Disease updates on Botryosphaeria (Bot)/Phomopsis, Anthracnose & Walnut Blight

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Yolo/Solano/Sacramento

Annual Walnut Production Meeting

March 1, 2017

acknowledgements

- research conducted by
  - Bot/Anthracnose: Themis Michailides, Plant Pathologist, UC Kearney REC
  - Walnut blight: Jim Adaskaveg, Plant Pathologist, UCR
    - Several slides/photos
- Funding:
  - CA Walnut Board
  - 2012-present
- Fungicide donations/support
  - BASF
  - Syngenta
  - Bayer
  - DuPont

Botryosphaeria (Bot)/Phomopsis Canker & Blight

Conditions for infection

- ✓Presence of inoculum
- ✓Rain: at least 1/4”
- ✓Temperature: ≥ 50°F
- ✓Presence of susceptible tissues

A review

Bot main symptom types

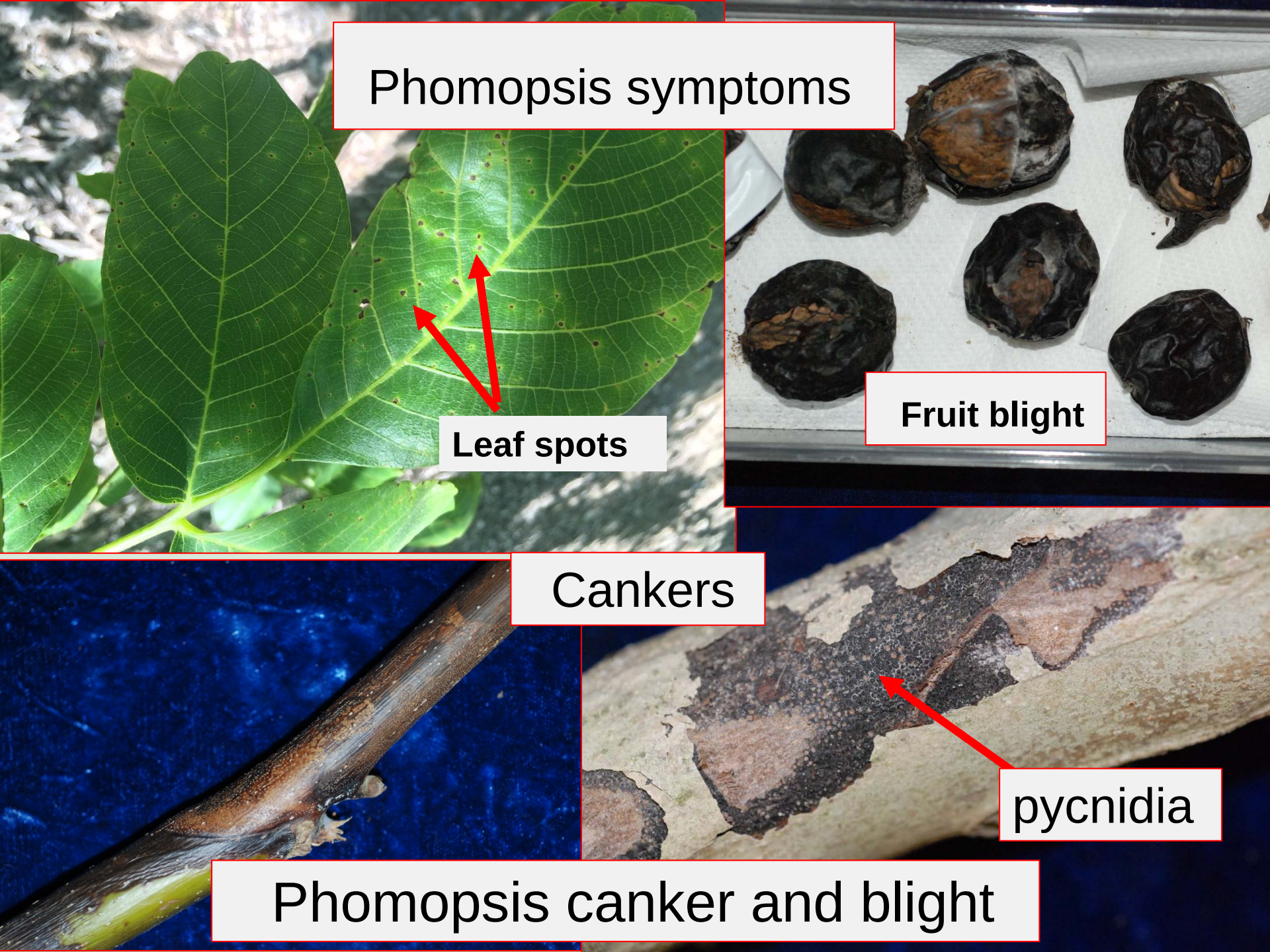
Branch canker & dieback

Blighted shoots

Twig blight

Fruit & shoot blight

Infected nuts


Phomopsis symptoms
Leaf spots
Fruit blight
Cankers
pycnidia
Phomopsis canker and blight

Botryosphaeria (10 species)

Phomopsis (2 species)

Botryosphaeria dothidea

Wind-borne

Water-borne

Perithecia

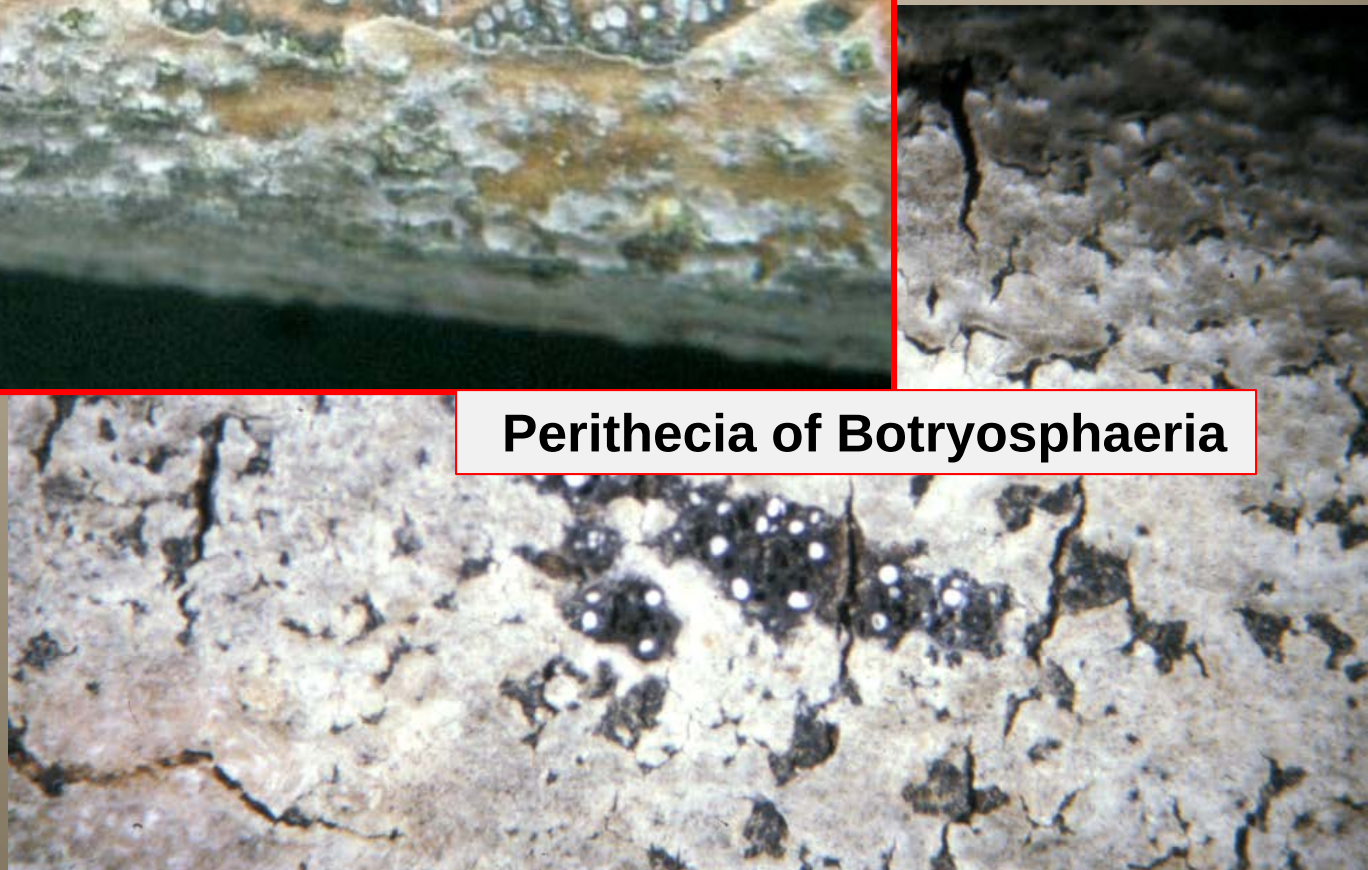
Pycnidia

Sexual stage

Asexual stage

Oozing pycnidia

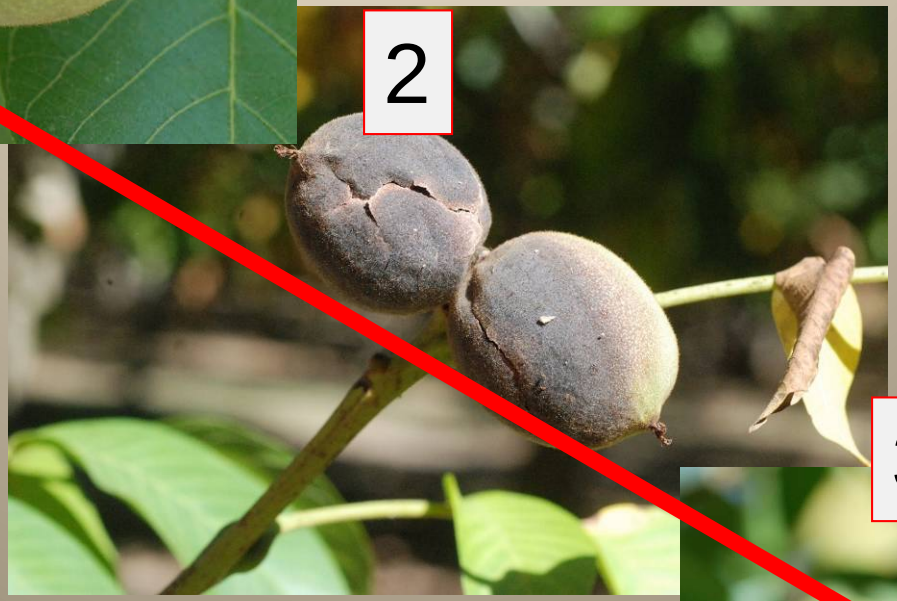
Pycnidia of Botryosphaeria

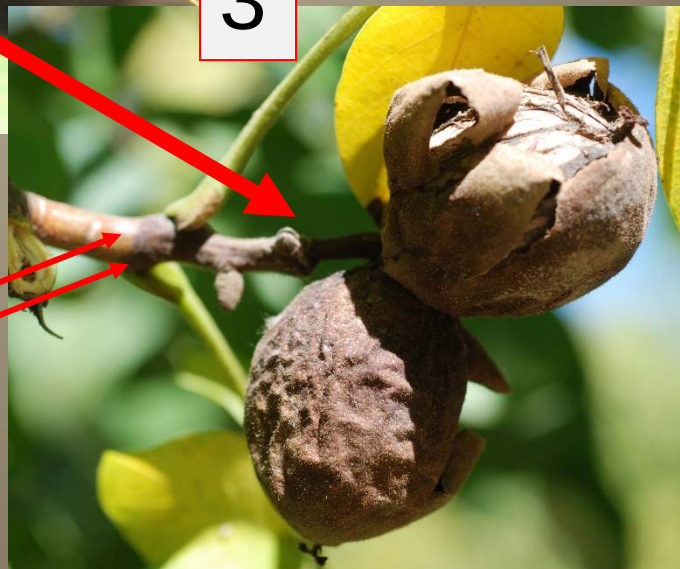

Perithecia of Botryosphaeria

spread & infection

- ✓Immature fruit can be infected
  - ✓remain symptomless
  - ✓lead to fruit blight Aug-Sept
- ✓Infected/blighted fruit -
  - ✓Infect spur causing canker/kill buds

Infection of intact fruit in the orchard
--- Disease Progress ---





All the species of *Botryosphaeria* and *Phomopsis*

Fruit → Fruit

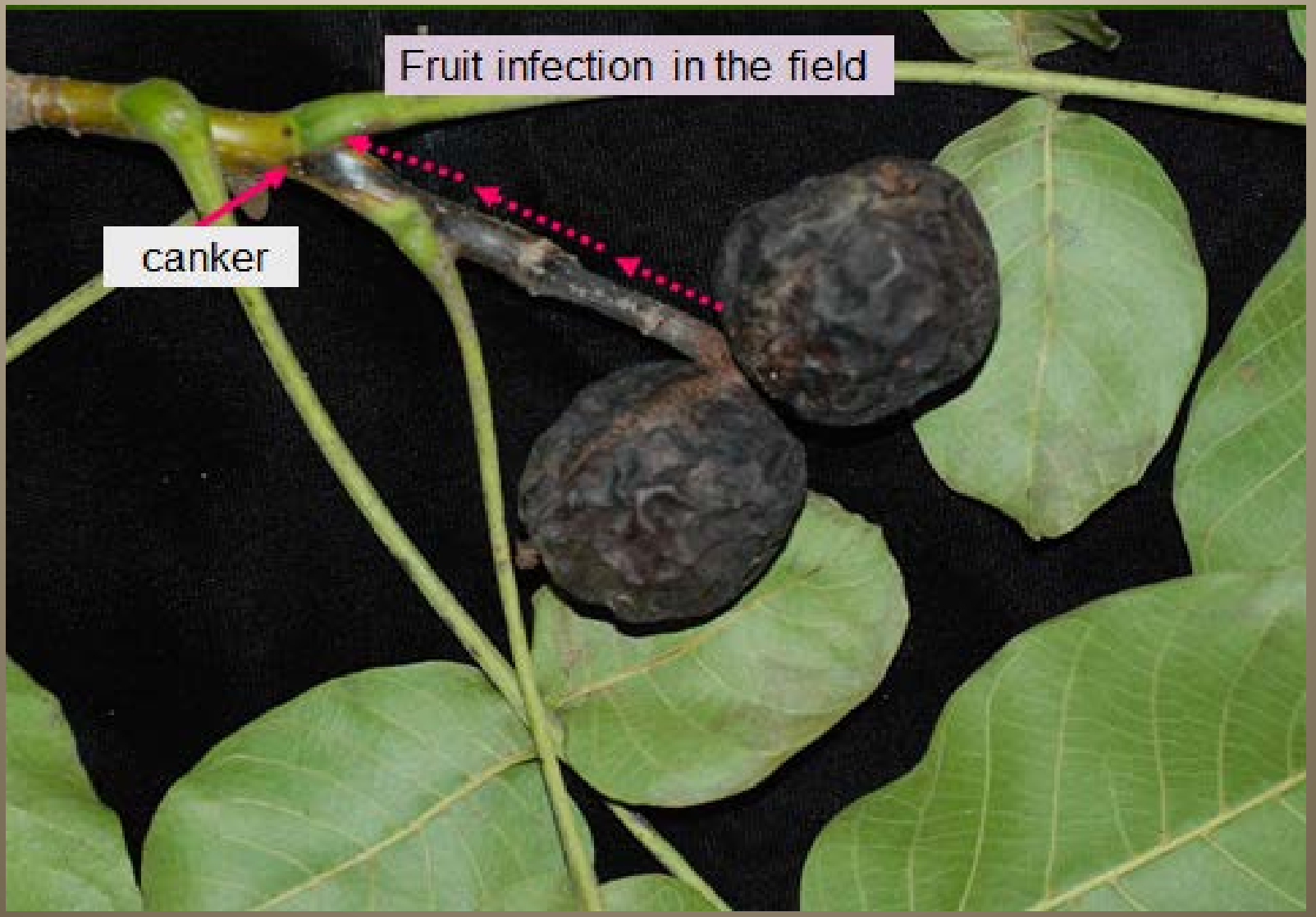
↓

Peduncle

↓

Infect Spurs/shoots

Fruit ➡ Peduncle ➡ Shoot



“Botryosphaeria blight” in Butte Co., October

Infection moving down the spur

Inoculation of fruit & invasion of spur

In addition to direct fruit infection, infection courts:

At harvest:

- ✓ Scars from peduncles
- ✓ Fruit scars
- ✓ Leaf scars
- ✓ Mechanical wounds

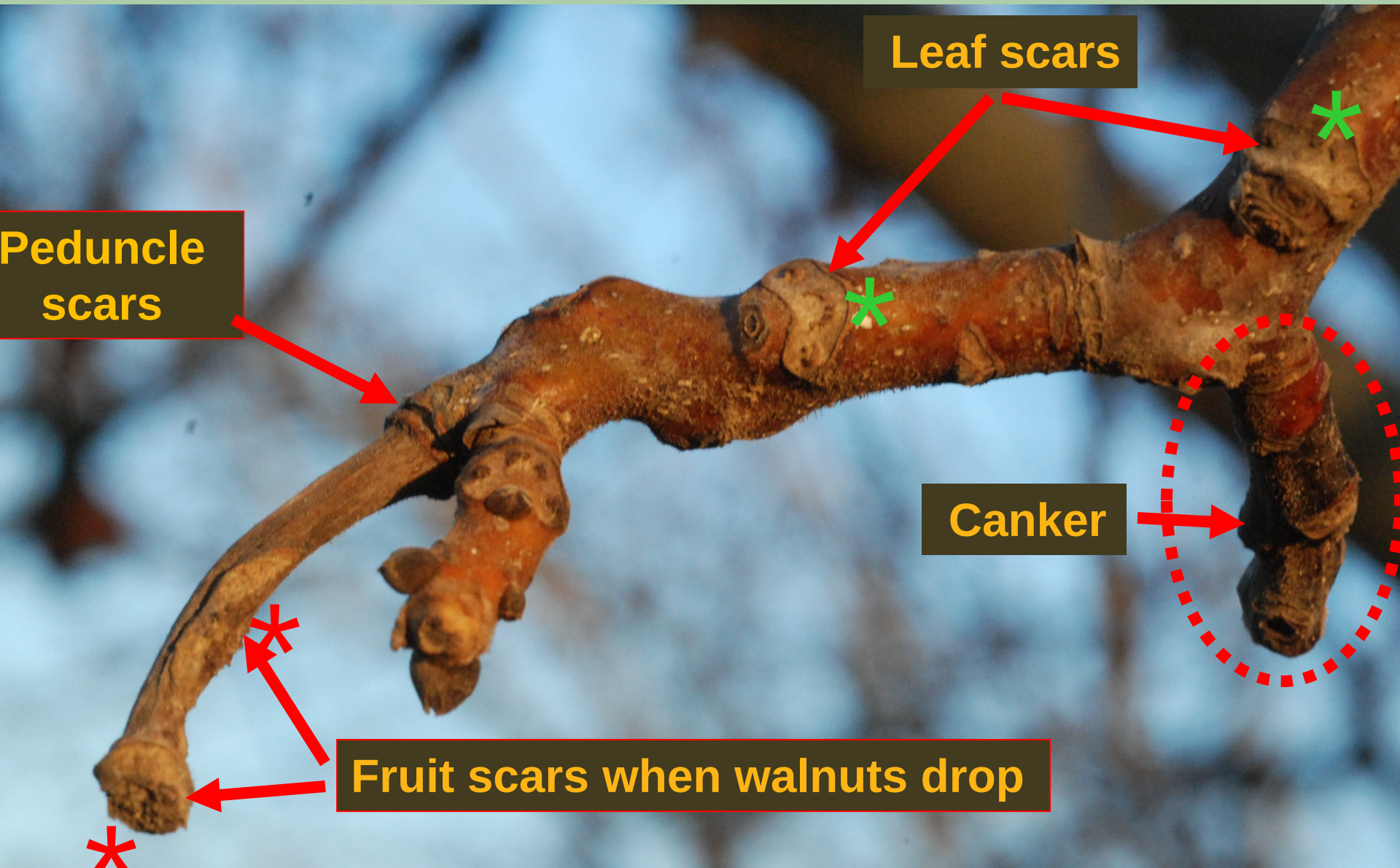
During the season:

- ✓ Wounds from hail, freeze, sunburn, wood peckers
- ✓ Pruning wounds
- ✓ Scale wounds
- ✓ Walnut blight lesions (BAN)*

Postharvest:

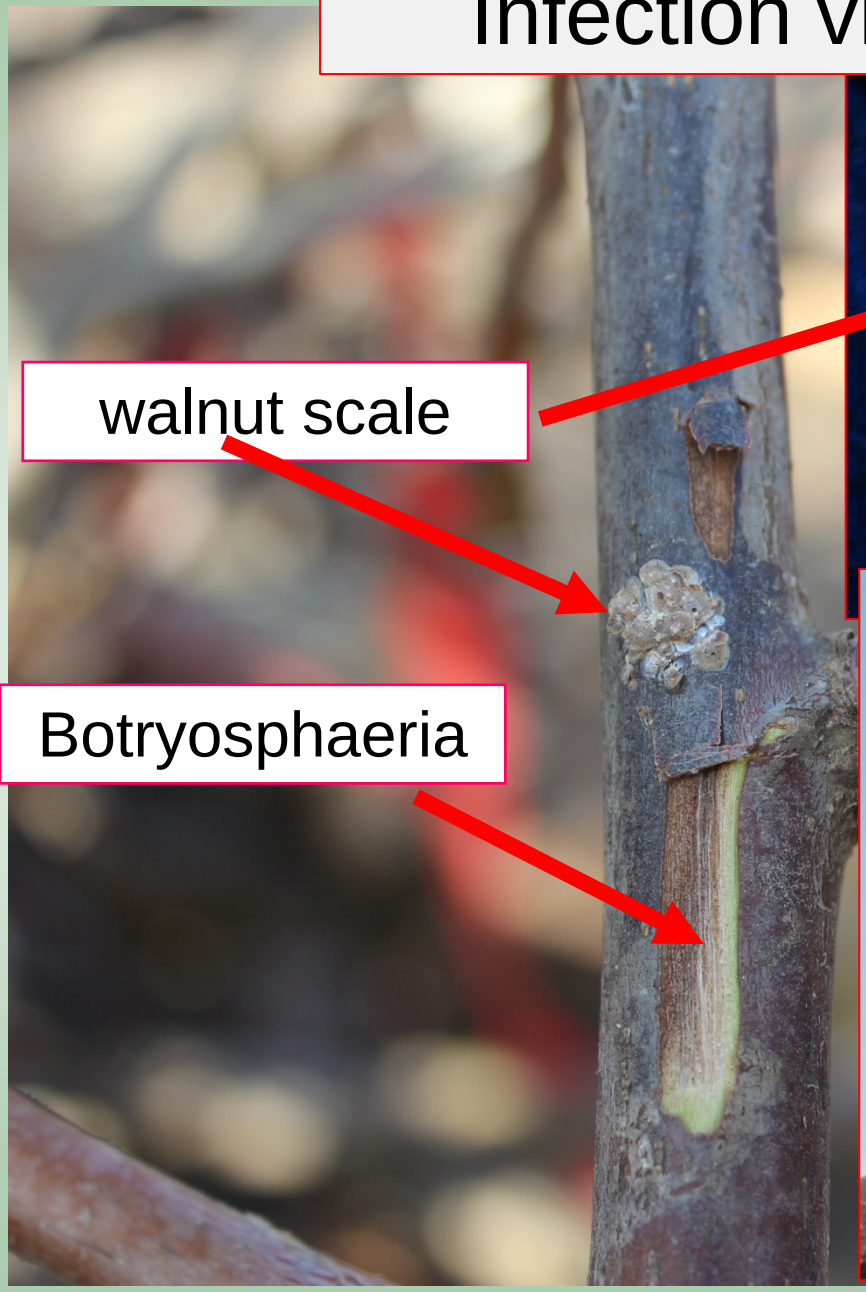
- ✓ Peduncle scars
- ✓ Leaf scars
- ✓ Husks (remaining on the tree)
- ✓ Pruning wounds
- ✓ Wounds from freeze damage
- ✓ Injuries from wood peckers
- ✓ Other type of injuries

Wounds in the field during 1) the season, 2) at harvest and 3) postharvest



Infection of leaf scars

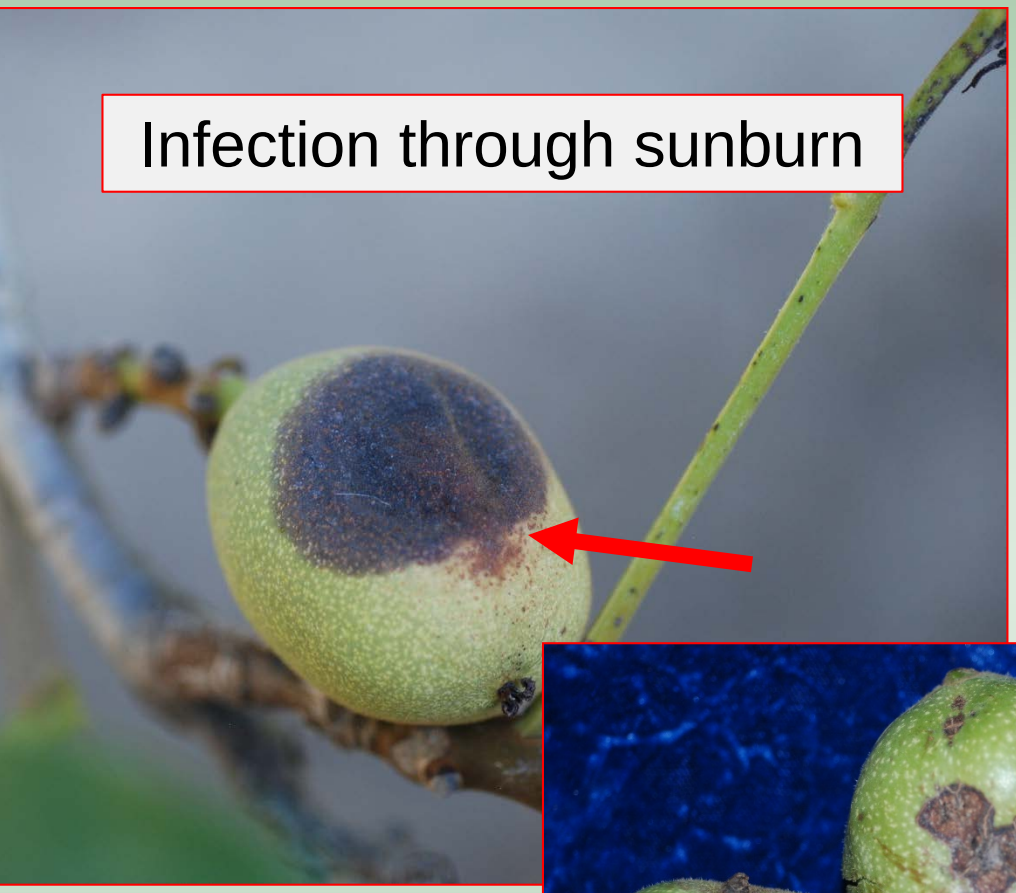
Infection via scale wounds

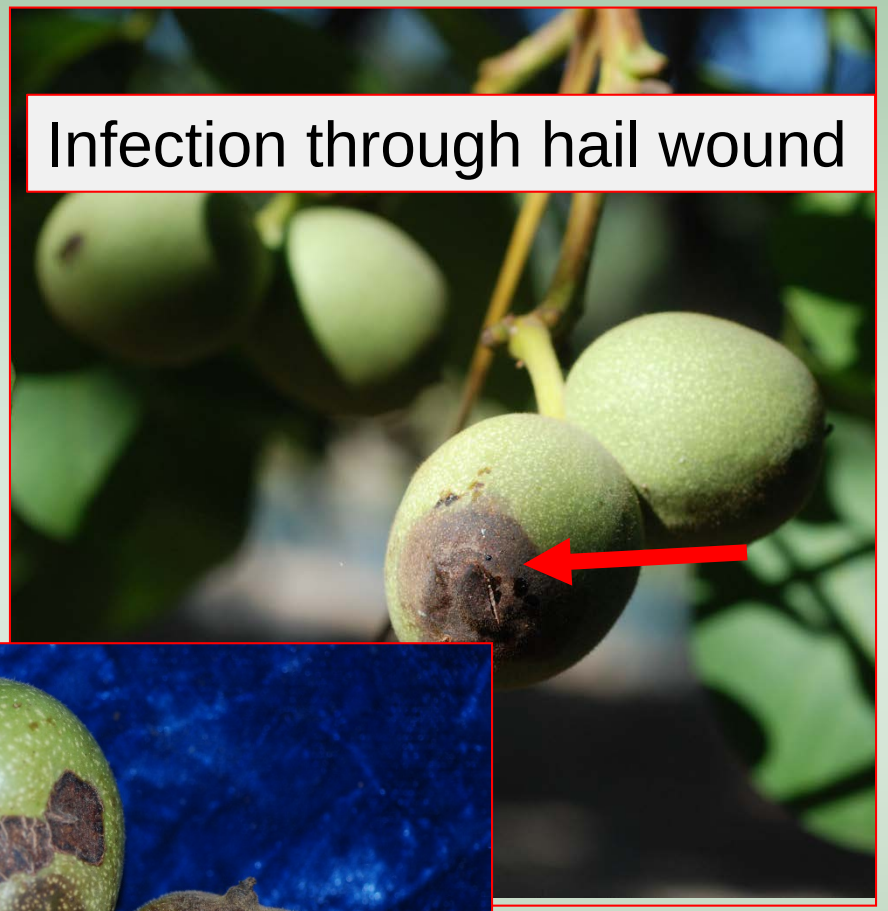


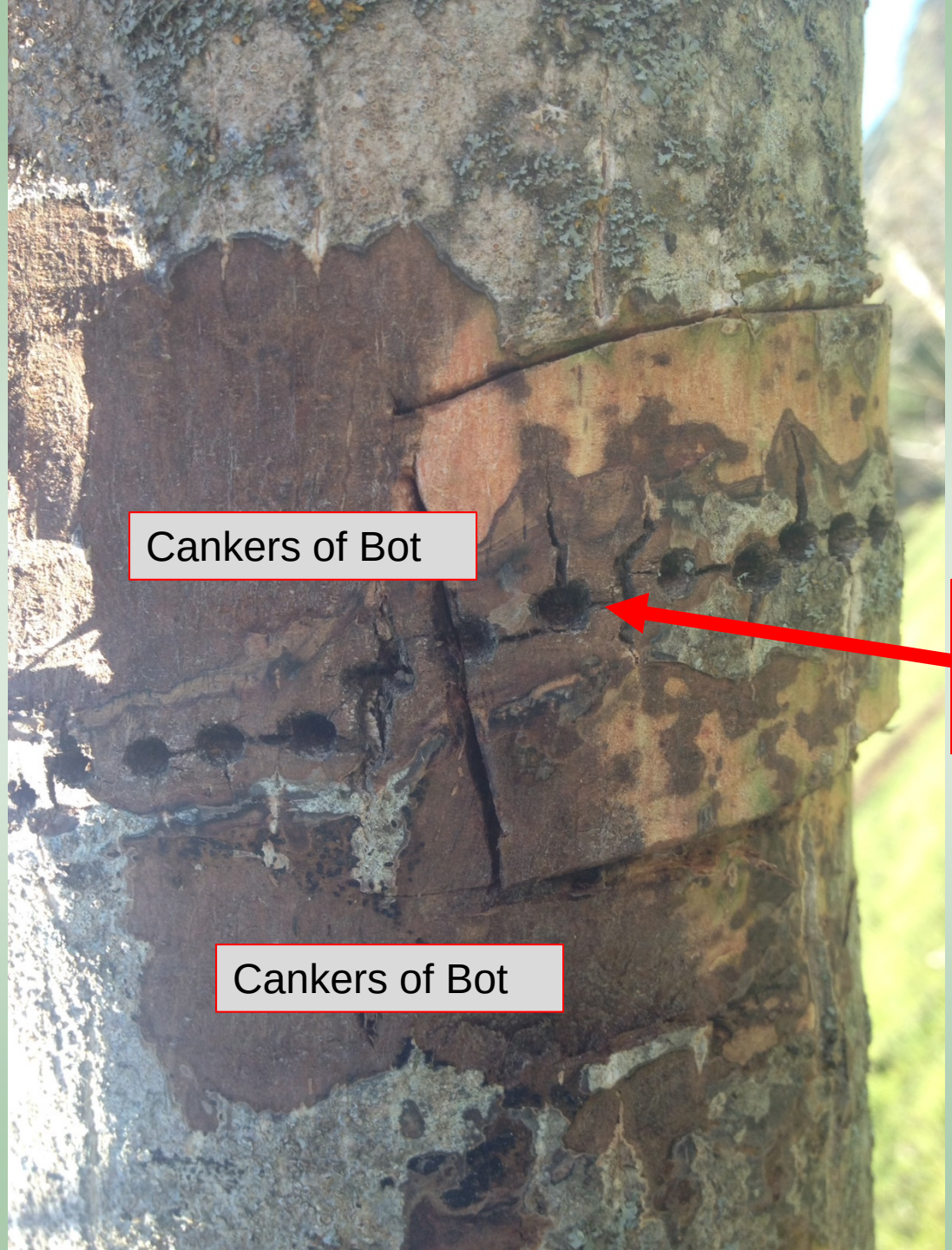
walnut scale

Botryosphaeria

Examples of wound infections





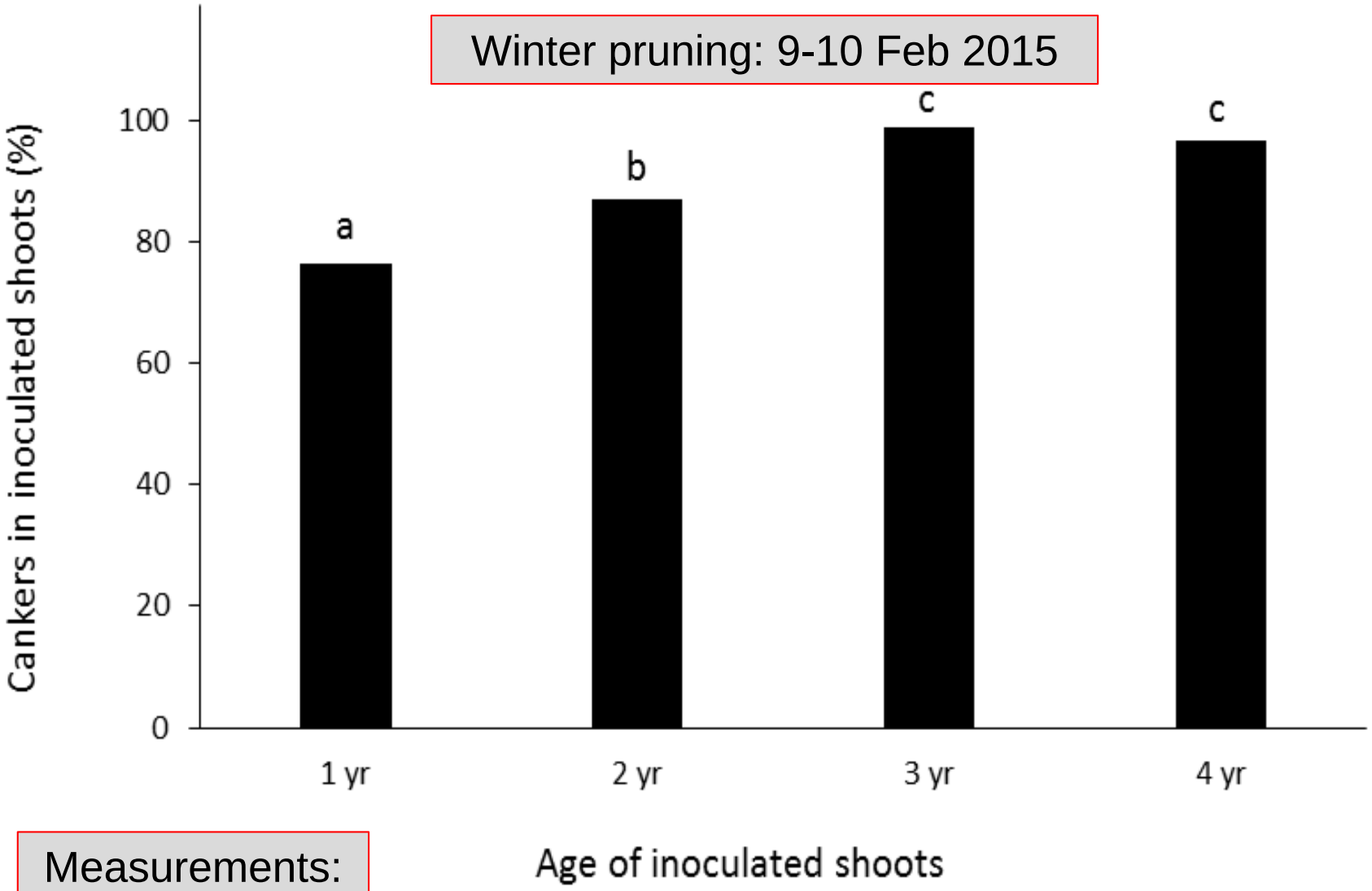


Wood-peckers' holes infected by Bot

Cankers associated with pruning wounds

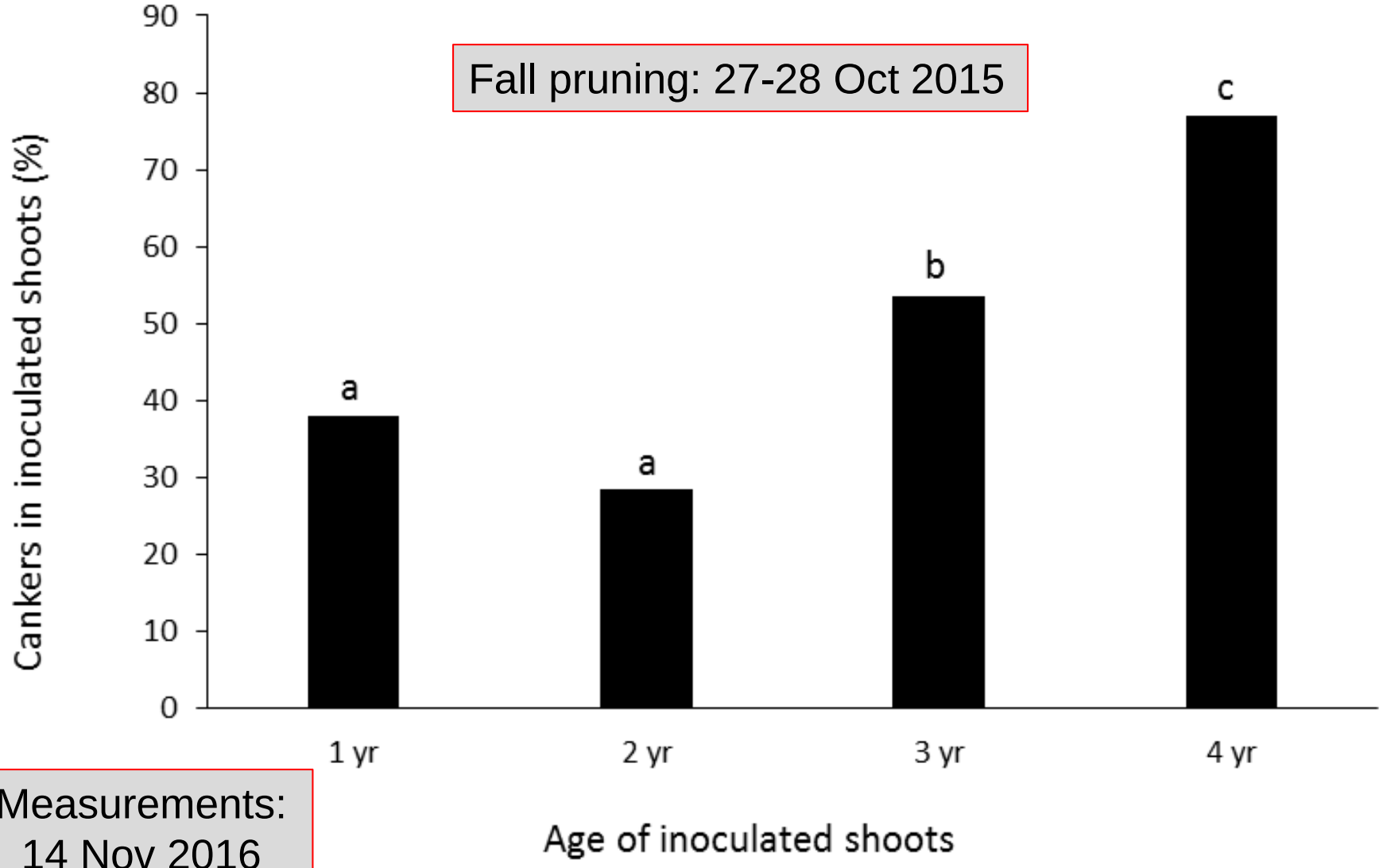
Susceptibility of pruning wounds after winter pruning of 1-, 2-, 3-, and 4-year-old shoots to infection by Bot

Winter pruning: 9-10 Feb 2015

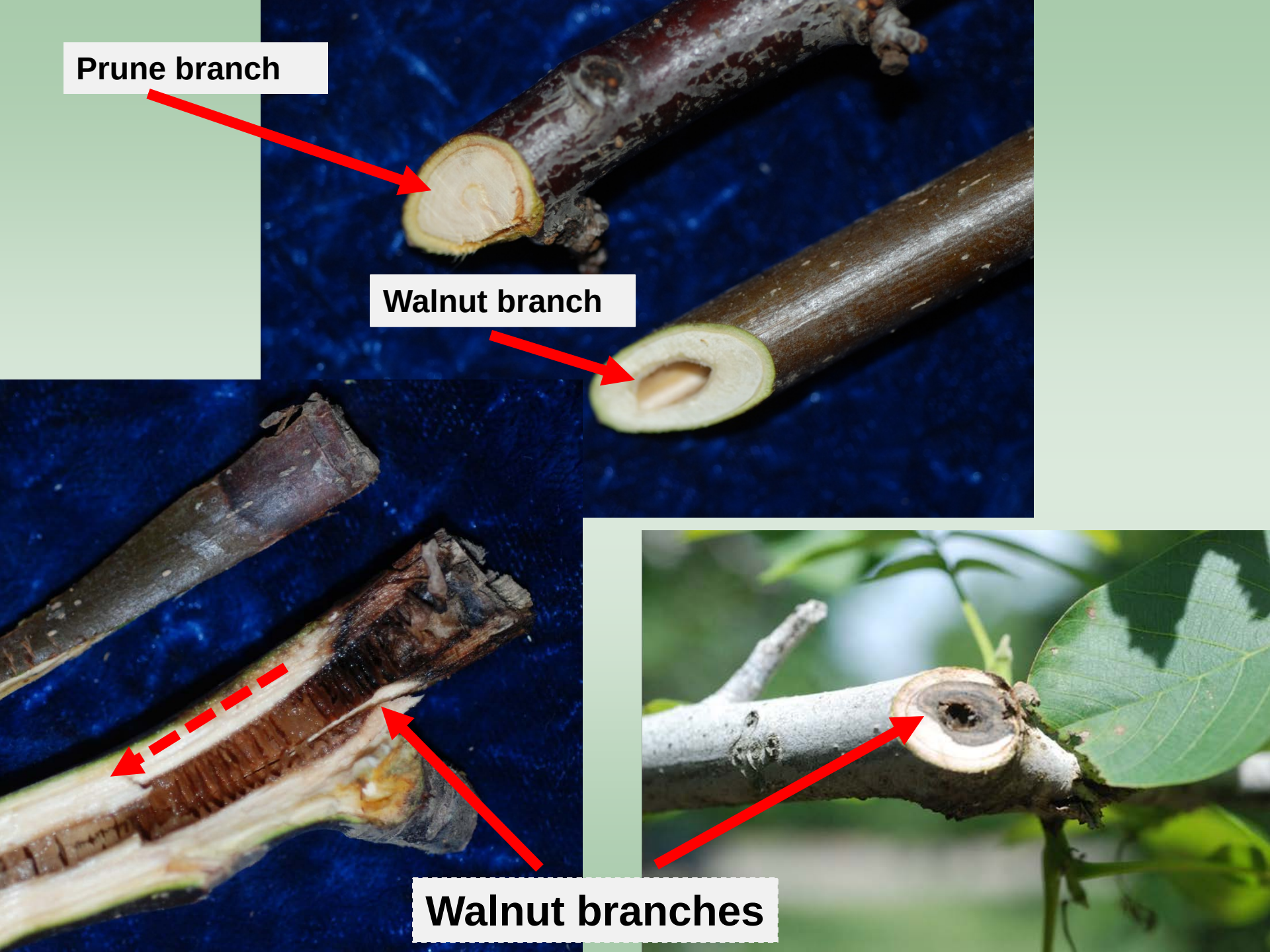


Measurements:
4-7 March 2016

Susceptibility of pruning wounds after fall pruning of 1-, 2-, 3-, and 4-year-old shoots to infection by Bot



Measurements:
14 Nov 2016


Prune branch
Walnut branch
Walnut branches

Best Management by Integrating Cultural and Chemical Control Practices

- **Cultural control:** Prune dead branches or blighted shoots (reduce inoculum in the orchard); avoid sprinkler irrigation that wets the canopy

+

- **Chemical control:** Apply effective fungicides (resistance in these fungi has not been a problem)

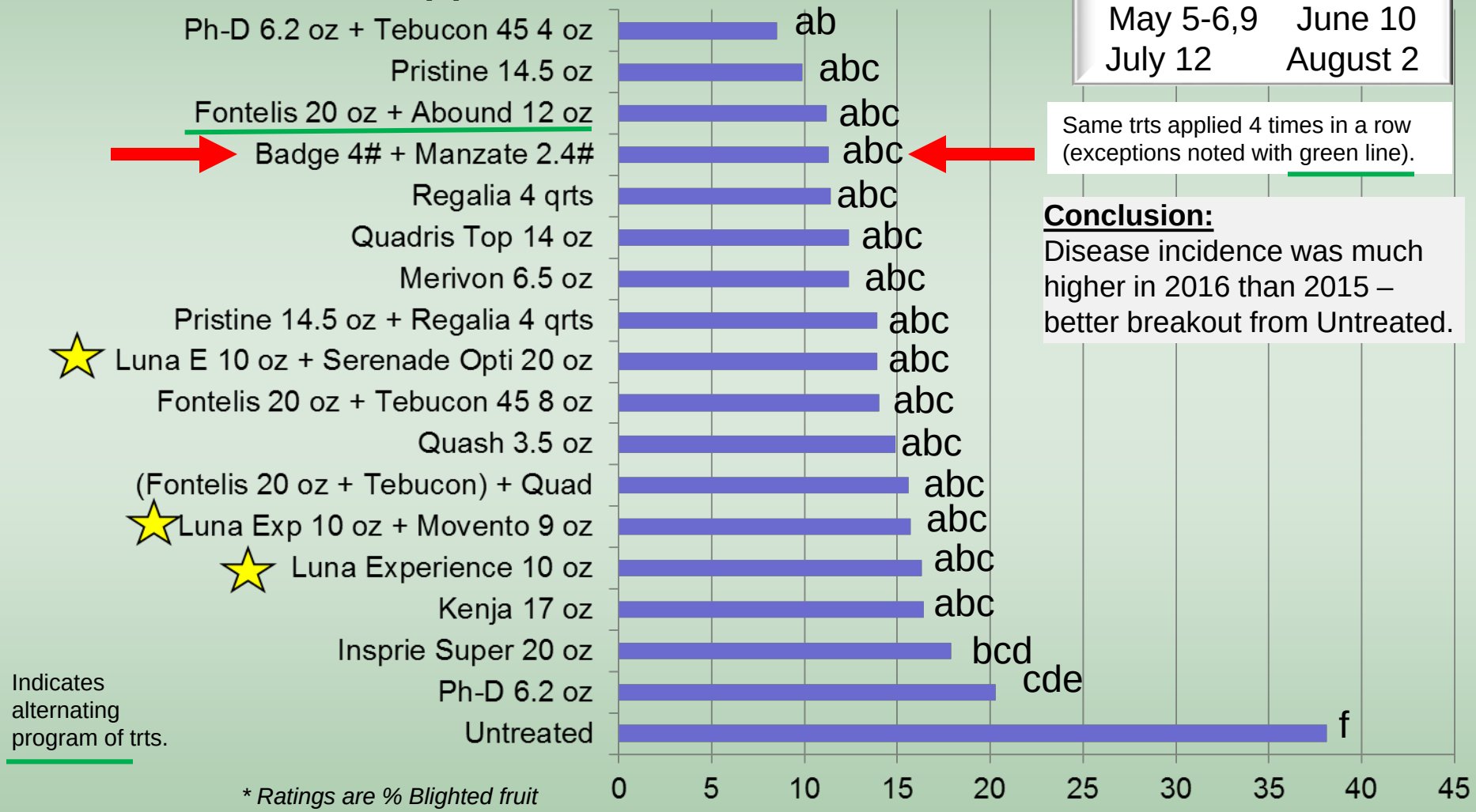
2016 Fungicide Trials

Butte co.

Themis Michailides

D. Morgan, D. Felts, R. Puckett

Efficacy* of treatments against Botryosphaeria fruit blight in a Chandler walnut (Butte Co., 2016)



Applications

May 5-6,9 June 10
July 12 August 2

Same trts applied 4 times in a row (exceptions noted with green line).

Conclusion:

Disease incidence was much higher in 2016 than 2015 – better breakout from Untreated.

Indicates alternating program of trts.

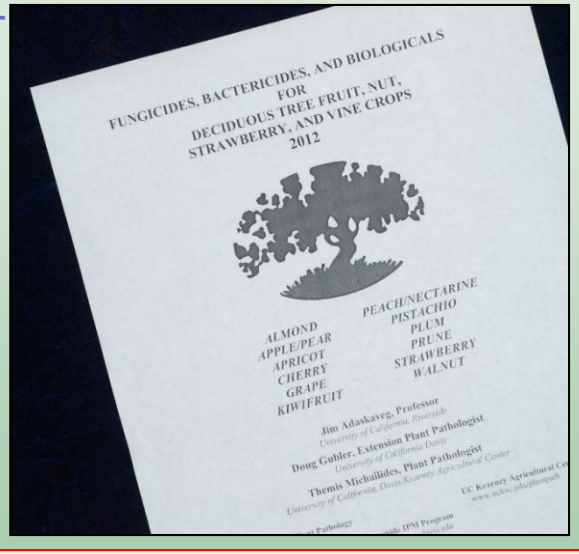
** Ratings are % Blighted fruit*

Single tree plots, replicated 5 times.
Disease assessments were performed on 7- 20-16

Efficacy of registered fungicides against Botryosphaeria canker and blight of walnut

Fungicide	Active ingredient	Efficacy
Quash……	metconazole	++++
Merivon…….	fluxopyroxad+pyraclostrobin	++++
Pristine …….	boscalid + pyraclostrobin	+++
Quadris Top…..	difenoconazole + azoxystrobin	+++
Switch……	cyprodinil + fludioxonil	++++
PhD…..……	Polyoxin-D	+++
Viathon……..	tebuconazole + phosphite	+++
K-Phite …….	Polyphosphite	++++
Luna Experience	fluopyram + tebuconazole	++++
Luna Sensation	fluopyram + trifloxystrobin	+++
Fontelis	penthiopyrad	+++
Copper+Manzate	copper+mancozeb	++

+ = poor; ++++ = excellent

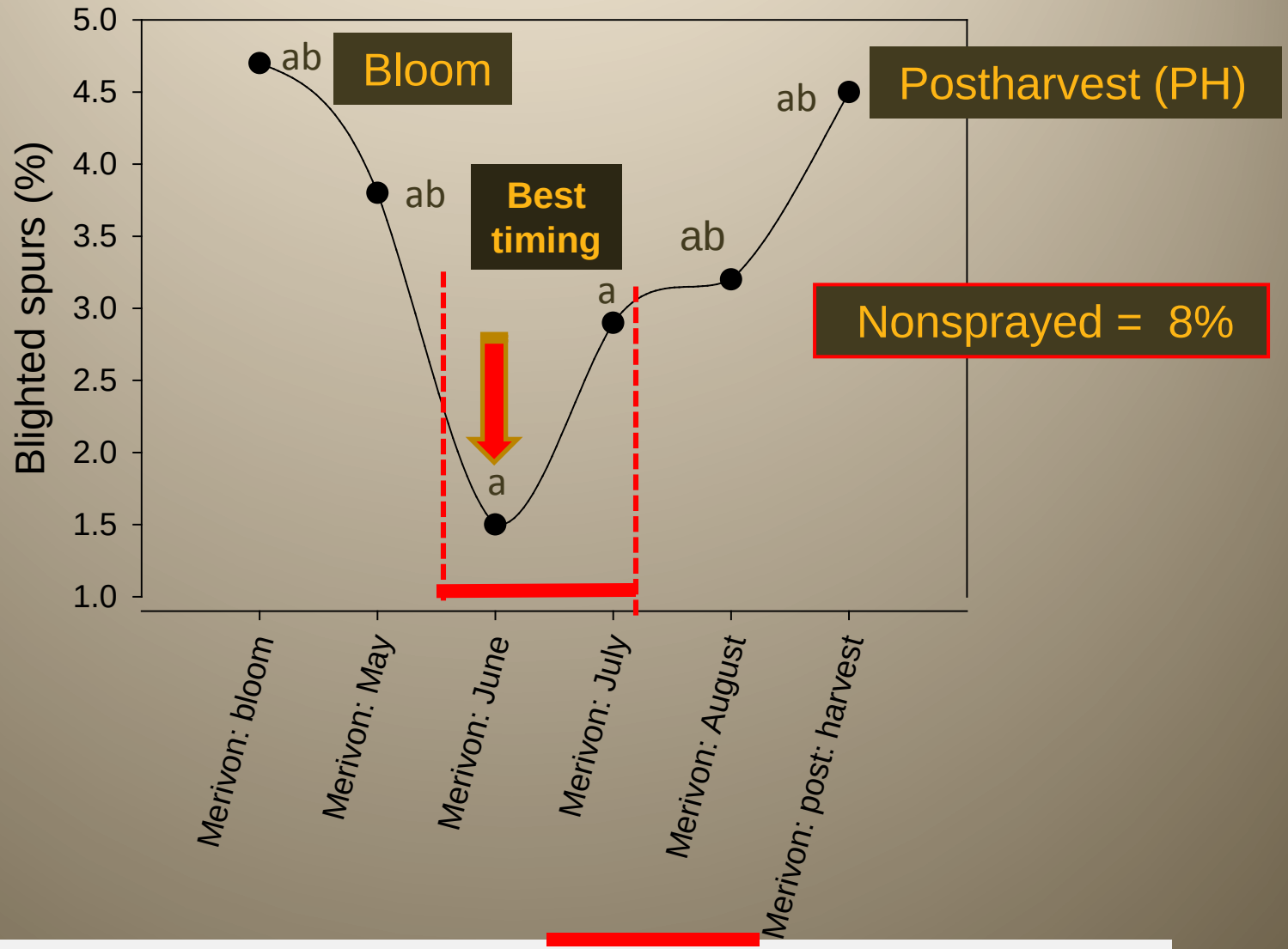


http://www.ipm.ucdavis.edu

2015-16 efficacy of timing of single spray

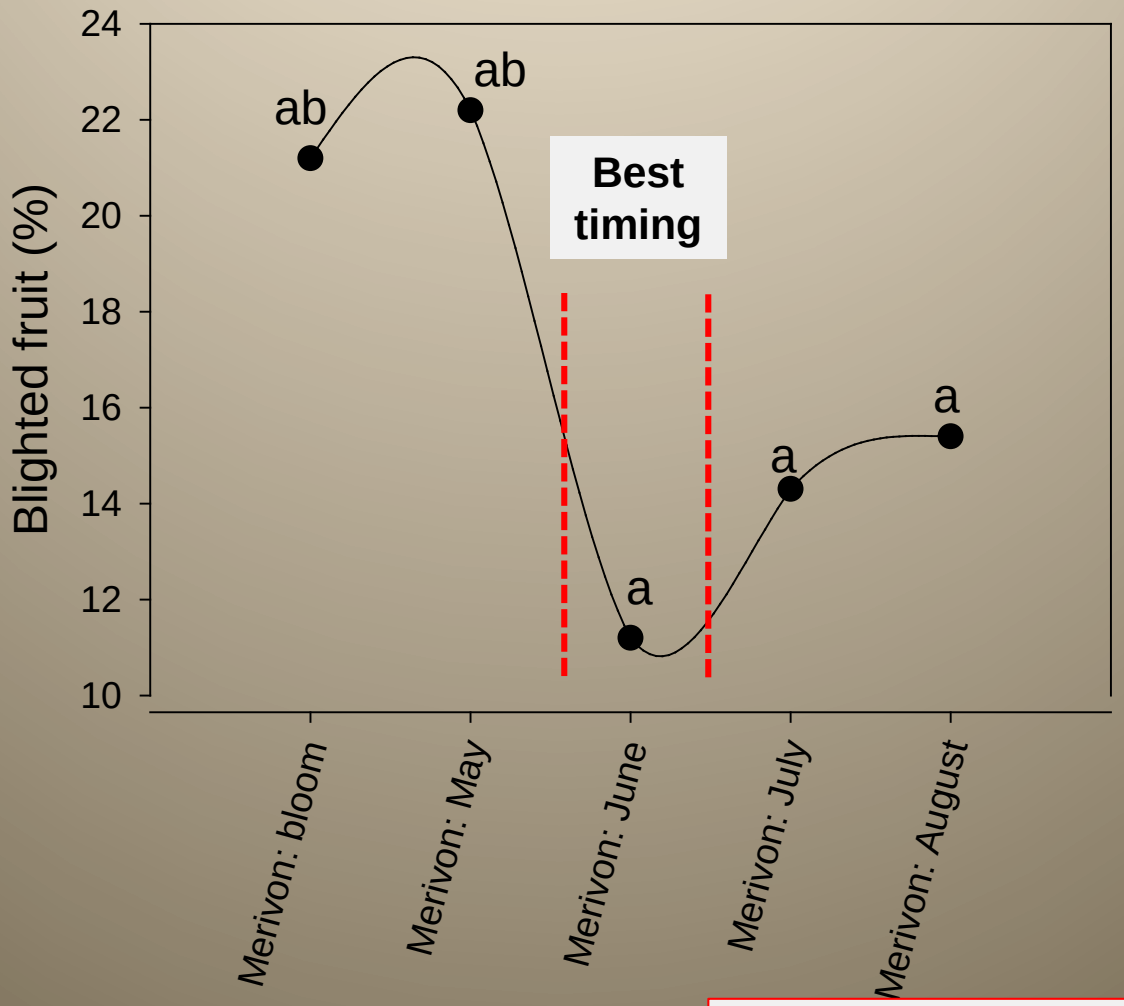
- ✓Saving $ trmt
- ✓Best time for **one-time spray**
- ✓**Mid-June to early July**
  - ✓Both years
  - ✓2016 – 38% blighted nuts in unsprayed

Best-timing of a single spray of Merivon® in a Chandler orchard in Butte Co. - 2015



SPRAYS: Apr 9 (bloom); May 12; **Jun 12; Jul 10**; Aug 10; Nov 3 (PH)

Best timing of single spray with Merivon® in reducing Chandler blighted fruit (Butte Co. 2016)

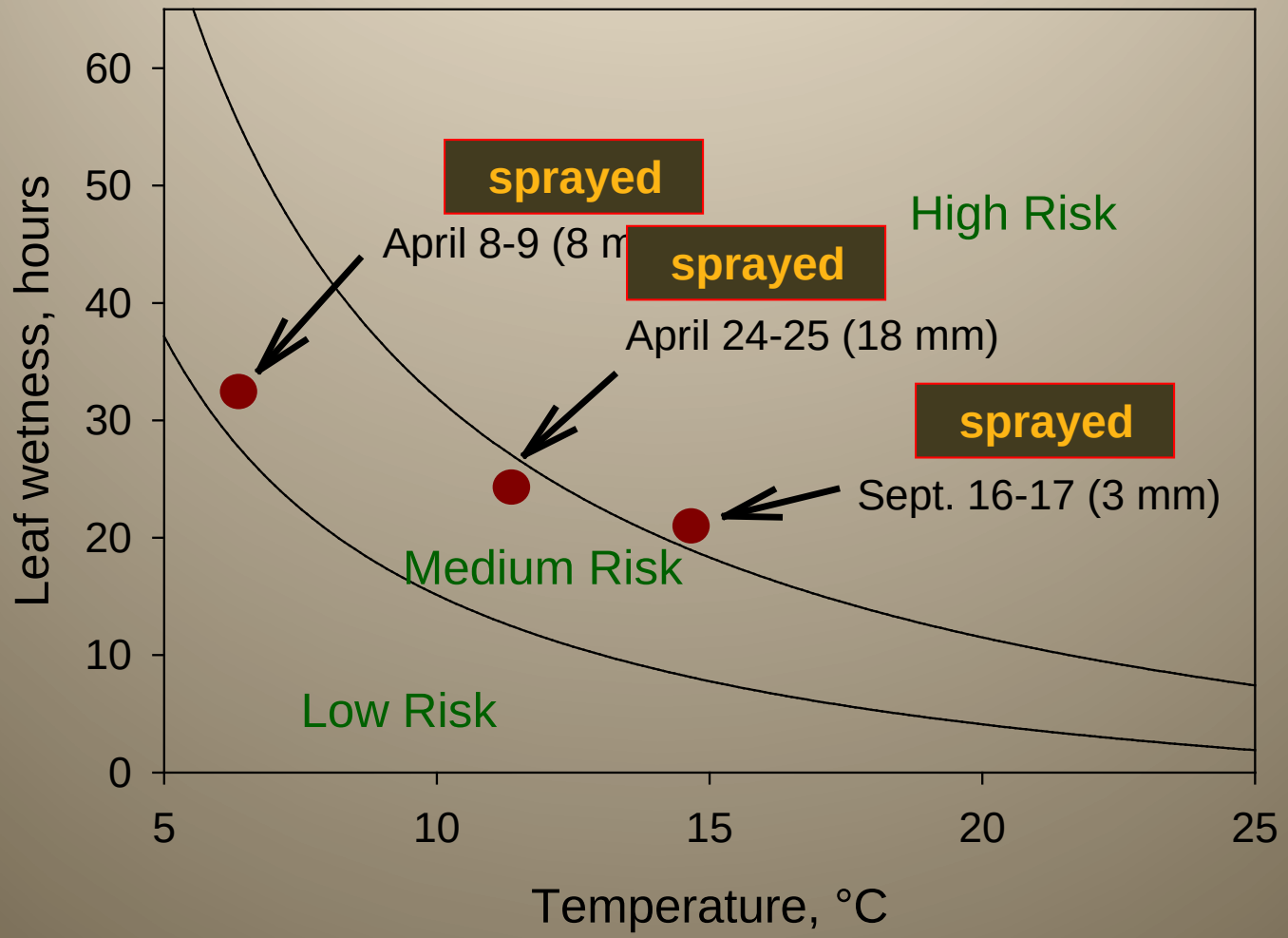


Untreated = 38% blighted fruit **b**

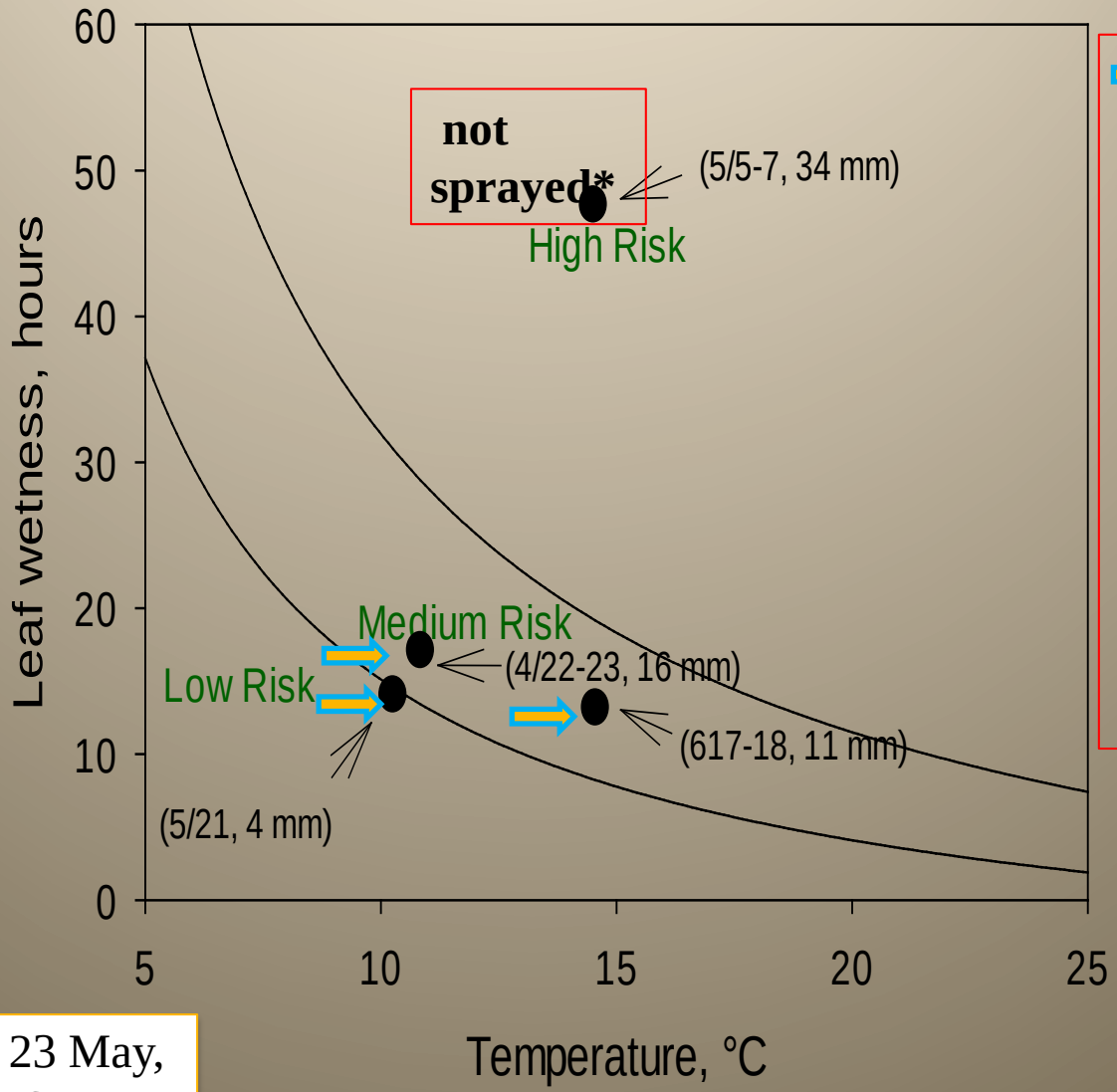
2015-16 Leaf wetness model (LWM)

- ✓Triggered 3 sprays (≥50^{o} F, ¼” wetness)
  - ✓Both years
  - ✓Spray 2-3 days after rain
  - ✓Assume 2 week residual for most fungicides

2015: Leaf wetness model (LWM) where rain exceeded threshold in Chandler (Butte Co)



2016: Leaf Wetness Model (LWM) where rain exceeded threshold in Chandler (Butte Co.)



⇨ = sprayed

*** Not sprayed; rain within the residual activity period of the previous spray on 26 April.**

Sprays: 26 April, 23 May, 20 June 2016

2016 Leaf wetness model (LWM)

- ✓Disease control similar to 4 spray calendar program
  - ✓Bloom (Mar 31), May 5, June 10, July 12
  - ✓%blighted fruit: unsprayed 38.1 b

    4 spray 8.3 a

    LWM 12.9 a

Bot management summary

- ✓ The pathogens (*Botryosphaeria & Phomopsis*) produce easily and abundantly both water-spread and airborne spores.
- ✓ Spores can infect intact fruit (latent infection) and wounds during the season and/or postharvest.
- ✓ Management of the disease requires both sanitation (pruning) and fungicide sprays.
  - Remove dead and infected wood in the summer or fall when not raining (pruning cut wounds susceptible to infection for **4 months** after wounds made)
  - disinfect pruning equipment

Sanitation by ***pruning*** is a necessary step ***to remove disease***, decrease future infection

What to do with all that pruned wood?

Scenarios

✓ ***Orchards*** **- Heavy infection-saturated (>50%):** Prunings need to be chipped and may be left in the orchard; annual full spray fungicide program (bloom, May, Jun, July, & postharvest). **WATCH FOR RAINS**

✓***Orchards*** **– Moderate infection (20% - 50%):**
Prune or hedge these orchards first and then move into more infected orchards; prunings need to be removed out of the orchard; (bloom, May, June, & July sprays). **WATCH FOR RAINS**

✓***Orchards*** **– Light infection (6% - 20%):**
Prune or hedge these orchards first and then move into more infected orchards; prunings need to be removed out of the orchard; (bloom and June spray). **WATCH FOR RAINS**

✓***Orchards*** **– No Botryosphaeria yet (0%):** Prunings can be chipped and left in the orchard; no spray(s) are needed.

Bot management summary

- ✓ Fungicide sprays from bloom through July reduce Botryosphaeria/Phomopsis infections.
  - ✓ **Check: http://www.ipm.ucdavis.edu**
- ✓ Spraying before or after an infection event (rain) is very effective: **WATCH FOR RAINS**
- ✓ The best-timing for **one** spray seems to be around **mid-June to early-July** (we need to refine this…)
- ✓ A postharvest spray may also help (we need to confirm…).

2017 Bot Research plans

- Adapt predictive assay methods for forecasting Bot/Phomopsis
- Continue investigating latent (symptomless) infections to predict disease risk
- Determine interactions of Bot and Phomopsis in walnut fruit
- Continue fungicide efficacy and best timing testing
- Determine infection of pruning wounds and managing disease using fungicides and/or biological control agents/wound treatments
  - Nickels Field Day May 10

Pruning wound fungicide & wound sealant efficacy treatments on Bot/Phomopsis canker development

Nickels Soil Laboratory

Treatments
April 7, 2016

Fungicide or wound sealant	Rate
Control	------
Quadris Top	14 fl oz/ac
Quadris Top + Viti-Seal	14 fl oz/ac; 1:50
Quadris Top + Spur Shield	14 fl oz/ac; 1:50
Tilt	8 fl oz/ac
Tilt + Viti-Seal	8 fl oz/ac; 1:50
Tilt + Spur Shield	8 fl oz/ac; 1:50

-fungicides were hand sprayed to run-off on pruning wounds using spray bottles
- natural infection (Bot now in Chandler no prune plot & nearby old Chandler/Howard hedgerow)

Pruning cuts on former no prune Chandler trial at NSL (March 28, 2016)

- Hedging trial

- Whisking trial

2016 Weather conditions
NSL weather station

- No rain between pruning cuts (March 28) and treatments (April 7, 2016).
- April 9-10 .07 in
- Remainder of April .26 in
- May .84 in over 8 days
- Max temps >50^{o}F
- 2017
  - Will evaluate in April
  - Nickels Field Day May 10

Anthracnose

Conditions for infection

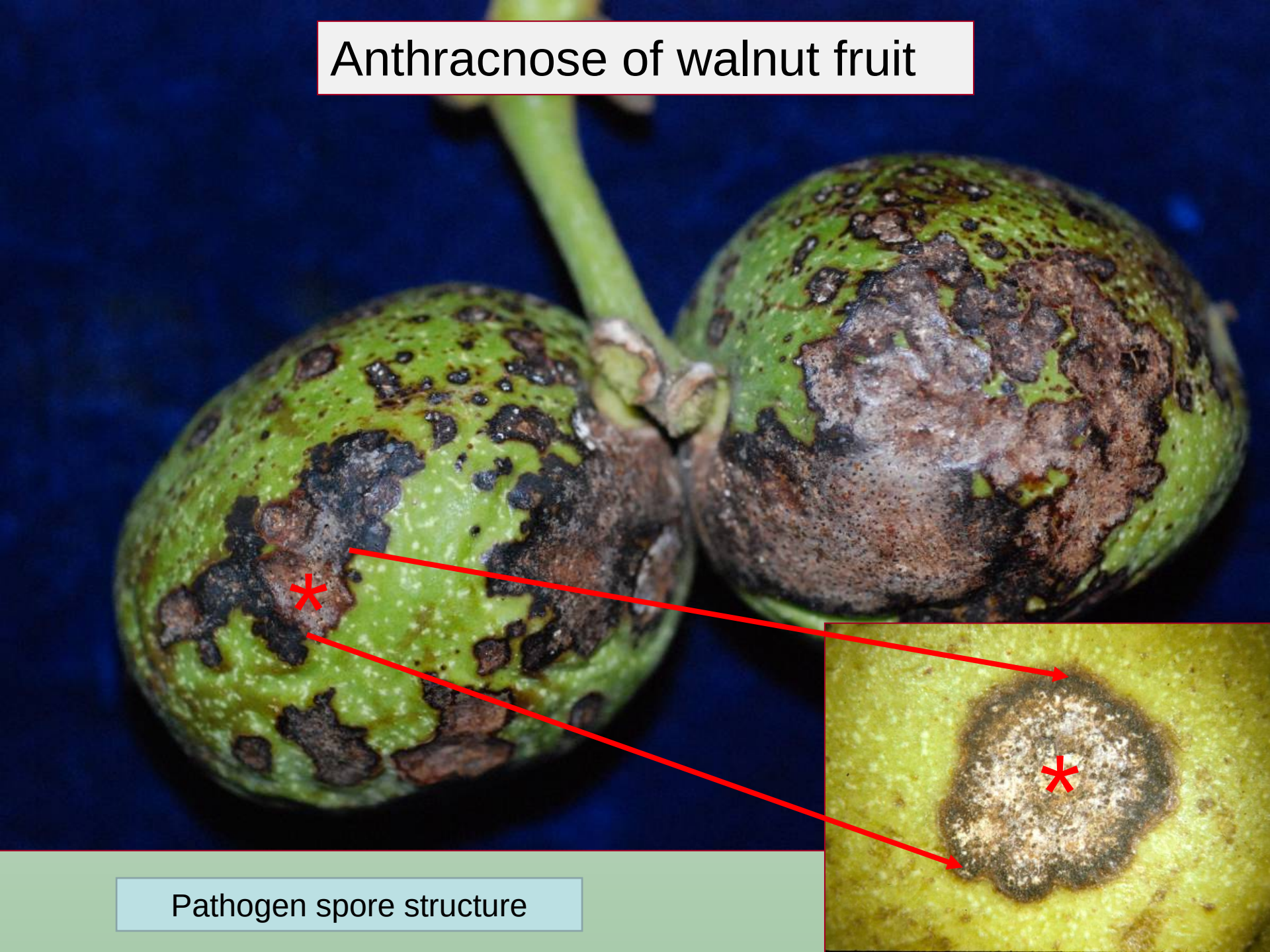
- ✓Presence of inoculum
- ✓Extended rain periods: when leaves & nutlets developing
- ✓Temperature: exact unknown; usually favorable
- ✓Presence of susceptible tissues

Anthracnose on Serr leaves

Sutter County 2012

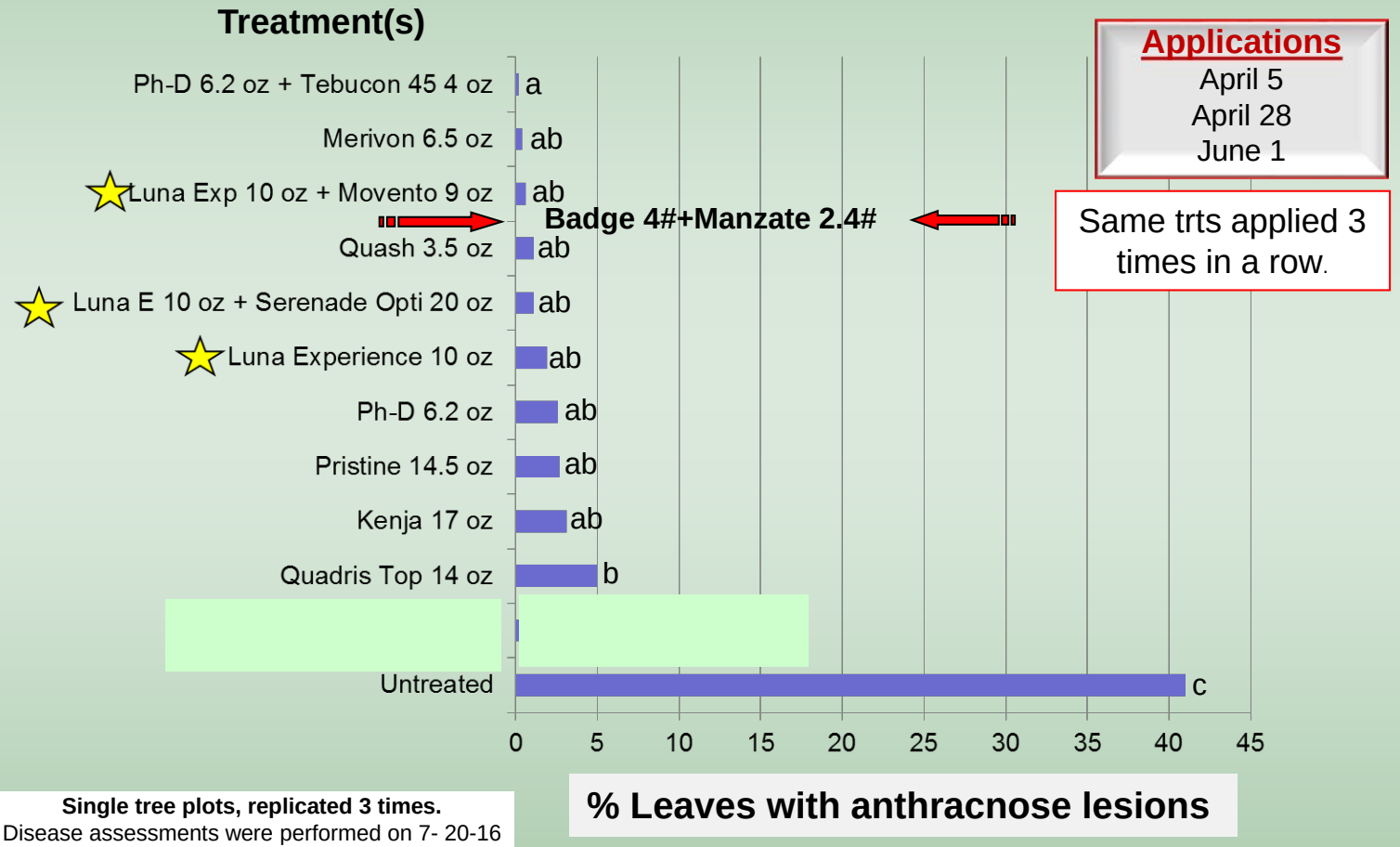
2016: Severe anthracnose of walnut in San Benito Co.

Anthracnose of walnut fruit



Pathogen spore structure

Efficacy* of treatments against Anthracnose of walnut leaves (*Marssonina juglandis*) (San Benito County 2016)



Applications
April 5
April 28
June 1

Same trts applied 3 times in a row.

Single tree plots, replicated 3 times.
Disease assessments were performed on 7- 20-16

Note: Kenja NOT registered in walnut

Walnut Blight

Conditions for infection

- ✓Presence of overwintering inoculum/ susceptible tissues
- ✓Use XanthoCast model as guideline
- ✓The Xanthocast index for walnut blight is a 7-day cumulative index based on temperature and leaf wetness.

http://www.agtelemetry.com/Walnut-Blight-Forecast.php

Epidemiology and Management of Walnut Blight

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Cooperating:

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UC Cooperative Extension, Tehama Co.

D. Thompson, D. Cary, H. Forster, K. Nguyen, C. Leslie, L. Wade

UC CE | University of California Agriculture and Natural Resources | Cooperative Extension

Objectives in 2017

- Evaluate bacterial pathogen populations using molecular approaches
- Evaluate methods to identify blight resistance in walnut varieties/new walnut genotypes
- Continue to test New treatments
  - Standard copper + Manzate

New treatments

- New copper products (CS 2005-Magna Bon)
- Enhancers of copper activity: ZTD, SBH
- Optimize the performance of antibiotics kasugamycin and oxytetracycline in mixtures
- Food preservatives: Niprosin or nisin, €-poly-L-lysine, calcium propionate, lactic acid (combinations with other bactericides)
- Biocontrols (Actinovate, Botector with nutritional additives) and natural bactericides (EXP-1552)

Registration update for antibiotics

- Kasumin (Trade name) federally registered on pome fruit in Sept. 2014.
  - Walnut: Environmental Toxicology – More data provided and reviewed by DPR (2016).
  - Full registration on walnut is pending.
  - Walnut Commission of California has encouraged CDFA and EPA to register Kasumin in a timely manner.

Registration update for antibiotics

- Oxytetracycline accepted into the IR-4 program -9/16 for 2017 residue studies

- Request to EPA by MCFA, university researchers, agrochemical industry, and commodity groups to facilitate registration of antibiotics for plant agriculture.

Thank you
Questions?

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