Ethylene: The Good, the Bad, and the Ugly

by Dr. H. Marc Cathey

ETHYLENE (C_2H_4) is a colorless, odorless gas naturally produced by many plants as they mature. It may, therefore, come as a surprise that this same compound is considered a hazard both to plants and the environment. The explanation: It is all a matter of quantity, and a little ethylene goes a long way.

Agricultural ethylene—that produced by plants or applied to plants—comprises only a small fraction of what is released into the environment. By far, the most is generated by the incomplete combustion of fossil fuels and the breakdown of a number of industrial chemicals. Scientists are concerned that although they have been able to slow the rate of accumulation of ethylene in the atmosphere, it continues to rise gradually.

PLANT RESPONSES

Ethylene is a plant growth compound that regulates specific physiological processes. Ethylene-triggered reactions vary from species to species and are further influenced by level of maturity, temperature, and other environmental conditions. Responses to ethylene run the gamut from ripening fruit to causing leaf or bud drop (abscission), and from stimulating flowering to delaying flowering. Ethylene also stimulates the elongation of stems and roots of aquatic plants and promotes the germination of some seeds.

UNDERSTANDING ETHYLENE

Understanding how different plants respond to ethylene has many material benefits for gardeners and the horticultural industry.

The flower buds of gardenias are extremely sensitive to ethylene and often drop before they open if plants are stressed and ethylene levels rise. One simple way to reduce bud drop is to spray all developing leaves and flower buds daily with ordinary tap water. This reduces the temperature and water stress, effectively slowing the natural generation of ethylene. As a result, more buds survive to develop into flowers.

Increasing the concentration of ethylene around plants, on the other hand, is widely used by the plant industry to stimulate desirable responses on certain plants. Because ethylene reduces apical dominance—the phenomenon whereby the terminal bud exerts a dominant influence that suppresses the development of lateral buds—it is used to stimulate lateral branching and create bushier, more floriferous plants. For this reason, many common bedding plants—including New Guinea impatiens, bacopas, petunias, and fuchsias—are treated with ethylene-generating compounds.

A similar approach is used with garden chrysanthemums. Monthly foliar applications of ethylene-generating compounds during the summer cause side shoots to develop all over young garden chrysanthemums. Treated plants do not require any hand pinching, and flowering is delayed until fall.

To induce a bromeliad to flower, enclose it with an apple in a plastic bag.

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LESSONS FROM HISTORY

During a trip to Israel in 1970, I visited with a senior horticulturist whose research indicated that the growth regulating characteristics of ethylene have been in use in the Middle East for centuries. He said that in ancient times, immature figs would be coated with rancid olive oil, which caused ethylene to build up inside the fruit, thus accelerating maturity.

At the end of the 19th century, ranchers in Cuba found that smoking pineapple fields accelerated flowering and fruiting. Subsequently, scientists learned that smoke contains ethylene, and today, ethylene is regularly applied to pineapples to induce uniform flowering and fruiting.

You can test this out at home by placing an apple—make sure it's not covered with wax—beside a non-flowering bromeliad and enclosing both with a large clear plastic bag. The apple naturally releases ethylene. After four days, remove the apple; the bromeliad will flower within six weeks to nine months, depending on genus.

So you can see that plants are complex organisms that differ greatly in how they respond to different stimuli. Determining these responses, and how they can be used to our advantage will keep scientists extremely busy for years to come.

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