

The Multiple Roles of the Plant Hormone Ethylene

By Dr. Terry Ferriss, UW-River Falls

Spring brings attention to plant quality issues as greenhouse and nursery products are shipped and enter the retail markets. During production, the plant hormone ethylene, C_2H_4 , is commonly used to enhance the branching and quality of many herbaceous annuals entering the market and yet it can also be the specific cause of deterioration of quality during shipping. The multiple responses to the exposure of plants to ethylene are indicative of the complexity reflective of the multiple roles that ethylene plays as a major plant hormone.

Ethylene (C_2H_4) is a water-soluble gas that is naturally produced by all plants. There are desirable and undesirable plant responses to ethylene. Ethylene is known as the “Ripening Hormone” as it promotes ripening of fruits as well as senescence of flowers and other plant parts. Ripe fruits and plants under stress release increased levels of ethylene. Injured plants and plants bending and swaying in the wind also release ethylene as a “wound response.” Ethylene released from moving plant parts causes a stem thickening and dwarfing response. This is noticeable in un-staked trees in the nursery as well as in plants on the edges of greenhouse benches where the leaves are constantly rubbed or touched. Frequently brushing tomato seedlings with a soft brush attached to a watering boom will release wound ethylene and help to limit seedling height prior to sales.

Avoiding the deleterious effects of ethylene is a major concern during the post harvest handling and shipment of floricultural crops and herbaceous plant material. Ethylene can cause leaf, bud and flower abscission, epinasty, early flower senescence, and leaf yellowing. Ethylene build-up and exposure during shipping is of great concern. Shipping or storing floriculture products with fruits should always be avoided. The exhaust from vehicles is another major source of ethylene that needs to be avoided. Diseased bulbs and dead leaf litter can also release significant levels of ethylene. Plants stored or shipped in boxes and/or plant sleeves can accumulate ethylene in the shipping packaging resulting in severe plant injury. Leaving plants in the packing sleeves for extended periods of time can result in ethylene damage. As the branches are flexed upwards during sleeving, the plants give off ethylene as a wound response to the bending. The ethylene levels can then rise within the sleeve during shipping, resulting in damage. Sleeve as close to shipping as possible and remove the sleeves as soon as possible after delivery to avoid injury. Poinsettias are especially susceptible to injury in this manner.

Examples of deleterious post-harvest exposure to ethylene include: flower bud abscission in Thanksgiving Cactus, hibiscus and other flowering plants, epinasty of poinsettia petioles, flower closing in kalanchoe, and leaf yellowing and flower shattering in geraniums. Proper ventilation, avoidance of ripening or senescencing plant material, cooler temperatures in transit, and the use of potassium permanganate filters are possible means to limit ethylene damage during shipping.

Silver thiosulfate (STS) and Ethyl-Bloc are compounds that inhibit ethylene synthesis in the plant. STS can be sprayed on geranium blossoms when they show 25% color. STS can also be used in the holding water of cut flowers to extend vase life. Ethyl-Bloc is a gaseous

compound that is also used in cut flower post harvest applications by wholesalers and retailers to block ethylene production.

Ironically, ethylene also produces several beneficial effects on plants, of which several are used commercially. Ethylene in its gaseous form is hard to apply, however, ethephon, a liquid form is sold as Ethrel and Florel. Upon spraying these products on a plant, ethylene is produced inside the plant tissue. Uses of ethephon include the following:

1. Promote flowering in Bromeleaceae.
2. Abort early flowers on New Guinea Impatiens.
3. Defoliate Hydrangeas prior to cooling.
4. Manage height control in bedding plants.
5. Increase the number of lateral branches and uniformity of branching on herbaceous crops.

Many growers pinch poinsettias, mums, geraniums, or other herbaceous flowering plants and then 24 hours later, spray them with an ethephon product to improve the branching response of the crop. The result is not only more branches but the branches that form are more uniform in length which makes the plant picture more appealing to the consumer.

Ethylene is an important plant hormone that can be an asset if managed properly.

Terry Ferriss is a member of the MNL A Certification Committee and can be reached at terry.l.ferriss@uwrf.edu.

Sample Exam Questions.

True/False

1. STS is labeled to be used to block ethylene synthesis and thereby inhibit early senescence in cut flowers and potted geraniums.
2. Ethephon / Florel / Ethrel products will inhibit leaf drop in plants.
3. When plants respond to ethylene and/or herbicides by a curling under of the leaves and petioles it is called epinasty.
- 4.

Answers (1-T; 2-F; 3-T)

Multiple Choice (select the one best answer)

1. Ethylene is commonly used in the horticulture industry for:

- a. Seed germination
- b. Promote branching on herbaceous crops
- c. Inhibit senescence on annual color pots
- d. Root stimulator at transplanting
- e. Inhibiting transpiration during shipping

ANSWER: B (Ethylene stimulates branching in herbaceous plants and is normally applied 24 hours after a pinch. Ethylene also promotes more uniform development of the lateral branches resulting in improved plant form and a higher quality plant.)

2. Which practice should be avoided when shipping bedding plants in the spring.
- a. Water within an hour prior to shipping so the plants will not wilt
 - b. Sleeve potted plant materials as close to shipping time as possible even though it may require additional labor allocated to the activity
 - c. Hold boxes of petunia plugs in the headhouse rather than on the tarmac at the airport to avoid ethylene injury
 - d. Groom the plants before shipping to prevent ethylene build-up from dead plant debris
 - e. Verify that the shipment matches the pull order

ANSWER: A (watering too close to shipment increases weight; causes excess moisture in closed compartments which can lead to promotion of diseases)