FloraLife®
Research Update

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Ethylene Effects in Postharvest Floriculture

Background

Plant hormones are chemicals released by different parts of the plant that send signals to initiate different processes of the plant's development such as flower production, leaf fall, flower death and fruit ripening. There are several types of hormones produced by plants. Among these hormones, ethylene is the most damaging one for ornamental plants (cut flowers, bedding plants and potted plants). Ethylene is also unique among plant hormones as it exists as a gas at air temperature. Because of this, ethylene produced by a plant is released into the air and can cause damage to another plant. Ethylene is also produced by smoke, propane heaters, ripening fruit and decaying plant material. These "external" sources of ethylene also act the same way as ethylene produced by plants and can cause the same type of damage to ornamental plants.

As ethylene has no smell or color at levels we see in nature, it is important to understand and recognize ethylene damage symptoms in flowers and take steps to control the damage. Ethylene damage is a major cause of postharvest loss of many cut flowers, bedding plants and potted plants. The symptoms can vary depending on the flower type. For example, carnation flower petals roll inwards in response to ethylene, delphinium and orchid flower buds drop, and alstroemeria leaves turn yellow. The damage due to ethylene depends on three factors:

1. The concentration of ethylene in the environment.
2. How long flowers are exposed to ethylene.
3. The temperature at which plants are exposed to ethylene.

Higher concentrations, longer durations and higher temperature cause more damage.

However, it takes only very low concentrations of ethylene to actually cause damage to plants and cut flowers. Concentrations as low as 10 ppb (parts per billion) have been shown to cause damage to plants. In our laboratory testing of ethylene levels in different phases of flower transport and storage, we often detect ethylene levels exceeding 100 ppb. In supermarket distribution centers where fruits and other perishables are stored together or closer to flowers, the ethylene concentrations can go greater than 1000 ppb in some instances.

Ethylene damage in plants can be prevented by three methods.

1. Reducing the concentration of ethylene in the environment.
2. Inhibiting the internal production of ethylene by flowers.
3. Blocking the action of ethylene.

Blocking the action of ethylene is the most effective method of protecting the ornamental from either its own ethylene or from external ethylene. There are two known technologies by which ethylene action can be blocked.

1. 1-methylcyclopropene (1-MCP) based products can be used as gas treatments for all types of ornamental plants.

   EthylBloc™ Technology from Floralife is an EPA-registered ethylene action inhibitor based on 1-MCP that protects plants from both external and internal ethylene. The following photographs illustrate the protective effects of EthylBloc™ treatments observed during recent experiments. All plants were exposed to ethylene after EthylBloc™ treatment.

2. Silver Thiosulfate (STS) based products can be applied as an uptake treatment for cut flowers.

   Floralife® EthylGuard 100 is a STS-based liquid concentrate uptake treatment that can be used to treat cut flowers at

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farm level immediately after flowers are harvested. Floralife® EthylGuard 100 is used at farms that prefer a short liquid uptake treatment before the shipping of cut flowers. We have done extensive collaborative testing with farms to evaluate the effects of the product. The following photos show the protection of cut flowers from ethylene damage. Flowers were exposed to ethylene gas overnight to induce ethylene damage.

Carnations

Treated with EthylBloc™ Technology

Control (no EthylBloc™ Technology)

Delphiniums

Treated with EthylBloc™ Technology *Control (no EthylBloc™ Technology)*

Snapdragons

Treated with EthylBloc™ Technology *Control (no EthylBloc™ Technology)*

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Phalaenopsis Orchids

Treated with EthylBloc™ Technology *Control (no EthylBloc™ Technology)*

Impatiens

Treated with EthylBloc™ Technology

Control (no EthylBloc™ Technology)

Phlox

Treated with EthylBloc™ Technology *Control (no EthylBloc™ Technology)*

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Carnations

Treated with EthylGuard 100

Control (no EthylGuard 100)

Research on the battle against ethylene damage in floral crops

Due to the potential postharvest damage and loss of quality due to ethylene, the research on combating ethylene damage has always been a priority for scientists around the world. This is true not only for floral crops, but also for other perishables such as fruits and vegetables. There are annual scientific conferences which focus exclusively on the subject of ethylene effects in plants. Since the basic cellular mechanisms are the same, scientists can study techniques and chemistries proven for fruits and vegetables and can apply them to floral crops, and vice versa. Current industry and academic research on ethylene focuses on several aspects. Developing more effective, less expensive and sustainable methods of reducing ethylene concentration in storage and shipping environments of perishables has gained much interest in recent years. Research on different application methods of ethylene action inhibitors such as 1-methylcyclopropene is also a popular area of research. For example, spray application of an ethylene inhibitor would be very useful for greenhouse bedding plants and potted plants. Researchers are also looking for new chemistries that are non-silver based and environmentally friendly. The floral industry can expect more novel, cost-effective and environmentally friendly techniques for combating ethylene damage in the near future.