Preventing ethylene damage in the greenhouse

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What is ethylene?

Ethylene is a plant hormone. This means that it is produced by plants and it is biologically active at very low concentrations. As a plant hormone it acts as a chemical signal that controls many aspects or normal plant growth and development.

Ethylene is involved in:

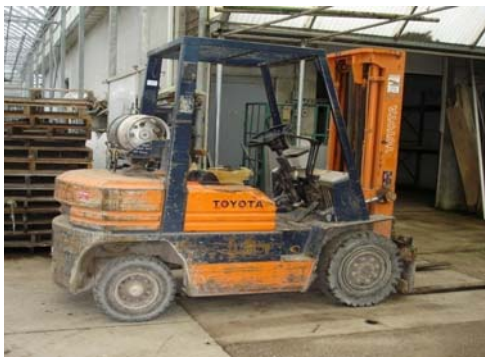
- Fruit ripening
- Flower wilting and senescence (i.e. death)
- Abscission or shedding of leaves and flowers
- Seed germination
- Disease and stress responses in plants
- Flower initiation and sex determination in some plants
- Adventitious rooting

While the negative effects of ethylene gas during handling, shipping, and storage (i.e. postproduction) are well known, most people do not realize that ethylene can damage plants in the production greenhouse. During winter and early spring when there is little natural ventilation, ethylene gas can accumulate to harmful levels.

If you are aware of the sources of ethylene gas in the greenhouse and you recognize the symptoms of ethylene damage, you can minimize crops losses due to ethylene contamination.

Sources of ethylene in the greenhouse:

An improperly functioning heating unit is the most common source of ethylene contamination in the greenhouse.



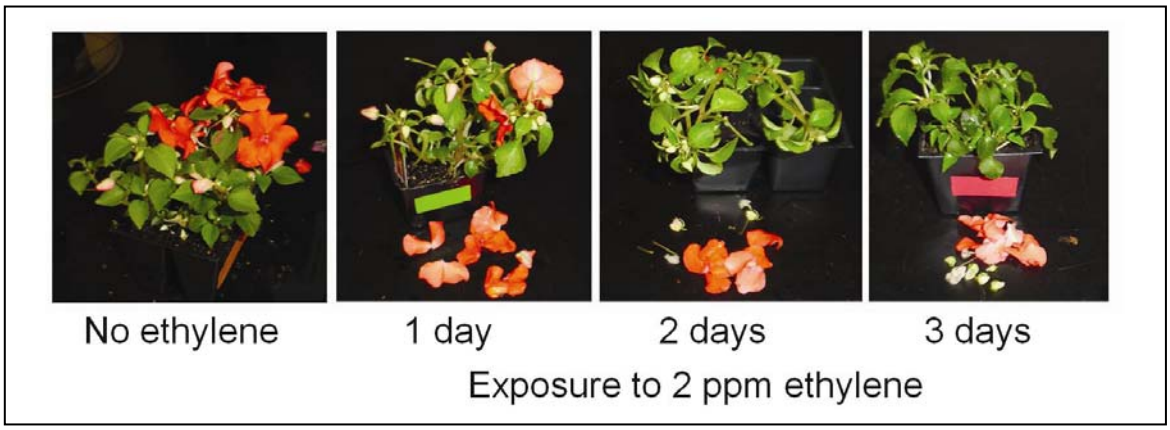
Equipment powered by propane can be a source of ethylene contamination in the greenhouse.

Other sources of ethylene include:

- Exhaust from combustion engines
- Cigarette smoke
- Leaky gas lines or contaminated fuel
- Ripening fruits
- Senescing flowers (i.e. dying)
- Decaying plant material
- Wounded plant tissues

Symptoms of ethylene damage:

The severity of ethylene damage depends on the sensitivity of the plant species to ethylene, the concentration of ethylene, and the exposure time (i.e. duration).

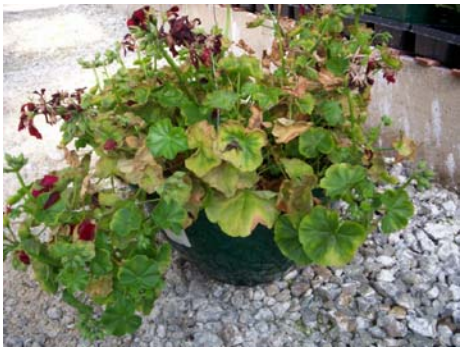


Ethylene dose response in impatiens. Flowers and flower buds abscise when plants are exposed to 2 ppm ethylene gas. The open flowers are more sensitive to ethylene and they are shed before the buds. After 3 days, all the flowers and buds have abscised.

Plants are also more sensitive to ethylene at higher temperatures. In general, young flower buds are less sensitive to ethylene than open flowers, and leaves are less sensitive than flowers.

General symptoms of ethylene damage include:

- Shedding or shattering of petals
- Bud, flower or leaf drop
- Rapid flower aging and wilting (i.e. senescence)
- Epinasty or drooping of the leaves and bracts
- Flower bud abortion
- Leaf yellowing or chlorosis
- Leaf necrosis
- Malformed leaves of flowers
- Stunted growth



Ethylene damage on geranium hanging baskets.

Epinasty or the downward curvature of the petioles is a common symptom of ethylene damage in tomatoes.

Specific symptoms for plant species can be found at the Chain of Life Network website (www.chainoflifenetwork.org). Table 1 lists some plant species that are classified as very sensitive to ethylene. Other plants are also sensitive to ethylene, but the plants in Table 1 are those that should show the first visual symptoms if you have ethylene contamination in your greenhouse. One thing to keep in mind is that ethylene sensitivity can be very cultivar specific, therefore it can be difficult to generalize and classify an entire species.

How to prevent ethylene damage

The proper maintenance and use of heating units is the best way to prevent ethylene damage in the greenhouse. Regular maintenance can identify leaks or cracked heat exchangers that may result in harmful levels of ethylene in the greenhouse. Incomplete combustion can result in the production of harmful gases including ethylene and carbon monoxide. These products should be vented outside of the greenhouse. Adequate ventilation is also needed so that the heaters have enough oxygen for complete combustion to reduce the production of these byproducts.

Other things you can do to prevent ethylene damage in the greenhouse include:

- Use electric carts or bicycles rather than modes of transportation that utilize gasoline or propane
- Clean up all dying and damaged plant materials

How do you determine if you have ethylene contamination in your greenhouse?

The best way you can determine if you have ethylene in your greenhouse is to carefully monitor plants that are sensitive to ethylene for the symptoms listed above. If you suspect that you have an ethylene problem, you can use place indicator plants in the greenhouse. The best indicator plant is tomato, which will show downward bending of the leaves when exposed to very low concentrations of ethylene. This downward

growth of the petioles is called epinasty. If you observe these symptoms you must act to remove the source of ethylene and ventilate the area to remove the ethylene gas. Ethylene damage may easily be confused with other types of stress that cause similar damage. If you suspect you may have an ethylene problem or you would just like more information please feel free to contact me. We can also use an instrument called a gas chromatograph to determine if ethylene levels in your facility are high.

Use tomatoes as an indicator plant. Ethylene will cause epinasty. Growing tomato plants under a heater will help you determine if you have ethylene contamination before other plants are damaged.

Photo courtesy of Dr. Peter Ling, OSU.

Table 1: Some ethylene sensitive crops

Crop	Visual symptoms
Achimene	Flower and flower bud abscission
Begonia, wax	Flower and flower bud abscission
Boston fern	Defoliation
Carnation	Accelerated flower wilting, sleepiness
Delphinium	Accelerated flower senescence (wilting)
Geranium	Flowers do not open, petal shattering, leaf chlorosis
Impatiens	Bud, leaf and flower abscission
Impatiens, New Guinea	Bud and flower abscission
Kalanchoe	Buds do not open, petal fading and drying, open florets close
Lily, Easter and hybrid	Floral bud abscission, flower numbers reduced
Orchid, Cattleya	Accelerated flower wilting and senescence
Petunia	Accelerated flower wilting and senescence
Primula	Flower wilting
Snapdragon	Flower abscission
Tomato	Epinasty, no fruit set