

DIAGNOSING GREENHOUSE TROUBLESR. E. Widmer¹ and H. G. Johnson²

Crop failures and crops of borderline quality cannot be tolerated in today's business climate. They constitute a luxury no one can afford. On the other hand, the grower who consistently produces crops of top quality need not fear competition. The grower with borderline quality is the one who may be unable to sell a large portion of his crop, even at below-cost prices.

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No grower is immune to troubles, but the good grower is the one who attempts to prevent trouble before it starts, and who, when trouble does develop, spots his difficulty and quickly and promptly remedies the situation. But, this is easier said than done. The cause of the difficulty cannot be removed until it is actually known.

Although extension and faculty personnel at the University, as well as good salesmen, are interested in helping growers whenever requested, they are not always free to visit your greenhouse as soon as may be desirable. This is especially true in the case of out-state greenhouses. A grower must, therefore, often attempt to diagnose his own difficulty as quickly as possible, so as to minimize injury to the crop.

Determining the cause of the difficulty may be rather complex at times, as so many factors must be considered. The following outline has been prepared primarily to help the grower to help himself. Taking time out to thoroughly analyze the situation may frequently provide the desired answer. A grower should never be too busy to stop and think about what he is doing and why he is doing it.

General

I. Symptoms

- A. Are they restricted to certain varieties, particular locations in the bench or greenhouse or scattered throughout the crop?
- B. Are they associated with the cultural handling of the plants?
- C. Are they associated with any particular age or stage of development of the crop?
- D. Are they associated with weather conditions or season of the year?
- E. Are the symptoms progressive or stable, once established?

The objective is to seek any patterns which may limit the possible causes. Knowledge of a crop from past experience and that gathered from reading and talking with other growers, as well as a record of the handling of the crop, is highly desirable.

II. Causes

- A. Cultural practices.
- B. Infectious diseases caused by fungi, bacteria, virus or nematodes.
- C. Insects.

Specific

I. Culture

- A. Starting plant material.
 1. Seeds
 - a. Fresh
 - b. True to name
 - c. Proper variety
 - d. From a reliable source.

2. Young plants

- a. Clean and healthy
- b. True to name
- c. Proper variety
- d. Proper growing condition - neither too succulent nor too hard.

B. Soil

1. Nutrients

- a. Excess or deficiency = individual nutrients in balance with each other?
- b. Reliable soil tests eliminate guess work. The Soils Department tests florists' samples regularly on Thursday of each week.

2. Moisture

- a. Excess or deficiency - enough added to permit dripping out of the bottom of the bench or pot - uniform application? Be sure water applied is not dripping out because it is running through cracks or channels rather than thoroughly wetting the soil.
- b. Water quality: high in salts or alkaline?
- c. Good drainage: openings in bench bottom, holes in pot not clogged?
- d. Time of day watering is done?
- e. Frequency of application?

3. Texture

- a. Moisture-holding capacity
- b. Aeration
- c. Drainage.

4. Temperature

- a. Cold: ground beds near outside wall?
- b. Hot: heat pipes against bed or bench?
- c. Air space between outside wall and side bench?

C. Atmosphere

1. Light

- a. Proper intensity: clean glass, shade where necessary?
- b. Proper photoperiod: age and condition of black cloth, size and spacing of light bulbs, influence of light from next greenhouse, adjacent homes, street light, car headlights?
- c. Duration and uniformity: shade from gutters, chimneys, adjacent structures, evergreens, black cloth stored above the bench, ice and snow on the glass?

2. Temperature

- a. Proper for crop day and night?
- b. Thermostat at plant level?
- c. Accuracy of thermometers checked at frequent intervals?
- d. Uniformity throughout house?
- e. No sudden changes - recorders eliminate doubt.

3. Aeration and humidity

- a. Insufficient ventilation - air cooling may cure.
- b. Drafts eliminated?
- c. Uniform ventilation?
- d. Foliage dry especially at night?
- e. Controlled humidity?
 - (1) Excess - coordinate heat with operation of vents.
 - (2) Deficiency - most likely on cold winter nights or hot, windy summer days.
 - (3) Carbon dioxide deficiency?

4. Spacing

Adequate and proper for light, air circulation and development requirements of the plant? The space outside the pot makes the plant. No competition from weeds.

5. Gases

- a. Fumes from improper combustion in heating plant?
- b. Oxygen deficiency - plastic house too tight to keep flame burning if heater is in greenhouse proper?
- c. Gas leaks - underground outside greenhouse when soil is frozen in winter.
- d. Ammonia gas from manure mulch - manure too fresh?
- e. Fumes from weed killers.
 - (1) Did weed killer contact heating pipes when applied under benches?
 - (2) Weed killers such as 2,4-D used to spray weeds around and over lumber in lumber yards? If such lumber is used for plastic house or bench construction, fumes may cause injury once the vents are shut during heating season.
 - (3) Careless use of volatile weed killers such as 2,4-D outdoors near greenhouse?
 - (4) Mercury volatilization from broken thermometers or chemicals used for insect or disease control? Roses are especially sensitive.
- f. Fumes from soil-sterilant chemicals?

6. Mechanical and other damage.

- a. Careless employees or visitors?
- b. Animal life?
 - (1) Cats
 - (2) Birds
 - (3) Rats.
- c. Steam pipe leaks?
- d. Improper supports?
- e. Plants pinched into hard rather than soft tissue?

II. Diseases caused by fungi, bacteria, virus or nematodes.

A. Leaf disorders - symptoms and causes. (Similar symptoms may frequently be caused by or intensified by faulty cultural practices.)

1. Spotting - fungus, bacteria, foliar nematode.
2. Yellowing - virus, root rots, wilt.
3. Mottling (mosaic) - virus.
4. Wilting - fungus or bacterial wilt or root rot.
5. Malformation - virus, fungus.
6. Leaf loss or drying - root rot, fungus, foliar nematode.

B. Flower disorders.

1. Spotting - fungi, especially at low temperature and high humidity.
2. Green petals or bracts - virus.
3. Pale color - virus, fungus.
4. One-sided - virus, fungus.
5. Malformed - virus, fungus.

C. Stem disorders.

1. Canker - fungi, bacteria.
2. Gall - bacteria.

D. Root disorders.

1. Seedling damp-off - fungus.
2. Root rots - fungus, nematodes.
3. Root knot - nematodes.

E. Bulb, corm, fleshy rhizome, disorders.

Rot - fungus, bacteria, nematodes.

Disease-free stock, good sanitation and a complete sterilization program help eliminate many diseases.

III. Damage from insects.

1. Stippling - mites, thrips.
2. Chewed plant parts (above ground) - larvae (caterpillars), grasshoppers, snails, slugs.
3. Galls - midge.
4. Stem tunneling - borers.
5. Webbing - mites.
6. Honeydew - scale, aphids, mealy bug.
7. Leaf rolling - leaf tyers.
8. Shed skins - aphids.
9. Crippled terminals - tarnished plant bug, cyclamen mite.
10. Glossy trails - slugs.
11. Leaf tunneling - leaf-miner.
12. Chewed roots - symphylids, sow bugs, millipedes, centipedes.

This outline is of necessity relatively brief. The primary purpose was to list ideas rather than full particulars. In some instances reference to more detailed articles may be advisable, once the cause of the difficulty is limited to a particular phase. One should also keep in mind that the outline does not include all possibilities.

In instances where a grower cannot isolate the cause of the difficulty and outside help is not immediately available, the grower is welcome to contact Mr. C. G. Hard, Extension Horticulturist and Assistant Professor, Mr. J. A. Lofgren, Extension Entomologist and Associate Professor, Mr. H. G. Johnson or R. E. Widmer on the St. Paul Campus, by telephone or mail. Plant samples accompanied by a letter providing a good accounting of the background of the crop are usually quite helpful in making a quick, accurate analysis possible.