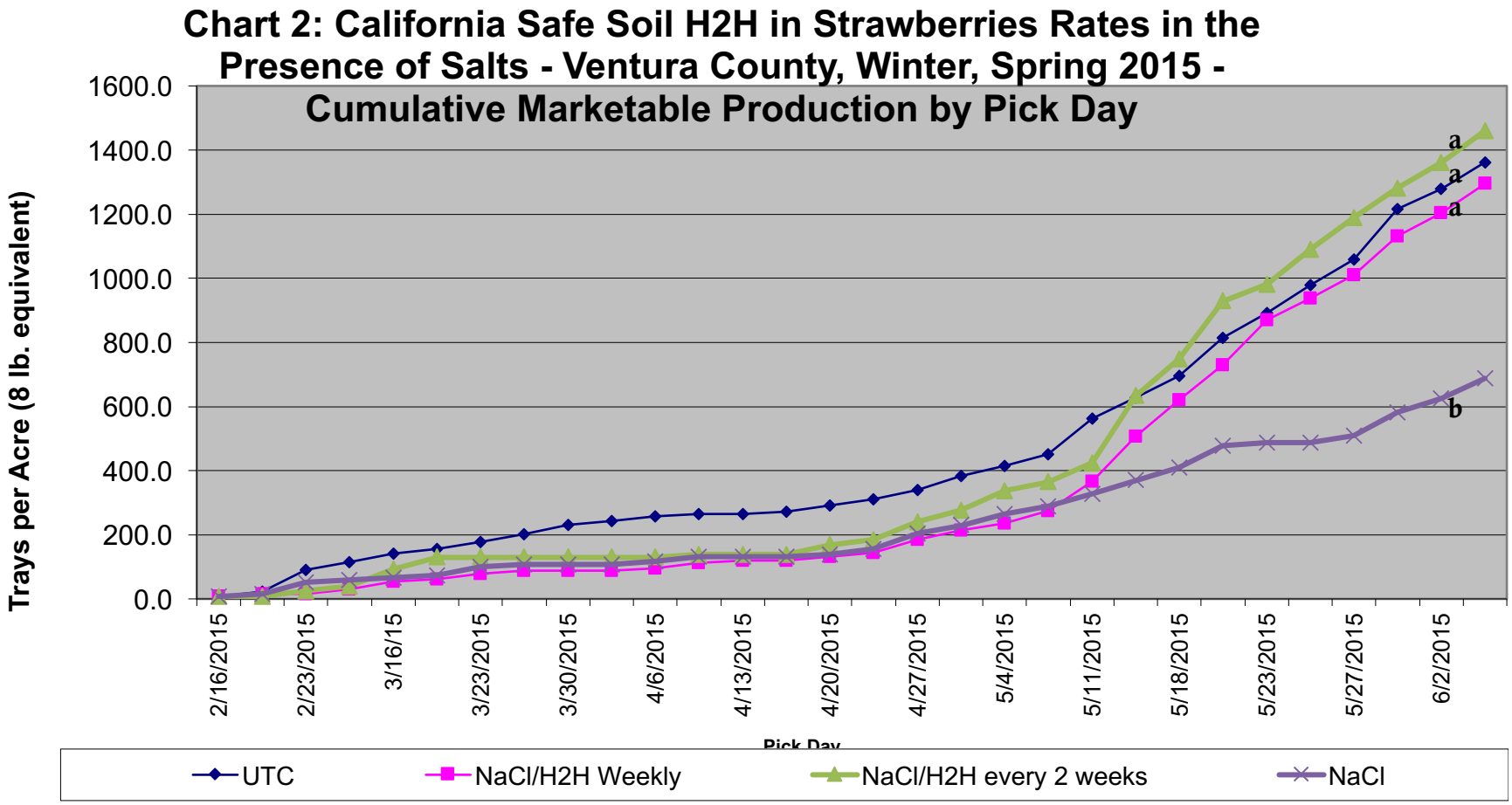
Strawberries Grown with Salt-2015



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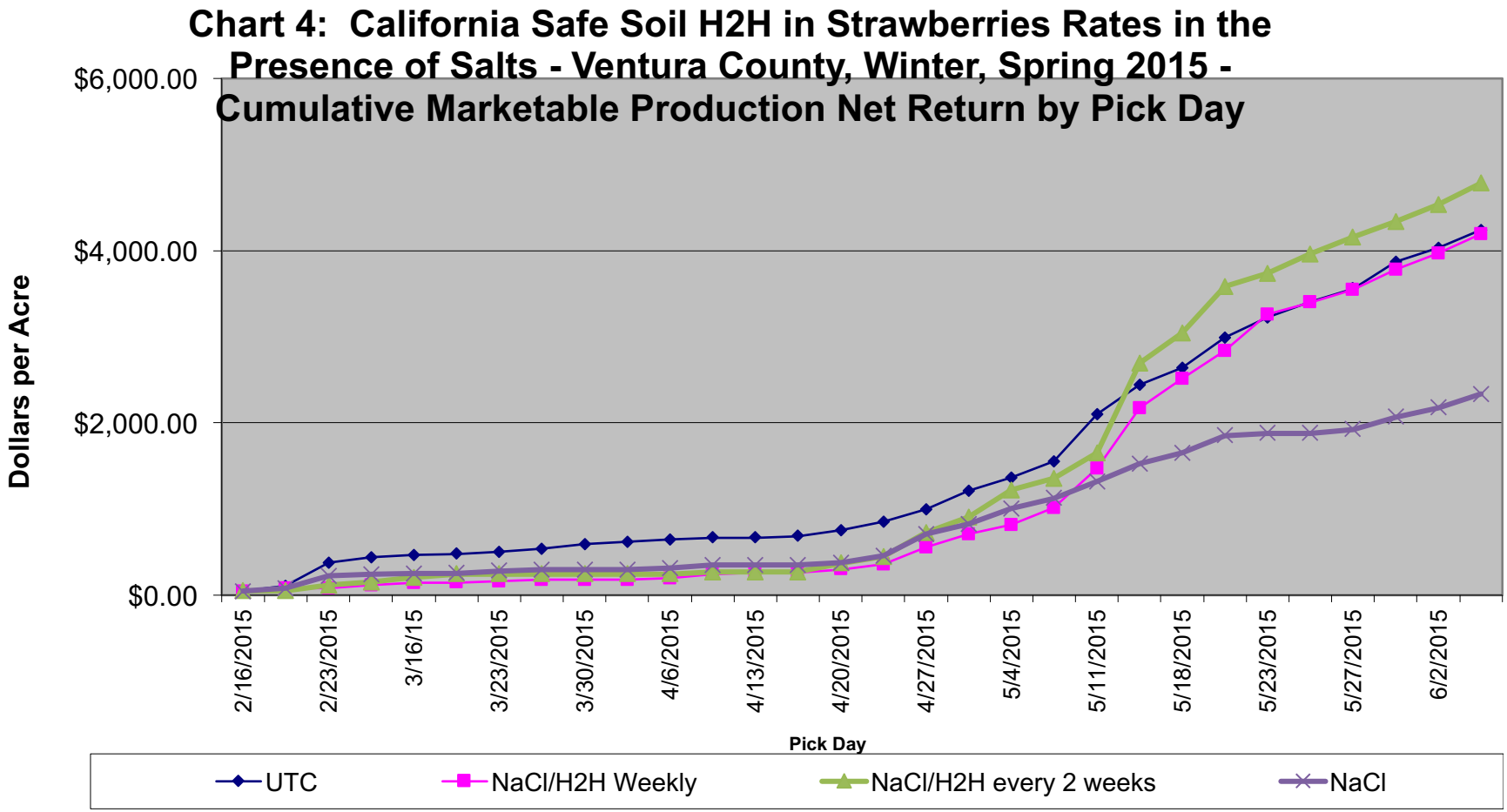
Strawberries Grown with Salt-2015



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California Safe Soils H2H utilized on drought stressed Avocados.

- Two Year study
- H2H utilized alone and in combination with a microbial agent
- This coming year we will use:
  - H2H 3-2-1
  - HYTA
- No significant data found this year with no set observed

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Zinc Uptake Enhancement with Grozyme

- Data presented recently at the Annual Soil and Plant Conference in early February by Dr. Patrick Brown based on the use of Grozyme with Zinc in Sunflowers
- "Supplemental macronutrients and microbial fermentation products improve theuptake and transport of foliar applied zinc in sunflower (Helianthus annuus L.) plants. Studies utilizing micro X-ray florenscence.

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2016-17 Studies in Avocados with Grozyme

- Two rates, 6 floz and 10 floz/ac applied three times in spring and summer 2016 to the soil with no change in growers zinc application.
- Interesting Nutrient Change

Treatment	Leaf Nitrogen - %	Leaf zinc - ppm	Soil Zinc in fall - ppm
Grower Standard	1.83	22	5.7
G.S./Grozyme – 6 floz rate	2.00 **(+ 9%)**	26 **(+18%)**	5.8
G.S./Grozyme - 10 floz rate	2.09 **(+ 14%)**	28 **(+27%)**	5.7

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Some Final Thoughts

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Fall 2015 Results from Biostimulants tested on Fall Strawberries - Oxnard

- Stress event occurred close to the start of fall harvest.
- Significant four day heat wave ranging from 95 at the coast to 108 inland on warmest day.
- The heat basically shut down the strawberry production.
- Pick averages declined from approximately 250 flats per day to 50 flats per day on average, while returns to the farm jumped from $9 per flat to $25 per flat.

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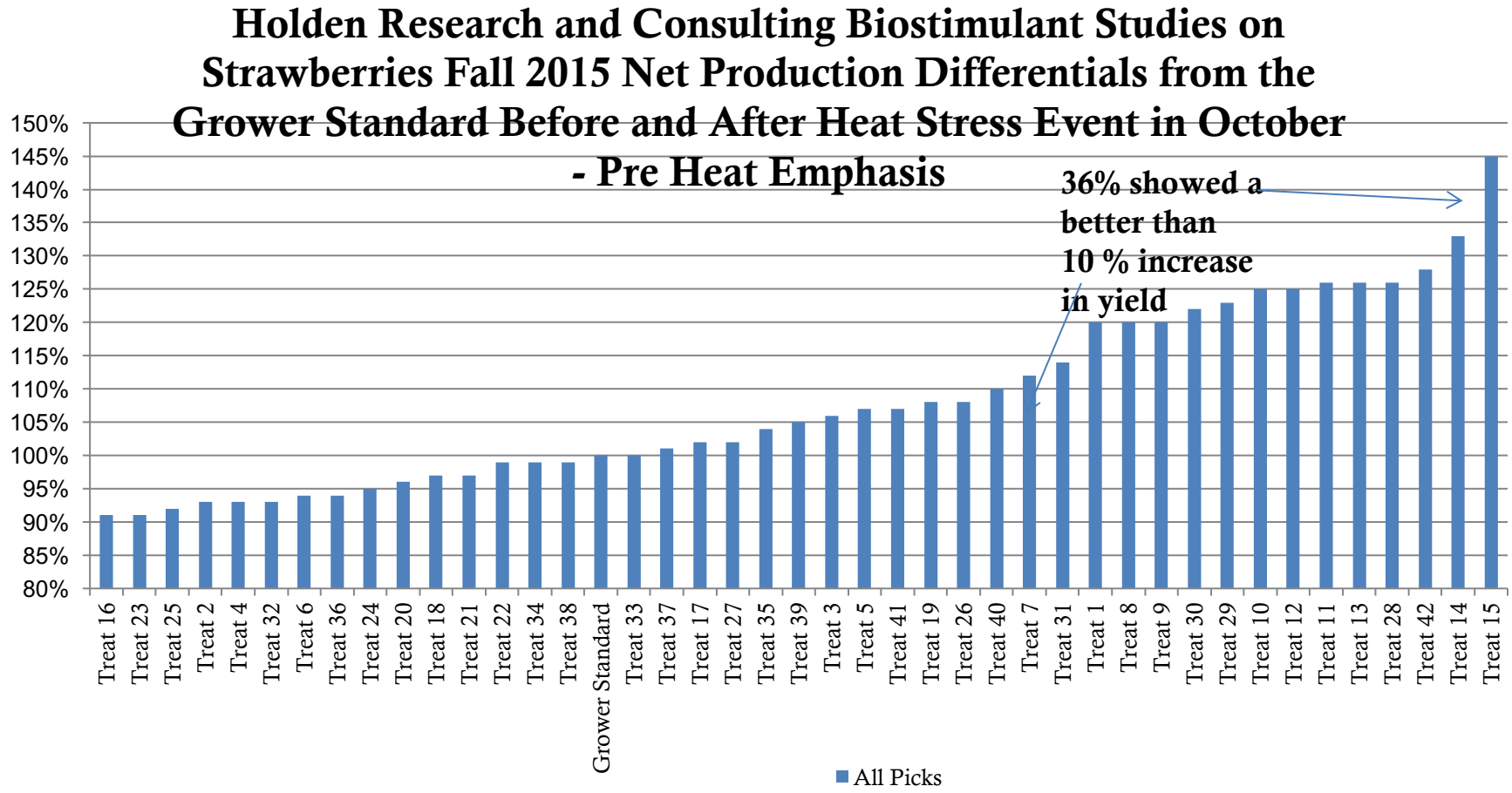
How did this heat affect Production for the Strawberries Produced with an Overlay application of Biostimulants?



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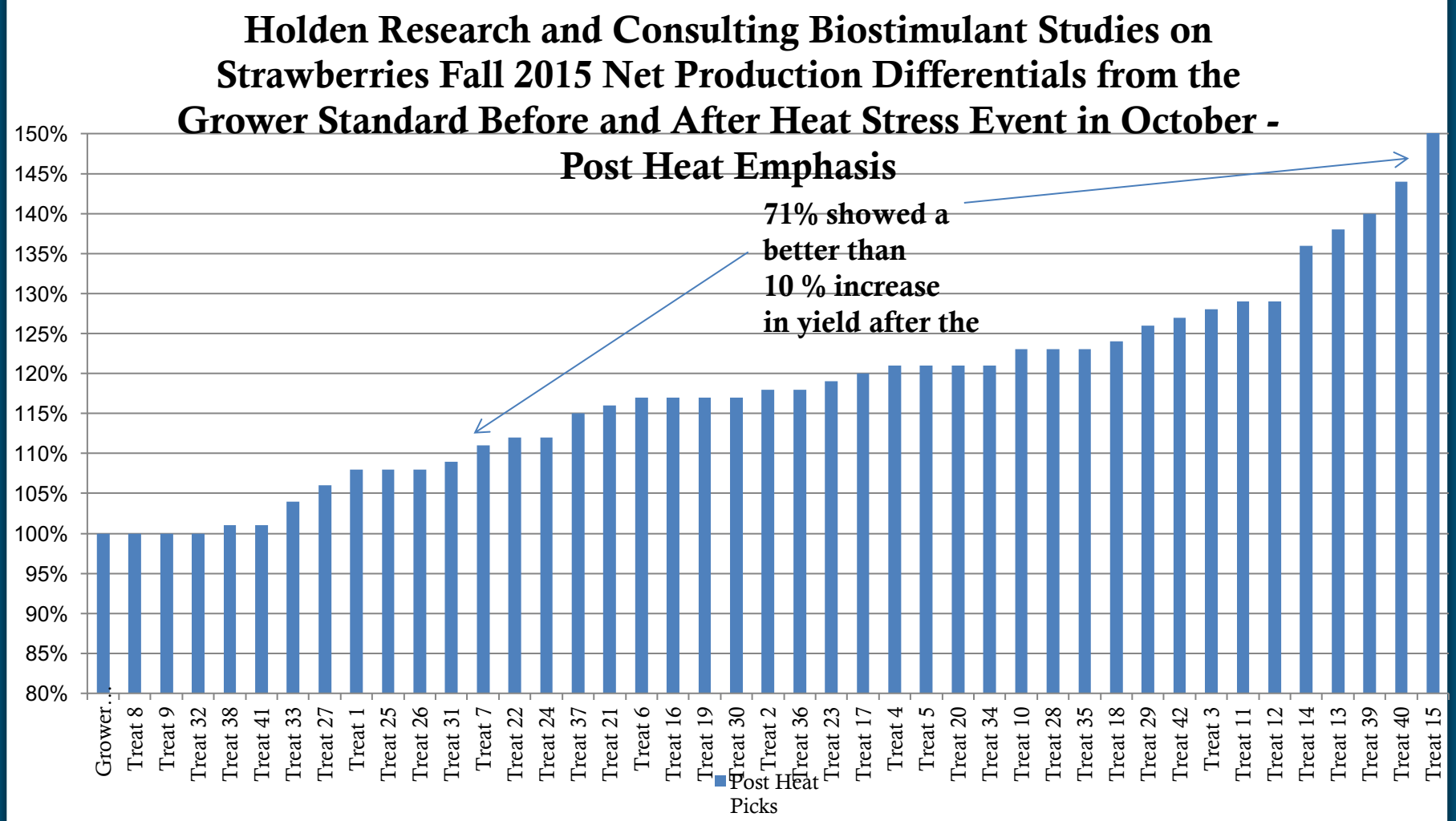

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A Final Thought!

- "The great diversity of plant response to biostimulants highlights the challenges faced by researchers. Many plant responses to biostimulants cannot be explained by our current understanding of plant processes and while this represents a challenge, it also presents a great opportunity." Biostimulants in Agriculture, Patick Brown and Sebastian Saa, *Frontiers in Plant Science*

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Thank you!

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