Avocado Diseases
Can we Conquer Root Rot?

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A Review of Avocado Diseases

- Avocado Root Rot (*Phytophthora cinnamomi)*
- Avocado Trunk Canker *(Phytophthora citricola)*
- Oak Root Fungus (*Armillaria mellea)*
- Dothiorella Canker
- Black Streak
- Sun Blotch Viroid

Are these Diseases? (some people think so)

Freeze!


PROPERTY OF ECO-FARMS

Avocado Thrips!

Avocado Lace Bug!

Persea Mites!

What Did This?

What Did This?

The Most Common Avocado Diseases

- Avocado Root Rot (*Phytophthora cinnamomi)*
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- Black Streak
- Sun Blotch Viroid

Avocado Root Rot

Avocado Root Rot

- By far the most common avocado disease
- Found in almost all of the older avocado areas
- Fungus spreads by:
  - water flow
  - soil on shoes, shovels, bins, ladders
  - dogs and coyotes moving infected fruit around

Avocado Root Rot - Diagnosis

- Small, pale green, wilted leaves
- Sparse foliage, usually leaf drop starts at the top of the tree
- New growth absent
- Branches become sunburned
- Small fibrous feeder roots absent, or if present are blackened and brittle

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Small Root Tips Infected

Over-watering problems

This is a fungus with more than 1000 hosts

- Attacks small feeder roots. The most serious avocado disease in California. Fungus thrives in excess soil moisture (over-irrigation and poor drainage).
- Attacks trees of any size or age. *Absence of feeder roots prevents moisture uptake so the soil under diseased trees stays wet even though tree appears wilted.*

IPM Treatment Plan for Root Rot

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Don’t Forget!

- The easiest thing to do is replant to a non-host, such as citrus or cherimoya

- But most avocado growers don’t want to do this

Sanitation comes first

- Fungus can spread on everything! (contaminated nursery stock, water in contact with infested soil including reservoirs,. Fungus can spread on anything that moves soil, including horse hooves, ladders, bins, shoes and cultivation equipment).

Planting and Re-planting

- Use only clean nursery stock and replant with only resistant clonal rootstocks. The most effective rootstock currently is ‘Dusa’.
- The nurseries appear to be clean at this time, but this wasn’t always the case!

Chemical Treatment

- For mature trees that are diseased, the best treatment appears to be trunk injection with a registered fungicidal buffered phosphorous acid.
- For areas that could be threatened by the fungus, soil treatments with registered fertilizer-type buffered or non-buffered phosphorous acids appears to be beneficial.

Mulch Treatment

- Mulch heavily with wood chip-based greenwaste mulch. Keep it 8 inches away from trunk. Mulch can be up to 4 inches deep under the tree. Manures are ineffective at control of the fungus.
- Apply gypsum under the mulch, 25 lbs per large mature tree. This supplies calcium with reduces the ability of the fungus to form spores.

Mulch Benefits

- Composted organic yard waste
  - Root rot control
  - Water retention
  - Improved soil fertility
  - Weed suppression
  - Improved plant growth
  - **Thrips control????**

Replanting

- The easiest method is to replant with a crop that is immune to the disease, such as citrus, cherimoya, all types of vegetables, most annual flowers, and many deciduous fruit trees and berries.
- If the grower wants to replant with avocado, use only resistant clonal rootstocks. This is a dynamic areas of research…the most effective rootstock now in 'Dusa'.

Clonal Rootstock Research

Escondido, May 2006	Heavy disease pressure	5 year old plot
Rootstock	Total fruit weight (lb)	Individual fruit weight (lb)
Dusa	117.0 a	0.40 a
Zentmyer	113.8 a	0.48 a
Latas	111.0 a	0.51 a
Uzi	96.1 a	0.42 a
Steddom	90.2 a	0.44 a
VC 241	61.5 a	0.44 a

Review: Avocado Root Rot - Diagnosis

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Review: Avocado Root Rot - Treatment

- Easiest – Replace with a non-host, like citrus or cherimoya
- Injection of trunk with registered pesticide phosphorous acid twice a year for life,
- Mulch heavily with greenwaste mulch, must be a wood-based mulch Apply gypsum to soil.
- Replace with a better rootstock

Evaluation of Potassium Silicate and Yucca Juice vs. Buffered Phosphorous Acid for Control of Avocado Root Rot

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Chemical Control

- Currently almost all growers in San Diego County are using phosphorous acid (either buffered or non-buffered) either as trunk injection or through the irrigation system
- Organic growers are increasing in numbers and they would like something that could equate to phosphorous acid for control
- Potassium silicate has been suggested as a viable alternative to phos acid (especially for organic growers).
- Yucca juice has also been suggested and was included in this trial

Previous Work

- Silicon is a bioactive element that has fungicidal properties
- It apparently stimulates several plant defenses including phytoalexins and increased phenolic levels (Fauteux, Remus-Borel, Menzies and Belanger 2005), (Cherif, Asselin, Belanger 1994), Bekker, Kaiser and Labuschagne (2006)
- Studies have shown increased resistance to powdery mildew in grape and cucumber and *Pythium* spp. in cucumber

Phytophthora cinnamomi

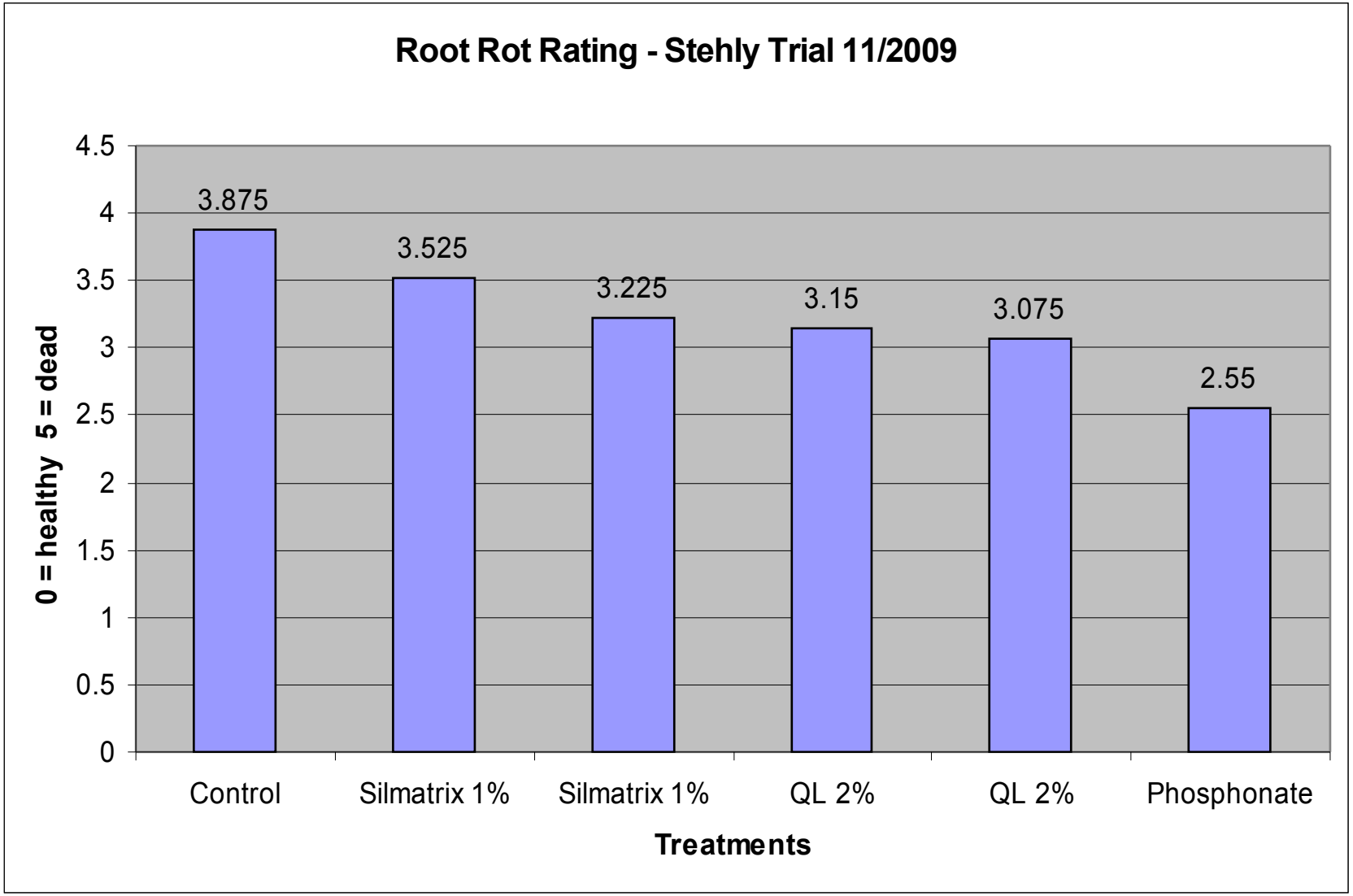
- In one field trial in South Africa, three soil drenches (20 L/mature tree at 1%) with potassium silicate of Hass/Duke 7 avocado trees (in a Pc-infested grove) resulted in higher root densities than the untreated control and trees drenched with potassium phosphonate (Bekker, Kaiser, Labuschagne 2006)
- Proposed as an alternative to potassium phosphonate for control of root rot

Trial Set-up

- Hass/Duke 7 was planted in July 2007 in a Pc-infested grove
- Previous mature trees had died
- 6 treatments, 20 replications

Trial Set-Up

- All materials were applied pre-plant in the pot, and three times in 2007 and 5 times in 2008
- Buffered phosphorous acid (0-28-25) applied at the rate of 62.5 ml/2L (1oz/2 L)
- Silmatrix (20 % potassium silicate) applied at the same times at 1% and 2% in 2L/tree
- QL (yucca juice) applied at 2% and 4% in 2L/tree
- Non-treated control


Root Rot Rating - Stehly Trial 11/2009
0 = healthy 5 = dead
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
3.875
3.525
3.225
3.15
3.075
2.55
Control
Silmatrix 1%
Silmatrix 1%
QL 2%
QL 2%
Phosphonate
Treatments

Final Data

Treatment	Rate of Product/Tree at time of Treatment (1)	Tree Height (cm) after 2 years (2)	Number of Dead Trees after 2 years	Number of Almost Dead Trees after 2 years
Non-treated		126 B	2	7
Phosphonate	62.5 ml/2L	147 A	2	0
1% Silmatrix	20 ml/2L	139 AB	0	4
2% Silmatrix	40 ml/2L	140 AB	2	5
2% QL	40 ml/2L	136 AB	1	3
4% QL	80 ml/2L	133 AB	0	5

(1.) Treated trees were drenched 2 days prior to planting in July 2007, and subsequently 3 times during the summer growing season in 2007 and 5 times during the growing season in 2008. Trial was concluded in November 2008.

(2) Tukey-Kramer HSD p=0.05

Conclusion

- **Disappointment!**
- Questions:
  - Is the dosage correct? (We went by the dosage suggested by the company rep.)
  - Perhaps we should try Potassium silicate in conjunction with Phosphonate
  - Perhaps we have a more virulent Pc strain than South Africa
  - Hopefully another trial in the near future looking at higher rates and combinations of products

One Final Comment

- From Bekker, Van der Waals, Aveling and Labuschagne (literature review, 2006) "Preliminary results indicate the application of water soluble potassium silicate to be a viable and practical method to suppress *Phytophthora cinnamomi* infection in avocado orchards"

Avocado Trunk Canker

- Fungus: *Phytophthora citricola*
- Trunk canker originating below ground
- Red resinous exudate that dries to a white crystalline powder
- Peel bark away, should be a reddish lesion below bark
- Tree may die very rapidly

Avocado Trunk Canker - Treatment

Keep trunk dry and keep mulch away from trunk

Do not wound the trunk

No chemical registered to control this disease

Dothiorella

Dothiorella

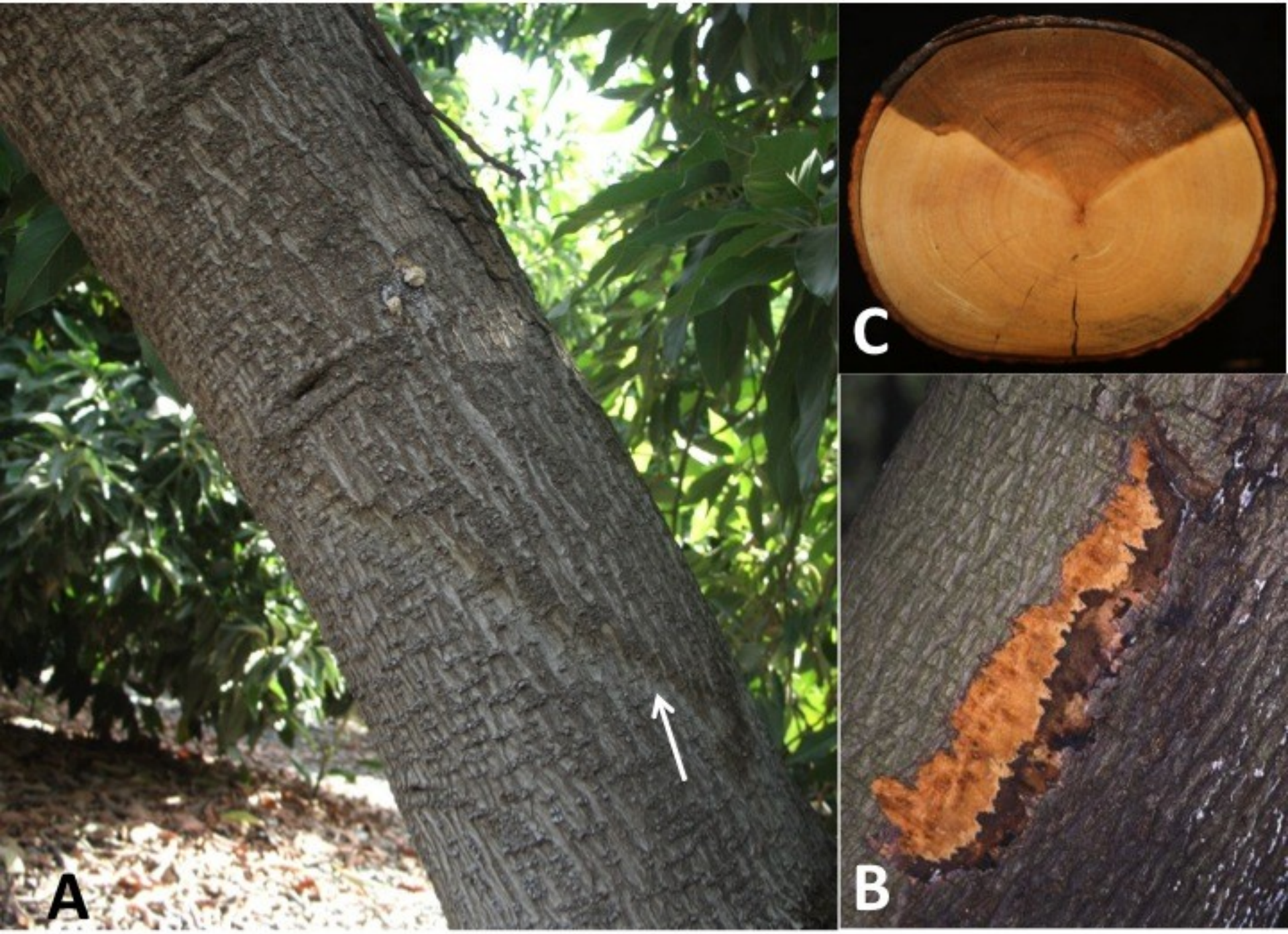
Dothiorella Canker

Dothiorella Canker

- Can be a serious problem in new plantings
- New trees sometimes arrive from the nursery with latent infections in the graft union, these can kill the graft union
- Older trees – usually a minor problem
- Drought stress often leads to this disease

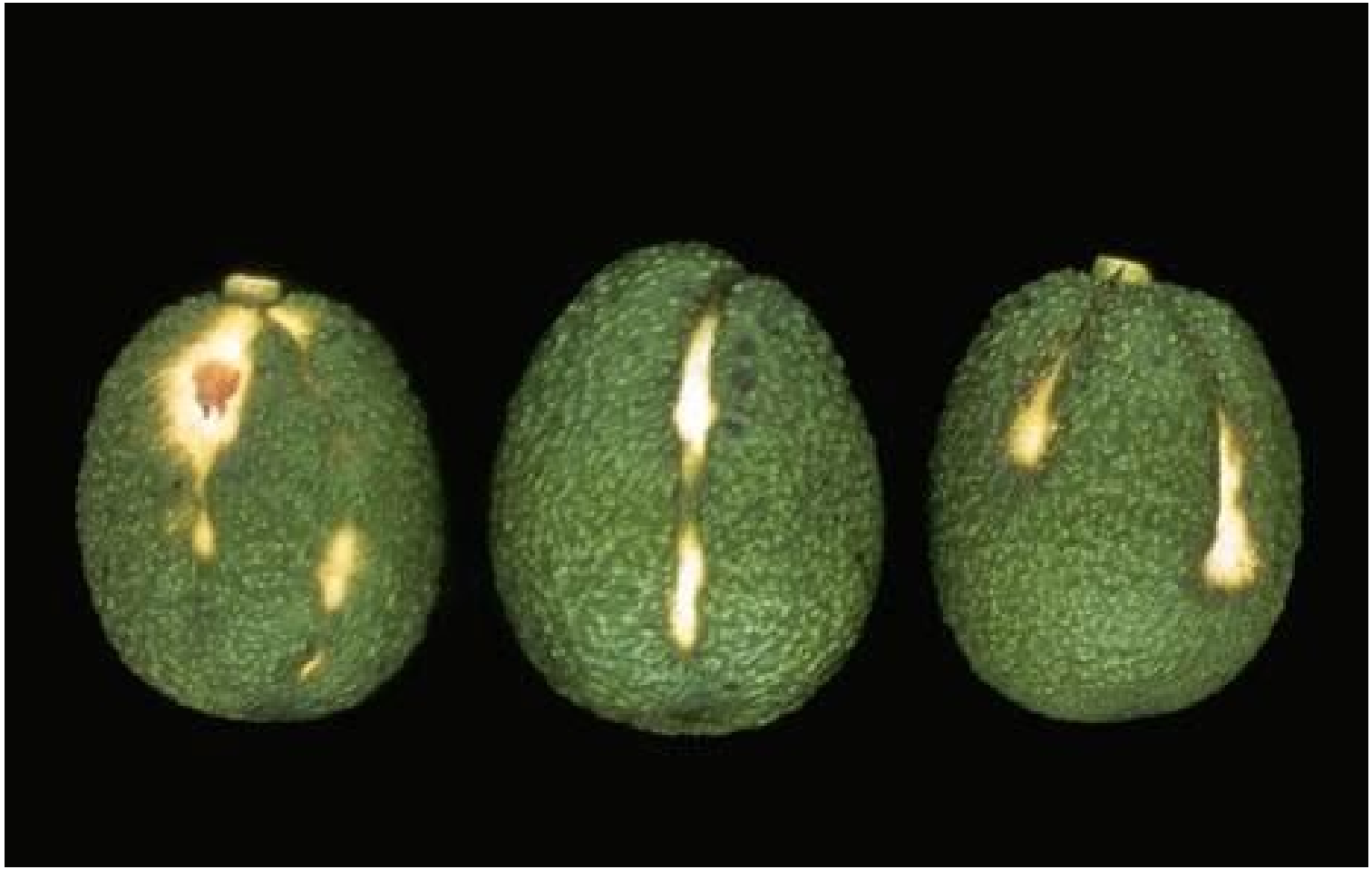
Blackstreak

- Shallow cracks that ooze sap, this will dry to a white powder
- Shallow reddish to black wood underneath the bark
- Appears under prolonged stress (drought, saline water)
- Possible microorganism involved, but cause is unknown


A
B
C

Avocado Sunblotch

- Twigs have narrow yellow, red or necrotic shallow indentations
- Fruit have yellow, white or red sunken blotches
- Bark on trunk and lower branches is rough and cracked, known as “alligator bark”



Sunblotch

- Caused by a viroid
- Major problem: One of the symptoms is lack of fruit production
- These trees should be removed from the grove, do not top-work these trees.
- And, this disease can be spread by chain-saws!

With that happy note: Thank you

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