DIAGNOSIS OF PLANT PROBLEMS

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First, try to avoid plant problems:
Plant Health Care: right plant, right place, proper cultural care

Second, if plant problems develop- employ: **Plant Problem Diagnosis**
in order to use effective, efficient, economical, environmentally safe
Integrated Pest Management

Systematic Approach to Plant Problem Diagnosis Using Simple Investigative Techniques for Powerful Results

Requirements for plant problem diagnosis:

1. Background information: history of plant and the problem
2. Fresh & adequate sample material: range of symptoms, living tissue, and appropriate plant part(s)
3. Reference materials: books, websites, extension bulletins, experience & skilled people
4. Tools: essential - hand lens, knife: technical - microscope, moist chambers, culture facilities
5. Attitude: continuing desire to learn, willingness to seek help, and humility!

How to systematically diagnose the plant problem:

1. Evaluate the entire plant
2. Formulate an idea as to the cause of the problem
3. Determine what to look for to confirm diagnosis
4. Look for evidence and re-evaluate the situation

I. Start with an overall evaluation of plant

A) Identify host- determine optimal cultural/ environmental requirements
B) Know what a healthy specimen is supposed to look like
C) Evaluate if a problem actually exists
D) Don't jump immediately to a symptomatic tissue
    *don't get distracted: root problems may cause foliar symptoms
E) Ask: What is the overall problem? What other problems do I see?
    * Stunting? Poor color?

Proceed to overall evaluation of individual tissues

(a) Roots
    look overall for quantity/quality of roots
    look for swellings, insects, rot, insect feeding, tunnels, holes
    cut across & length-wise for discoloration of vascular tissue/ cortex

(b) Stems
    check for swellings, cracks, lesions, holes, frass (insect "poop")
    cut lengthwise and across the stem, looking for vascular discoloration
    check integrity of stems

(c) Leaves
    check for insect feeding (tissue missing or scraped away); frass
    look at spots and discoloration-- What do patterns tell you?
        (veinal/interveinal, older leaves vs. younger leaves)

(d) Flowers, fruits, bulbs, corms,
    look for obvious rot, insects, holes,
    cut in cross section, then cut the other way

II. Formulate an idea as to the cause of the problem

Where on the plant is the cause of the problem originating?
root rot? stem rot? leaf spot?
What has been found on this plant before that can cause the symptoms?
references; experience (yours and others) with horticulture, soils, nutrition, insects

Is the problem of biotic (living) or abiotic origin?
Base on information gathered:

* **symptoms** (abnormal plant appearance) & **signs** (physical presence of cause)
* random vs. regular distribution of symptoms
* progressing vs. static or declining symptoms
* number of plant species affected (one/few or many/different)
* rate of appearance of symptoms (gradual or quick)
* associations

Be aware of:

* symptoms common to several types of pathogens!
* above-ground symptoms caused by below-ground problems
  (root injury, moisture stress, root diseases)
* multiple plant problems! (abiotic stresses leading to development of disease)
* primary vs. secondary problems

Symptoms	Biotic (living)	Abiotic (nonliving)
distribution	random	regular
Rate of appearance	gradual	quick
# species affected	one-few (related)	one-many (unrelated)
Spreading/infectious	yes	no

If you suspect an ABIOTIC DISEASE, determine the type of problem:

physical or environmental causes:
moisture, oxygen (roots need to breathe)
temperature and light (extremes & rapid fluctuations)

(many cultural problems with plant care)

mechanical injury: hail, wind, equipment

chemical injury:
pesticides: especially herbicides (contact burns or growth regulation)
type(s) of chemicals, rate(s) & application method and timing
(drift, vaporization, root absorption)
pollution

nutrient deficiencies/toxicities
Deficiencies:
immobile elements - Fe, Mn, Cu, Mo, Zn (symptoms on new growth)
mobile elements - N, P, K, Mg, Cl (symptoms on older growth)
Toxicities: burning damage (roots or foliage)

If you suspect a BIOTIC DISEASE, determine the type of pathogen or pest:

fungal:
circular or irregular lesions; concentric dead rings; often colorful margins
roots with rotting cortex & healthy pith; discolored & soft roots
signs: hyphae (mycelium), fruiting bodies, dormant structures (sclerotia)

bacterial:
angular shaped lesions, limited by veins
water-soaking (enzymes), yellow halo, transparent (when held to light)
soft rot with bad odor
signs: bacterial ooze (microscopic)

viral:
chlorotic rings or mosaic pattern
veinal yellowing or interveinal yellowing
stunting and/or distortion of tissue
usually no necrosis (dead tissue) or plant death (obligate pathogen)

nematode:
foliar nematodes - limited between major veins, wedge-shaped lesions
stunting; moisture and nutrient stress symptoms
roots swollen or distorted; localized root lesions
signs: stylet-bearing nematodes (microscopic)

insects & mites:
feeding habit: chewing (notches, holes, skeletonizing) vs. sucking (stippling, puckering)
life cycle: incomplete (adult most damaging) vs. complete (larvae most damaging)
signs: insect, frass, eggs, webs & cocoons, cast skins

animal:
e.g. slugs & snails damage (slime trails, skeletonizing)
dogs, cats, deer, rabbits (urine damage, wounding, girdling)

III. Determine what to look for to confirm

What should be present to confirm preliminary diagnosis?
e.g. Compare how the plant be properly cared for and the care it actually receives.
Determine how many roots are healthy and how many are damaged.
What would the fruiting structures/spores of the leaf spotting fungus look like?
What is the identity of this insect I found?

IV. Look for evidence and re-evaluate the situation

A) Proceed to closer evaluation of individual tissues
Roots/ Leaves/ Stems:
examine with hand lens (or microscopically if available)

Don't be misled by secondary organisms
always use a representative sample of the problem

B) Is the evidence there?
C) If not, can it be induced? e.g. by using a moist chamber
D) If evidence is not there, why not?
Was the sample adequate?
Was your technique at fault?
Do you have the wrong hypothesis?

If the evidence of the sample doesn't fit the hypothesized diagnosis, start over.
Don't try to force fit a diagnosis!!!!!!

(Winter 2003 materials adapted from Diagnosticians Melodie Putnam, OSU, & Lindsey du Toit, WSU