

Biology and control of *Neofabraea* leaf and twig lesions of oil olives in California

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2016 disease discovered in CA:

Super High Density olive orchards in SJ County



2018 Surveys for Neofabraea diseases of olive:

Mainly found in Super High Density orchards and Arbosana olive so far

Minor finds in Arbequina

Not found in Koroneiki



Olive oil olives, San Joaquin County, Spring 2016:



Symptoms: defoliation

Arbosana



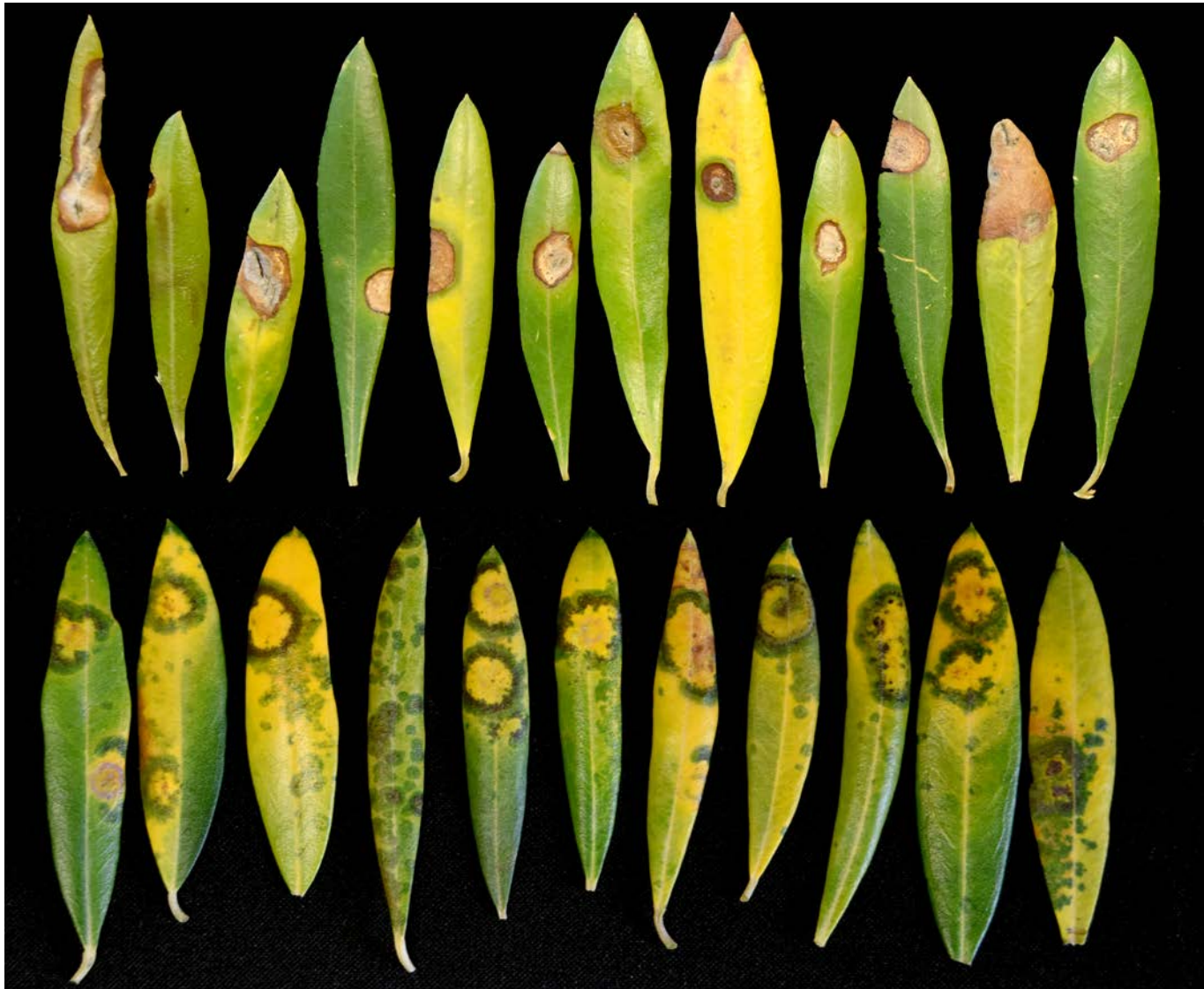
Koroneiki



Symptoms: Arbosana



Not to be confused with:



*Neofabraea
leaf spots*

*Peacock
leaf spots*

Fungal disease causing leaf drop may increase the incidence of olive knot (Increased number of leaf scars)



Symptoms: Branch cankers (Arbosana)



Symptoms: host susceptibility

Arbosana



Koroneiki

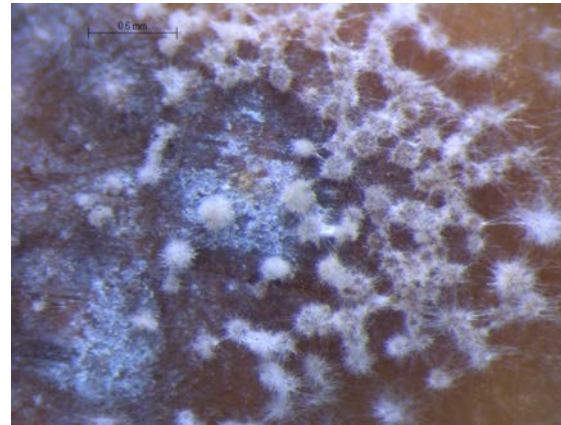


Symptoms: twig dieback (Arbosana)



Neofabraea diseases in olive:

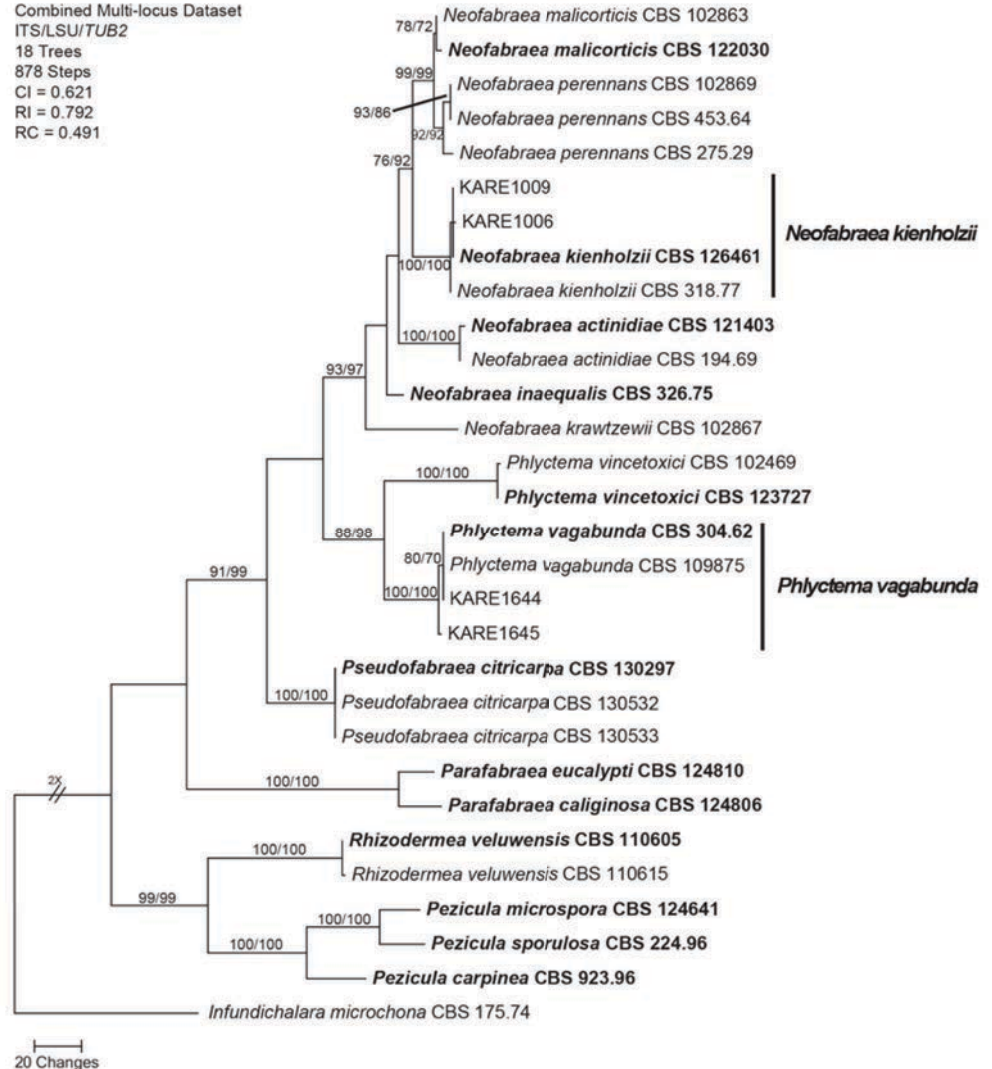
- Fruits can also get infected in CA (**Arbequina**)



Pathogen identification: morphological and molecular studies



Combined Multi-locus Dataset
ITS/LSU/TUB2
18 Trees
878 Steps
CI = 0.621
RI = 0.792
RC = 0.491



Neofabraea diseases in olive:

- Lepra Fruit Rot/Leprositis
 - Tuscany Italy in 1907 (Petri, 1915)
 - Spain (Roca et. al., 2007)
- First report of *Neofabraea alba* causing fruit spot on olive in North America. (Rooney-Latham et al., 2013). Found in coratina and picholine cultivars in two commercial orchards in Sonoma County. Pathogenic in frantoio.



Photo credits: S. Rooney-Latham and Doug Gubler

Neofabraea diseases in olive:

- A problem increasing problem in Spain and Portugal
- 2016. First report of *Neofabraea vagabunda* causing branch cankers on olives in Spain. Found in Arbequina and Picual. (Romero et al. 2016).



Photo credits: J. Romero

Neofabraea diseases in olive:

- Detected in SHD olives in Italy



Disease diagnosis: An old disease, “Lepra”

SERGIO FOSCHI

GLOEOSPORIUM OLIVAE (PETRI) N. COMB., AGENTE DI ANTRACNOSI SU RAMI, FOGLIE E FRUTTI D'OLIVO

Nel 1907 il Petri rinvenne e studiò una malattia delle olive comparsa in Toscana su drupe delle var. « Moraiola » e « Mignola » all'epoca della loro maturazione. Egli determinò che l'agente di tale malattia era una crittogama cui diede il nome di *Cylindrosporium olivae* n. sp.

Noi abbiamo trovato il medesimo microrganismo su alcune varietà* d'olivo, nel 1953, in Romagna, dove però, oltre ai frutti, attaccava i rami e le foglie.

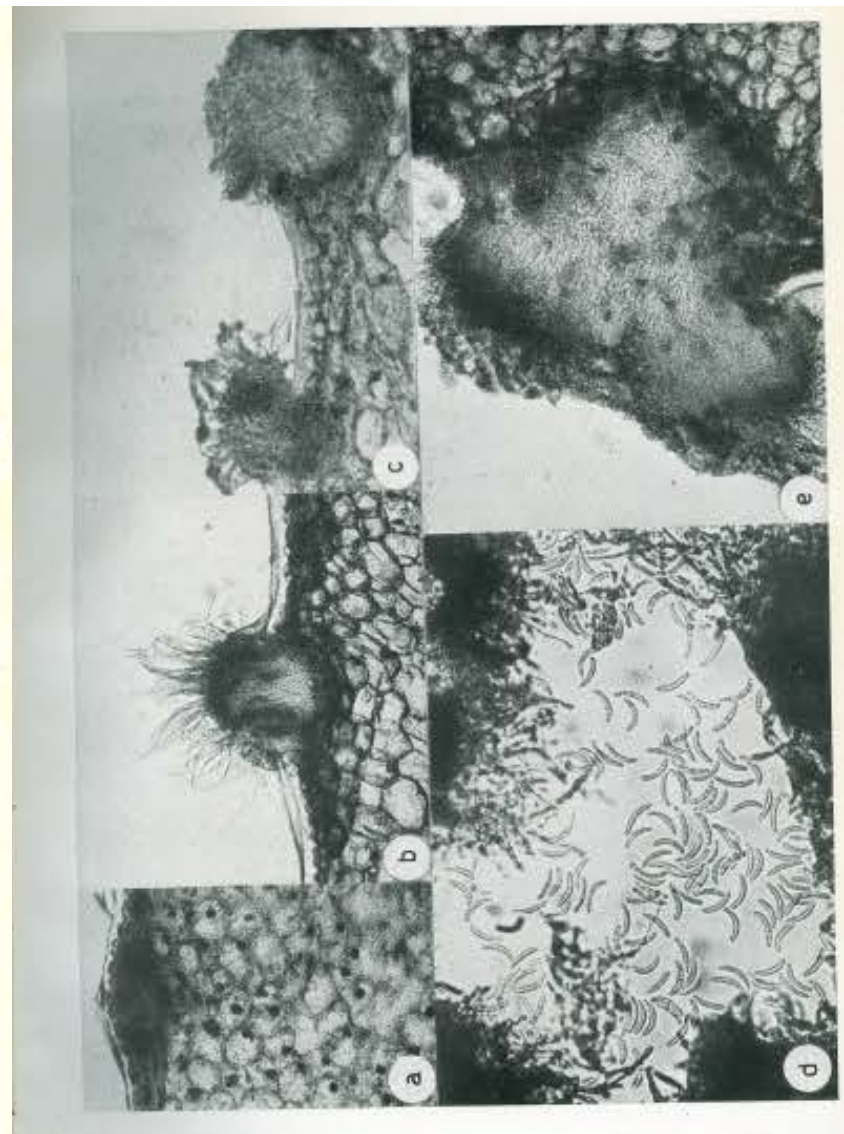
Alla descrizione delle alterazioni macro e microscopiche, che l'infezione fungina produce su questi vari organi, sono appunto destinate le pagine di cui è composta la prima parte del presente lavoro. Ad esse segue una relazione sugli esiti delle prove di riproduzione artificiale della malattia, e, infine, uno studio delle caratteristiche morfologiche e colturali del parassita insieme con una discussione sulla sua posizione sistematica; a conclusione della quale, anticipiamo fin da ora, ci è parso opportuno di compiere un trasferimento di genere, per cui la vecchia specie di Petri diviene *Gloeosporium olivae*.

SINTOMATOLOGIA

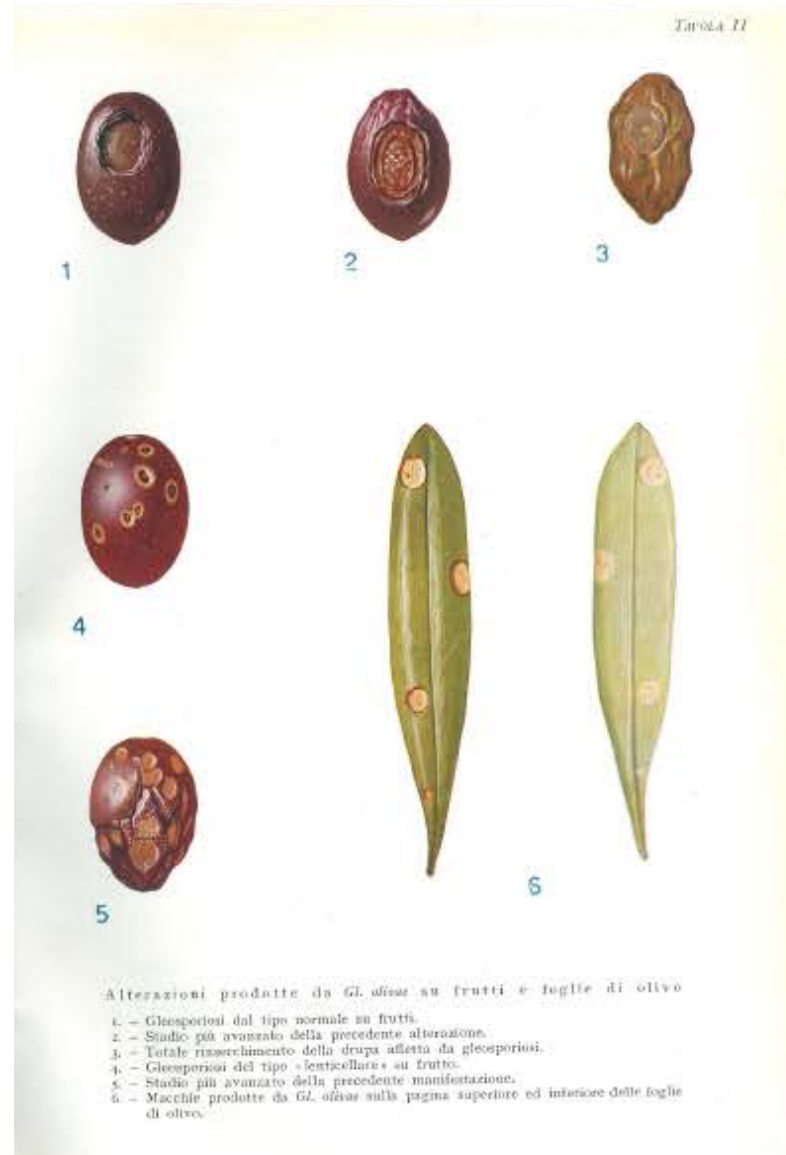
a) Rametti. — Abbiamo iniziato queste indagini nella primavera del 1953 quando venne richiamata la nostra attenzione su un caso di deperimento manifestatosi su numerose piante d'olivo, site in località « Madonna dell'olivo », a Cesena (Forlì). La varietà particolarmente colpita — che è anche la più diffusa nella zona — risultò essere il « Correggiolo ».

In un esame preliminare effettuato, verso la fine di maggio, alle piante malate abbiamo constatato un evidente appassimento e seccume,

* Come è noto, è stato proposto di recente che le varietà di piante coltivate vengano indicate col termine « cultivar » (abbreviato: « cv. »), e già in alcuni lavori pubblicati in questa stessa rivista è stata applicata tale regola di nomenclatura. Noi però usiamo ancora la vecchia denominazione, nell'attesa che sia raggiunto sull'argomento il pieno accordo fra i botanici e gli agronomi italiani.



Disease diagnosis: An old disease, "Lepra"



Neofabraea diseases in apple and pear: *Bull's eye rot and canker*



Photo credits: Iain MacSwann

- "Bull's-eye rot" occurs on fruit at open lenticels or at breaks in the skin
- The rot spots may be only specks, but most of them are 0.5 to 1 inch
- Spots may occur singly or be numerous.

Neofabraea diseases in apple and pear: *Bull's eye rot and canker*

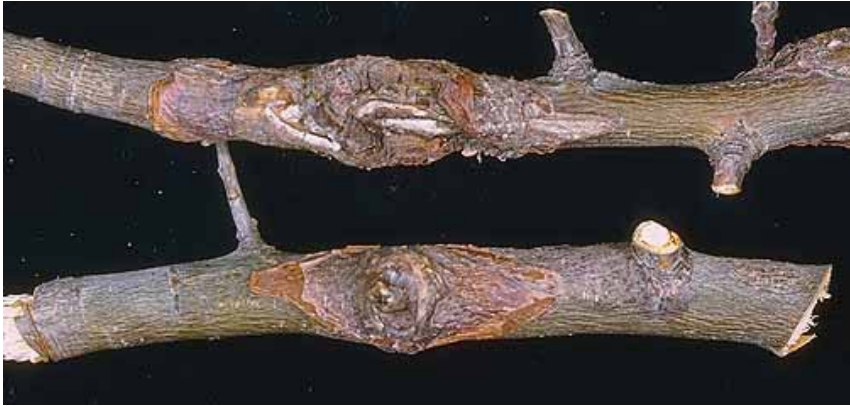


Photo credits: OSU Extension Plant Pathology Collection

- The fungus overwinters in cankers and infected fruits
- Conidia are exuded from acervuli and dispersed by rain
- Perennial canker is associated with the low temperature or southwest injury, and pruning wounds
- The fungus can infect through the wounded portions of the tree
- Oregon, Washington, and California

Pathogenicity in apple: Possible inoculum source

plant disease

Editor-in-Chief: Alison E. Robertson
Published by The American Phytopathological Society

[Home](#) > [Plant Disease](#) > [Table of Contents](#) > [Citation](#)

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May 2016, Volume 100, Number 5
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<https://doi.org/10.1094/PDIS-08-15-0949-PDN>

DISEASE NOTES

First Report of *Neofabraea alba* Causing Branch Canker Dieback of Apple in California

S. Rooney-Latham and **M. C. Soriano**, California Department of Food and Agriculture,
Sacramento 95832.

Pathogenicity in apple:

- CA olive isolates are pathogenic to apple: source of inoculum?



Neofabraea coin disease of ash:

- Found on nursery stock Michigan, Oregon, and Ontario, Canada
- Cankers are annual
- Fraxinus species were examined around olive orchards in CA, but the olive pathogens were not detected



Photo credits: Linnea Skoglund and OSU Plant Clinic

Disease emergence: super-high-density oil olive



- Intensification of agricultural practices
- Mechanical harvest
- Changing weather conditions

Disease emergence: Infection occurs at wounds caused by mechanical harvesters



Disease emergence: Infection occurs at wounds caused by mechanical harvesters

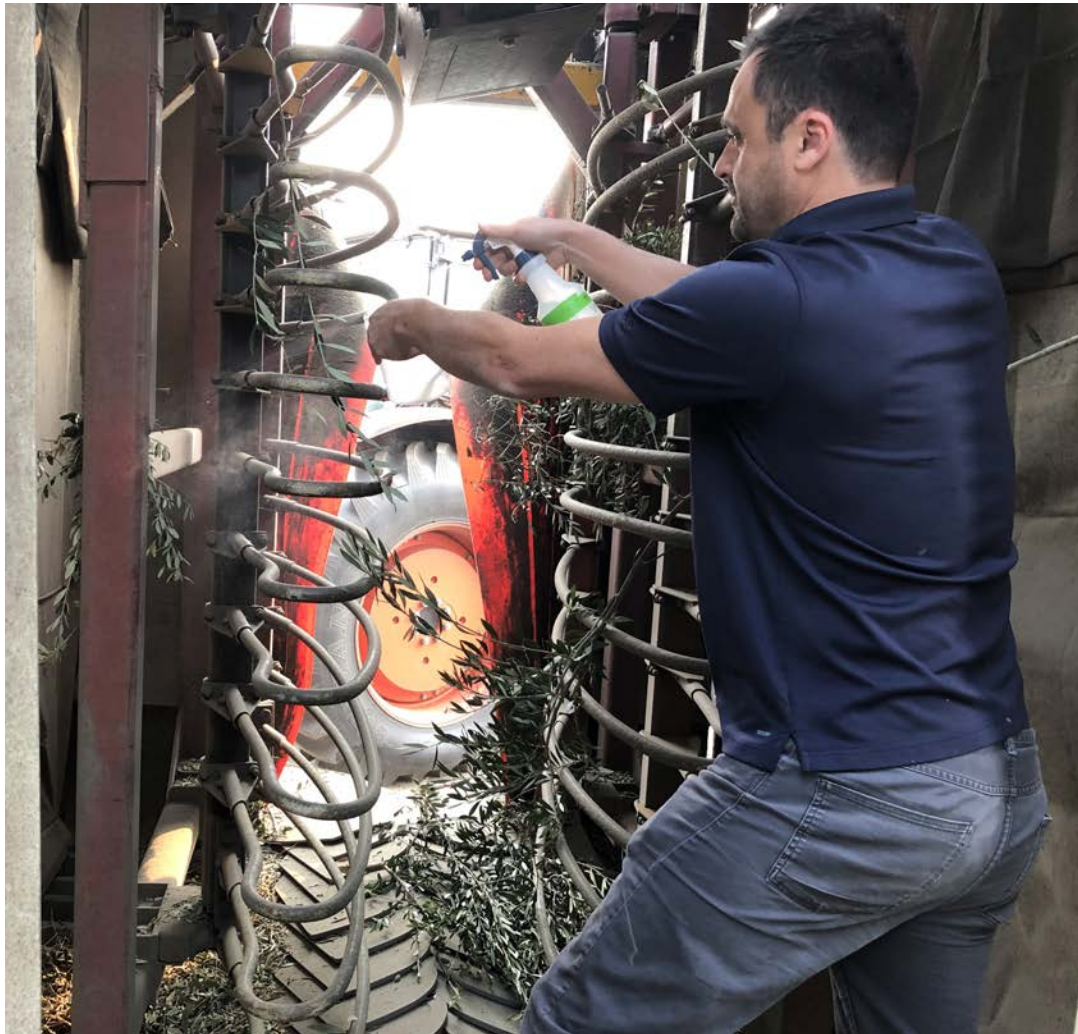


Disease emergence: Infection occurs at wounds caused by mechanical harvesters



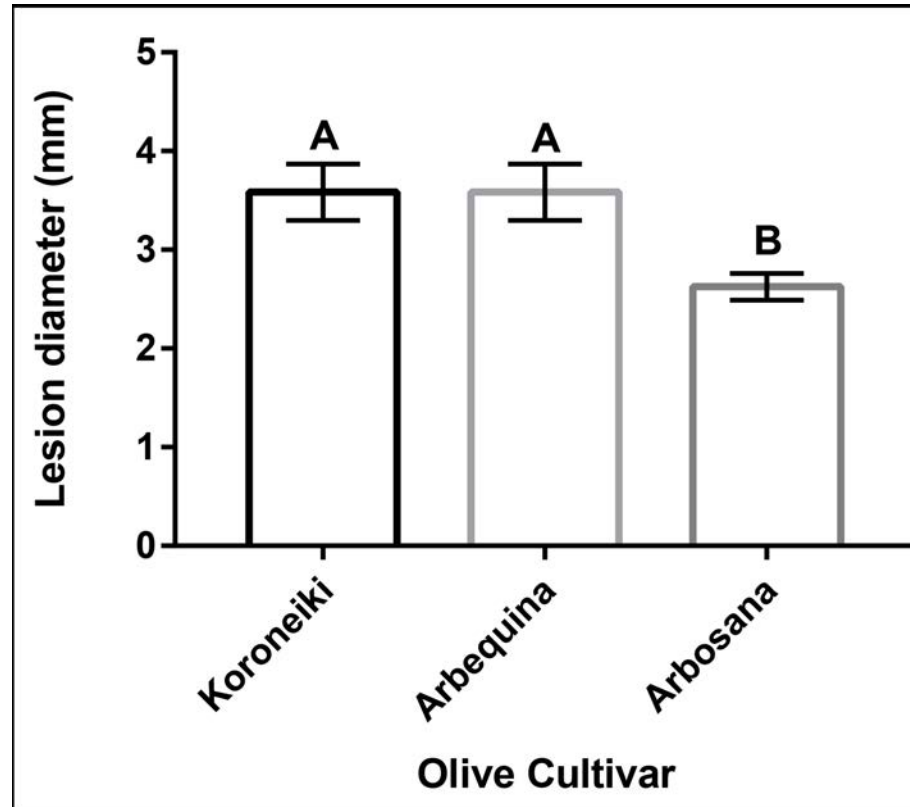
Disease emergence: super-high-density oil olive

- Pathogens not detected from harvester pads: not a source for disease spread

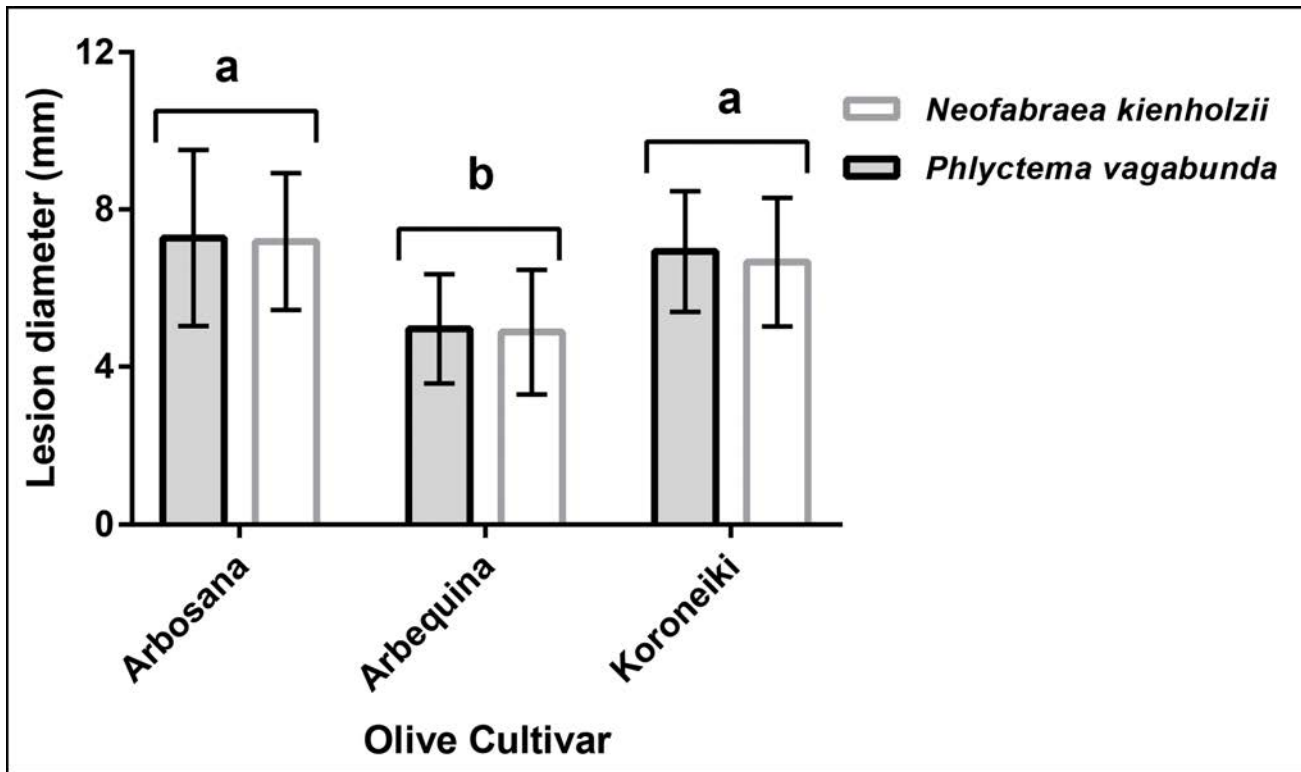


Pathogenicity on leaves:

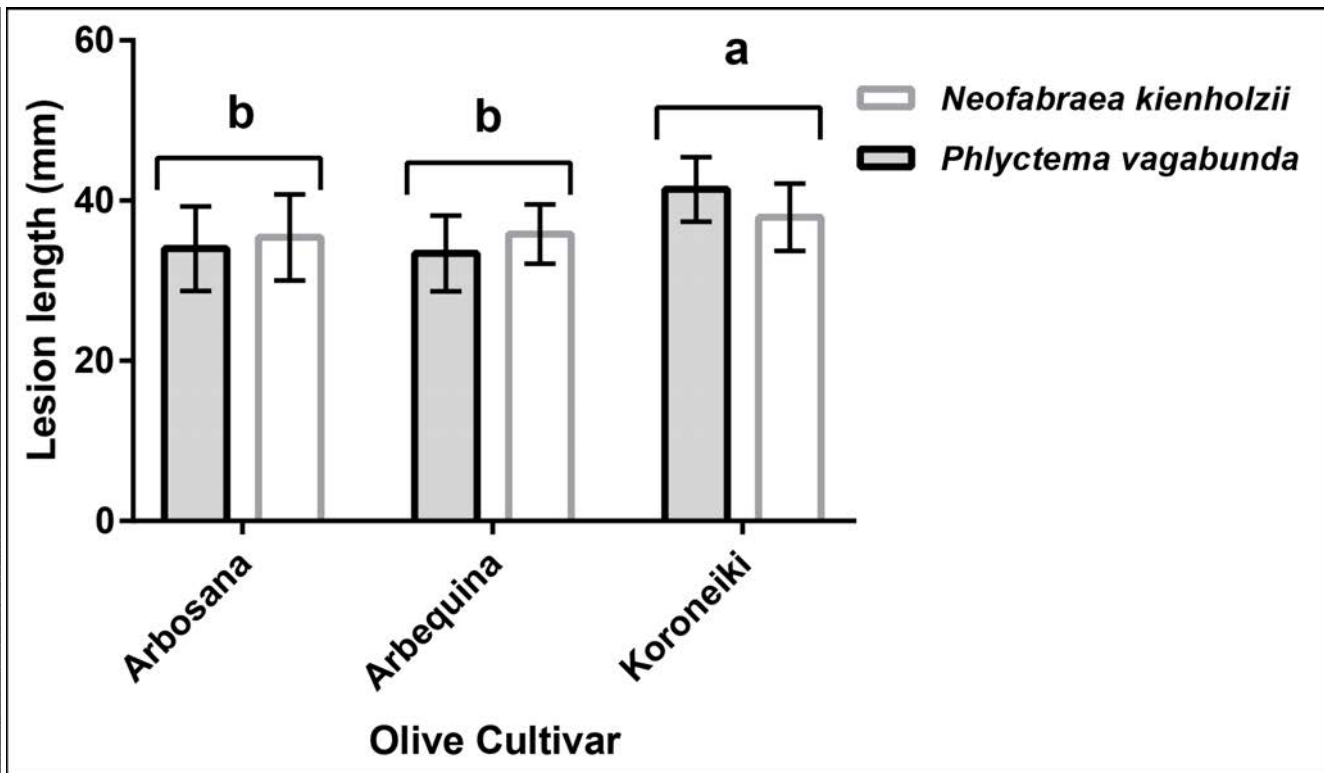
- Wounds are required for infection!
- New growth in the spring does not get infected



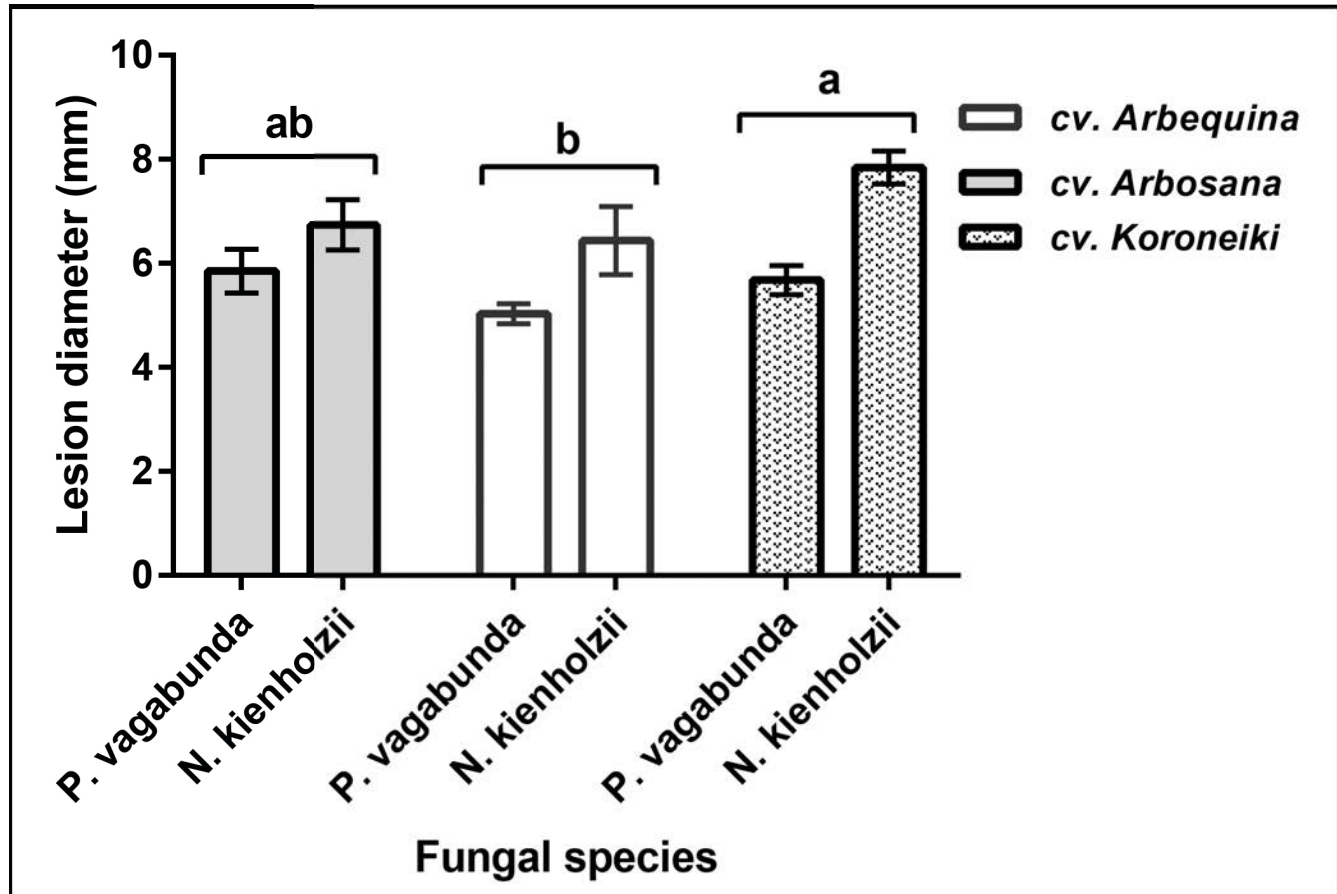
Pathogenicity in leaves:



Pathogenicity in shoots:



Pathogenicity in olive fruits:

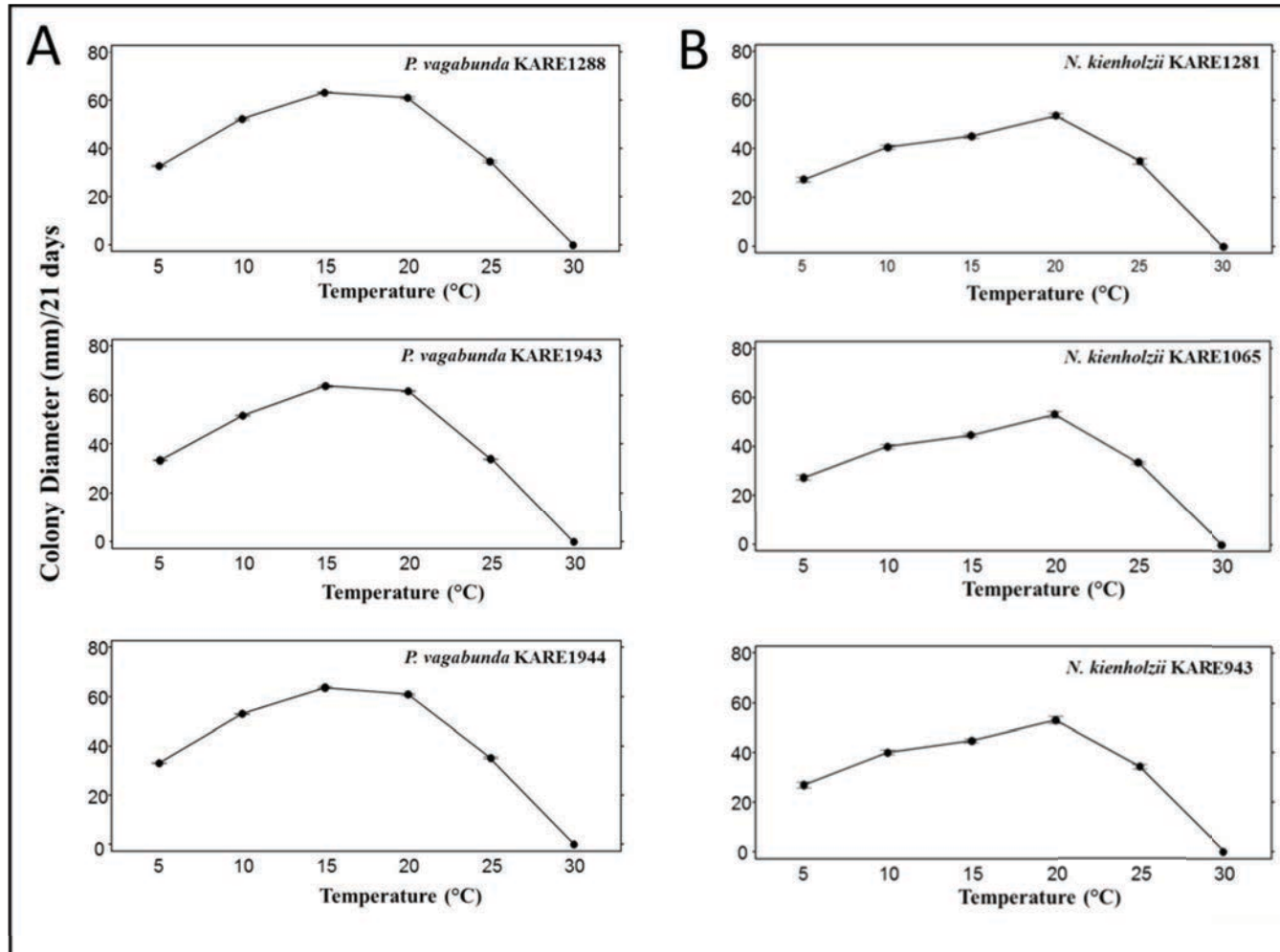


Pathogenicity in olive fruits:



Gordal Sevillana olives

Temperature study:



Disease cycle:



Fall: Mechanical harvest

Rain



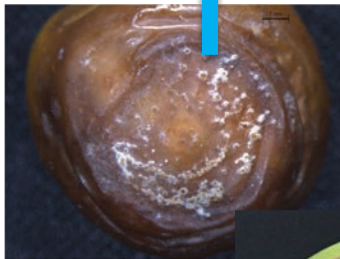
Fall: Infection of fresh wounds



Symptoms best visible in March



April: Defoliation



Inoculum reservoir:
Old olive leaves and
fruits, apples
(November)

Disease control: fungicide trials



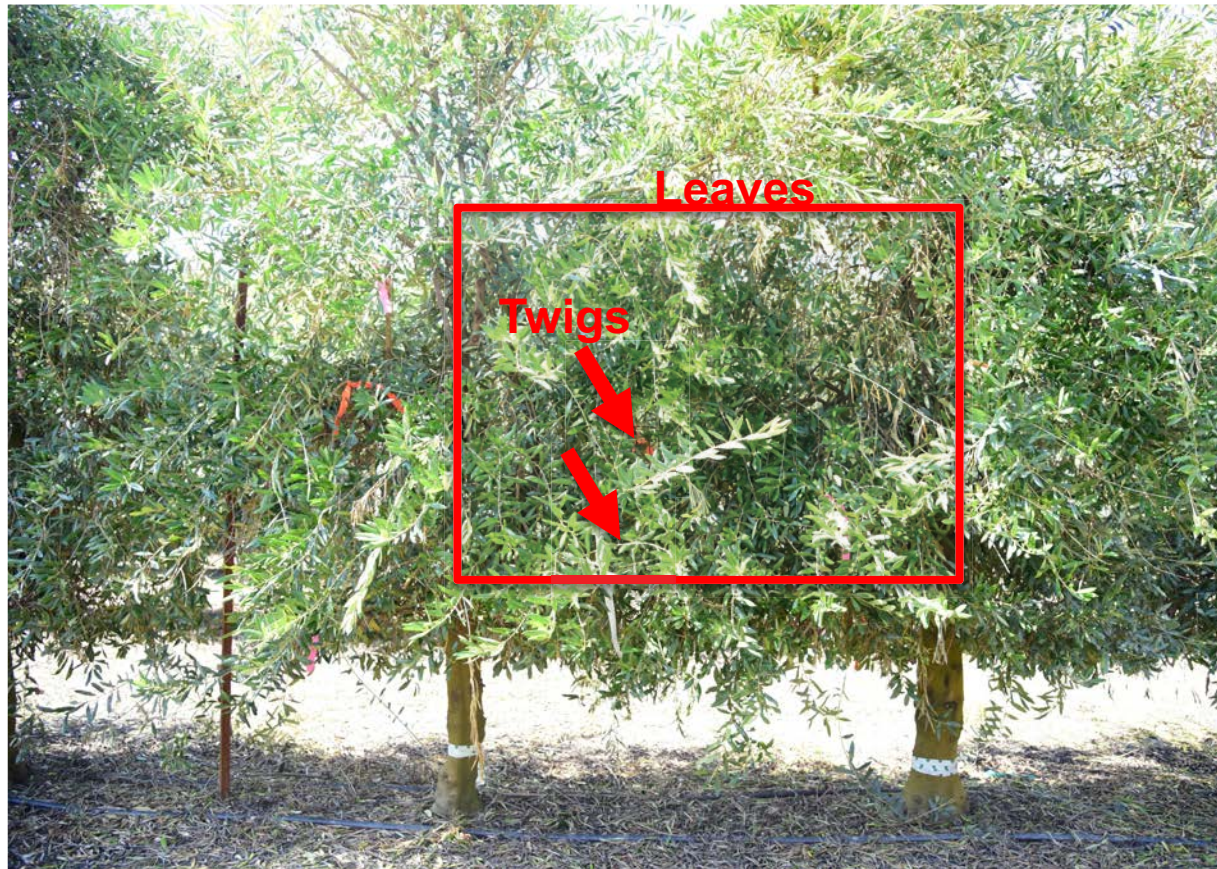
Copper fungicides?

Fungicide trials 2016-2017:

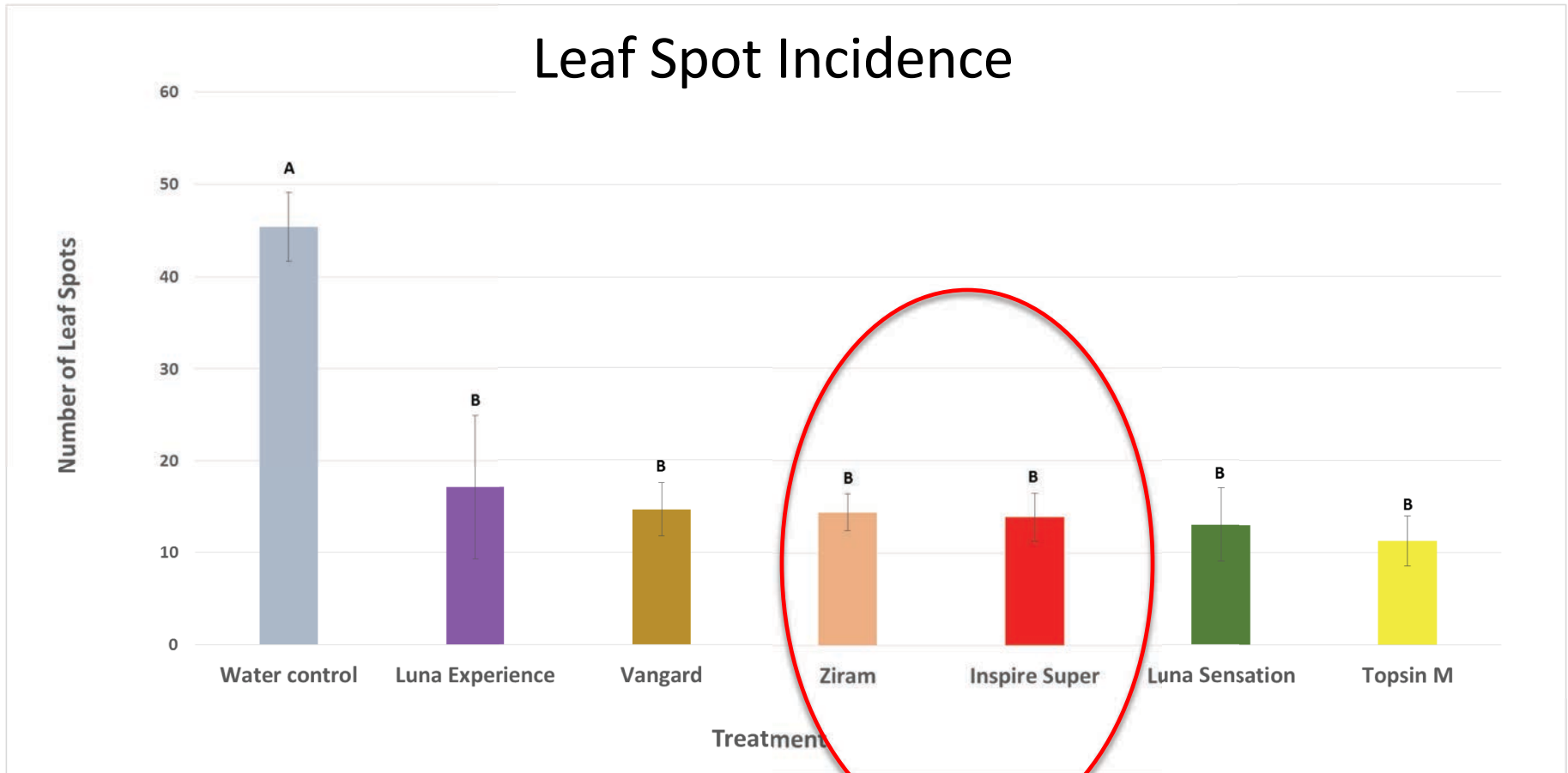
- Arbosana trees
 - Stihl SR 450 Backpack Sprayers
 - Rating on March 8, 2018
 - Single application at harvest: November 22, 2017
 - Two applications, one at harvest: November 22, 2017 and 2nd on January 5, 2018
-
- Topsin M (thiophanate-methyl – group 1)
 - Inspire Super (difenoconazole/cyprodinil – group 3+9)
 - Luna Experience (fluopyram/tebuconazole – group 3+7)
 - Luna Sensation (fluopyram/trifloxystrobin – group 7+11)
 - Mertect (thiabendazole – group 1)
 - Kocide 3000 (Copper Hydroxide)
 - Rhyme (flutriafol – group M3)
 - Vanguard WG (Cyprodinil 75% – group 9)
 - Ziram (ziram – group M3)
 - Bravo (Chlorothalonil – group M5)



Fungicide trials: Experimental unit = 2 Trees, 4 repetitions

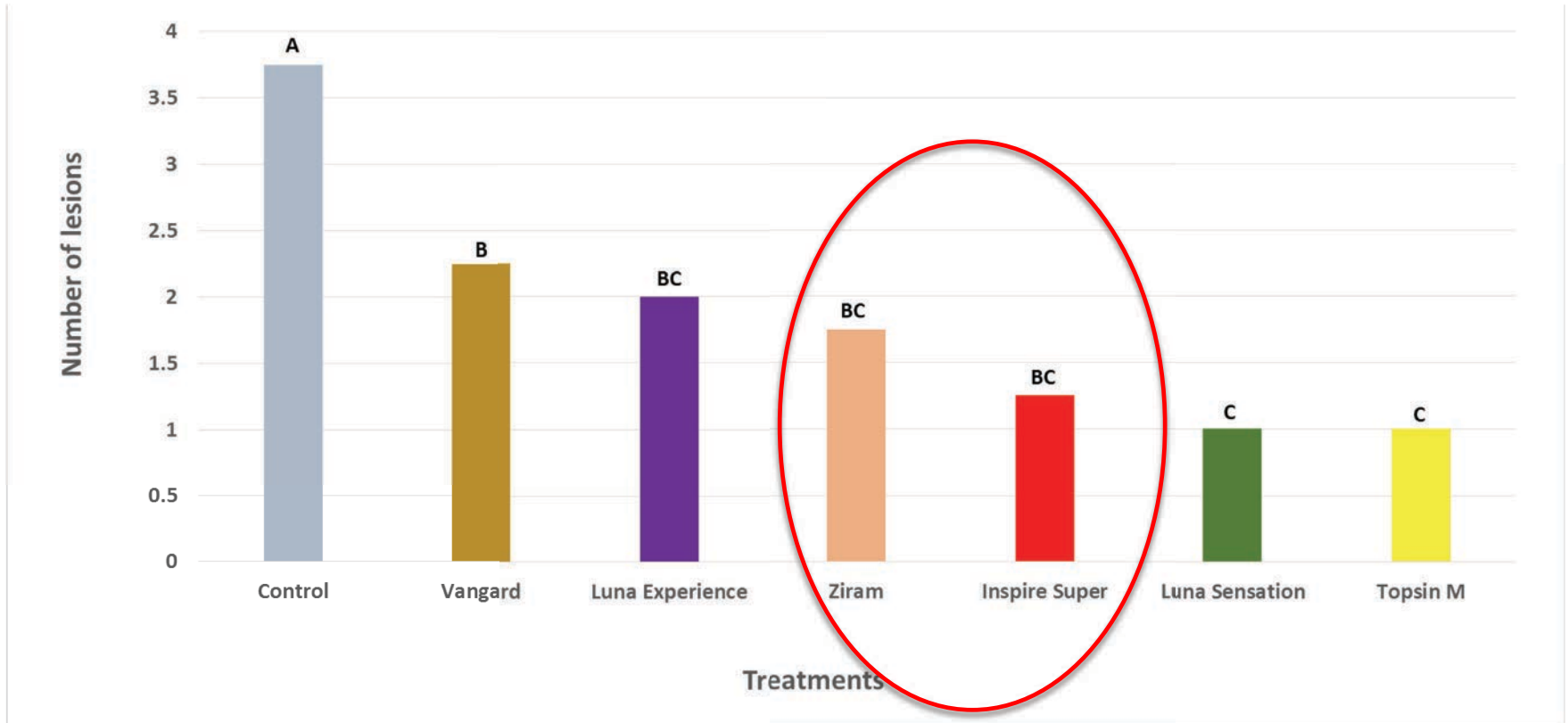


Fungicide trials 2016-2017:

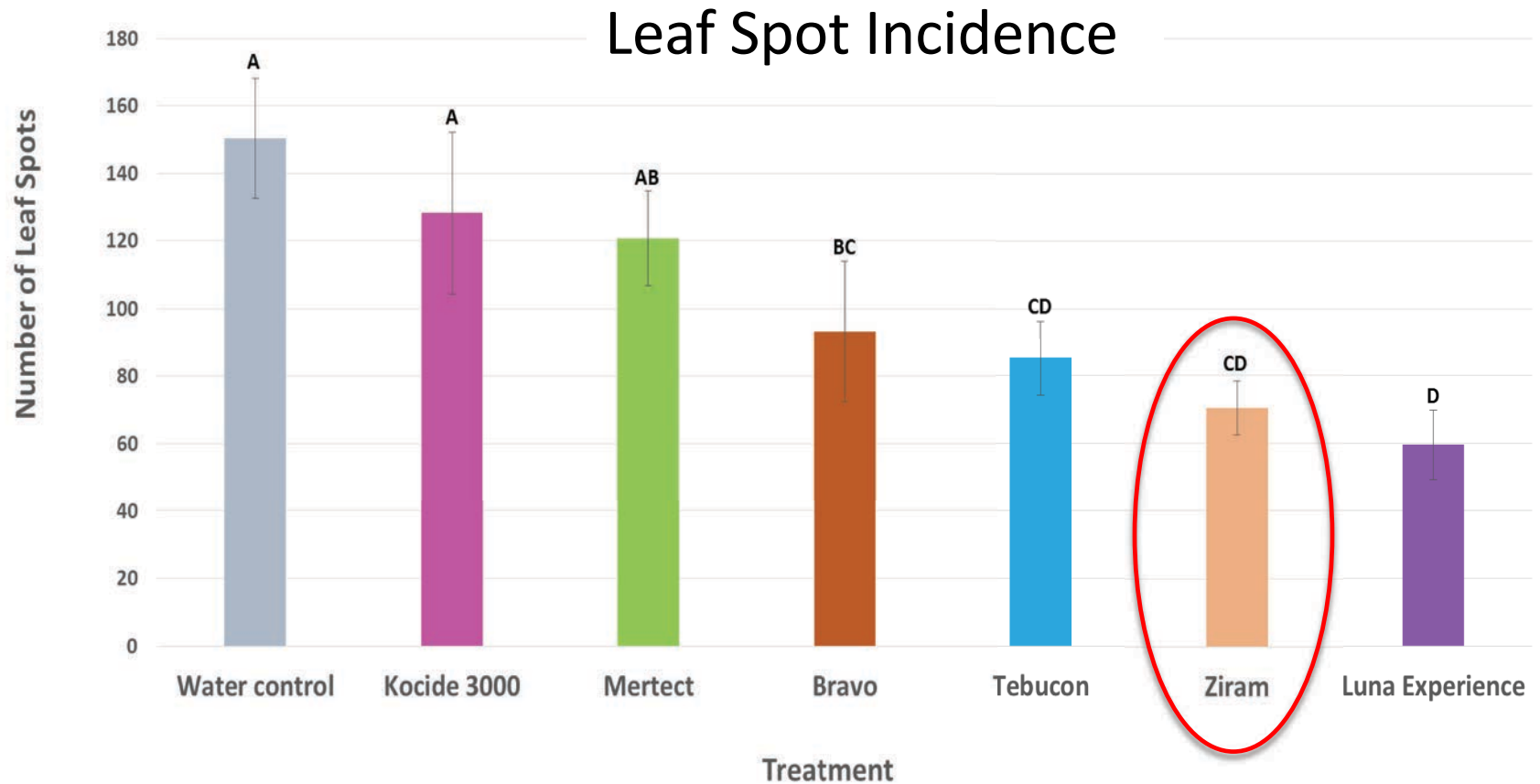


Fungicide trials 2016-2017:

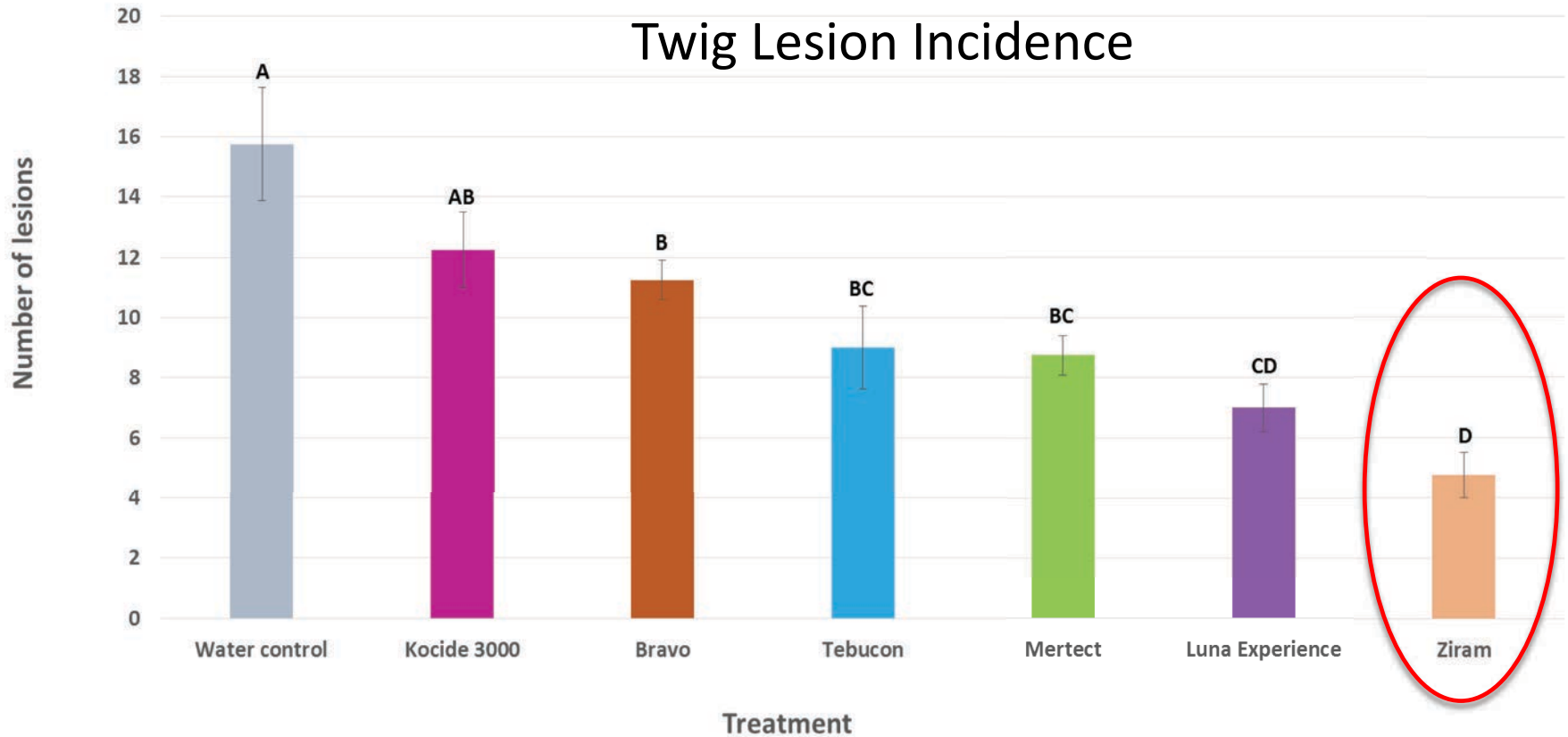
Twig Lesion Incidence



Fungicide trials 2016-2017:



Fungicide trials 2016-2017:

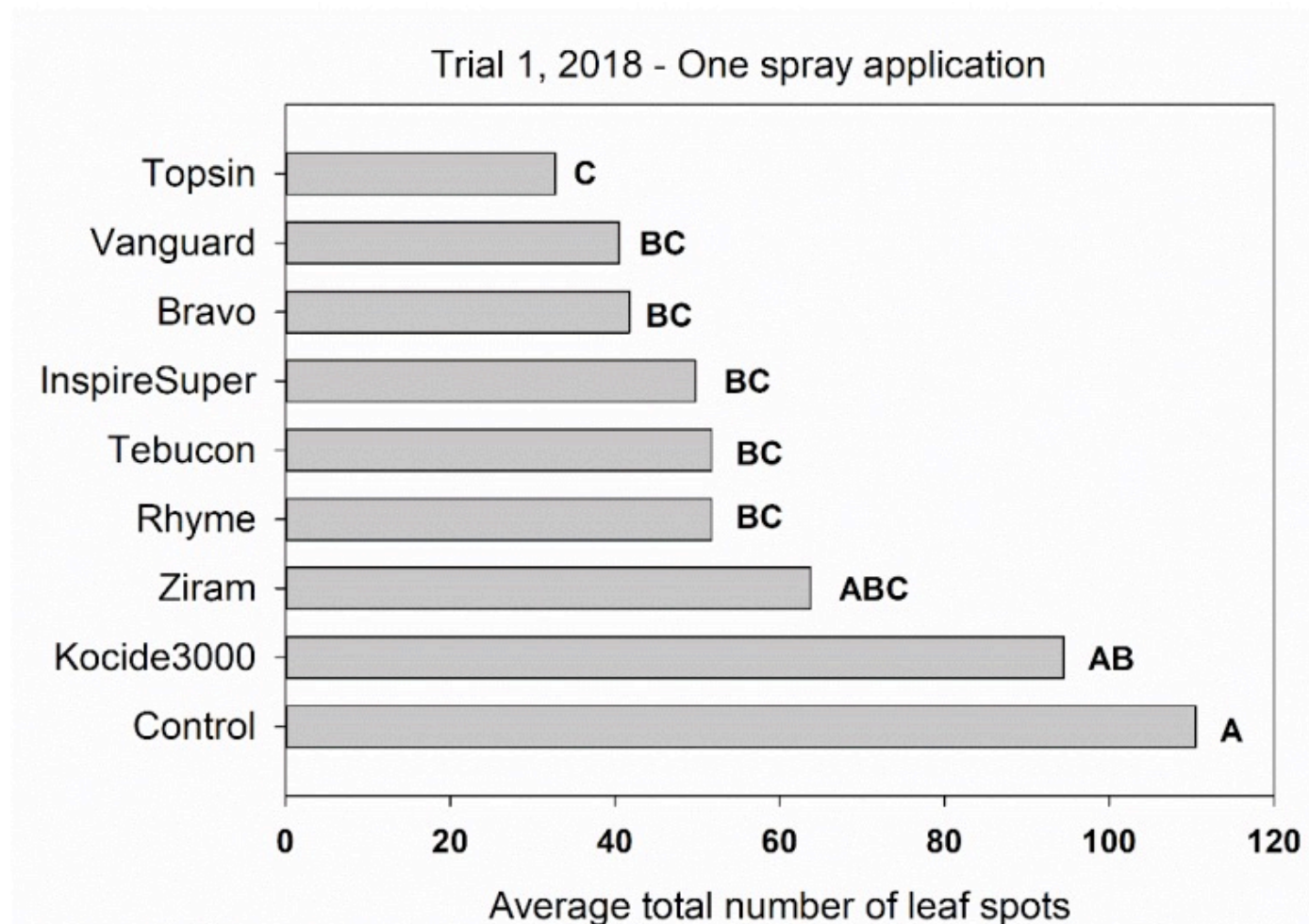


Fungicide trials 2017-2018:

Eight products were tested in the field during the fall and winter 2017-2018:

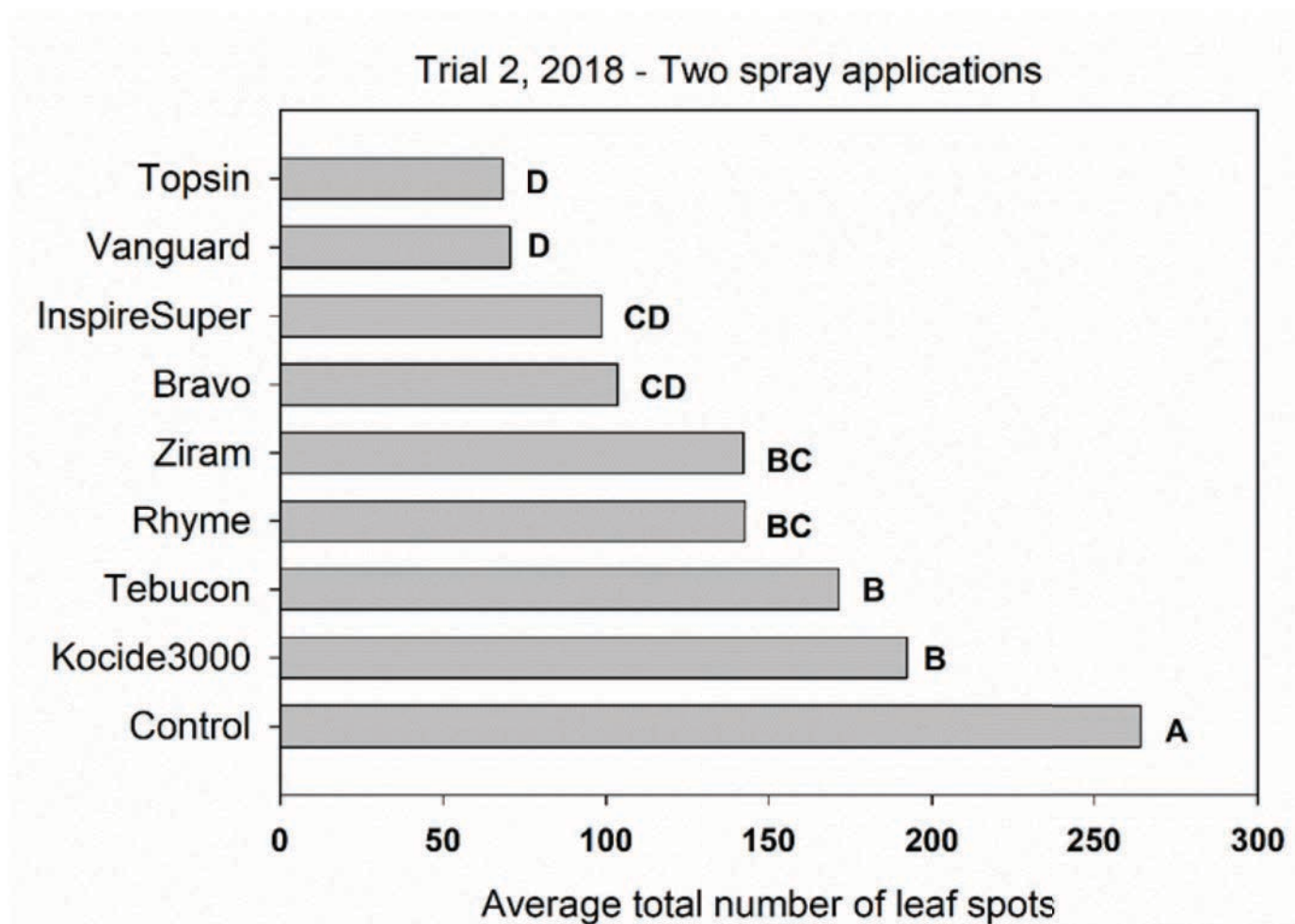
- Topsin M (thiophanate-methyl – group 1)
- Inspire Super (difenoconazole/cyprodinil – group 3+9)
- Kocide 3000 (copper hydroxide)
- Tebucon (tebuconazole – group 3)
- Rhyme (flutriafol – group M3)
- Vanguard WG (cyprodinil – group 9)
- Ziram (ziram – group M3)
- Bravo (chlorothalonil – group M5)

Fungicide trials 2017-2018: Trial 1



Trial 1, single spray application: Average number of leaf lesions per olive tree according to various fungicide treatments and compared to the water treatment a copper treatment (Kocide 3000).

Fungicide trials 2017-2018: Trial 2



Trial 2, two spray applications: Average number of leaf lesions per olive tree according to various fungicide treatments and compared to the water treatment a copper treatment (Kocide 3000).

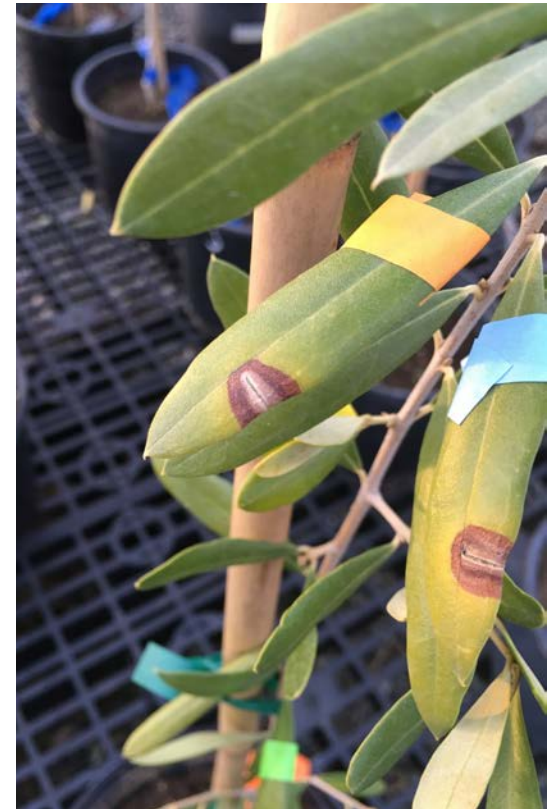
Fungicide trials 2018-2019: Trial 2

| Company | Fungicide | Flag | Rec. Rate/A | My Calc (2.8gal) | Unit |
|----------------------------|---------------|------|-----------------|------------------|------|
| UPI, United Phosphorus Inc | Ziram 76DF | | 6 pounds / acre | 37.5 | gr |
| Syngenta | Inspire Super | | 20 fl oz | 8.2 | mL |
| Certis | Kocide 3000 | | 7 lb | 43.7 | gr |
| | Control | W | | | |

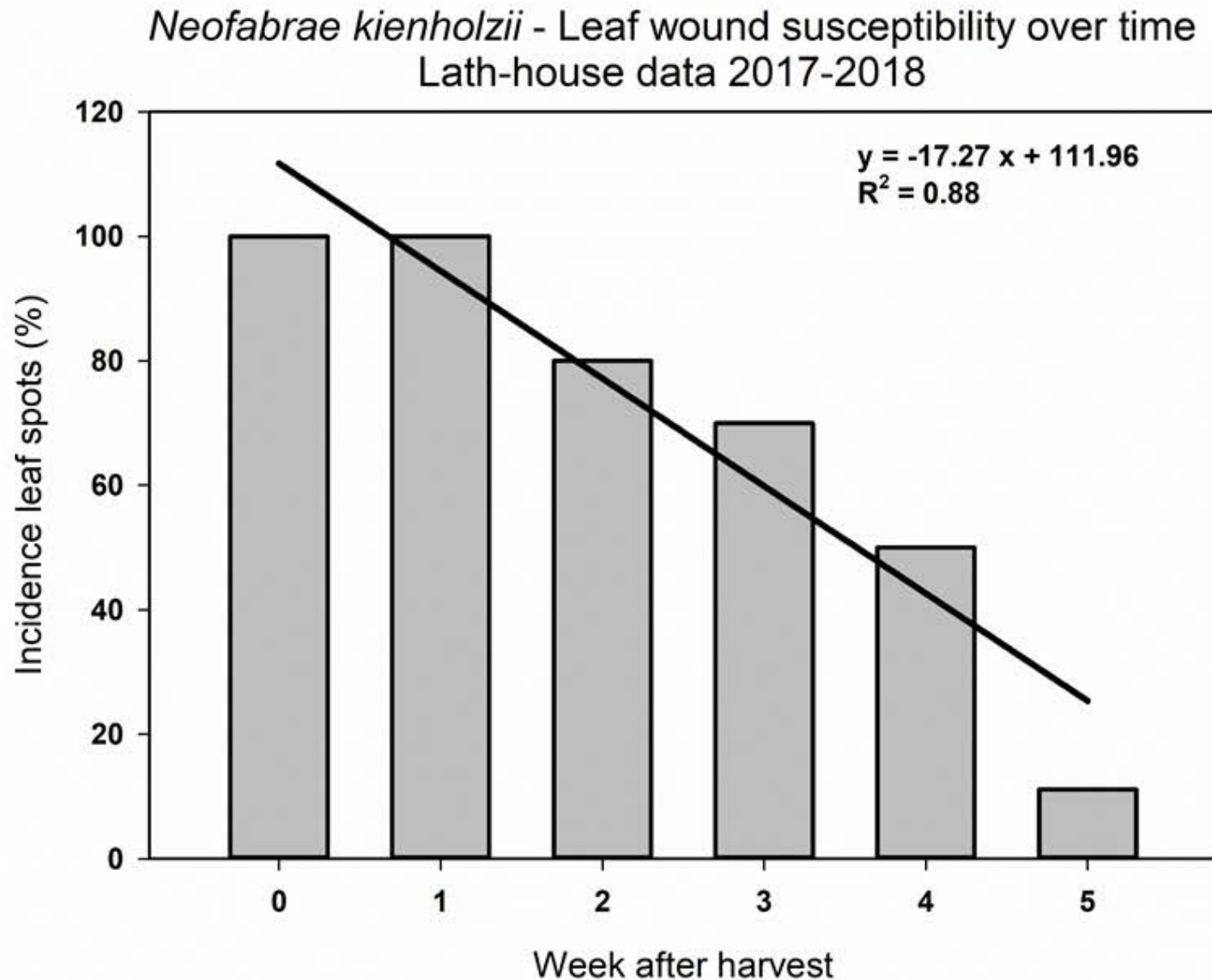
| Trt. # | Treatment | Assigned Flag |
|--------|-----------------------------|------------------------|
| 1 | Ziram T1 | Black (B) |
| 2 | Inspire Super T1 | Pink (P) |
| 3 | Kocide 3000 T1 | Yellow (Y) |
| 4 | Inspire Super T1 + T2 | Orange (O) |
| 5 | Ziram T1 + T2 | White Red Dots (RD) |
| 6 | Inspire Super T1 + Ziram T2 | White Blue Stripe (BS) |
| 7 | Ziram T1 + Inspire Super T2 | Green (G) |
| 8 | Control | White (W) |

Duration of wound susceptibility: Leaves

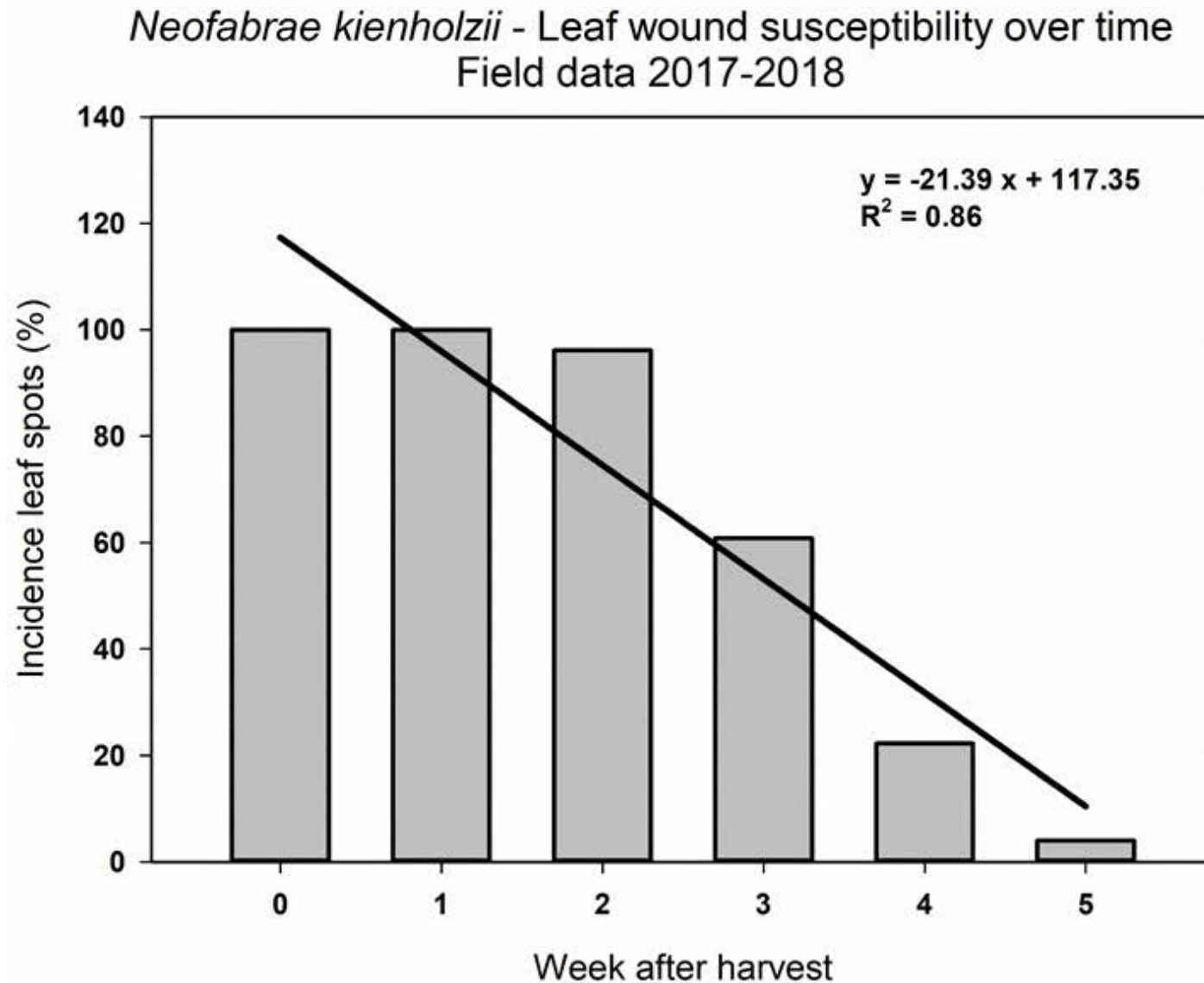
| Week | Flag color | Inoculation | Record |
|------|------------|-------------|------------------|
| W 0 | Orange | 22-Nov | 2/1/2018 |
| W 1 | Blue | 29-Nov | 2/8/2018 |
| W 2 | Green | 6-Dec | 2/15/2017 |
| W 3 | Purple | 13-Dec | 2/22/2017 |
| W 4 | Red | 20-Dec | 3/1/2017 |
| W 5 | Yellow | 27-Dec | 3/8/2018 |



Duration of wound susceptibility: Leaves

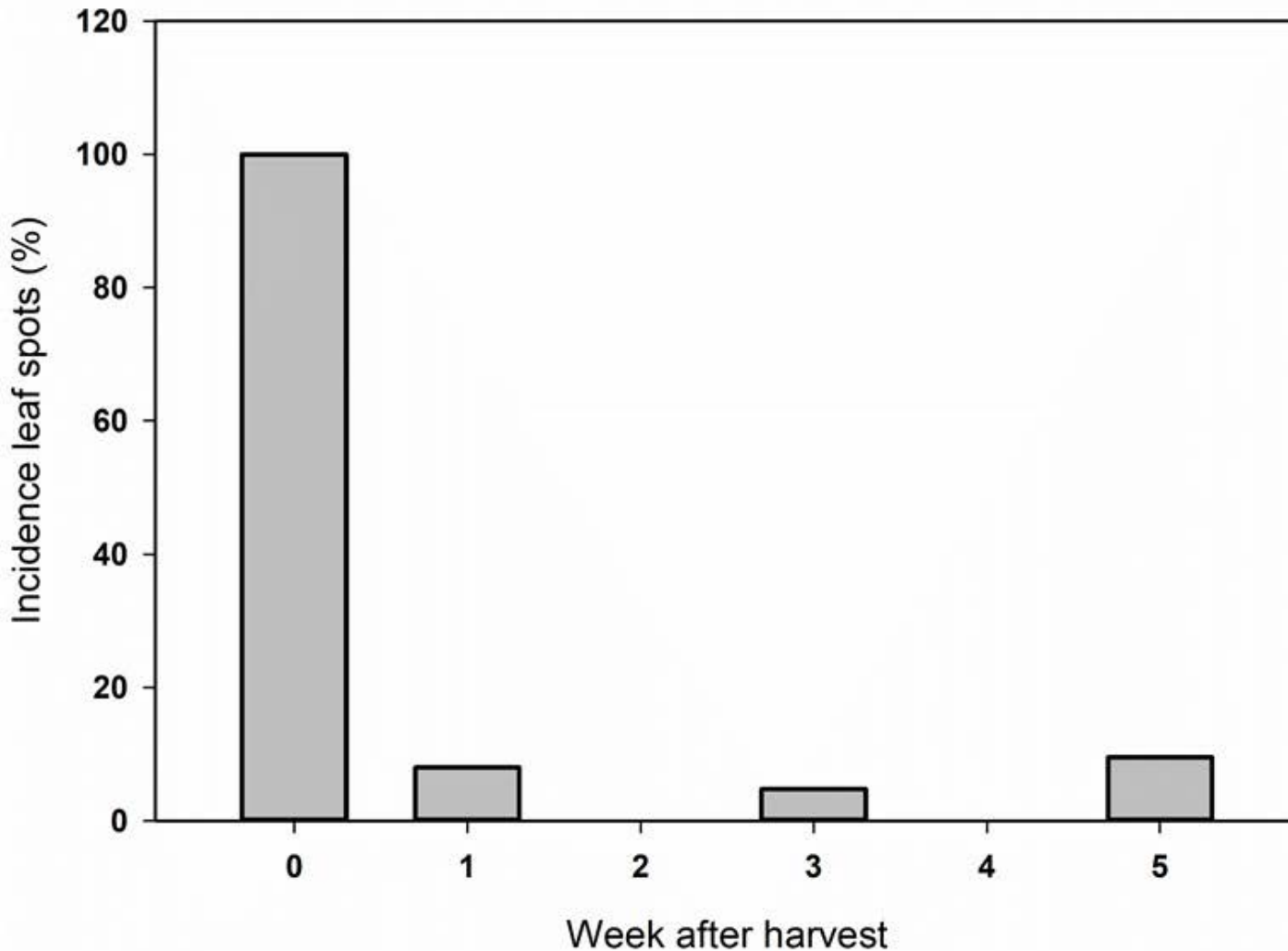


Duration of wound susceptibility: Leaves

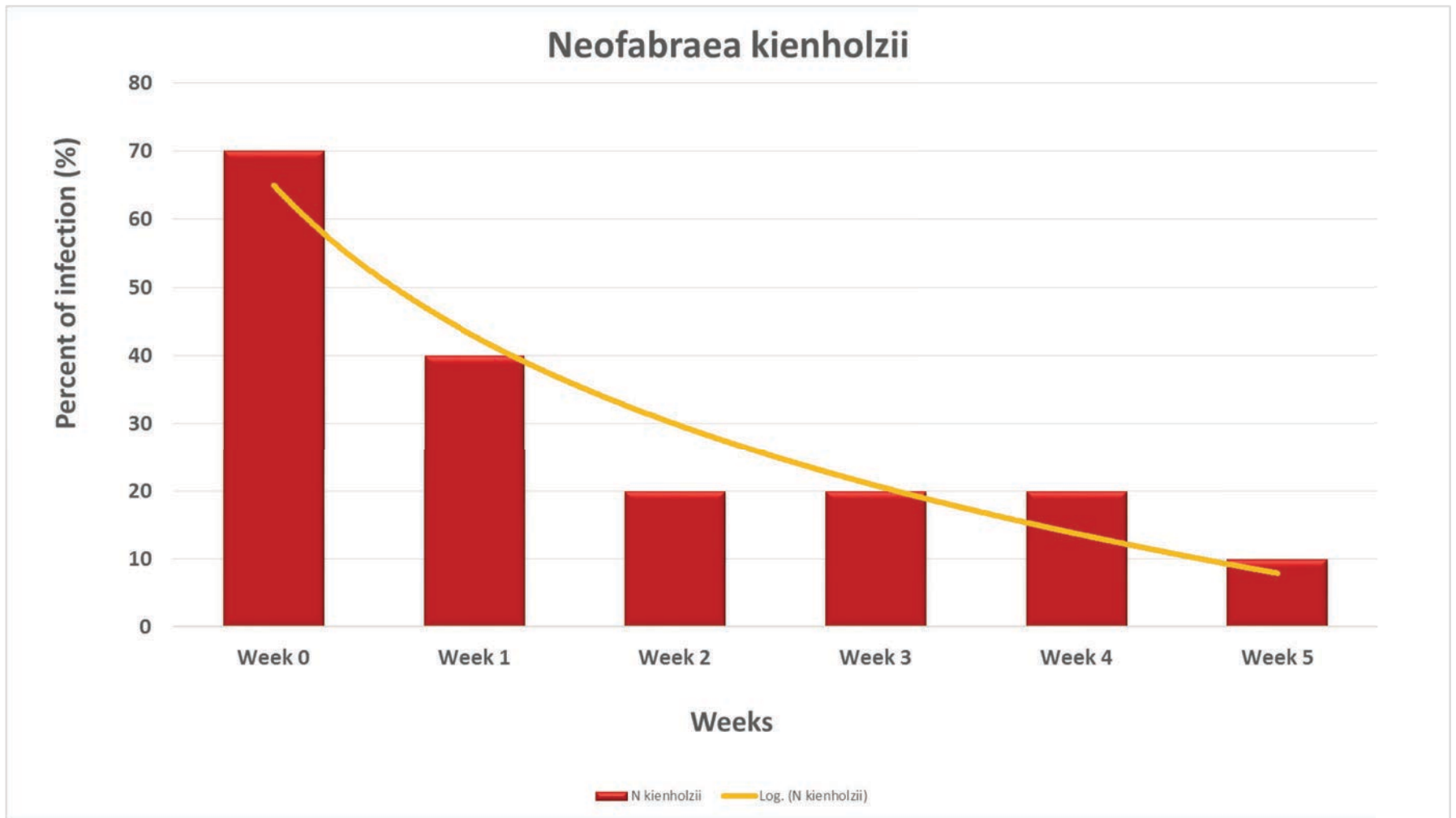


Duration of wound susceptibility: Leaves

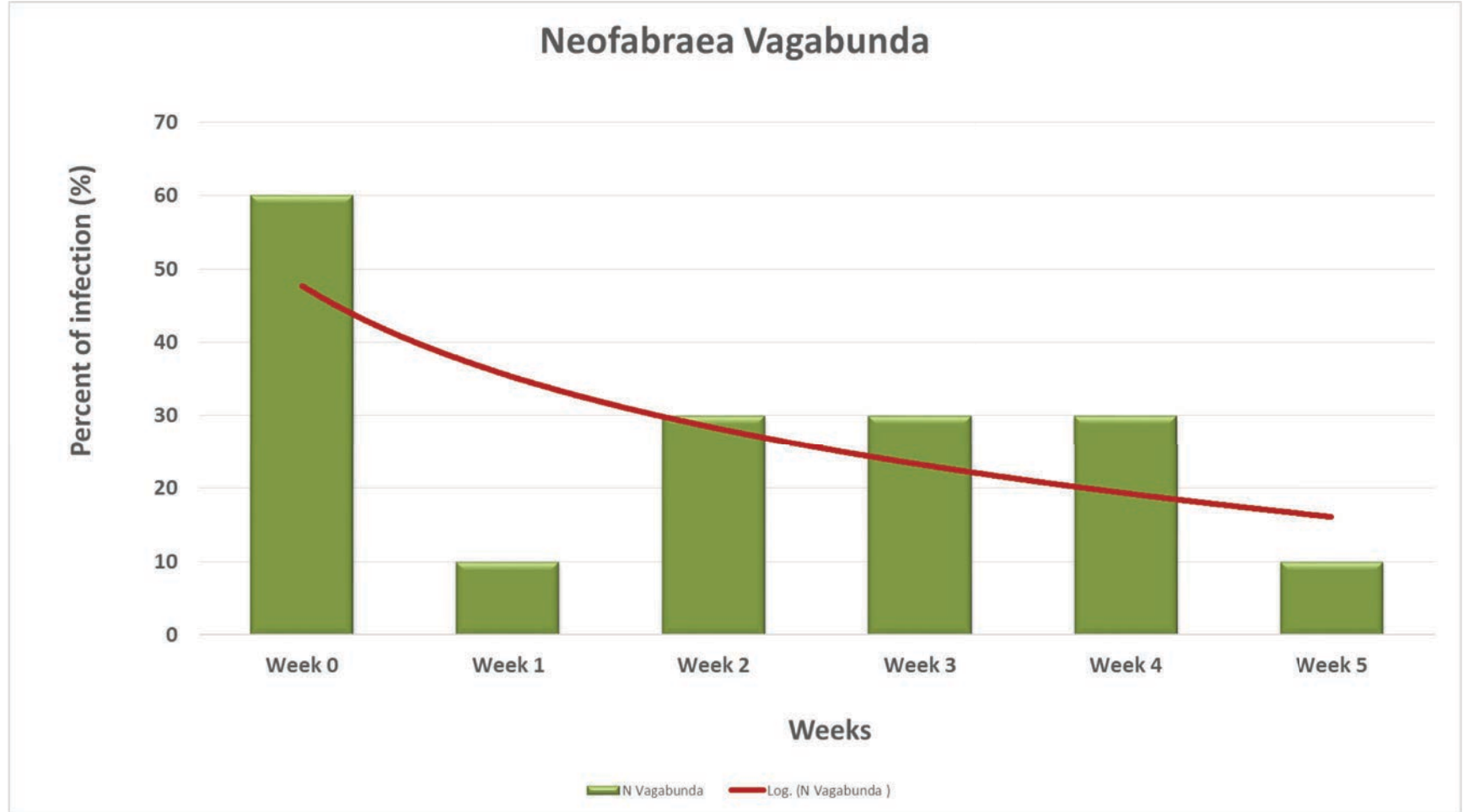
Phlyctema vagabunda - Leaf wound susceptibility over time
Field data 2017-2018



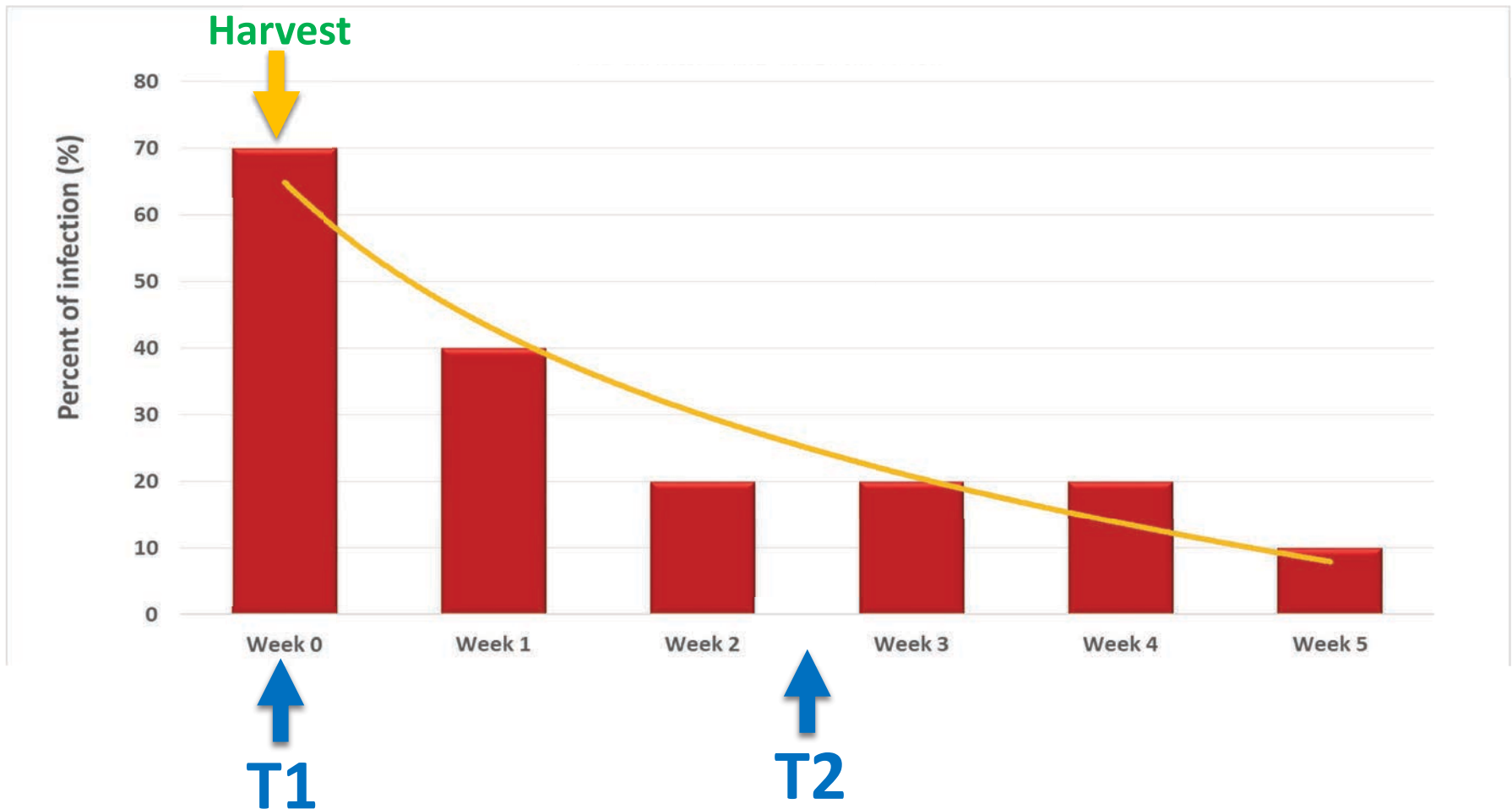
Duration of wound susceptibility: Twigs



Duration of wound susceptibility: Twigs



Timing of fungicide applications:





Fungicide registration:

- IR-4 Registration
- Section 18 emergency exception on pesticide use
- Requires efficacy data from field trials (UC)
- Working with OOCC to submit a section 18 request to DPR
- If granted, the Section 18 label would allow growers to use the “new” fungicide for one year

Section 18: in coordination with Dr. Jim Adaskaveg for Neofabraea and peacock spots control

State of California
Department of Pesticide Regulation
Pesticide Registration Branch
PR-REG-003 (Est. 7/91) (Rev. 3/10)

APPLICATION FOR SECTION 18 EMERGENCY EXEMPTION

The following information is required for an emergency exemption request based on the revised United States Environmental Protection Agency (USEPA) Code of Federal Regulations, Title 40, Part 166 concerning Section 18 requests. Requests which are incomplete will be denied by the USEPA without review. In order to comply with these requirements, the information listed below must be provided. **Use additional pages if necessary.** Please note that the more complete the questionnaire, the better your chances are of obtaining the exemption.

Check box if this is a reissuance request. (Year)

TYPE OF EXEMPTION BEING REQUESTED (check one)

- SPECIFIC
 QUARANTINE
 PUBLIC HEALTH

Section 18:

flotrouillas@ucanr.edu

P. O. No: OOCGRESIDUE2018 Project: Neofabraea Olive

| <u>Client Sample</u> | <u>EMA Sample No</u> | <u>Sample</u> | <u>Date Analyzed</u> | <u>Method</u> | <u>Chemical</u> | <u>Amount</u> | <u>RL</u> | <u>Units</u> |
|----------------------|----------------------|---------------|----------------------|--|------------------------------|---------------|--------------|--------------|
| T1-Pu | 18071821-01 | Olive Fruits | 07/26/18 07/26/18 | LC/MS/MS Extended LC/MS/MS Extended | Cyprodinil Difenoconazole | ND ND | 0.01 0.01 | ppm ppm |
| T2-Pu | 18071821-02 | Olive Fruits | 07/26/18 07/26/18 | LC/MS/MS Extended LC/MS/MS Extended | Cyprodinil Difenoconazole | ND ND | 0.01 0.01 | ppm ppm |
| T1-O | 18071821-03 | Olive Fruits | 07/24/18 | EBDC Screen | Ziram | ND | 0.05 | ppm |
| T1-P | 18071821-04 | Olive Fruits | 07/27/18 | LC/MS/MS Extended | Thiophanate Methyl | ND | 0.01 | ppm |

P. O. No:

Project: Neofabraea Olive

| <u>Client Sample</u> | <u>EMA Sample No</u> | <u>Sample</u> | <u>Date Analyzed</u> | <u>Method</u> | <u>Chemical</u> | <u>Amount</u> | <u>RL</u> | <u>Units</u> |
|----------------------|----------------------|---------------|----------------------|-------------------|--------------------|---------------|-----------|--------------|
| T2-O | 18071822-01 | Olive Fruits | 07/24/18 | EBDC Screen | Ziram | ND | 0.05 | ppm |
| T2-P | 18071822-02 | Olive Fruits | 07/27/18 | LC/MS/MS Extended | Thiophanate Methyl | ND | 0.01 | ppm |

ND = None Detected at the Reporting Limit (RL)

RL = Reporting Limit.

Excess sample and extracts are stored for a minimum 30 of days from the date of analytical report. Special storage arrangements possible.

Results relate only to items tested.

Samples are analyzed as received.

Reports should not be reproduced, except in full, without written consent by Environmental Micro Analysis, Inc.

To see the scope of our ISO 17025 accreditation go to <http://emalab.com/ISO17025.pdf>

Section 18:

Table 1. Yield data for two locations where Neofabrae diseases have been documented.

| Arbosana Olive Orchards | Yield* (TPA/Year) | | | | | | Avg. Yield (2012, -13, -15, and -17) | Avg. Yield (2014 and -16) | Difference in Yield (%) |
|-------------------------|-------------------|------|------|------|------|-------|--------------------------------------|---------------------------|-------------------------|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | | | |
| Orchard A - 203 acres | 5.78 | 7.16 | 3.37 | 6.93 | 4.92 | 6.567 | 6.61 | 4.15 | 37.28 |
| Orchard B - 38 acres | 4.1 | 5.8 | 2.8 | 6.1 | 4.7 | 5.6 | 5.40 | 3.75 | 30.56 |

*- TPA = tons per acre.

Conclusion:

- Neofabraea leaf spot is an emerging disease of oil olives in CA
- Limited to Super-High-Density orchards
- Two Neofabraea species are involved
- Aggressive pathogens of increasing concern in Spain, Italy and Portugal
- Associated with mechanical harvest
- Requires wounds (leafs and twigs) for infection
- Mainly Arbosana cultivar is susceptible
- We understand the disease cycle
- Duration of wound susceptibility: 4 weeks
- Ziram and Inspirer Super after harvest + 2-3 weeks after
- Section 18 emergency exception on pesticide use + IR4

Field observation and disease diagnosis:

- Neofabraea on fruits



Field observation and disease diagnosis:

- Botryosphaeria



Field observation and disease diagnosis:

- Lygus or Stink bug



Thank you!

Dr. Mohamed T. Nouri, UCD

Dr. Renaud Travadon, UCD

Dr. Juan Moral, UCD

Dr. Jim Adaskaveg, UCR

Dr. Brenna Aegerter, UCCE

Dr. Dani Lightle, UCCE

