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COMMON DISEASES OF BEDDING PLANTS

Growing and maintaining healthy plants are the primary objectives of bedding plant growers and one of the key challenges to each crop is disease control. Certain diseases occur with such frequency that they are considered primary problems such as damping-off and Botrytis blight. Other diseases occur with less frequency and are considered secondary or occasional problems. Among these are powdery mildew, fungal leaf spots, and Rhizoctonia aerial or web blight. Growers also encounter unusual problems such as the parasitic seed plant dodder.

The development of plant diseases in the greenhouse is influenced by many factors. In fact, disease *cannot* occur unless there is a susceptible plant host, a disease-causing agent, and a favorable environment. In the case of some diseases (e.g. those caused by some viruses and phytoplasmas), disease cannot spread without the presence of an insect vector or carrier. Plants are continually challenged by disease agents which gain entrance into the greenhouse in many ways. Some are brought in on infected plants from suppliers or through exchange between growers, others with infested soil, equipment, and clothing, and yet others from windblown fungal spores, aerosols containing bacteria, and insects capable of transmitting viruses and phytoplasmas. The warm, humid, and usually wind-free conditions common to most greenhouses are not only favorable for plant growth but are also ideal for the development and spread of many plant diseases.

The best strategy for disease control is *prevention*. Because of the opportunities for intensive management of greenhouse crops, growers have great flexibility in their ability to effectively integrate a program of sanitation, cultural manipulations, genetic resistance, and appropriate pesticide usage for disease control into their crop production plans.

I. STEPS FOR DISEASE PREVENTION AND CONTROL:

A. *Diagnosis-*

knowing what you're trying to control; **accurate diagnosis is critical for successful disease control;**

B. *Assessing the Severity of the Problem-*

1. Nature of pest problem-

type of disease, i.e., root vs. foliar, systemic vs. localized

2. Level of disease-

loss threshold, i.e., amount of disease, number of plants or flats infected

C. *Control Options-*

1. Culture:

this includes cultural methods that modify the plant's growing conditions; maintaining optimum plant vigor by proper watering and fertilizing; appropriately timed transplanting; adjusting pH of the soil mix or planting medium; use of spacing, heating, and ventilating to maintain a relative humidity < 85% and to prevent condensation

2. Sanitation:

- involves the use of certified seeds, vigorous, healthy, disease-free cuttings, or plants (virus- and/or culture-indexed); use of sterile, well-drained media; disinfesting tools, propagating benches, and containers; removing plant debris; roguing and destroying infected plants

3. Resistance:

- involves the use of resistant/tolerant cultivars; plants with genetic resistance to specific diseases when available

4. Chemical:

- involves the use of pesticides which are registered for control of specific diseases; proper selection and timing of pesticide applications are **very** important; it is also very important to **thoroughly** read the pesticide label; the current status of many fungicides is unstable and labels are frequently being modified; specific recommendations for pesticide applications for commercial growers can be found in the current edition of the *New England Greenhouse Floriculture Guide, A Management Guide for Insects, Diseases, Weeds, and Growth Regulators*.

II. PRIMARY DISEASE PROBLEMS:

A. Damping-Off and Related Root Rots-

1. Symptoms: Damping-off is the most important disease of bedding plants which results in the destruction of seeds and young seedlings by soil-borne organisms. Two types of damping-off occur which can threaten crops from the time of seeding until sales. Preemergence damping-off occurs when germinating seeds are attacked and rot before they break through the soil. This is recognized by bare spaces in what should be uniform rows of seedlings and by poor stands. Postemergence damping-off occurs when newly emerged seedlings topple over or wilt. Succulent stems often have necrotic, water-soaked lesions at the soil line. In many cases, a circular pattern of collapsed plants develops in the seedling flat as the fungus moves out from the point of initial infection.

2. Causal Agents: several fungi including *Pythium*, *Phytophthora*, *Fusarium*, *Rhizoctonia*, and *Thielaviopsis*

3. Commonly Affected Plants: all seeds and seedlings are susceptible

4. Control Measures:

- a. good sanitation, including use of pasteurized soil or soilless mixes, clean benches, and new or disinfested flats or pots; avoid contamination of mixes and containers during storage
- b. buy fungicide treated seed or use alternative preplant seed treatments
- c. promote optimum growth and vigor by providing bottom heat to maintain media temperatures of 70-75°F to assist germination
- d. avoid overwatering and overfertilizing
- e. apply fungicide drenches or sprays of appropriate fungicides such as etriadiazole, etriadiazole + thiophanate methyl, thiophanate methyl, and PCNB

B. Botrytis Blight-

1. **Symptoms:** Botrytis symptoms can develop on any above-ground plant part including leaves, stems, and flowers. Symptoms first appear as soft, tan to brown dead areas that rapidly enlarge under moist conditions. This disease is usually associated with losses mid- to late in the production cycle but the fungus can also attack germinating seeds or seedlings, particularly if they are injured or excessively crowded. Botrytis readily attacks tender succulent tissues, wounded tissues, and senescing plant parts and flowers. A diagnostic feature of this fungus is its ability to produce characteristic brown, fuzzy masses of airborne spores on surfaces of necrotic or senescing tissues.
2. **Causal Agent:** *Botrytis cinerea*
3. **Commonly Affected Plants:** vast host range including most herbaceous ornamentals
4. **Control Measures:**
 - a. *sanitation is critical!* all dead and dying plant tissues, weeds, and plant debris should be removed from the greenhouse prior to the start of each crop *and* during the entire production cycle
 - b. avoid overhead irrigation or splashing during watering
 - c. regulate RH by ventilating, heating, and circulating air
 - d. time seeding and transplanting to avoid holding plants any longer than necessary before selling
 - e. provide adequate spacing for good air circulation between plants
 - f. apply appropriate chemicals for control including iprodione, chlorothalonil, trifloxystrobin, azoxystrobin, and fenhexamid; it is very important to alternate the type or class of fungicides used and to monitor for resistance in the *Botrytis* population

III. SECONDARY DISEASE PROBLEMS:

A. Powdery Mildew-

1. **Symptoms:** Mildew infections are recognized by the white powdery appearance they impart to infected plant parts. Infections are often limited to the upper surfaces of leaves but can occur on both surfaces. Young foliage, stems, and flowers are usually most susceptible although older tissues of certain plants may also be susceptible. Severe infections result in yellowing and curling of leaves, stunting, distortion, and necrosis but rarely cause plant death. However, infections nearly always reduce the aesthetics as well as the market value of the plants.
2. **Causal Agents:** several genera of fungi, *Erysiphe*, *Oidium*, *Sphaerotheca*
3. **Commonly Affected Plants:** wide range of ornamentals, particularly susceptible are *Cosmos*, *Phlox*, *Verbena*, *Begonia*, and *Viola*
4. **Control Measures:**
 - a. good sanitation in and around the greenhouse; remove weed hosts to reduce inoculum
 - b. use air movement to reduce localized pockets of high RH and leaf wetness and provide adequate spacing between plants
 - c. maintain optimum plant vigor without excess nitrogen fertilization

- d. select and apply appropriate fungicides such as chlorothalonil, thiophanate methyl, sulfur, and thiophanate methyl + mancozeb

B. Rhizoctonia Aerial/Web Blight-

- 1. Symptoms:** Infections often start with small water-soaked spots on leaves or stems of seedlings. When conditions are favorable, spots expand to encompass entire leaves and seedlings frequently collapse. Characteristic white to gray, web-like strands of the fungus appear on the infected seedlings under conditions of high temperature and high RH.
- 2. Causal Agent:** *Rhizoctonia* spp.
- 3. Commonly Affected Plants:** any bedding plant
- 4. Control Measures:**
 - a. usually only a problem under extremely humid, warm conditions so spacing, circulating air, and moderating greenhouse temperatures are important for management
 - b. avoid overhead watering or water early in the day
 - c. apply appropriate fungicides for control such as chlorothalonil

C. Fungal Leaf Spots-

- 1. Symptoms:** Necrotic spots or blighted tissues appear as defined dead areas on leaves and stems. These spots are often brown and have white to tan centers with dark margins. Symptoms may first be visible on lower foliage or on plants in the center of the bench or flat where leaves tend to stay wet for longer periods of time due to poor air movement.
- 2. Causal Agents:** numerous fungi, including *Alternaria*, *Septoria*, *Cercospora*
- 3. Commonly Affected Plants:** almost all bedding plants but particularly susceptible are *Zinnia*, *Viola*, and *Petunia*
- 4. Control Measures:**
 - a. good sanitation in and around the greenhouse to reduce inoculum
 - b. eliminate free water on leaf surfaces by adequate spacing between plants, watering early in the day or avoiding overhead watering
 - c. when symptoms first appear, apply appropriate fungicides such as thiophanate methyl + mancozeb, iprodione, and chlorothalonil

D. Tospo Viruses (Tomato Spotted Wilt Virus and Impatiens Necrotic Leaf Spot Virus)-

- 1. Symptoms:** Depending on plant host, symptoms are highly variable. These include stunting, ringspots, discolored veins, black to purple streaks on stems, sunken purple-brown lesions on leaves, stems, and petioles, and bud drop.
- 2. Causal Agents:** Tomato Spotted Wilt Virus and Impatiens Necrotic Leaf Spot Virus;
Vector: nine species of thrips but the most important species is the Western Flower Thrips, *Franklinia occidentalis*
- 3. Commonly Affected Plants:** almost all bedding plants are susceptible but losses are significant in impatiens, begonia, and vegetable transplants such as tomato and pepper

4. Control Measures:

- a. good sanitation, including weed control in and around the greenhouse
- b. inspect cuttings and plugs **thoroughly** before allowing them into the greenhouse; routinely inspect crop for symptomatic plants and rogue and destroy infected plants as soon as detected
- c. monitor and control thrips in the greenhouse; consider use of petunias as indicator plants

IV. UNUSUAL PLANT PROBLEM:

A. Dodder-

1. Symptoms: Recognized as orange-to-yellow, leaf-less, threadlike strands or vines that occur in tangled patches on individual plants or in flats. This parasitic seed plant attaches to the host plant by producing haustoria or suckers which absorb nutrients. Young seedlings are often strangled and killed by dodder. Older host plants may not be killed but exhibit stunting and symptoms of poor nutrition and stress.

2. Causal Agent: *Cuscuta* spp.

3. Commonly Affected Plants: any plant but dodder can be a contaminant in seeds of similar size such as impatiens

4. Control Measures:

- a. purchase certified, properly cleaned seed
- b. rogue and destroy infested plants as soon as they are evident and before the dodder begins to flower
- c. pre-emergence herbicides?

V. EXAMPLE OF A DISEASE PREVENTION PROGRAM FOR BEDDING PLANTS:

In many cases it is helpful to give some thought to the crop that you are growing *before* the production cycle begins. Consider what problems you have encountered in the past and the frequency in which they occurred. This may be very different for each grower. Problems can be categorized into those that are definitely problems unless protective measures are taken, those that are rarely problems under normal production practices, and those that are rare but when they do occur, can be devastating and require quick action once detected. The following is an example of a disease prevention program for bedding plants based on the problems highlighted by this handout.

DISEASE PREVENTION PROGRAM

Crop Production Stage	Prevention Practice	Purpose
Preparation for planting seed and/or plugs	Disinfest trays, flats, benches, and equipment before use; Prepare planting mix; fumigate or steam mix or use soilless mix; store so as to prevent contamination; Check pH and adjust to 4.5-5.5 if necessary;	Diseases prevented: -damping-off and related root rots
Time of seeding for plugs or seedlings	Disinfest and thoroughly clean seeder machine weekly and/or between each seed lot; Avoid high density seeding; Apply appropriate fungicide drenches to seeding flats of petunias, pansies, and vinca immediately after seeding; Germinate seed under high humidity and at the optimum temperature for each plant species, if possible; When seedlings emerge, remove trays from high humidity germination chambers and treat for water mold diseases (<i>Pythium</i> , <i>Phytophthora</i>); Monitor weather for conditions favorable for Botrytis (cloudy, damp days);	Diseases prevented: -damping-off -general disease control -damping-off and related root rots -Botrytis blight
Transplanting and growing plants	Prepare media for transplanting; pasteurize or fumigated soil-based mixes or use soilless media; adjust pH to 4.5-5.5; Work on clean benches and use new or disinfested pots or cellpacks; Keep walkways clean and free of plant debris; Set up system for monitoring thrips population using sticky traps or indicator plants such as petunias;	Diseases prevented: -damping-off and related root rots -Rhizoctonia web/aerial blight -Botrytis blight -Impatiens necrotic leaf spot

Do not overfertilize, especially with ammonia nitrogen products; -general disease control
 Immediately after potting, begin weekly scouting program for disease;

DISEASE PREVENTION PROGRAM (cont'd)

Crop Production Stage	Prevention Practice	Purpose
	rogue and remove infected plants; After first watering of transplanted seedlings, drench with an appropriate fungicide to prevent water molds and Rhizoctonia;	-damping-off and related root rots
	Vent and heat to reduce relative humidity; space plants for good air circulation; Avoid overhead watering or water early in the day;	-general disease control including fungal leaf spots and powdery mildew
	In cool, cloudy weather, apply preventative fungicides for Botrytis control; monitor <i>Botrytis</i> populations for evidence of fungicide resistance;	-Botrytis blight
	After periods of high temperature and humidity, scout for Rhizoctonia aerial/web blight;	-Rhizoctonia aerial/web blight

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