BALLTECH ON DEMAND™

Ball Seed®

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TECH TRAINING:
PLANT HEALTH DIAGNOSTICS PART IV: FOLIAR DISEASES

Identifying the exact cause of disease symptoms on the leaves can be challenging due to the wide range of symptoms that vary among species and cultivars. Fungal, bacterial and viral pathogens can cause similar diseases, and proper identification is crucial for implementing the best treatment and control measures. While lab analysis may be necessary to determine the specific pathogen, many diseases can be identified and treated through a combination of in-house testing and diagnostics.

Tip 1: Describe Symptom Appearance and Distribution

- Disease symptoms tend to appear sporadically throughout a crop with varying levels of severity.
    - Are symptoms affecting a specific variety or species?
- Common foliar signs and symptoms include:
    - Leaf Spots—Chlorotic (yellow) or necrotic (brown) spots, can be fungal, bacterial or viral.
    - Distortion—Cupping, strapping and abnormal growth, often viral.
    - Blight—Rapid foliar chlorosis, necrosis and collapse.
    - Mosaic / Mottle—Patterned discoloration, typically viral.
    - Sporulation—Fungal growth on the leaf surface.

Mosaic symptoms on petunia from tobacco mosaic virus (TMV).

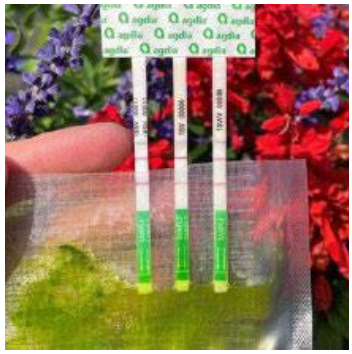
Tip 2: Consider the Environment and Vectors

- The pathogen, a susceptible host and a conducive environment are required to cause disease.
- Temperature and humidity are key factors for disease development.
    - For example, downy mildew prefers cool and humid conditions while powdery mildew prefers warm and humid conditions.
- Diseases can spread from tools, pests and splashing water.
    - Determine if these factors are present or have occurred.

Downy mildew sporulation on the underside of an impatiens leaf.

Tip 3: Confirm with In-House or Lab Testing

- Know and recognize the common diseases for your crops.
- Use ImmunoStrips from Agdia to test key pathogens including:
    - Tobacco Mosaic Virus (TMV)
    - Impatiens Necrotic Spot Virus (INSV)
    - *Xanthomonas hortorum* pv. *pelargonii* (*Xhp*)
- If in doubt, send samples for lab-based diagnostics.
    - **It is best to confirm the pathogen for proper treatment and control measures.**



ImmunoStrips can provide quick in-house disease test results.

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Foliar Diseases. Some of the common fungal foliar diseases include botrytis blight, powdery mildew, *Septoria* or *Alternaria* leaf spot and anthracnose. Downy mildew is one of the common foliar diseases caused by fungal-like oomycete pathogens. Common bacterial pathogens causing leaf spots and steaking include *Xanthomonas*, *Acidovorax*, *Pseudomonas* and *Erwinia*. There are a vast number of viral pathogens causing foliar diseases, but some of the most common include Tobacco Mosaic Virus (TMV), Impatiens Necrotic Spot Virus (INSV) and Tomato Spotted Wilt Virus (TSWV). Accurate symptom description and identification is essential for implementing the correct treatment and control measures.

Leaf Spots. A "spot" is a relatively vague term that requires further descriptions to not only identify the particular pathogen, but even to simply determine if the pathogen is fungal, bacterial or viral. Bacterial and fungal leaf spots can be difficult to distinguish. Typically, bacterial leaf spots tend to be more prevalent in warm conditions, while fungal leaf spots are more prevalent in cool conditions. Another distinguishing factor is that bacterial leaf spots may have a water-soaked appearance while fungal leaf spots tend to look dry and desiccated. Fungal leaf spots may also have visible fungal sporulation if conditions are conducive. Viral leaf spots are often distinct due to the characteristic ringspot symptom that appears as concentric rings.

Mildews and Rusts. Powdery and downy mildews are two diseases that commonly affect greenhouse crops and are often confused due to similar symptoms. Powdery mildews are caused by several fungal pathogens which cause white, powdery fungal growth on the upper side of the leaf. In contrast, downy mildews are an oomycete or water mold that typically cause grayish sporulation to grow on the underside of the leaf. Rusts are another group of fungal diseases that causes pale spots that develop spore-containing pustules that are often rust colored but can be other colors like white, black or yellow.

Distortion and Abnormal Coloration. Some diseases, particularly those caused by viral pathogens, can cause leaf distortion that looks like auxin herbicide drift. Specific distortion symptoms include cupping and strapping. Viral pathogens can cause other abnormalities including mosaic and mottle patterns on leaves and color breaks in flowers. Viral diseases often cause stunting, but this can be difficult to notice and identify unless other viral symptoms are present.

Pathogen Testing. Testing is the best way to correctly identify and treat diseases when symptoms are observed. Some diseases have characteristic signs and symptoms, such as powdery mildew, but many others can be hard to distinguish without proper testing. In-house testing can be achieved using ImmunoStrips from Agdia—see previous Tech Training covering On-Site Pathogen Testing. These are a quick and easy way to narrow down potential pathogens, so growers should consider keeping some test kits on hand for the most common diseases faced for their crops. Sometimes ImmunoStrips are inconclusive, or may not be available for a particular pathogen, in which case plant samples should be submitted to diagnostic labs for analysis. Diagnostic labs can include private organizations like the labs at Ball Helix or through public institutions such as your local university. *It is best to have testing kits on-hand and preferred labs identified prior to the start of the growing season.*

For more information, check out these additional resources:

Tech on Demand. Plant Health Diagnostics Part I: Identifying Symptoms.
Tech on Demand. On-Site Pathogen Testing.
Michigan State University. The basics of diagnosing greenhouse floriculture problems.