Diagnosing Tree Crop Problems in the Field

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Diagnosing plant pests, diseases and disorders

**FIRST, MUST KNOW:**
Correct plant identification

- Healthy plant appearance
- The diseases, insects and other problems that can affect the crop
Roses, Diseases and Abiotic Disorders

Pests in Gardens and Landscapes

A variety of plant pathogens may attack roses from time to time. By far the most common problem in California is powdery mildew, but a number of other diseases including rust, black spot, botrytis, downy mildew, and anthracnose may cause problems where moist conditions prevail. To limit problems with pathogens, choose varieties and planting practices carefully, promote air circulation through bushes with careful pruning and placement of plants, and remove severely affected material promptly. Although some rose enthusiasts consider regular application of fungicides a necessary component of rose culture, many others are able to produce high-quality blooms with little or no use of synthetic fungicides, especially in California's dry interior valleys.

In addition to diseases caused by bacterial, fungal, and viral pathogens, roses may display symptoms similar to those that are the result of chemical toxins, mineral deficiencies, or environmental problems. Such problems are termed abiotic disorders and can often be corrected by changing environmental conditions.

LEAF AND SHOOT DISEASES AND DISORDERS

**Powdery mildew**, caused by the fungus *Sphaerotheca pannosa var. rosea,* is recognized by its white to gray powdery growth on leaves, shoots, sepals, buds, and occasionally on petals. Leaves may dannel and drop. Powdery mildew does not require free water on the plant surfaces to develop and is active during California's warm, dry summers. Overhead sprinkling (irrigation or washing) during midday may limit the disease by disrupting the daily spray-release cycle, yet allows time for foliage to dry. The pathogen requires free access in order to colonize, so regular collection and disposal of debris helps reduce carryover.
Biotic vs. Abiotic Causes

• Biotic
  – Fungi
  – Bacteria
  – Viruses
  – Phytoplasma
  – Nematodes
  – Insects & Mites

• Abiotic
  – Soil moisture extremes
  – Temperature extremes
  – Salts
  – Air pollution
  – Wind, light effects
  – Mechanical damage
  – Pesticide damage

MAY PREDISPOSE TO BIOTIC!
QUESTIONS TO ASK

• History
• Situation
• Spatial variability
• Symptom expression
QUESTIONS TO ASK

• History: of orchard and problem
  – Of the ground and orchard
  – Adjacent properties
  – What is rootstock and scion
  – When first noticed?
  – How long? Chronic or One-time
  – Progression in tree or field?
QUESTIONS TO ASK

• **Situation**
  - Age and production
  - *Soil type and condition*
  - *Soil and water quality*
  - Leaf Analysis
  - *Weather around time symptoms developed?*
  - Cultural practices
  - *Fertilizer, pesticides, irrigation applied*
QUESTIONS TO ASK

- **Spatial variability**
  - % of field / orchard affected?
  - Pattern?
  - Other plants in field / orchard affected?
Pattern in the orchard, or random? or scattered? or clumped?
QUESTIONS TO ASK

• **Symptom expression**
  - What plant parts are affected?
  - Top-down? Bottom-up?
  - Where is PRIMARY site of injury?
  - Progressing in severity or on plant over time?
What plant part plan affected

Entire canopy

Individual branches
Where is the **PRIMARY** site of injury?
Diagnostic Equipment & Tools

• Field
  – POCKET KNIFE
  – HAND LENS
  – PLASTIC BAGS
  – NOTEBOOK
  – SHOVEL
  – CAMERA

• Lab / Office
  – MICROSCOPE
  – DISSECTING SUPPLIES
  – CULTURING
  – NOTEBOOK
  – ANALYTICAL EQUIPMENT
Method of Recording Information

- Write down the information!!!
Biotic vs. Abiotic Causes

• **Biotic**
  - Fungi
  - Bacteria
  - Viruses
  - Phytoplasma
  - Nematodes
  - Insects & Mites

• **Abiotic**
  - Drought
  - Over-watering
  - Freeze / Frost
  - Sunburn
  - Salts
  - Nutrient deficiencies
  - Herbicide toxicity/injury
  - Mechanical damage
• History
• Situation
• Spatial variability
• Symptom expression
• History
• Situation
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• **Situation**
• **Spatial variability**
• **Symptom expression**
- History
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- History
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- Symptom expression
Laboratory tests for Abiotic Causes

Soil, water
- pH testing
- Nutrient analysis
- Soluble salts analysis
- Analysis for chemicals

Plant tissue tests
- Nutrient analysis
- Analysis for chemicals
Biotic vs. Abiotic Causes

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- History
- Situation
- Spatial variability
- Symptom expression
Plant Pathogens

- Fungi
- Bacteria
- Viruses

Nematodes
Plant Pathogens

- Fungi
- Bacteria
- Viruses

Nematodes
Symptoms and Signs

• Plants respond to infection by plant pathogens with disease symptoms

• Signs are the pathogen or its parts or products seen on the host plant

Diagnosis based on symptoms alone can be very difficult
Disease symptoms can be variable

- More than one problem
- More than one pathogen
- Pathogens vary in virulence
- Environmental conditions affect symptom expression
Symptoms and Signs

Fungi

- Leaf spots usually round, not vein-limited
- Alternating zones of light and dark tissue
- Spores or mycelia may be present
Signs: FUNGI

Powdery mildew form mycelia and spores on tissue surface
Tomato Powdery Mildew

Symptoms and signs
Signs: FUNGI

Brown rot (Monilinia spp)

Sooty Mold
Fruiting bodies

- Shape of fruiting body aids in identification

Signs: FUNGI

Rust Fungi
Symptoms and Signs

BACTERIA

- Leaf spots often dark and water-soaked
- Vein-limited, angular shape
- Bacterial ooze, streaming under microscope
**Symptoms and Signs**

**VIRUS Symptoms**

- Stunted & distorted growth
- Mosaic, mottle, curling, yellowing
- Abnormal flowers & fruit
- Can be confused with nutrient deficiencies, herbicide damage
Symptoms

CANKERS

• Sunken or swollen or both
• Fungi OR bacteria
Symptoms: Vascular discoloration

Verticillium wilt in...

Chinese pistachio

Maple

Tomato
Symptoms

BLIGHT, DIEBACK

- Blight = rapid death or dieback. Also from coalescing leaf spots, e.g., early blight of tomato
- Fungal OR bacterial causes
Symptoms

ROOT ROT

- Darkening and softening of roots or crown
- Yellowing, stunting, death of plant
- Fungal OR bacterial causes
Symptoms

GALLS

- Bacteria
- Nematodes
Root Knot Nematodes
Insects & Mites

- Easiest to diagnose
  - Damage
    - Chewing, sucking, boring
  - Specific to crop
  - Often readily seen
Surface or internal feeding insects
Leaf chewing and folding insects
Sucking insects
Mites

Leaf “silvering”, “bronzing”, and webbing
Sampling Techniques: Collecting Specimens

✓ Important for accurate diagnosis
✓ All specimens should be fresh, kept refrigerated
✓ Collect the whole plant if possible
✓ Submit samples showing all stages of problem
Sampling techniques

✓ Don’t 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

[Image of packages and materials]
Acknowledgements

• **History**
• **Situation**
• **Spatial variability**
• **Symptom expression**

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