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

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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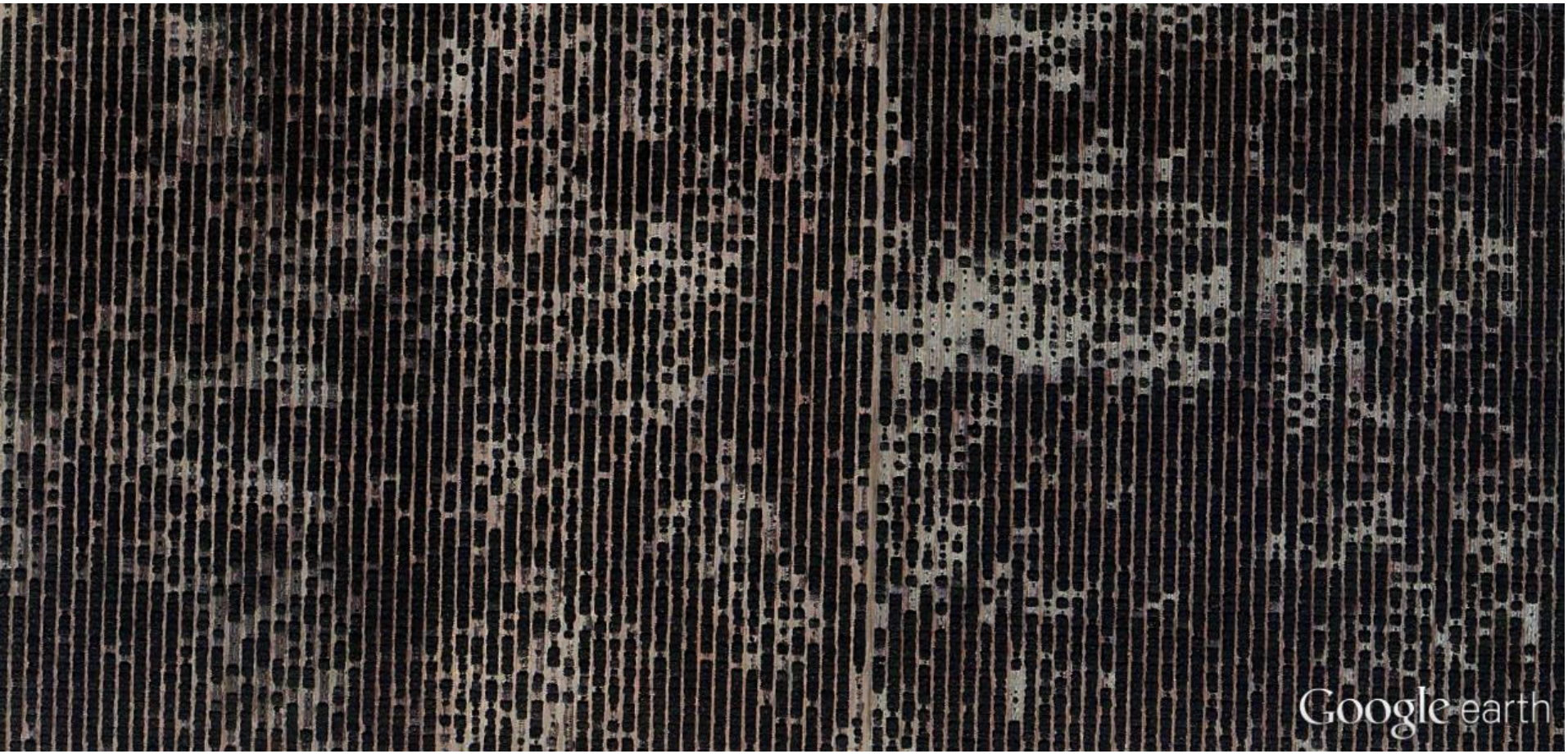
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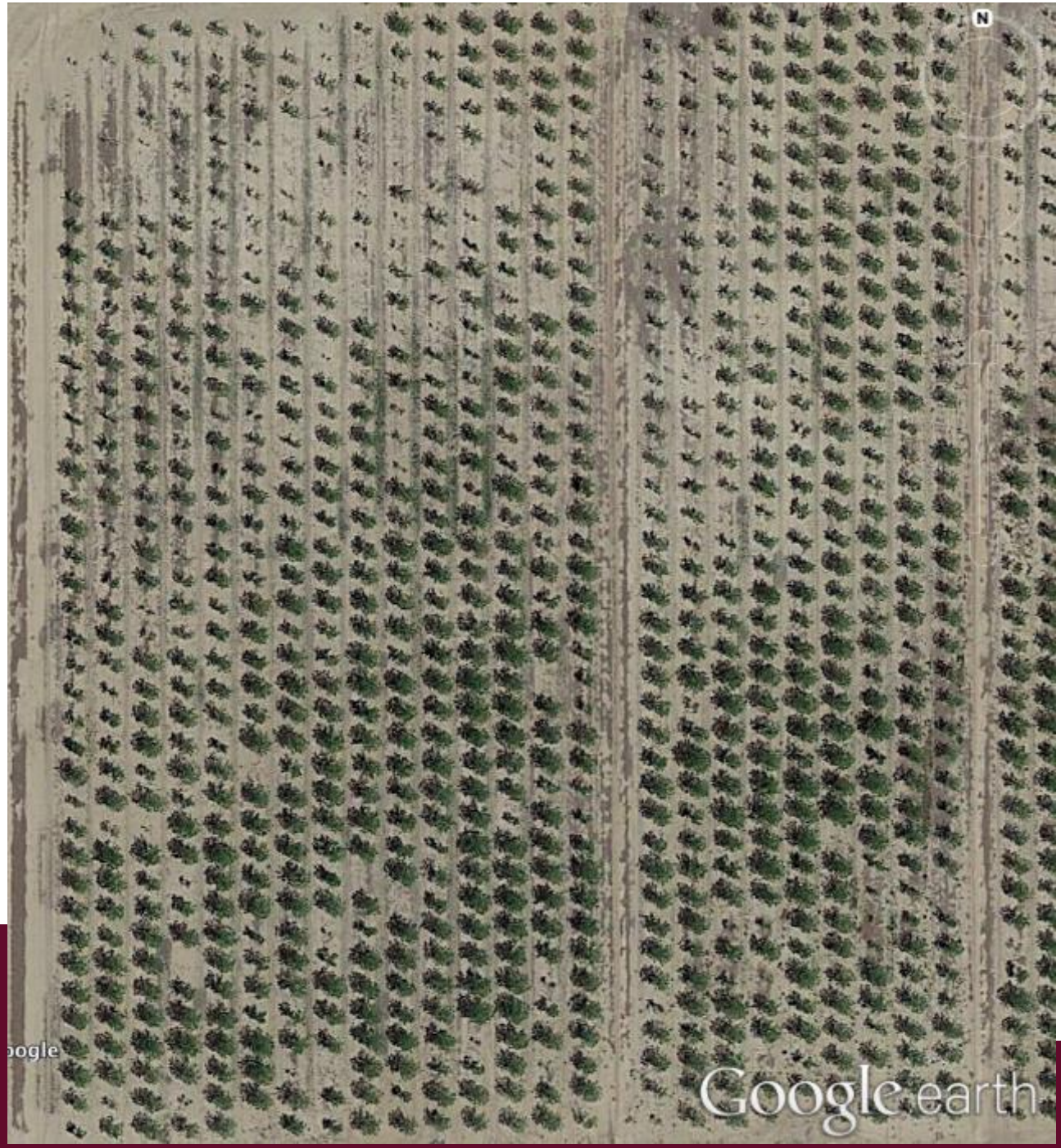

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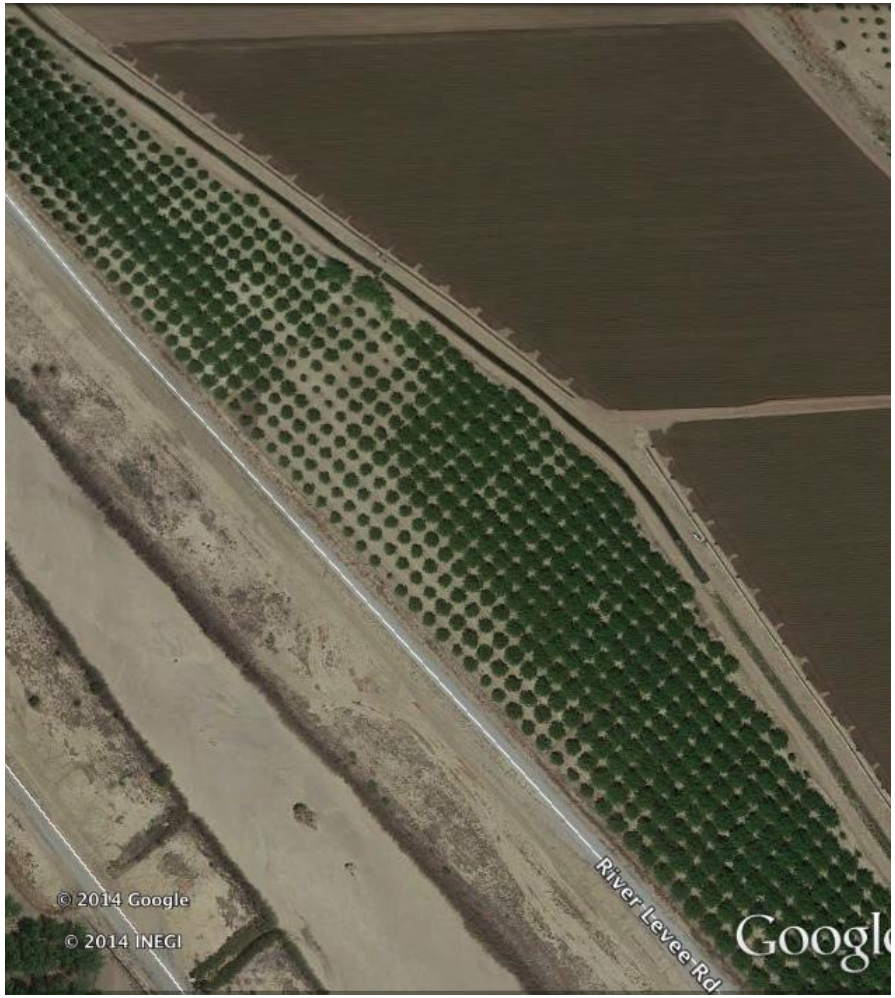
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Critical Information Needs

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. Please follow these guidelines and submit the best sample possible (if the sample is insufficient for diagnosis, you will be asked to submit a new sample).

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. When the whole plant can't be collected, select sample from the margin of the diseased area. Include a healthy plant if possible.
3. Send a representative sample from **all parts** of the plant. Dig plants out of the soil **(DO NOT PULL). DO NOT** wash roots. Gently shake excess soil from roots.
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. Do not use plastic if there is a lot of moisture associated with the sample. Never add moisture to any sample.
6. Submit a **completed** Plant Specimen Submission Form. Processing of the sample may delayed for specimens received without the proper form or if information provided is insufficient.

PACKING:

1. Keep sample cool prior to shipment.
2. Pack the sample carefully in a sturdy box or padded envelope. Be sure not to crush specimens.
3. Mail immediately (***overnight delivery is recommended***). Avoid mailing over weekends and holidays.

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
945 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)**

_____ _____

_____ _____

_____ _____

_____ _____

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.
- ☐ 50% 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 (ºF)_____ 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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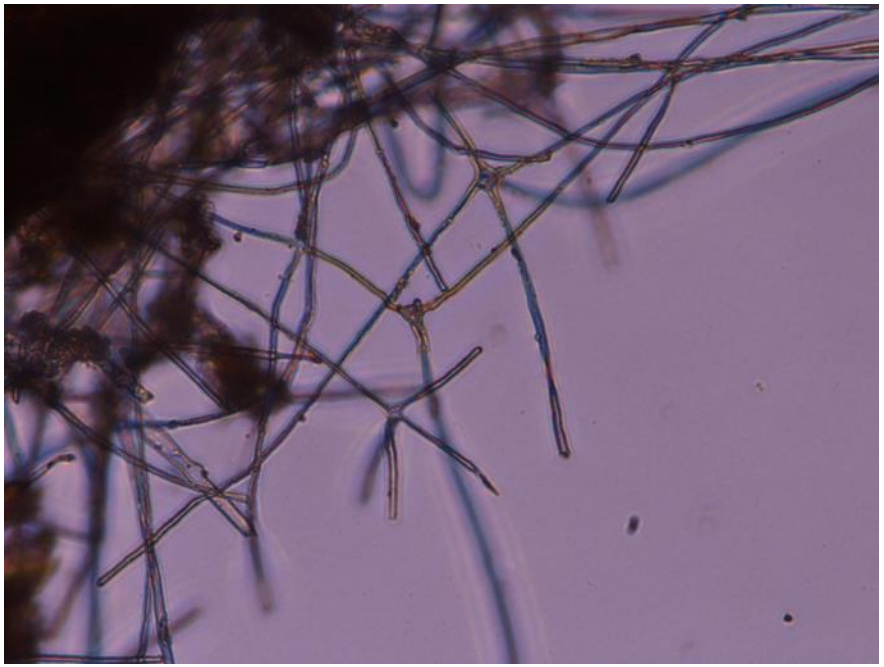
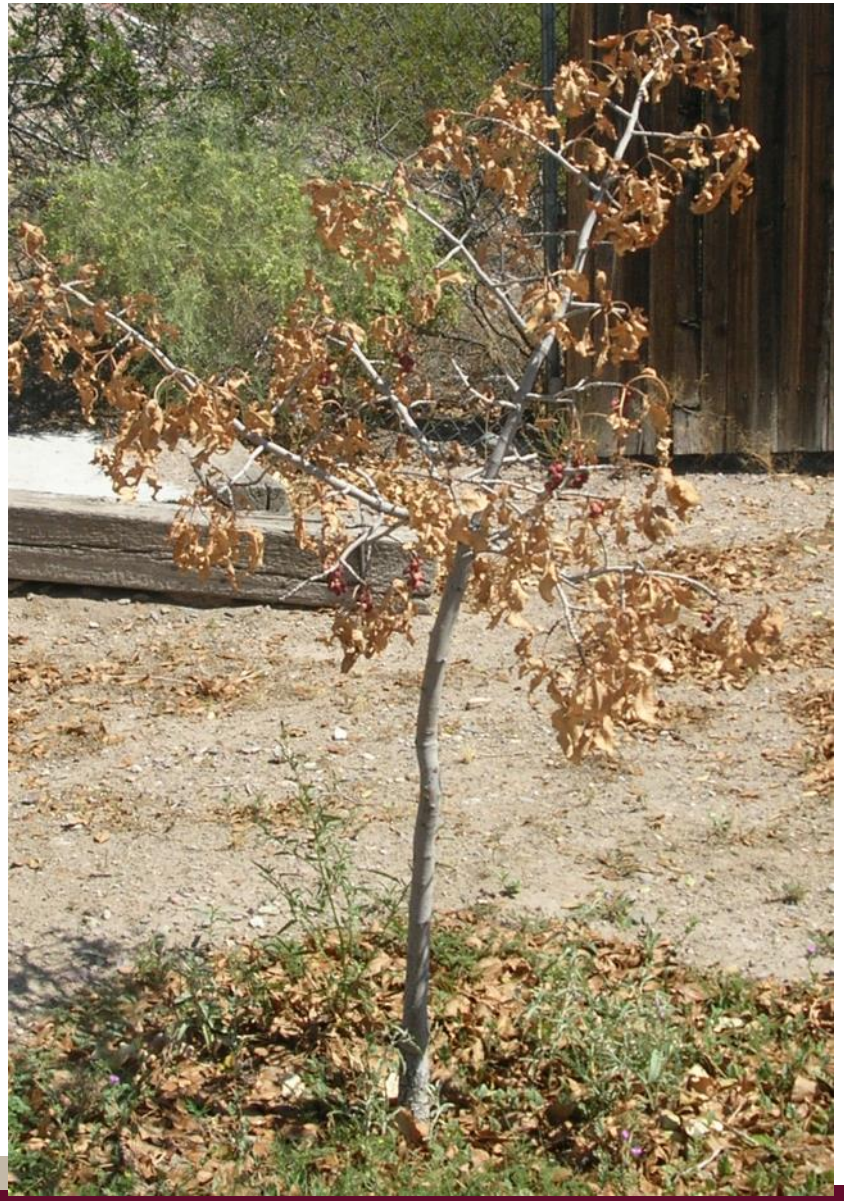
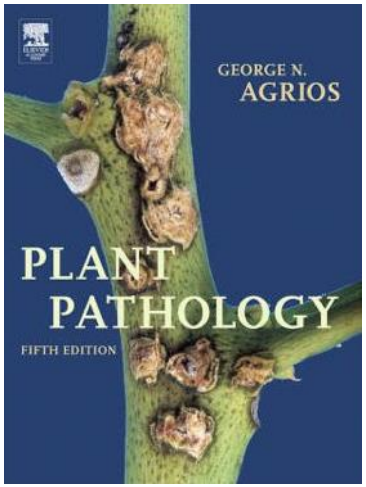
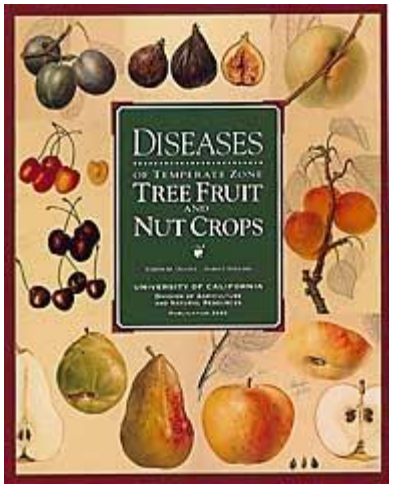
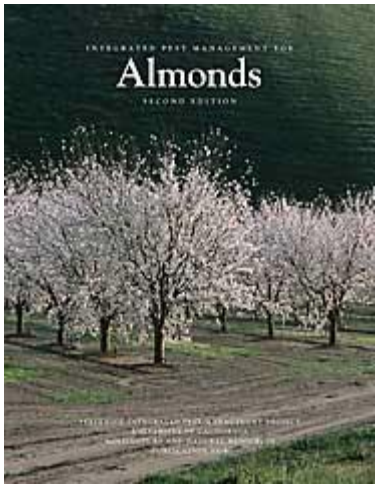


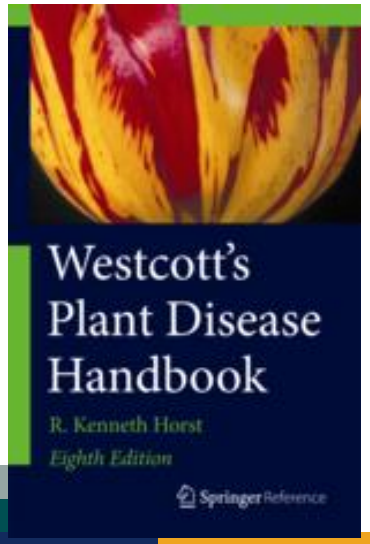


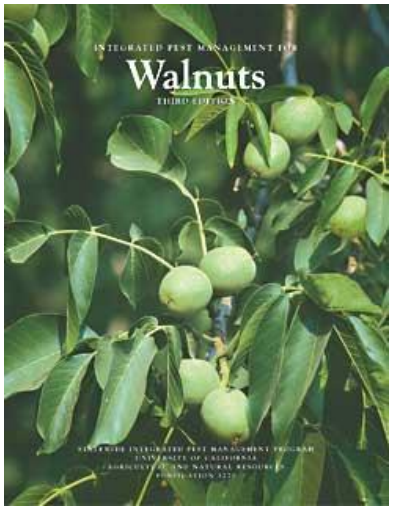
Some General References

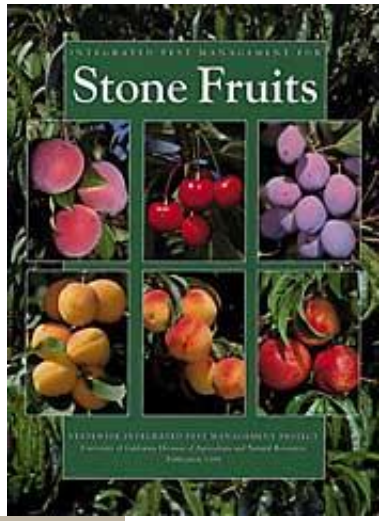








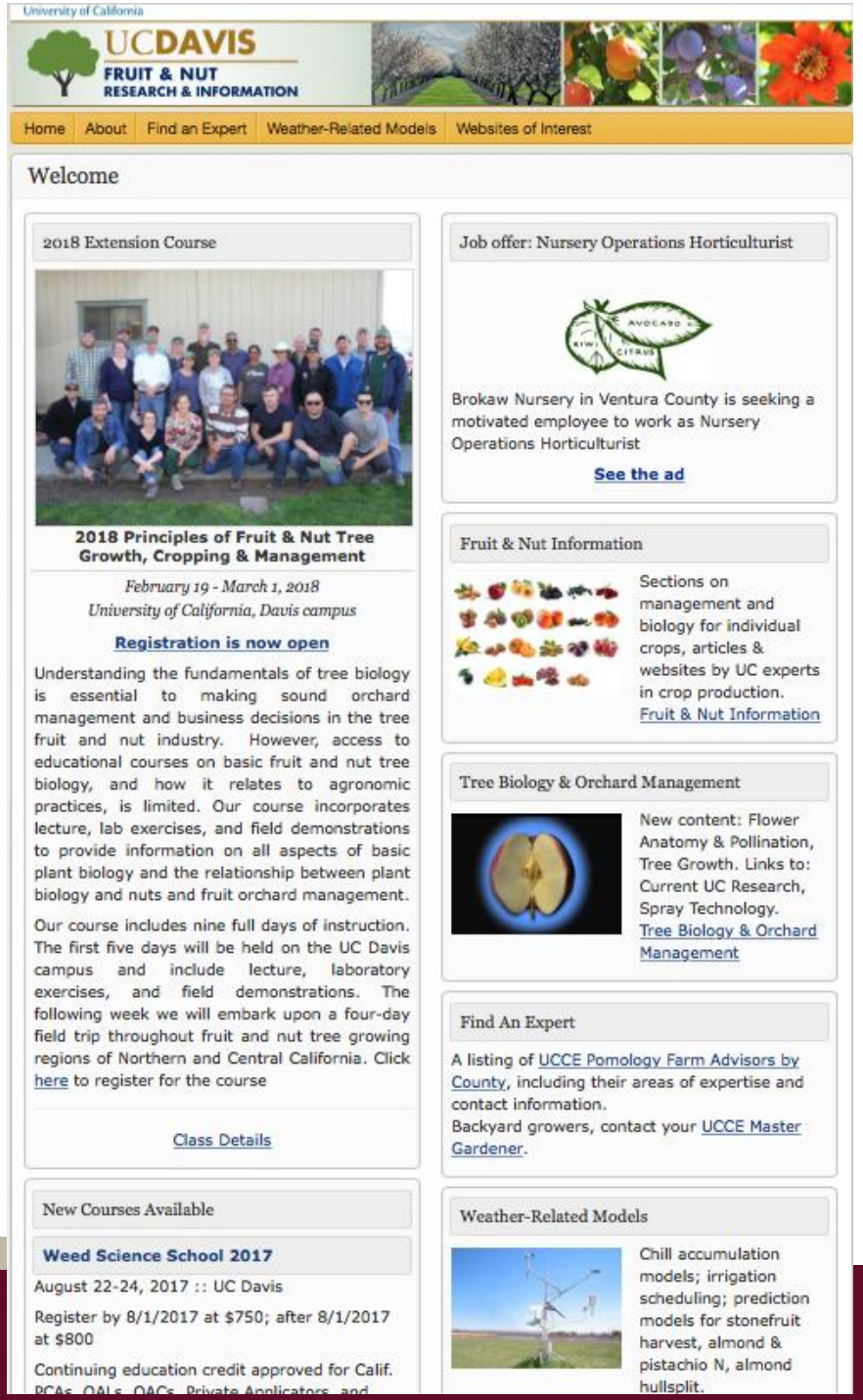




Many great resources available at
http://anrcatalog.ucdavis.edu

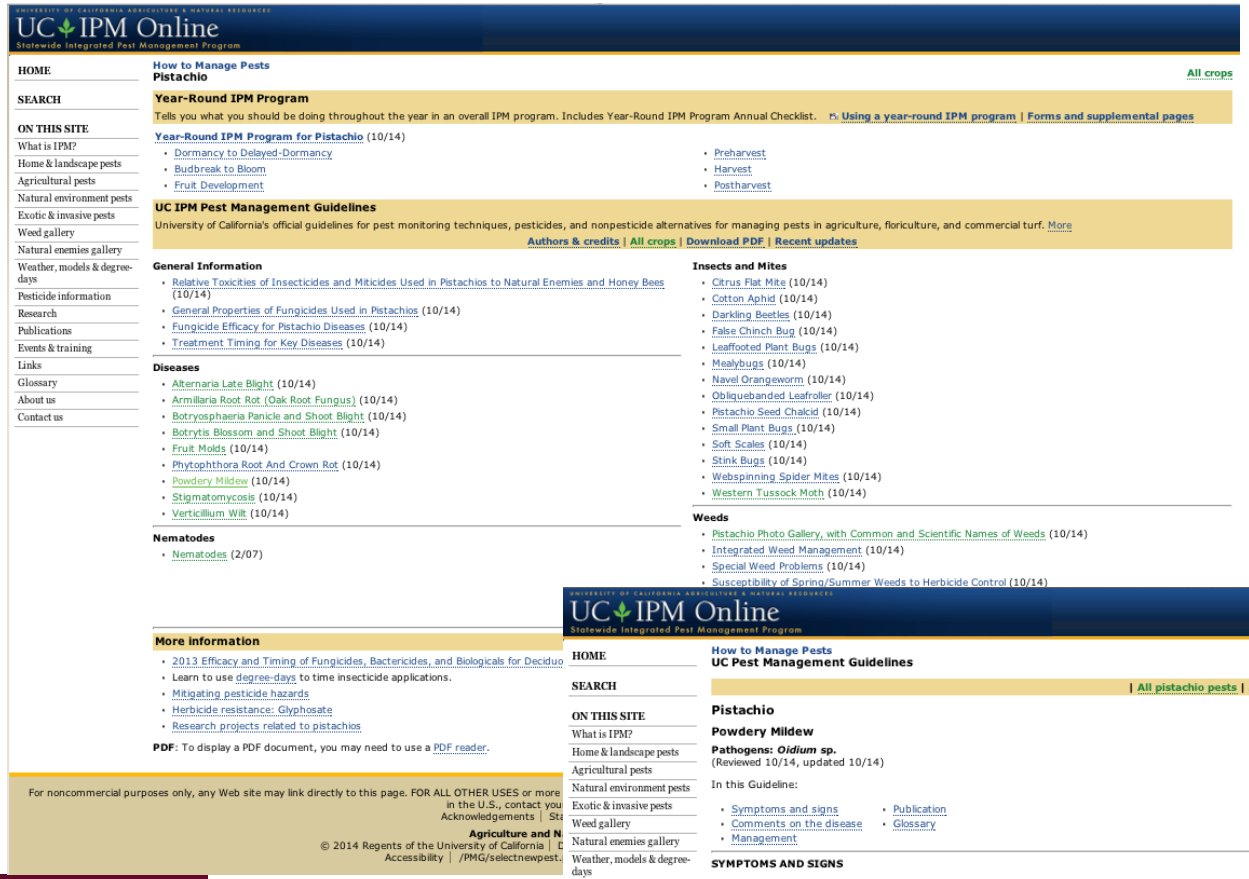
Online Resources

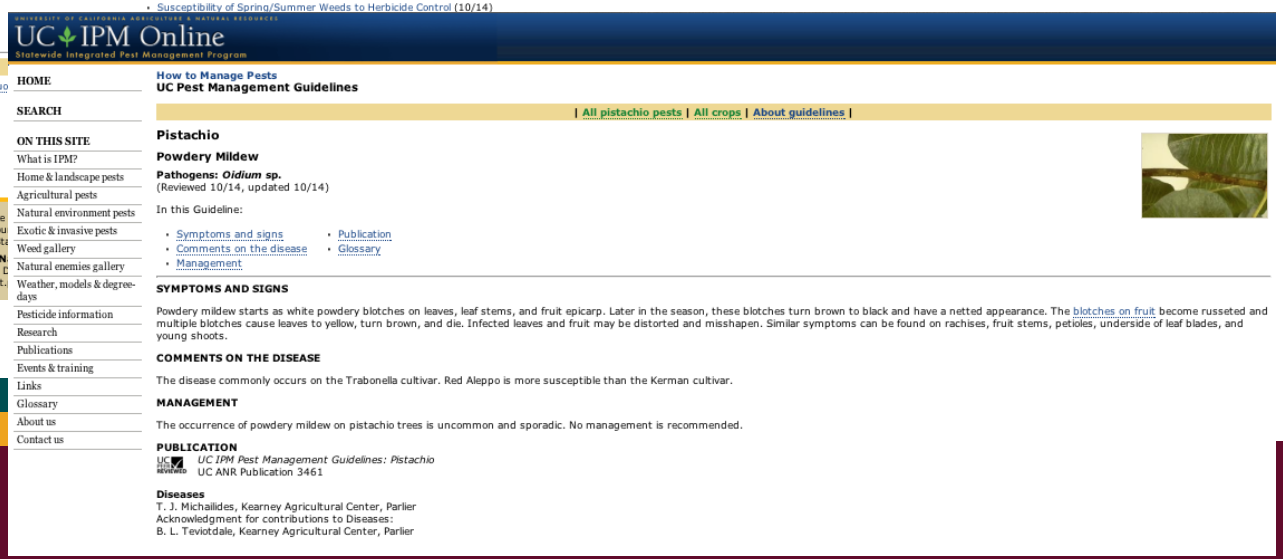
http://fruitsandnuts.ucdavis.edu



Online Resources

http://www.ipm.ucdavis.edu





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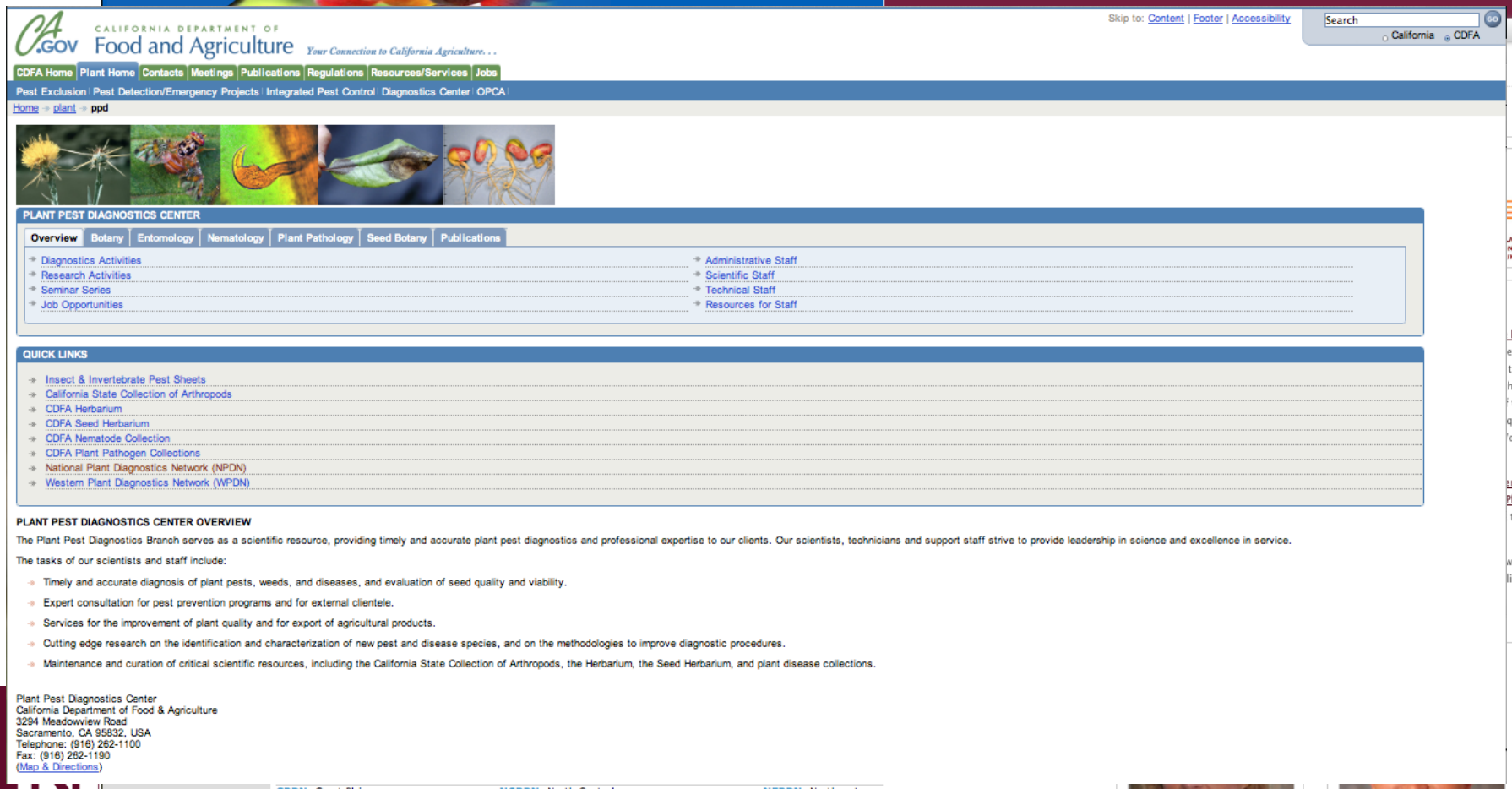

Thank You!

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