

Step-by-Step Guide to Field Diagnostics



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Causal Agents of Disorders

- **Biotic**

- Fungi
- Bacteria
- Viruses
- Phytoplasma
- Nematodes
- Insects & Mites

- **Abiotic**

- Soil moisture extremes
- Temperature extremes
- Salts
- Air pollution
- Wind, light effects
- Mechanical damage
- Pesticide damage

Diagnosing Disorders

- The **process** of determining the cause of an abnormality
- Diagnosis is a **team** effort
 - Grower/Consultant/Manager
 - Farm Advisor/Extension Agent
 - Diagnostic Clinic
- Conclusions are derived from **critical evaluation of the trees and the environment**
 - Requires a blend of good observational skills, science, and experience

Diagnostic Advice

- Don't jump to conclusions
 - Keep an open mind
- Be a detective: observe, question, gather clues
- Evaluate the whole plant, the whole orchard, and the areas around the problem area
- When possible...
 - Dig up and look at roots
 - Cut open stems, branches, fruits, etc.

The First Step: Spot the Problem

- Diagnosis begins with the ***observation*** that there is a problem with the tree(s)
 - Know the healthy/normal appearance (cultivar diffs)
 - Symptoms
- This means you need to *physically* be in your orchard on a regular basis.

Symptoms

Symptoms usually develop because the causal agent:

- Produces (or induces the plant to produce) enzymes, toxins, or growth regulator imbalances
- Interferes with specific cellular functions
 - The particular symptom develops based on whatever plant process(es) are affected

The Difficulties with Symptoms

- Change over time (progression)
- Vary with severity/virulence of the stressor/pathogen
- Vary due to age or stage of the tree
- Vary due to environmental conditions during and after infection

Symptoms are often insufficient for diagnosis

Symptoms are Complex!

- Symptoms are not always specific to causal agents
- Causal agents often affect more than one plant process at a time leading to complex symptomology
- Plants may be affected by more than one causal agent (abiotic and biotic) at a time
 - adds to complex symptomology

Symptoms are often insufficient for diagnosis

Abiotic disorders may predispose the tree to biotic disorders!

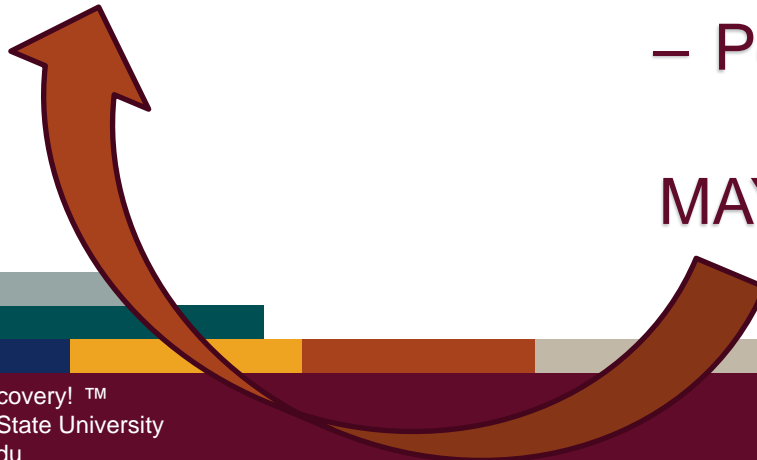
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MAY PREDISPOSE TO
BIOTIC!



The Second Step:

Gather accurate and complete information

- Situation of the Orchard
- History of the Disorder
- Spatial Variability
- Symptom Expression

Critical Information Needs

- Situation of the Orchard
 - Cultivar and rootstock (incl. whether clonal or seedling)
 - Age and production history
 - Soil textures
 - Cultural practices:
 - irrigation, fertilizers, pesticides...
 - Weather conditions before and during symptom development
 - Historic land use of orchard site.
 - Land use in adjacent properties
 - Soil and water analyses
 - Leaf tissue nutrient analyses



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Critical Information Needs

- History of the Disorder in the Orchard:
 - When the problem began. Or when symptoms were first noticed.
 - Whether it is a chronic problem
 - Whether the symptoms are spreading (within tree or to other plants in the orchard)

Critical Information Needs

- Spatial Variability of the Disorder in the Orchard:
 - Percentage of orchard affected
 - Pattern of symptoms in orchard
 - Scattered
 - Clumped
 - Random
 - Other plants in orchard affected

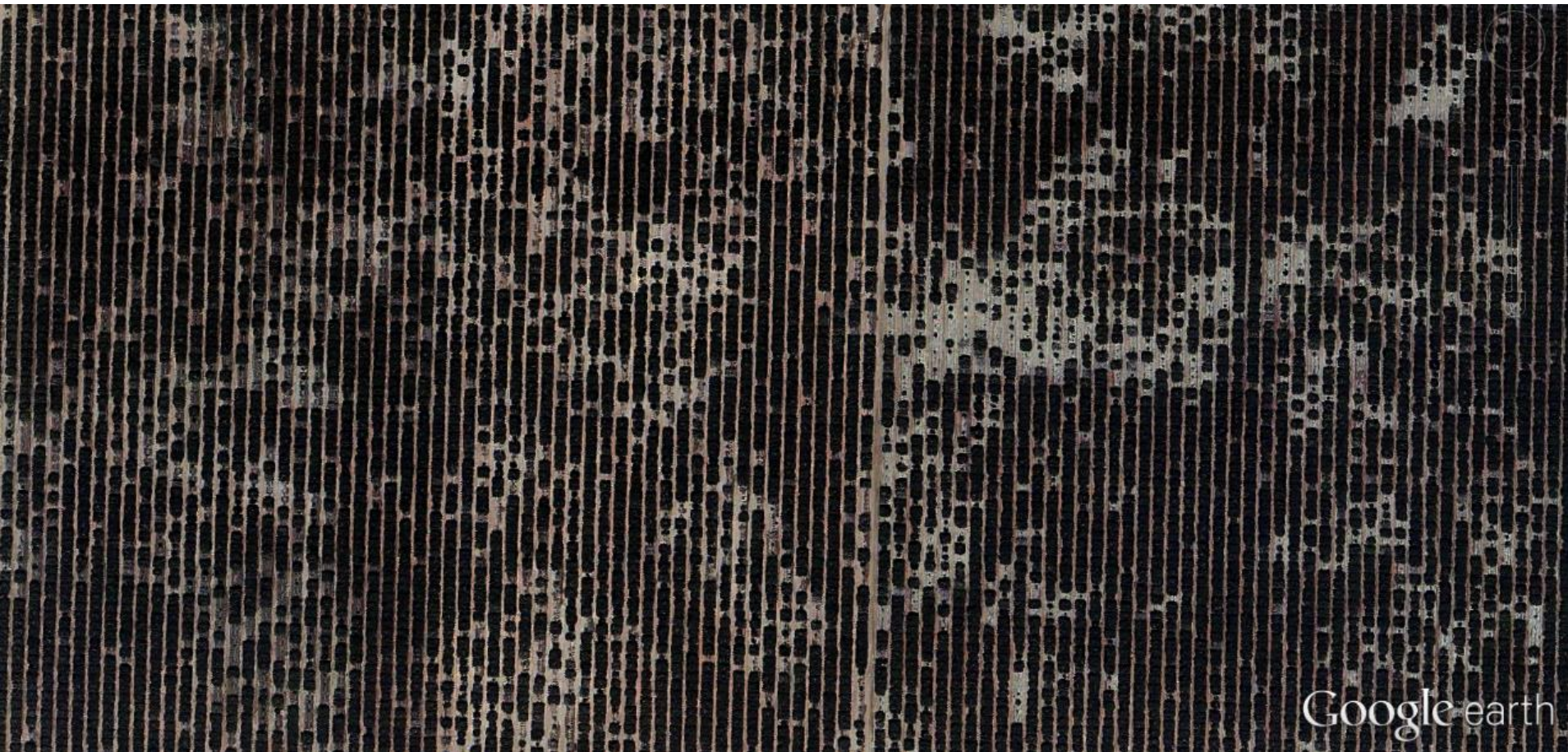


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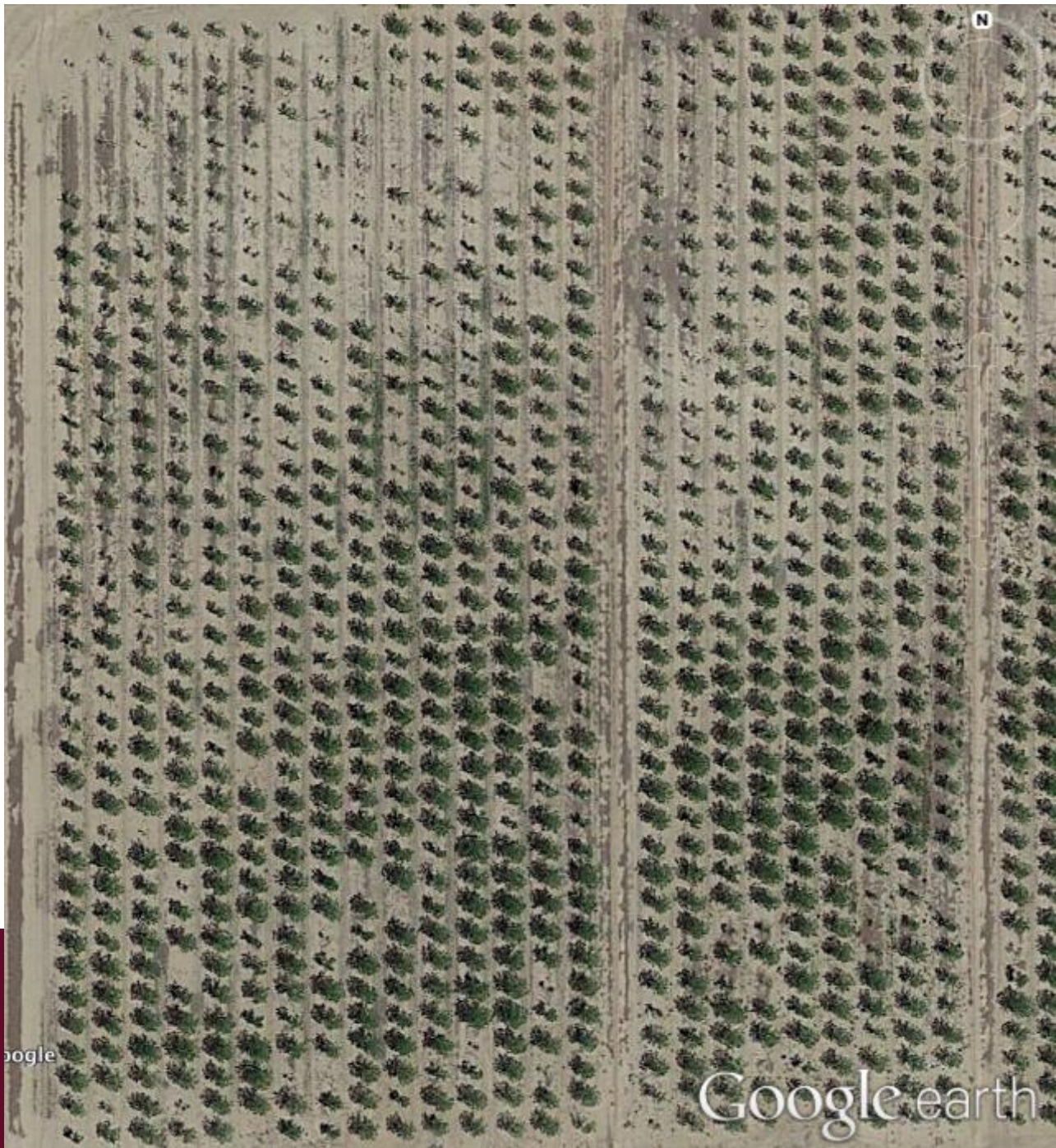
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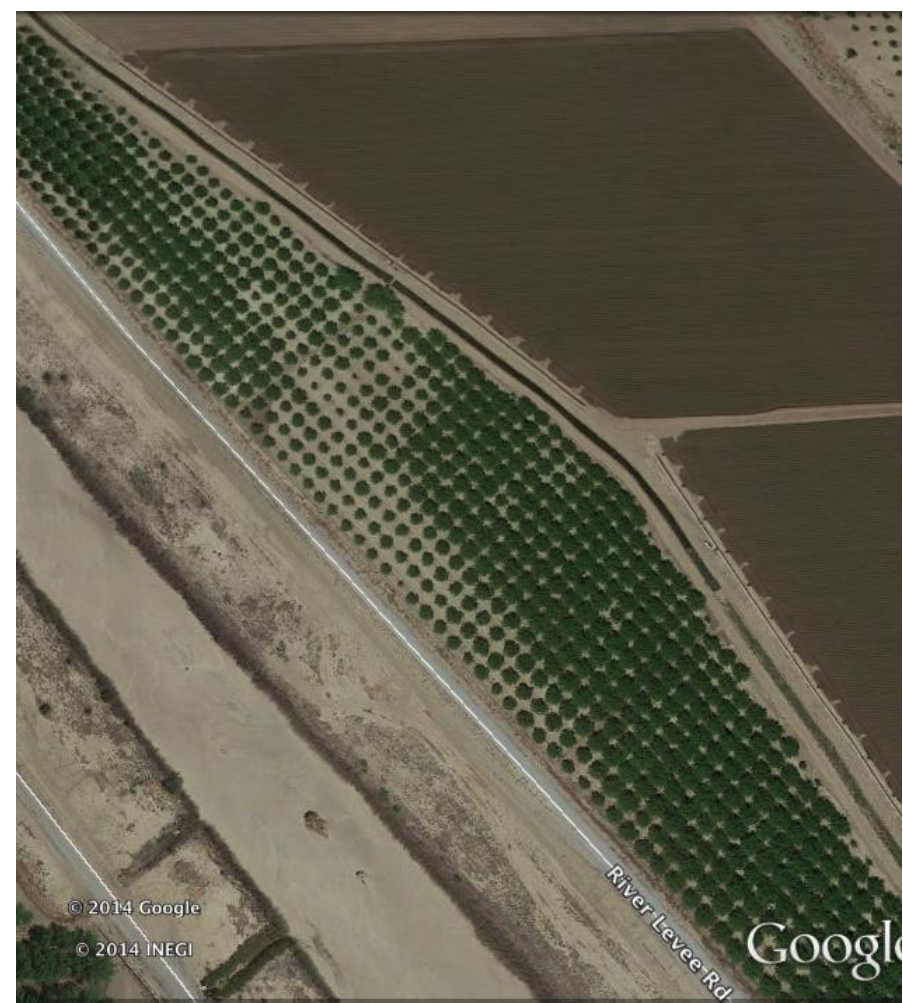
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Critical Information Needs

Symptom expression

The plant parts affected

Top-down or bottom-up in canopy

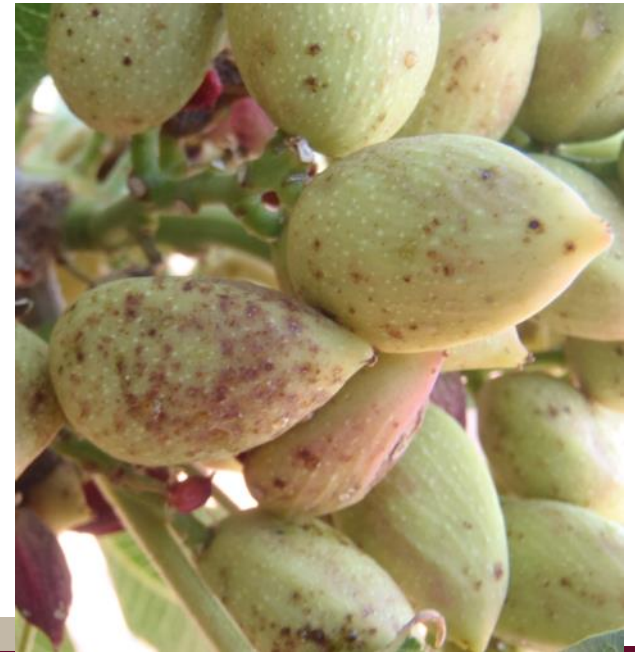
Where is PRIMARY site of injury?

The progression in severity on plant over time

Evaluating Leaf Symptoms

- Uniformity or patterns?
 - Leaf and plant
 - Size of spots
- Margin (borders)?
 - Thickness
 - Color
- Spread or growth?
 - Edge definition
 - Merging of spots
- Fruiting bodies?





The Third Step: Collect Specimens

- Important for accurate diagnosis
- All specimens should be fresh, kept refrigerated
- Submit samples showing all stages of problem
- In some cases it may be best to collect the whole tree if possible

Sampling:

Include samples from all affected organs

- Do not destroy signs or symptoms
- Roots: Remove soil, include tissue above and below visible lesions
- Stem and leaf: Include tissue above and below visible lesions
- Flower, fruit, seed: Collect the entire organ

Sampling Techniques: Handling and Packing

- Identify/label correctly every specimen
- Package delicate material in a sturdy box
- Do not add water or wet paper towels
- Ship immediately overnight and early in the week





PLANT SPECIMEN SUBMISSION FORM



*****Diagnostic Lab Use Only - Do Not Write In Box*****
Sample No. Date Sample Received:

PLEASE REMEMBER...Successful plant disease diagnosis is a team effort. Proper diagnosis begins with the submission of a good-quality specimen accompanied by accurate and complete information.

If you have any questions, please call before submitting your sample [575-646-1621 or 575-646-1965].

COLLECTION:

- 1. DO NOT send dry or dead material.
2. Collect several samples showing various stages of symptom expression.
3. Send a representative sample from all parts of the plant.
4. For turfgrass, select a 2-4" sample (including at least 2" of soil) from the margin of the diseased area.
5. Wrap sample in dry paper towel or newspaper and place in a paper or plastic bag.
6. Submit a completed Plant Specimen Submission Form.

PACKING:

- 1. Keep sample cool prior to shipment.
2. Pack the sample carefully in a sturdy box or padded envelope.
3. Mail immediately (overnight delivery is recommended).

ADDRESS PACKAGE TO:

New Mexico State University
Attn: Plant Diagnostic Clinic
Box 30003, MSC 3AE
Las Cruces, NM 88003

For Overnight UPS or Fed Ex:

New Mexico State University
Attn: Plant Diagnostic Clinic
943 College Avenue
Skeen Hall Room N140
Las Cruces, NM 88003

PLEASE FILL OUT THE FOLLOWING:

Grower/Homeowner (Name, Address, Phone No.) Submitted by: (If different from grower)
[Blank lines for text entry]

E-Mail Address:

Level of Diagnostic Services Requested (If no box is checked, diagnosis will be completed as needed):

- Basic evaluation (\$25.00 non-commercial, \$40.00 commercial, \$50.00 commercial turfgrass)
Extension or University submitted - no fee.
30% surcharge for out-of-state samples

Special request or instructions:

VARIETY (genus and species, and/or common name of plant)

AGE OF THE PLANT: PLANTING DATE:

SYMPTOMS (mark all that apply):

Plant parts affected: roots/crowns stems/branches leaves fruit whole plant
Symptoms: spots tipburn distortion mosaic/mottle chlorosis necrosis rot
mildew blisters defoliation wilt dieback blight stunting canker galls

Description (be as specific as possible, describe the whole plant - remember the clinician is only seeing the specimen submitted).

When did symptoms first appear:

Are the symptoms (mark one): spreading or localized

Symptom development (mark one): gradual or sudden

Distribution of diseased plants (mark one): scattered clustered in a row or pattern

Number or percent of plant(s) infected

SOIL TYPE (mark all that apply):

Sand Silt Clay Well drained Poorly drained Heavy Light

GROWING CONDITIONS (mark all that apply): Indoors Greenhouse Home Garden Lawn

Landscape Organic Garden Commercial Field Other

WEATHER CONDITIONS (immediately prior to and during development of symptoms) (mark all that apply):

Wet Dry Humid Windy Dusty Hail

Temperature (F) Other Conditions

IRRIGATION HISTORY: (Mark all that apply):

Furrow Flood Drip Sprinkler Hand

How often? How much water is applied?

FERTILIZATION HISTORY: (type, nutrient ratio, amount applied, and frequency of application)

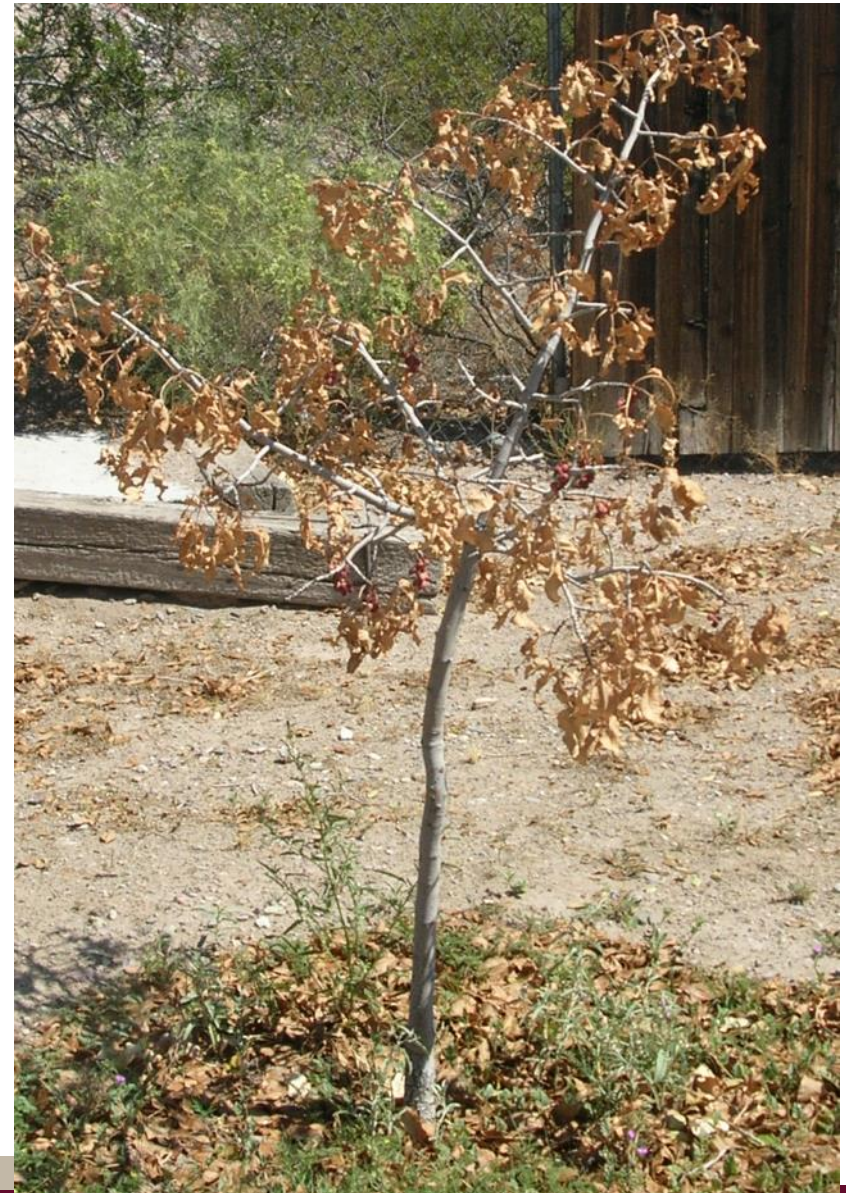
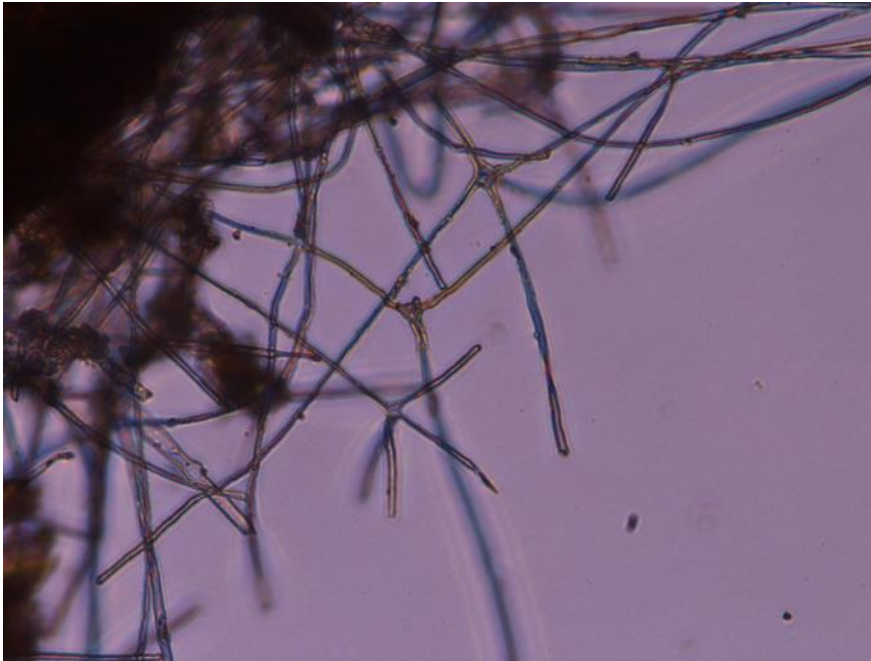
CHEMICALS APPLIED (chemical name, method and frequency of application and amount applied)

CROPPING HISTORY (for agricultural fields or home gardens):

Rotation (previous 3 years)

Past Problems (in field)



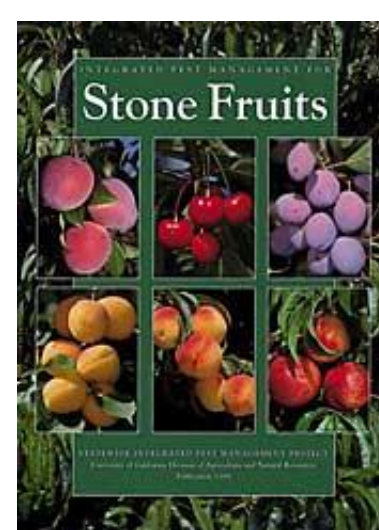
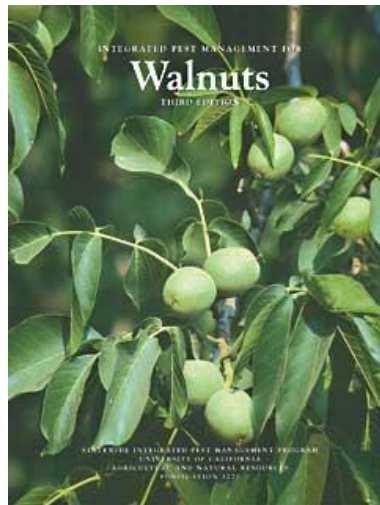
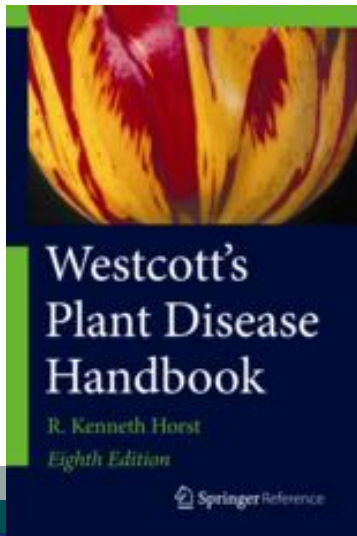
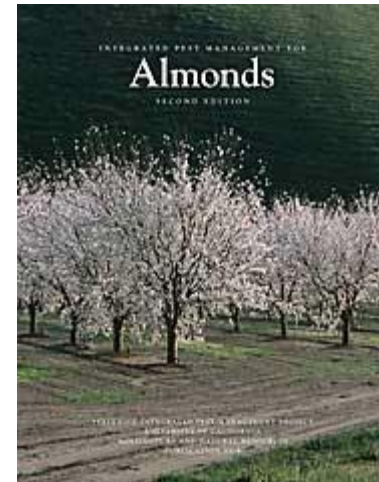
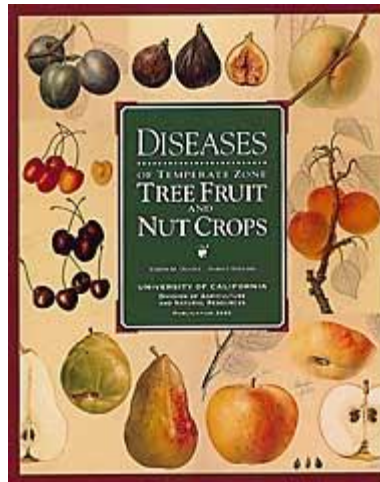
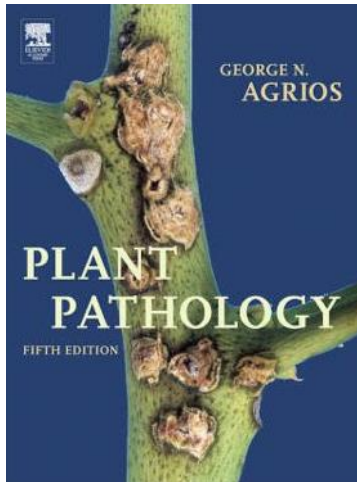


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Some General References



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<http://anrcatalog.ucdavis.edu>

Online Resources

<http://fruitsandnuts.ucdavis.edu>

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Welcome

2018 Extension Course



2018 Principles of Fruit & Nut Tree Growth, Cropping & Management

February 19 - March 1, 2018
University of California, Davis campus

Registration is now open

Understanding the fundamentals of tree biology is essential to making sound orchard management and business decisions in the tree fruit and nut industry. However, access to educational courses on basic fruit and nut tree biology, and how it relates to agronomic practices, is limited. Our course incorporates lecture, lab exercises, and field demonstrations to provide information on all aspects of basic plant biology and the relationship between plant biology and nuts and fruit orchard management.

Our course includes nine full days of instruction. The first five days will be held on the UC Davis campus and include lecture, laboratory exercises, and field demonstrations. The following week we will embark upon a four-day field trip throughout fruit and nut tree growing regions of Northern and Central California. Click [here](#) to register for the course

[Class Details](#)

Job offer: Nursery Operations Horticulturist



Brokaw Nursery in Ventura County is seeking a motivated employee to work as Nursery Operations Horticulturist

[See the ad](#)

Fruit & Nut Information



Sections on management and biology for individual crops, articles & websites by UC experts in crop production.

[Fruit & Nut Information](#)

Tree Biology & Orchard Management



New content: Flower Anatomy & Pollination, Tree Growth. Links to: Current UC Research, Spray Technology.

[Tree Biology & Orchard Management](#)

Find An Expert

A listing of [UCCE Pomology Farm Advisors by County](#), including their areas of expertise and contact information. Backyard growers, contact your [UCCE Master Gardener](#).

Weather-Related Models



Chill accumulation models; irrigation scheduling; prediction models for stonefruit harvest, almond & pistachio N, almond hullsplit.

New Courses Available

Weed Science School 2017

August 22-24, 2017 :: UC Davis

Register by 8/1/2017 at \$750; after 8/1/2017 at \$800

Continuing education credit approved for Calif. PCAs, QALs, OACs, Private Applicators, and



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<http://www.ipm.ucdavis.edu>

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SEARCH [Year-Round IPM Program](#)

ON THIS SITE [Tells you what you should be doing throughout the year in an overall IPM program. Includes Year-Round IPM Program Annual Checklist. \[rs. Using a year-round IPM program\]\(#\) | \[Forms and supplemental pages\]\(#\)](#)

Year-Round IPM Program for Pistachio (10/14)
[Dormancy to Delayed-Dormancy](#) • [Preharvest](#)
[Budbreak to Bloom](#) • [Harvest](#)
[Fruit Development](#) • [Postharvest](#)

UC IPM Pest Management Guidelines
University of California's official guidelines for pest monitoring techniques, pesticides, and nonpesticide alternatives for managing pests in agriculture, floriculture, and commercial turf. [More](#)
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General Information
[Relative Toxicities of Insecticides and Miticides Used in Pistachios to Natural Enemies and Honey Bees](#) (10/14)
[General Properties of Fungicides Used in Pistachios](#) (10/14)
[Fungicide Efficacy for Pistachio Diseases](#) (10/14)
[Treatment Timing for Key Diseases](#) (10/14)

Diseases
[Alternaria Late Blight](#) (10/14)
[Armilaria Root Rot \(Oak Root Fungus\)](#) (10/14)
[Botryosphaeria Panicle and Shoot Blight](#) (10/14)
[Botrytis Blossom and Shoot Blight](#) (10/14)
[Fruit Molds](#) (10/14)
[Phytophthora Root And Crown Rot](#) (10/14)
[Powdery Mildew](#) (10/14)
[Stigmatomycosis](#) (10/14)
[Verticillium Wilt](#) (10/14)

Nematodes
[Nematodes](#) (2/07)

Insects and Mites
[Citrus Flat Mite](#) (10/14)
[Cotton Ashid](#) (10/14)
[Darkling Beetles](#) (10/14)
[False Chinch Bug](#) (10/14)
[Leafhopper Plant Bugs](#) (10/14)
[Mealybugs](#) (10/14)
[Navel Orangeworm](#) (10/14)
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[Web-spinning Spider Mites](#) (10/14)
[Western Tussock Moth](#) (10/14)

Weeds
[Pistachio Photo Gallery, with Common and Scientific Names of Weeds](#) (10/14)
[Integrated Weed Management](#) (10/14)
[Special Weed Problems](#) (10/14)
[Susceptibility of Spring/Summer Weeds to Herbicide Control](#) (10/14)

More information
[2013 Efficacy and Timing of Fungicides, Bactericides, and Biologicals for Deciduo](#)
[Learn to use degree-days to time insecticide applications.](#)
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What is IPM? [Powdery Mildew](#)

Home & landscape pests [Pathogens: *Oidium* sp.](#) (Reviewed 10/14, updated 10/14)

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SYMPTOMS AND SIGNS
Powdery mildew starts as white powdery blotches on leaves, leaf stems, and fruit epicarp. Later in the season, these blotches turn brown to black and have a netted appearance. The blotches on fruit become russeted and multiple blotches cause leaves to yellow, turn brown, and die. Infected leaves and fruit may be distorted and misshapen. Similar symptoms can be found on rachises, fruit stems, petioles, underside of leaf blades, and young shoots.

COMMENTS ON THE DISEASE
The disease commonly occurs on the Trabonella cultivar. Red Aleppo is more susceptible than the Kerman cultivar.

MANAGEMENT
The occurrence of powdery mildew on pistachio trees is uncommon and sporadic. No management is recommended.

PUBLICATION
[UC IPM Pest Management Guidelines: Pistachio](#)
[UC ANR Publication 3461](#)

Diseases
T. J. Michailides, Kearney Agricultural Center, Parlier
Acknowledgment for contributions to Diseases:
B. L. Teviotdale, Kearney Agricultural Center, Parlier



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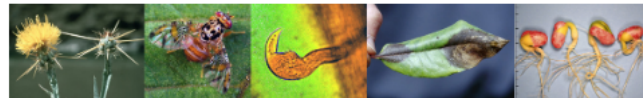
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QUICK LINKS

- [Insect & Invertebrate Pest Sheets](#)
- [California State Collection of Arthropods](#)
- [CDFA Herbarium](#)
- [CDFA Seed Herbarium](#)
- [CDFA Nematode Collection](#)
- [CDFA Plant Pathogen Collections](#)
- [National Plant Diagnostics Network \(NPDN\)](#)
- [Western Plant Diagnostics Network \(WPDN\)](#)

PLANT PEST DIAGNOSTICS CENTER OVERVIEW

The Plant Pest Diagnostics Branch serves as a scientific resource, providing timely and accurate plant pest diagnostics and professional expertise to our clients. Our scientists, technicians and support staff strive to provide leadership in science and excellence in service.

The tasks of our scientists and staff include:

- Timely and accurate diagnosis of plant pests, weeds, and diseases, and evaluation of seed quality and viability.
- Expert consultation for pest prevention programs and for external clientele.
- Services for the improvement of plant quality and for export of agricultural products.
- Cutting edge research on the identification and characterization of new pest and disease species, and on the methodologies to improve diagnostic procedures.
- Maintenance and curation of critical scientific resources, including the California State Collection of Arthropods, the Herbarium, the Seed Herbarium, and plant disease collections.

Plant Pest Diagnostics Center
California Department of Food & Agriculture
3294 Meadowview Road
Sacramento, CA 95832, USA
Telephone: (916) 262-1100
Fax: (916) 262-1190
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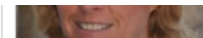
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Acknowledgements

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