GROWERTALKS

Cover Story

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Preventing Petunia Flower Meltdown

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Market-ready petunia plants can be lost to flower wilt and disease in just hours or days during transport to retail outlets. Not only is the loss of plants disheartening, the resulting financial losses are frustrating to growers and retailers.

Figure 1. Petunia flower meltdown results in unmarketable petunias following shipping.

Petunia flower meltdown is observed when growers load "ready-for-market" petunias, with open flowers, onto trucks and ship the plants to retail markets. When the petunias are unloaded, retailers discover wilted flowers and, in most cases, a heavy infection of gray mold or Botrytis (Figure 1). Is the damage due to high humidity, mechanical damage or vibration during transport? Probably all of these are contributing factors, but the real culprit is found within the petunia flower.

Ethylene—The likely villain

Petunia flowers are highly sensitive to ethylene, a naturally-occurring plant hormone that causes petunia flowers to wilt and die prematurely. Ethylene is a colorless and odorless gas that's produced either within the flower or may be present in the air. Dead and decaying flowers, fruits and vegetables generate ethylene. It's also present in exhaust fumes from vehicles. Whether from internal or external sources, ethylene kills petunia flowers and damages flowers and foliage of many other bedding plants, flowering potted plants and potted foliage plants. With petunia flower meltdown, the damage comes from ethylene produced within the flower.

Ethylene is recognized as a "wound hormone." Flowers produce ethylene when stressed by high temperatures, drying out and vibration during transport. It's not unusual for temperatures to increase during transport or for damage to occur as flowers are shipped to retail markets.

What does ethylene have to do with petunia flower meltdown?

Wilting and death of petunia flowers is controlled by ethylene, either as a result of aging or pollination. Petunia flowers, once pollinated, begin to wilt and die within 24 to 36 hours. Ethylene production in the flower

increases within 12 hours of pollination, followed by premature death. The contents of cells—proteins, nutrients, hormones and other cell contents—move from the dying flower to other parts of the plant within three to four days. With these changes, cells are weakened and Botrytis easily invades the dying petunia flower. Dying and dead cells are much more sensitive to Botrytis infection because the disease feeds off of the liquid and nutrients remaining in the cells. Furthermore, ethylene produced during the wilting of the flowers pre-disposes the flowers to greater levels of infection and development of Botrytis.

Just how does this happen? Vibration during transport causes the self-pollination of petunia flowers. And, with this pollination, the wilting and death of the flowers and invasion of the flower by Botrytis can be very rapid in high-humidity conditions, rendering the plants unmarketable.

Botrytis—The secondary cause of damage

Botrytis conidia (spores) are always present in greenhouses and in packing houses. Spores may be on floors, carts and the hands and clothes of growers and packers. Wind and water spread spores from plant to plant. Resilient spores can survive in greenhouses for a year or more and will attack flowers and plants when the environmental conditions are right. Infection symptoms become visible within 24 hours at temperatures between 60 and 75F (15 and 23C) and a humidity of 90% or higher or in the presence of wet flowers and leaves.

Botrytis can become a problem even if flowers are symptomless when shipped. Problems on bedding plants are often observed only after the plants leave the production facility since environmental controls and fungicides keep the disease at bay during production. Sanitary conditions in production and packing areas are vital to prevent the spread of Botrytis spores.

Botrytis spores germinate and penetrate the surface of flowers and petals where they inject a toxin that damages the cells, leading to decay. Spores can also enter the leaves and flowers through broken stems and leaves. Botrytis damage causes the flower to produce ethylene, establishing a vicious cycle. Botrytis will quickly destroy an infected flower and spread to adjacent flowers and leaves. The complex nature of this problem makes it difficult for petunia breeders trying to select for ethylene insensitivity and resistance to Botrytis.

Production practices may contribute to the problem

Production practices have changed significantly over the last decade. Bedding plants are now grown with practices promoting rapid growth and little, if any, hardening off prior to shipping. These production practices, in most cases, result in a “softer” plant that’s more sensitive to diseases. Growing plants close together (more plants per flat or pots closer together), frequent watering, high nutrition and high humidity have been shown to increase sensitivity to diseases. Fewer Botrytis problems are observed when:

- Greenhouse coverings prevent or limit UV light
- Humidity levels are held below 85%
- Watering practices keep foliage and flowers dry
- Overwatering is prevented
- Plants are grown further apart

- Fertilizers are reduced (especially nitrogen fertilization)

For instance, plant spacing has a significant impact on the incidence of Botrytis. In pot-grown cyclamen, close spacing resulted in three times the number of dead plants from Botrytis compared to normal spacing. Close spacing leads to reduced air movement and higher humidity conditions during production and shipping—conditions that promote the incidence of Botrytis. Frequent fungicide applications may not control diseases effectively. Growing conditions that promote Botrytis also lead to the presence of more spores once the plants are shipped. Also, if plants are overwatered or grown in high humidity, the uptake of calcium is restricted. Calcium strengthens petals and leaves.

Figure 2. Treatment with EthylBloc (right) prevents the production of ethylene by flowers during shipping and reduces the incidence of Botrytis. Photos courtesy of Jim Barrett.

The days immediately prior to shipping are particularly critical. Watering bedding plants the day of shipping and/or wrapping carts with plastic provides a closed environment with high humidity levels. Wet leaves or flowers will worsen Botrytis problems.

Growers should review their operations to assure that the best environmental conditions are combined with proper cultural practices for petunias and other bedding plants. Optimal control will be achieved when sound production practices are followed by careful post-production handling and ethylene control during transport.

Control petunia flower meltdown—Prevent ethylene damage

Since petunias can self-pollinate as the plants vibrate during transport, it's important to anticipate the presence of ethylene and prevent damage by using anti-ethylene products. Anti-ethylene products—EthylBloc and Ethylene Buster—prevent flowers from producing ethylene internally and protect flowers from ethylene gas in the air. Treatments should be applied as soon as plants are loaded onto trucks. Some products, referred to as ethylene scrubbers, do not provide protection from both internal and external ethylene. With anti-ethylene treatments, flowers won't wilt and Botrytis is reduced.

University research and commercial trials have demonstrated the success of anti-ethylene treatments in petunias. In a commercial trial, flats of petunias were grown to marketable stage and treated with EthylBloc. Treated flowers didn't wilt and didn't have significant Botrytis problems, while un-treated plants wilted and had severe Botrytis infection (Figure 2). Botrytis control is important, but even if all Botrytis spores are prevented from germinating, the primary production of ethylene by self-pollination and possibly wound ethylene from

mechanical damage will lead to rapid flower wilting. The detrimental impact of ethylene can be eliminated only by treating petunias with anti-ethylene products, such as EthylBloc and Ethylene Buster.

Post-production procedures to prevent petunia flower meltdown

- Treat petunias with anti-ethylene products during transport
- Practice strict sanitation in the greenhouse, packing areas and trucks
- Avoid mechanical damage to plants and flowers
- Water plants the day before placing on carts
- Avoid water on leaves and flowers and maintain humidity below 90% during shipping **GT**

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