

Sources Of Plant Disease In Greenhouses

Where do diseases begin? The greenhouse manager who can answer this question is in an excellent position to prevent losses due to plant pathogens by reducing or eliminating the numbers of pathogens at their source.

The major sources of living things that commonly plague greenhouse crops are noted here. After reviewing this article, make an inventory of the practices you employ in your operation and note which make your crops vulnerable to a disease problem and which help avoid diseases.

Infested Soil

Many plant pathogens can be found in soil. Fungi such as Pythium, Phytophthora, Fusarium, Rhizoctonia, and Thielaviopsis, crown gall bacteria (Agrobacterium) and most nematodes reside in the soil. Pythium species are found in sand and peat as well. When greenhouse crops are potted in a mix containing these pathogens, the pathogens are stimulated into activity by nutrients that leak from the plants' roots and disease may begin. Therefore, the potting mix must be free of pathogens before planting. A potting mix that has been treated to kill plant pathogens or a soilless mix purchased with the assurance of being free of pathogens should be handled as if it were food and kept free of unwanted organisms. It should be stored on a clean surface, moved with clean implements to a clean potting bench, and placed in clean pots or flats.

No matter how careful a grower is, disease caused by soilborne pathogens still can occur. Besides the potting mix, soil is found many other places in the greenhouse. Soil is usually under benches, in aisles, and in the benches in older greenhouses. Soil is brought into the greenhouse on workers' and pets' feet, on machinery used to move materials into the greenhouse, and on crates, flats, and boxes stored outdoors unprotected on the ground. Care must be taken to avoid getting this soil that may be contaminated into the potting mix. Tools, hose ends and other things that have the potential of moving pathogen-containing soil into a pathogen-free potting mix must be thoroughly cleaned and

disinfested. If old benches are full of soil, the soil should be sterilized or covered with clean plastic sheets to separate it from the potted plants placed on the bench.

Debris from Previous Crops

Most plant pathogens have a stage in their life histories that can rest in a dormant state and survive periods of time when temperatures are extreme or moisture is not sufficient for growth. Some pathogens have evolved a strategy of becoming dormant in the dead leaves, stems, and roots where they previously caused disease. Inside those tissues they are protected from the hostile environments of the soil and air and are away from competition with other organisms in the soil and air. They have at hand a ready supply of nutrients when conditions become favorable again. Bacteria such as *Erwinia chrysanthemi*, fungi such as *Botrytis* and *Pythium*, foliar nematodes (*Aphelenchoides*), and tobacco mosaic virus, survive for months in plant debris. A disease may recur if infested debris is left in the greenhouse where it may come in contact with the next crop.

Plants Kept All Year

Some pathogens must have living plant tissues in order to grow, reproduce, and survive. Viruses like impatiens necrotic spot and cucumber mosaic only survive in living plant cells. Rusts, such as geranium or fuchsia rust, must pass from living plants to other living plants or they die within weeks. Powdery mildew fungi may be on grape ivies, begonias, roses, and African violets unnoticed or at a level of severity thought insignificant until they later to explode into activity. Similarly, *Botrytis* on geraniums can usually be found on branch stubs and fading leaves and flowers most of the year. When light, humidity, and temperature conditions turn in favor of these pathogens, disease can seem to appear and spread rapidly when, in fact, the problem had been building for some time. Thus, plants kept in the greenhouse all year act as reservoirs of pathogens and should be under strict disease control.

Weeds (especially bittercress and oxalis) fall under this heading as do plants such as *Tradescantia* and English ivy

that are allowed to escape and grow under benches. Plants found all year in the greenhouse not only harbor pathogens, they are excellent havens for the thrips, whiteflies, and aphids that can spread diseases.

Vegetatively Propagated Crops

Cuttings purchased each year may be new to your greenhouse but someone, somewhere had them and the stock plants in the greenhouse all year. Thus, the problems mentioned in the above section apply to vegetatively propagated plants. Any disease affecting stock plants is likely to be found on cuttings taken from those plants, particularly if the pathogens reside inside the plant. Vascular wilt diseases such as *Ralstonia* and bacterial blight of geraniums, *Fusarium* wilt of chrysanthemums and *Verticillium* wilt of impatiens; virus diseases caused by dasheen mosaic, impatiens necrotic spot, and tomato ringspot viruses; foliar nematodes in chrysanthemums, begonias, and African violets all will accompany cuttings if stock plants are infected. The propagator must assume responsibility for strictly controlling diseases and insects on stock plants so that these pests are not sold to the customer on the cutting. The customer must inspect purchased material carefully as soon after arrival as possible. If inspection is put off until the plants have been in the greenhouse many days, it is not possible to be certain whether the pathogens accompanied the cuttings or moved to the cuttings from sources within the greenhouse.

Culture indexing systems have been devised to determine that plants are free of major fungi, bacteria, and nematodes affecting the crop and virus indexing was developed to be certain those plants do not harbor the most important viruses that threaten the crop. Once indexed plants are purchased and placed in a producer's greenhouse, it may only be a matter of time before the plants again become infected with the pathogens for which they had been indexed. Indexing does not guarantee the future health of the plant. As the time during which indexed plants are kept in the greenhouse passes, the likelihood that diseases will occur increases.

It is important to realize that indexed plants are only examined for some disease-causing organisms. Culture and virus indexed plants are not necessarily "disease-free". That is, disease-causing organisms other than those for which indexing was done may be present. For example, to my knowledge, no company indexes for *Botrytis*. However, in crops where culture and virus indexing is done, the probability of serious losses due to organisms carried on or in the cuttings is greatly reduced.

Water

Phytophthora and Pythium, which can cause root and stem rot, and cutting rots are probably the main pathogens that can be brought into the greenhouse in water.

Surface water such as lakes, ponds, rivers, and streams contain *Pythium* or *Phytophthora*. Run-off can carry these and various fungi from the soil into wells. Care should be taken to avoid pumping bottom sediment from water supplies into the greenhouse irrigation system. *Pythium* and *Phytophthora* are major problems in hydroponic systems and can become important in ebb and flow systems.

Air

The spores of powdery mildew fungi, *Botrytis*, rust fungi, *Alternaria*, and others can be carried by air currents from outdoor plants into the greenhouse. Infected plants in nearby gardens and weeds close to the greenhouse can supply enormous numbers of spores. Thus, even if great care is taken to eliminate other sources of pathogens, the air we breath may carry certain disease-causing organisms. During the warm months, it is critical to maintain greenhouse conditions that inhibit pathogen activity and to eliminate non-crop sources of pathogens around the greenhouse. However, cautious use of herbicides near the greenhouse is called for since many crops have been ruined when herbicide vapors have been drawn in by fans or natural air currents. Since most greenhouse crops are dicotyledenous plants and very few pathogens attack both monocots and dicots, consider establishing a grassy lawn around the greenhouse.

Conclusion

These are the major sources of living things that cause diseases in greenhouse crops. There are other sources but these are the first to suspect when trying to answer the question "Where did the disease begin?" Every greenhouse manager should be aware of the sources of pathogens for each crop grown in their particular operation and should plan to eliminate those sources of disease. Money can be saved by not losing plants during production and by minimizing the expense of purchasing and applying disease control chemicals.

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