Plant Problem Diagnosis

Recognizing, diagnosing and exploring solutions for plant problems
PLANT DISEASES NEED JUST THE RIGHT CONDITIONS TO TAKE OFF

All three factors must be present for disease to occur.

- **Turfgrass**
- **Susceptible Host**
- **Pathogen**

**Conducive Environment**

- High humidity, warm nights, hot days
- Fungus in soil/air
What is normal for that plant?

Cottonwood in winter

Bermudagrass in winter
PLANT REQUIREMENTS

- Exposure
- Appropriate environment
- Water requirements
- Space requirements
- Fertility needs
- Maintenance needs

- Pittosporum in full sun in July
- Jacaranda is great, in San Diego
- Overwatering desert ironwood
- Mesquites in parking lot islands
- Gardenia in backyard garden
- Formal myrtle hedge

Is the plant attractive?
What happens when all the requirements appear appropriate for the plant?
Observations and Questions

- Are all species affected?
- Are other species affected?
- Recent chemical or fertilizer application?
- Recent weather changes?
- Construction in past few seasons?
- Sudden onset or gradual over time?
- Check the soil?

Make as many observations as you can, even if you think you already know the answer.
Observations will be essential to any plant problem diagnosis
SYMPTOMS

Change in the appearance of functioning of the plant as a result of the disease

Other examples: Plant dieback, wilting, galls, distortion, necrotic spots on leaves from fungal pathogen
**SIGNS**

*Actual evidence of the causal agent*

Other examples:
Mycelia, spores, conks, other fruiting bodies, webbing, insect body casings
*Most often signs are from a biotic source*
ABIOtic Causal Agents

Disorders caused by non-living entities
Abiotic Causal Agents

- Weather conditions
  - Temperature extremes
  - Humidity
  - Wind
  - Hail
  - Exposure (scorch or frost)

- Air quality
  - Pollution damage

- Soil conditions
  - Moisture
  - Texture
  - Structure
  - pH
  - Salinity
  - Organic matter content
  - Compaction issues
**Abiotic Causal Agents**

- Water quality (if irrigated)
- Water quantity – (over or under watered)
- Reflected heat or light
- Nutritional disorders (likely due to another abiotic factor)
- Chemical injury (phytotoxicity)
  - Herbicide, insecticide, fungicide or PGR injury
- Mechanical injury
- Construction damage
- Vehicular damage
- Improper planting depth
- Equipment damage
  - Line trimmers
ABIO TIC DISORDERS

Frost damage

Hail damage

Sun Scorch
Abiotic Disorders

- Herbicide damage
- Micronutrient deficiency
- Micronutrient imbalance
- Root damage
**Abiotic Disorders**

- Structurally ruined
- Overwatered conditions
- Pruning damage
ABIOTIC DISORDERS

- Staking damage
- Phototropism
- Deep planting
- Deep planting
**Abiotic Disorders**

- Construction damage
- Root structure defects
- Reflected light/heat damage
Abiotic Disorders

Know your plant, what it should look like at that time of year, determine if it is normal.
Abiotic Disorders

Sunburn damage

Mechanical damage
Poor Pruning Practices
Herbicide Injury
Examples of poorly adapted plants in the Desert Southwest
Aleppo Pine Blight

- Until recently thought of as abiotic - due to winter drought
- More on this later…

This is not an Aleppo pine. Make sure you know your plant species before making diagnosis.
What questions will you ask to figure out what is causing dieback?

Property continued to lose limbs on grapefruit tree each summer
FIELD INVESTIGATION

- Other plant species on side of the yard also show branch dieback
- No automatic irrigation
  - Inconsistent watering
- Digging under 4” of river rock to inspect roots you discover…..

BLACK PLASTIC

What was the cause of the citrus tree decline?
Nutrient Deficiencies

Various deficiencies may be expressed differently on different species.
**Nutrient Deficiencies**

- Deficiencies may occur when
  - Soils do not contain adequate minerals for the plant
    - Nitrogen commonly lacking in Arizona soils
  - Physical conditions inhibit availability of minerals to plant
    - Water and soil pH
      - Phosphorus and Iron “deficiencies” due to alkalinity of soil
    - Soil temperatures
    - Soil texture
    - Soil moisture
NUTRIENT AVAILABILITY AND pH

Figure 1. This graph shows how nutrient availability changes with the pH of mineral soils. Nutrients are most available when the band is wide. When the band is narrow, the nutrients are less available. Graphic adapted from the Corn & Soybean Field Guide (Purdue Extension publication ID-179). Source: Brady and Weil, 2007.
There are many charts available online to help with field diagnosis.
Essential Plant Elements

Macronutrients

- **Needed in larger amounts**
  - Primary macronutrients
    - Nitrogen (N)
    - Phosphorus (P)
    - Potassium (K)
  - Secondary macronutrients
    - Calcium (Ca)
    - Sulfur (S)
    - Magnesium (Mg)

Micronutrients

- **Needed in smaller amounts**
  - Iron (Fe)
  - Boron (B)
  - Manganese (Mn)
  - Zinc (Zn)
  - Copper (Cu)
  - Chlorine (Cl)
  - Molybdenum (Mo)
  - Nickel* (Ni)

Other essential plant elements include Hydrogen (H), Carbon (C) & Oxygen (O)

* recently added
**Nutrient Deficiencies**

- **Nitrogen (N)**
  - Chlorosis (yellowing) of older leaves, bottom of plant
  - Rest of the plant is often light green
  - Stunted growth
  - Foliage may drop early in fall
  - **Mobile** in plants

- **Treatment**
  - Ammonium, Urea, Nitrate, manures
Nutrient Deficiencies

- Phosphorus (P)
  - Older leaves turning a dark green or reddish purple
  - Leaf tips look burnt
  - Stunting
  - Loss of lower leaves
  - Poor root growth
  - Mobile in plants

- Treatment
  - Phosphate products
  - Bone meal
Nutrient Deficiencies

- Potassium (K)
  - Older leaves may wilt, look scorched
  - Interverinal chlorosis begins at the base, scorching inward from leaf margins
  - Necrotic (dead) spots between veins
  - Mobile in plant

- Treatment
  - Potash sources
  - Greensand
  - Kelp
**Nutrient Deficiencies**

- **Calcium (Ca)**
  - *New leaves* distorted or irregularly shaped
  - Terminal bud dies
  - Causes blossom-end rot in fruits (tomato, peppers)
  - Cupping of mature leaves
  - *Immobile* in plants

- **Treatment**
  - Gypsum (Calcium sulfate)
  - Bone meal
  - Other calcium sources
**Nutrient Deficiencies**

- **Iron (Fe)**
  - Interverinal chlorosis on **newer growth**
  - (yellowing leaf with green veins)
  - Leaves may be small
  - **Immobile** in plants

- **Treatment**
  - Iron chelates
  - Ferrous sulfate
NUTRIENT DEFICIENCIES

- Many micronutrients may be caused by multiple minerals lacking
- Application of micronutrient packages will help broaden the spectrum
- Foliar testing to confirm mineral deficiency


**Nutrient Deficiencies**

- Southwest desert soils are naturally **high** in calcium... but we still get calcium deficiencies... Why?
  
  - Calcium in the form of calcium carbonate= **caliche**, which is not a soluble form of calcium (high pH).
  
  - Breaking through caliche layer may help provide some drainage.
  
  - Addition of elemental sulfur to high calcium soils may solubilize and break up caliche. This is not a solution but a management strategy for poorly drained soils.
  
  - Addition of gypsum can be used (replaces insoluble Ca with soluble Ca) but gypsum should only be used if there is a high sodium content (sodic soil).
  
  - High pH/ calcium soils often cause **iron deficiencies** in plants due to that mineral being unavailable to plant.
CULTURAL PRACTICES CAUSING PLANT DISORDERS

- Over pruning
- Over watering
- Under watering (or not watering properly)
- Too much or too little light
- Inappropriate fertilization
- pH or salinity issues
- Lack of plant protection
- Planting too deep
- Soil compaction
BIOTIC CAUSAL AGENTS
Disorders caused by living entities
Biotic Causal Agents

- Insects, mites, nematodes
- Parasitic plants
- Fungi
- Bacteria
- Protists
- Virus
- Nematodes
BIOTIC CAUSAL AGENTS
PLANT DISEASES

Root Diseases
Wood Rots
Foliar Diseases
Texas Root Rot

- Caused by the fungus *Phymatotrichopsis omnivora*
- Only affects dicots
- Affects over 2300 plant species

Symptoms
- wilting
- rapid death in summer
- dead foliage remains attached to limbs
Texas Root Rot

- Visible hyphae can be seen covering roots
- Fungal mats may form after rain storms around infected plants
- Can be a very quick death or slow decline
- No cure or treatment available
**Phytophthora, Pythium Diseases**

- Oomycetes in the Protist kingdom with algae
- Not true fungus, but are ‘water molds’
- ‘Zoospores’ are fast swimming spores that cause infection
- Often referred to as a fungus, treated with a fungicide (or water mold specific product)
- Soil-borne pathogens
- Can lay dormant in soil for long periods of time
Many species of *Phytophthora*, water loving organisms (oomycetes), cause root and crown rots.

Control disease by watering less frequently and providing good drainage.
Phytophthora Root Rot
Wilting of transplants, spreading quickly through beds

Roots turn blackish brown with root rots caused by *Pythium* and *Phytophthora*, yet remain white with other diseases
DAMPING-OFF

✓ Collapse of seedlings and root rot of transplants

➢ *Phytophthora, Pythium* (water loving oomycetes)
➢ *Rhizoctonia, Thielaviopsis* (soil borne fungi)

➢ Prevent disease by planting at the right time and using healthy, fast growing plants

➢ Rotate the kinds of plants in any one location from year to year

➢ Often seen in overwatered soil conditions
DAMPING-OFF

*Pythium* - oomycete pathogen depends on being over-watered

What is another clue here?
Wood Rots

- Pose hazards by weakening limbs
- Transmitted through wounds or grafted roots
- Once conk visible the damage is extensive
- No treatment available
- Tree may fail quickly or survival many years with few symptoms
**Ganoderma Root Rot**

Cottonwood in North Phoenix golf course

Pecan in Central Phoenix
CROWN GALL

- Caused by *Agrobacterium tumefaciens*
- Enters via wounds on lower stems, trunks and roots
- Large tumor at soil line
- No treatment

Seen on almonds, apples, cottonwoods, figs, peaches, pears, pecan, privet, roses, willows and pyracantha
BACTERIAL NECROSIS OF SAGUARO

- Caused by *Erwinia cacticida*
- If lesion is small, remove one half inch beyond rotting tissue
- Disinfect tissue with 10% bleach solution and one teaspoon of detergent per gallon solution
- Allow air to heal wound
SLIME FLUX/ WETWOOD

- Water-soaked wood under a branch crotch or wound
- Liquid may run down bark
- Fermentation may occur and increase pressure under bark
- Draining is not recommended due to the introduction of new wounds
- No treatment necessary
- Hose off to remove oozing sap if posing a problem to property
- Remove branch if it is hazardous or weakened
SOOTY CANKER

- Occurs most commonly in smooth bark trees
- Caused by
  - Sunburn
  - Over-pruning (opening up canopy)
  - Wounds
  - Commonly seen in citrus, mulberry, ash, ficus
- Airborne – spreads into pruning cuts
- Prune out 6” below infection – best to do in winter
- Sanitize pruning equipment with 20% bleach solution – between every cut!
POWDERY MILDEW

- Grey or white spots on leaves and stems
- Very common in springtime
- Many hosts, but disease is host-specific
- Disease prefers:
  - mild spring temperatures
  - moderate to high humidity
  - no surface water
  - low light and poor air flow
- Treat with labeled fungicide
OLEANDER LEAF SCORCH

- *Xylella fastidiosa* bacteria
- Transmitted by sharpshooter insects (xylem feeders)
- Symptoms easily confused with abiotic disorders such as salt toxicity and water stress
- Lab testing is best way to confirm diagnosis
- No treatment available
Oleander Leaf Scorch

Symptoms
- Leaf yellowing followed by browning
- Necrotic leaf tips and margins
- Appear on random branches on plant
- Plant continues to decline
- Often seen first in summer months
Oleander Gall

Distinguished by hard brown galls at the florets or at pruning wounds
**Oleander Gall**

- Bacterial infection caused by *Pseudomonas syringae pc. savastanoi*
- Swelling at limb tips, branches, flowers and seed pods
- Bacteria enters plant via pruning wounds, frost damage and natural openings
- Rain, sprinkler water and pruning tools spread disease to healthy plants
Oleander Gall

- Manage by pruning out infected plant parts (a few inches beyond gall)
- Disinfect all pruning equipment with a 25% bleach solution or Lysol spray (make sure you pay attention in the coming slides)
- Prune during the dry seasons
- Avoid overspray of irrigation water
**Sanitation Practices**

**Household disinfectants- Lysol**
- Easy to find and most aren't corrosive
- Little research has been done regarding their effectiveness against plant pathogens
- Relatively expensive when compared to other options

**Chlorine bleach**
- Inexpensive, effective, and easy to find
- Corrosive, can produce harmful fumes
- Mix up a 10-25% bleach solution and do a 30-minute soak
- The solution has a short lifespan—effectiveness is cut in half after two hours—so fresh batches should be made for each round of cleaning
- Rinse tools with clean water after soaking to prevent corrosion

**Ethanol or Isopropyl Alcohol**
- Not as effective on killing plant pathogens—use other products

**Pine Oil Products**
- Not as corrosive as some other disinfecting products on the market, but they're also not as effective
- Mix a 25% solution (one part pine oil to three parts water) and then soak the tools in the solution

**Industrial Products**
- *Quaternary ammonium compounds*: Green-Shield® and KleenGrow™.
- Hydrogen dioxides: ZeroTol® 2.0 and Oxidate® 2.0

**Keep It Clean**
- Keep tools clean
- Longer soaking may be needed for pruning surfaces that are not smooth
- Tools should be disinfected after working on every plant; however, this is usually not practical
- Rotate between several tools while working in the garden, one tool can be disinfected while you work with another
- After dipping your pruning tools, be sure to wipe away excess disinfectant to avoid injuring the next plant
INSECTS AND OTHER ARTHROPOD PESTS

Creepy crawly things
Arthropod Pests

- Most insects and other arthropods are beneficial or otherwise harmless
- Control may or may not be needed
- Identification is critical
FOLIAR PESTS

- Recognize feeding damage
  - Chewing mouthparts
  - Piercing/sucking mouthparts
  - Rasping mouthparts
THRIPS

- Citrus thrips and western flower thrips
- Leaf, fruit or flower distortion
- Once damage is observed too late to control
- Commonly seen on citrus in the springtime
WHITEFLY, APHIDS AND PSYLLIDS

- Piercing-sucking mouthparts
- Fast generation time
- Cause
  - Stippling
  - Defoliation
  - Sooty mold
  - Honeydew mess on nearby hardscape or vehicles
- Treatment
  - Spray or drench with systemic insecticide
  - Use of IGRs is great (insect growth regulators)
Whiteflies  
Aphids  
Psyllids
Fig (Ficus) Whitefly

- Exotic pest introduced to Arizona in 2015
- Concerning for Ficus
  - Weeping fig
  - Indian laurel fig
- Defoliates plant
- Feeds on underside of leaf
- ID by looking at egg pattern, which is in a spiral formation
- Feeds in Spring (March - May)
- Watch for natural predators like midge flies and parasitic wasps to control populations
- Treat similar to other whitefly infestations

http://cisr.ucr.edu
COCHINEAL SCALE

- Soft bodied scale feeds on cactus (prickly pear cactus)
- Leaves behind a cottony wax for shelter
- When smashed, red dye is seen, used as a textile and food dye for the last century
- Hose off plants when populations are small, remove pads with heavy infestation
**Sesame leaf roller/ Leaf tier**

- *Antigastra catalaunalis*
- New problem in our area
- Attacking *Tecoma spp.* and *Bougainvillea spp.*
- Caterpillar is protected by rolling itself into leaf with webbing
- Seen in spring and again in summer
SPIDER MITES

- Twospotted spider mite
- Prefers dry, warm and dusty conditions
- Sucks sugars out of leaf and petiole
- Webbing likely seen once population establishes on plant
- Hosing off plant regularly helps keep populations low during peak season (April-May and Sept.-Oct)
- Miticide applications may be used if necessary
  - The use of adulticides, ovicides and IGRs may be needed for management
ALEPPO PINE BLIGHT

- Caused by pine spider mite *Oligonychus milleri*
- Lack of rain causes the pest population to soar
- Branches can recover
Leafcutter Bees

- Seen on bougainvillea and roses
- Important pollinators
- Impossible to control
- Purely cosmetic
ROOT AND STEM PESTS

Critters who prefer to dine below ground or on wood
Agave Weevil

- Prefer large, open-rosette forms of agaves
- Also attacks desert spoon and yucca
- Bacteria found on weevil transmitted to agave, causing plant to wilt
- Spring *imidacloprid* drenches may help prevent larvae from feeding
Agave Weevil
BORERS

- Flathead
- Roundhead
- Attack stressed plants
  - Sunburn
  - Freeze damage
  - Over-pruned
  - Other stresses like poor irrigation management
- Borers tunnel through sapwood then continue into heartwood
- Galleries often found just under bark
BORERS

- Management with insecticides may or may not be helpful
  - If feeding on sapwood, treatment may work
  - If feeding on heartwood, pesticide will not reach borer (including systemic)
- Removal of infested limb and dispose off site (do not recycle)
- Maintain tree health to prevent borer invasion
Palo Verde Root Borer

- Large beetle larvae feed on palo verde, sissoo, ironwood and other roots
- Emerge in summer leaving large holes in soil under tree canopy
- Best defense is good tree health
- May kill tree or may weaken, becoming prone to blowing over in wind
Palo Verde Root Borer

Exit holes found in roots

Damage seen in trunk
Palo Verde Root Borer

- Look for broomstick-sized holes in ground around declining tree
- Branches turn a golden brown, then reddish brown as they die
- No treatment once tree has extensive damage
Weeds

Plants growing out of place
Weeds

Are a matter of perception
WAYS TO CATEGORIZE WEEDS

- Cool season vs. warm season
- Broadleaf (dicot) vs. grass and sedge (monocot)
- Annual vs. perennial vs. biennial
Broadleaf (dicot) or Narrowleaf (monocot)?
## Plant Lifecycles

<table>
<thead>
<tr>
<th>Annual Weeds</th>
<th>Perennial Weeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Complete lifecycle in one year (seed -&gt; adult -&gt; seed)</td>
<td>• Persist year after year</td>
</tr>
<tr>
<td>• Seeds may remain dormant in soil for years (soil seed bank)</td>
<td>• May go dormant during drought or cold weather</td>
</tr>
<tr>
<td></td>
<td>• Can sprout back if roots or underground portions not removed or killed</td>
</tr>
</tbody>
</table>
Bermudagrass - *Cynodon dactylon*

- Warm season
- Perennial
- Narrowleaf
- Reproduces by seed and vegetatively (rhizomes and stolons)
- Loves sidewalk cracks, growing among broadleaf shrubs
PUNCTUREVINE - *Tribulus terrestris*

- Warm season
- Broadleaf
- Annual
- Prostrate (grows along the ground)
NUTSEDGE (PURPLE AND YELLOW)

*Cyperus rotundus* or *esculentus*

- Warm season
- Perennial
- Narrowleaf
- Difficult to control
- Prefers high moisture soil conditions
- Spreads via seed and underground ‘nut’, sending up new plants right and left
SOWTHISTLE

Sonchus oleraceus

- Cool season
- Broadleaf
- Annual
- Flower is dandelion-like, followed by white puff seedhead
- Can reach 5 feet in height!
- There are many other thisles, use guides to help identify
London Rocket  *Sisymbrium irio*

- Cool season
- Broadleaf
- Annual
- In the Mustard family
- Center bolts straight up when ready to flower
**Little Mallow**  
*Malva parviflora*

- Cool season
- Broadleaf
- Annual or biennial
- Long taproot
- Palmate venation
- aka “cheeseweed”
  - Seed looks like a wheel of cheese
SPURGE - *Euphorbia spp.*

- Prostrate spurge, Hyssop spurge, etc..
- Warm season
- Broadleaf
- Annual
- Prolific seeds
- Often seen accompanied by ants
- Milky substance (in the Euphorbia family)
- Turns purple at first frost
STINKNET - *Oncosiphon piluliferum*

- Aka Globe Chamomile
- Leaves resemble carrots and have a pungent odor
- Plants can grow to knee height
- Emerges in November and continues to emerge through January
- Blooms in late February
- Very aggressive growth, should be controlled as soon as it appears
- Can cause skin rashes, breathing difficulties, and very flammable when dry
FOUNTAIN GRASS - *Pennisetum setaceum*

- Recently added to the Arizona Noxious Weed list
- Commonly planted in landscapes
- Erect good-looking plant, but very weedy
- Stays green most of the year
- Purple fountaingrass variety is not noxious
BUFFELGRASS - *Pennisetum ciliare*

- Perennial from Africa
- Invasive to Desert Southwest
- Threatens desert ecosystems
- Introduced in the 1930s for erosion control
- Early treatment of invaded areas can dramatically reduce presence
- Significant weed in Tucson area
True Mistletoe

- Parasitic flowering plants with characteristic clumps of growth on host plant
  - Disseminated by birds that eat or transport the berries and deposit seeds on host plants
- Reduces growth of host plant
  - Takes many years for true mistletoe infections to kill a mature tree or shrub
- Can be controlled by periodic removal of aerial shoots
  - Cut off infected branches
  - Remove heavily infested trees and shrubs
CULTURAL CONTROL OF WEEDS

- Don’t introduce weeds from nursery stock
- Don’t over-fertilize garden or landscape plants
- Don’t apply water outside of drip zone of desirable plants
  - Sprinkler overspray
  - Try using drip irrigation
  - Cap unused emitters
  - Use of ground covers and mulches
- Pre-emergent programs help prevent weed populations from getting out of control
Physical Control of Weeds

- Hula hoe
  - Works for small areas

- Mulching for Weed suppression
  - DG – maintain 2” layer
  - Organic mulch also improves soil
Landscape Fabric

- Permeable
  - Allows air movement
  - Water can penetrate
- Not 100% effective
  - May degrade over time
- Plastic is NOT a landscape material that can be used around plants
  - Can cause plant death due to root suffocation
**Chemical Control/Herbicides**

**Pre-emergence**
- Helps prevent weed outbreaks
- Applied to soil via spray or granule
- Watered in via rain or irrigation
- Kills germinating seedlings as they emerge and contact barrier in soil

**Post-emergence**
- Kills growing weed
- Foliar applied
- Full coverage necessary
- Adjuvants help
  - Stickers
  - Spreader
  - Water conditioners
# Chemical Control/Herbicides

<table>
<thead>
<tr>
<th>Contact herbicide</th>
<th>Systemic herbicide</th>
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<tbody>
<tr>
<td>• Kills only plant parts they touch</td>
<td>• Absorbed by leaves and transported throughout plant</td>
</tr>
<tr>
<td>• “Burn down”</td>
<td>• Kill roots</td>
</tr>
<tr>
<td>• Useful with certain annual weeds</td>
<td>• Take care with nearby trees</td>
</tr>
<tr>
<td>• May or may not be impacted by temperature</td>
<td>• May be impacted by temperature if plant is not growing</td>
</tr>
<tr>
<td>◦ Reward herbicide is <strong>not</strong> impacted by temperature, burns tissue it contacts</td>
<td>◦ Roundup is slow to act in the winter because growth is</td>
</tr>
<tr>
<td></td>
<td>slow in cold weather</td>
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PLANT PROBLEM DIAGNOSIS TOOLKIT

- Soil probe
- Long handled screwdriver
- Temperature gun
- EC meter
- Soil thermometer

- Sharp pruners – 1 for roots, 1 for shoots
- Paper bags
- White paper plates
- Well rinsed plastic water bottles
- Shovel
- Measuring tape
- Hand lens
- Cooler
- Clorox wipes
- Bleach Dips
Field Diagnosis and Plant Assessment Checklist

**Plant ID**
- Age of plant
- Location of plant

**Symptoms**
- Plant parts affected
- Chlorosis
- Wilt
- Leaf Spots
- Leaf Distortion
- Rot

**Degree of symptoms**
- Whole plant
- Isolated sections
- Few leaves or shoots
- Few roots

**Symptoms on all similar plants or isolated on a few plants**
- How many plants
- which plants with symptoms
- Percentage of plants

**Length of time symptoms observed?**
- days, weeks, months

**Changes to property**
- Construction
- When/ type
- Power outages

**Soil**
- Texture
- Drainage
- Grade changes/disturbances
- Has soil been amended
- Compaction
- Water infiltration or percolation
- Root crown visible/correct level
<table>
<thead>
<tr>
<th><strong>Fertilization</strong></th>
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<tbody>
<tr>
<td>Product/rate</td>
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<tr>
<td>Application method</td>
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<tr>
<td>Frequency or timing</td>
</tr>
<tr>
<td>Application dates</td>
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<table>
<thead>
<tr>
<th><strong>Irrigation</strong></th>
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<tbody>
<tr>
<td>Delivery method</td>
</tr>
<tr>
<td>Frequency, volume, depth</td>
</tr>
<tr>
<td>Schedule changes in last 4 seasons</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th><strong>Recent weather changes</strong></th>
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</thead>
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<tr>
<td>Day &amp; night temp. patterns</td>
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<tr>
<td>Winds, extremes</td>
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<tr>
<td>Precipitation</td>
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<table>
<thead>
<tr>
<th><strong>Plant or soil testing</strong></th>
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<tbody>
<tr>
<td>Prior diagnosis provided</td>
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<tr>
<td>Testing provided by</td>
</tr>
<tr>
<td>Results</td>
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<table>
<thead>
<tr>
<th><strong>Pest Infestation</strong></th>
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<tbody>
<tr>
<td>ID pest</td>
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<tr>
<td>Damage seen</td>
</tr>
<tr>
<td>Symptoms of pest infestation</td>
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</tbody>
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<table>
<thead>
<tr>
<th><strong>Pesticide Use</strong></th>
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</thead>
<tbody>
<tr>
<td>Past use of pesticides (all)</td>
</tr>
<tr>
<td>Currently use of pesticides</td>
</tr>
<tr>
<td>Damage seen</td>
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<td>Symptoms of damage</td>
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<th><strong>Description of concern</strong></th>
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<th><strong>Thoughts or recommendations</strong></th>
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Questions?

Please remember to check out the resources page for valuable downloads and links to information. All resources can also be found at www.ALCA.org/study-materials
Presentation created by:

Beth Postma, Kasey Billingsley and Kelly Young

References: The University of Arizona Cooperative Extension