



Considerations for Diagnosis of Vegetable Diseases in Production

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Diagnosing plant problems can be challenging. However, detailed observations of the growing site can provide the information necessary for a complete and accurate diagnosis. Once on-site, it is important to know how to proceed. The following guidelines are intended to assist in gathering pertinent information and determining a possible cause. Keep in mind while going through this process that not all plant issues are disease related. Often, abiotic conditions (such as environmental damage or mechanical injury) or other biotic causes (such as insects or wildlife) may be to blame. Should the field site diagnosis be inconclusive, and samples need to be submitted to a local Extension office, the information gathered here can provide valuable supplementary information.

STEP 1: BEGIN THE EVALUATION

At the start of the evaluation, consider the following:

- Plants affected (including cultivars)
- Normal appearance and growth patterns of plants
- Location of plants
- Plant height
- Planting date/Age of plant
- Planting depth
- Soil type
- Watering program
- Drainage
- Sun exposure
- Fertilizers (dates and rates applied)
- Fungicides/Insecticides/Herbicides (dates and rates applied)

When assessing a plant problem, taking photos of the affected plant and surrounding area may be helpful in the diagnostic process, especially if it becomes necessary to consult with a local Cooperative Extension Service office, specialist, or other consultant. The following are suggestions, but other pictures may be needed depending on the situation.

- Close-up of affected plants
- Close-up of plant symptoms
- Wide view of affected plants
- Wide view of area around affected plant

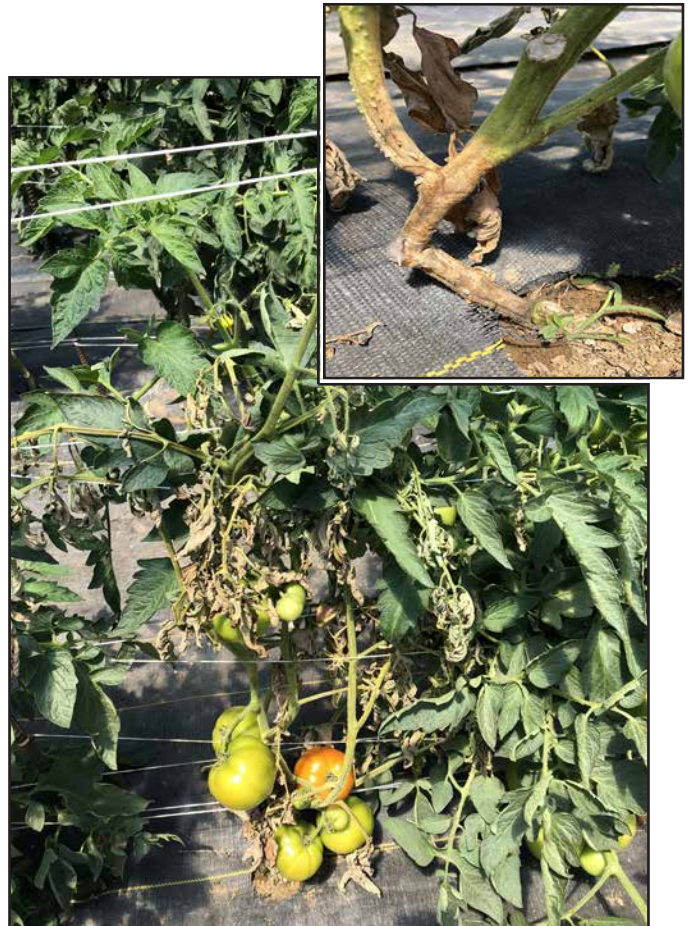


FIGURE 1. PHOTOS THAT INCLUDE THE ENTIRE PLANT AND CLOSE-UPS OF AFFECTED PLANT PARTS (SEE INSET SHOWING LOWER STEM) ARE HELPFUL IN THE DIAGNOSTIC PROCESS.

STEP 2: EXAMINE THE SITE

(More than one may apply)

TYPE(S) OF PLANTS AFFECTED

- Only one plant of its type; others are healthy
- Multiple plants all of the same type
- Multiple plant species
- Entire planting (all plants)
- Comments/other:

LOOK FOR A PATTERN

- Near neighbor's property
- Near a building or foundation
- One section or side of property
- Shady areas only
- Sunny areas only
- Follows drainage patterns
- Groups of plants
- Near wooded areas
- Comments/other:

LOOK AT THE TOPOGRAPHY

- Low area(s)
- High area(s)
- Slopes
- Compacted (e.g., due to foot traffic, vehicles, equipment)
- Hard pan or underlying rock (probe soil with narrow spike)
- Comments/other:

CONSIDER SITE/PLANT HISTORY

- Fertilizer applications
- Grade change (soil added or removed)
- Herbicide applications
- Irrigation practices
- Recently transplanted
- Site disturbance (e.g., construction, digging, utility lines, irrigation lines)
- Weather extremes in past (cold, drought, flooding) – Check KY MESONET for past weather patterns
- Weather extremes recently (e.g., flooding, drought, hail, lightning)
- Surrounding weeds
- Deicing salts applied nearby (driveways, roads)
- Comments/other:



FIGURE 2. ASSESS TYPE(S) OF PLANTS AFFECTED AND SITES FOR A PATTERN.

FIGURE 3. WEEDS AND LACK OF AIR MOVEMENT CAN NEGATIVELY IMPACT PLANTS.

FIGURE 4. CONSIDER IRRIGATION PRACTICES, TOPOGRAPHY, AND SOIL DRAINAGE.

STEP 3: EXAMINE THE WHOLE PLANT

(More than one may apply)

SYMPTOM PROGRESSION TIMELINE

- Gradual progression of symptoms
- Rapid progression of symptoms
- Symptoms reoccur most years
- No symptoms observed prior to current season
- Comments/other:

SYMPTOM PROGRESSION

- Begins at top of plant and moves downward
- Begins lower on plant and moves upward
- Tips of leaves moving inward toward main stem
- Tips of vines moving inward
- Base of plant moving outward along vines/leaf tips
- Comments/other:

DISTRIBUTION OF SYMPTOMS

- Uniform over entire plant
- New leaves/shoots
- Older growth
- Upper portion of plant
- Lower portion of plant
- One side of plant
- Single side stem
- Comments/other:

OTHER OBSERVATIONS

- Failed trellising or damage due to trellising
- Plastic mulch or landscape fabric rubbing or cutting plants
- Insect activity on underside or upper surface of leaves or around plants
- Evidence of animal activity near plants
- Comments/other:

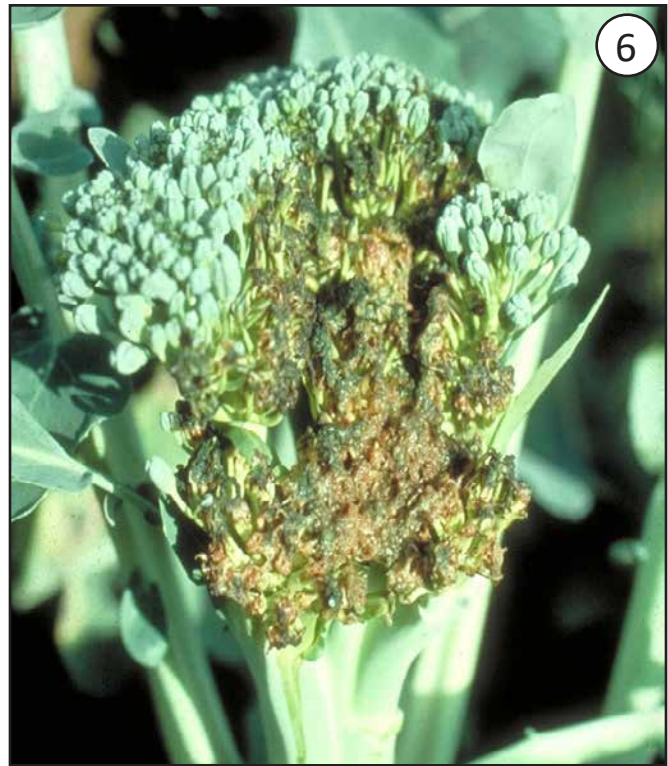


FIGURE 5. SYMPTOMS MAY ONLY APPEAR ON ONE PORTION OF THE PLANT UNTIL DISEASE PROGRESSES, SUCH AS POWDERY MILDEW SPREADING ACROSS ENTIRE PLANTS (OKRA).

FIGURE 6. DISEASE MAY ONLY DEVELOP WHEN A CERTAIN PART OF A PLANT IS PRESENT, SUCH AS WHEN BACTERIAL ROT OCCURS ON BROCCOLI FLORETS.

FIGURE 7. SYMPTOMS MAY DEVELOP UNNOTICED ON ROOTS, WHICH ARE OUT OF VISUAL RANGE (ROOT KNOT NEMATODE).

STEP 4: IDENTIFY THE SYMPTOMS & POSSIBLE CAUSE

(More than one may apply)

LEAF SYMPTOMS

- Rapid death/blight
 - Cultural or environmental factors
 - Fungal or bacterial leaf blight disease (e.g., early blight, late blight)
 - Stem canker, crown rot (e.g., southern blight, timber rot)
 - Root decay (Rhizoctonia root rot, Fusarium root rot)
 - Vascular wilt (e.g., Fusarium wilt, bacterial wilt)
- Leaf spots, blotches, lesions
 - Fungal or bacterial leaf spot (e.g., Septoria leaf spot)
 - Nutritional (e.g., interveinal spots develop with iron deficiency)
 - Herbicide injury
- Defoliation or premature leaf drop
 - Leaf spot (fungal or bacterial) (e.g., anthracnose, bacterial speck)
 - Root/crown-related disease (e.g., root-knot nematode, Fusarium crown rot)
 - Root/crown-related abiotic problem (e.g., equipment or mechanical damage)
- Discoloration (yellowing, chlorosis, reddening)
 - Nutritional deficiency or excess
 - Root/crown-related disease (e.g., timber rot)
 - Root/crown-related abiotic problem
- Wilting or drooping
 - Vascular disease (e.g., gummy stem blight, bacterial wilt)
 - Root decay (e.g., Rhizoctonia root rot, Pythium root rot)
 - Root/crown-related abiotic problem (e.g., equipment or mechanical damage)
 - Drought
- Fuzzy or powdery growth
 - Surface of leaf (e.g., powdery mildew)
 - Underside of leaf (e.g., Botrytis, downy mildew)
- Sooty black growth covering surfaces
 - Fungal growth on honeydew excretions of some insects (e.g., aphids, thrips)
- Scorch or burn; brown leaf margins
 - Drought
 - Root/crown-related (e.g., physical injury)
 - Root decay (e.g., Rhizoctonia root rot)
 - Vascular disease (e.g., yellow vine decline)
 - Stem canker/crown rot (e.g., southern blight)
 - Excessive fertilizer
- Distorted, twisted, curled
 - Environmental problems (e.g., cold)
 - Herbicide injury
 - Fungal growth (e.g., powdery mildew)
 - Viruses (e.g., tomato spotted wilt virus)
 - Nutritional deficiency
 - Insect injury (e.g., aphids)
- Mosaic or mottling
 - Viruses disease (e.g., cucumber mosaic virus)
 - Herbicide injury
- Stunted/undersized foliage
 - Nutritional problems
 - Root-related abiotic issues (e.g., physical injury)
 - Root decay (e.g., Pythium root rot)
 - Vascular disease (e.g., Fusarium wilt)
 - Cultural/environmental issues
- Bumps or growths
 - Arthropod (e.g., eriophyid mite, parasitic wasp)
- Holes in leaves, frass
 - Insect (chewing or feeding damage)
 - Leaf spot disease (e.g., angular leaf spot)
 - Hail damage
- Sticky substance on surface
 - Honeydew from some insects (e.g., aphids, thrips)



FIGURE 8. MOSAIC OR MOTTLING SYMPTOMS ARE CHARACTERIZED BY ABNORMAL COLOR VARIATIONS ACROSS LEAVES (TOMATO SPOTTED WILT ON PEPPER).

FIGURE 9. LEAVES MAY APPEAR COVERED WITH A FLUFFY OR POWDERY GROWTH (POWDERY MILDEW).

STEP 4: IDENTIFY THE SYMPTOMS & POSSIBLE CAUSE (CONT'D)
(More than one may apply)

FRUIT/PRODUCE SYMPTOMS

- Decay/Rots
 - Fungi (e.g., black rot, belly rot)
 - Bacteria (e.g., bacterial soft rot)
 - Water molds (e.g., Phytophthora rot, Pythium crown and root rot)
- Fruit spots, specks, lesions
 - Bacteria (e.g., bacterial spot, bacterial speck)
 - Fungi (e.g., anthracnose, rust)
 - Viruses (e.g., mosaic viruses, mottle viruses)
 - Abiotic (e.g., sunscald, freeze damage, herbicide)
- Cracks/wounds
 - Abiotic (e.g., sunscald, freeze injury, overripening, mechanical damage, harvest damage, overwatering)
 - Insects (e.g., squash borer, aphids)
- Scabs
 - Bacteria (e.g., potato scab)
 - Insects (e.g., thrips, aphids)
- Ringspots and mosaic patterns
 - Viruses (e.g., tomato ringspot virus, tobacco mosaic virus)
 - Insects (e.g., aphids, thrips, white flies)
- Distortions
 - Viruses (e.g., cucumber mosaic virus, tomato yellow leaf curl virus)
 - Insects (e.g., aphids, thrips)
 - Abiotic (e.g., herbicides, cold damage, trellising)

STEM SYMPTOMS/SIGNS

- Staining or streaking of inner stem tissue
 - Vascular diseases (e.g., Fusarium wilt)
- Dieback, slow decline, thinning
 - Vascular pathogens (e.g., Fusarium wilt, bacterial wilt)
 - Root-related (disease or abiotic)
 - Environmental stress
 - Transplant shock
- Cankers or lesions
 - Fungal or bacterial disease (e.g., bacterial canker, ashy stem blight)
 - Mechanical injury (e.g., tillers, equipment)
- Fungal structures, sclerotia
 - Black, irregular (lettuce drop, timber rot)
 - Tan/brown, round, external (southern blight)
- Cracks or wounds
 - Sunscald or freeze injury
 - Mechanical injury (e.g., tillers, equipment)
- Galls or swellings
 - Insects
 - Bacteria (e.g., crown gall)
- Holes or insect tunnels, frass
 - Borers (e.g., squash vine borer)



FIGURE 10. FUSARIUM FRUIT ROT ON PUMPKIN.



FIGURE 11. PHYTOPHTHORA FRUIT ROT ON SUMMER SQUASH.



FIGURE 12. TIMBER ROT OF TOMATO; NOTE FUNGAL BODIES (SCLEROTIA) INSIDE STEM.



FIGURE 13 SOUTHERN BLIGHT OF BEET RESULTING IN WILT.



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STEP 4: IDENTIFY THE SYMPTOMS & POSSIBLE CAUSE (CONT'D)
(More than one may apply)

ROOT SYMPTOMS

- Black lesions or browning/root decay
 - Excessive mulch
 - Root disease (e.g., nematodes, Pythium rot, Rhizoctonia rot, Phytophthora rot)
 - Poor Drainage
 - Flooding
- Restricted roots/stunted roots
 - Inhibited growth due to sidewalk, road, or other obstruction
 - Compaction
 - Girdling root
 - Poor planting practices
 - Hard pan or underlying rock layer
- Galls or swellings
 - Nematode (root knot nematode)



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FIGURE 14. OOZING SAP FROM FUNGAL LESION ON STEM (GUMMY STEM BLIGHT ON MUSKMELON).

FIGURE 15. IT MAY BE NECESSARY TO DIG UP PLANTS TO EXAMINE ROOTS FOR LESIONS (RHIZOCTONIA ROOT ROT ON POTATO).

FIGURE 16. COMPACTED SOIL CAN LEAD TO STUNTED ROOTS (CARROTS).

STEP 5: CONCLUSION

After assessing the affected plant(s) and surrounding area, it may be necessary to contact a local Cooperative Extension Service office for assistance. For difficult diagnoses, the Extension office may elect to submit the sample to the UK Plant Disease Diagnostic Lab. Information gathered using this guide, along with plant samples, photographs, and submission form, can be very helpful in making a definitive diagnosis.

Before collecting samples to submit for diagnosis, see *Submitting Plant Specimens for Disease Diagnosis* (PPFS-GEN-09).

RESOURCES

- Plant Pathology Extension Publications
<http://plantpathology.ca.uky.edu/extension/publications>
- Entomology Extension Publications
<https://entomology.ca.uky.edu/entfacts>
- Horticulture Extension Publications
<http://www.uky.edu/hort/>
- Submitting Plant Specimens for Disease Diagnosis (PPFS-GEN-09)
<https://plantpathology.ca.uky.edu/files/ppfs-gen-09.pdf>
- Kentucky Mesonet (Western Kentucky University)
<http://www.kymesonet.org/>

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