

# Special Research Report # 451: Post Production Geranium Leaf Yellowing: Causes and Solutions

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## Background

During the first week in propagation, unrooted zonal geranium cuttings frequently exhibit yellowing of the most mature leaves. Normally, plants do not die from this phenomenon, but leaf-picking and cleaning requires a significant amount of expensive labor.

Experiments were conducted to identify the causes of leaf yellowing and to develop applicable solutions for cutting suppliers and propagators.

## Causes

The three main factors that contribute to leaf yellowing of unrooted geranium cuttings in propagation are: cultivar sensitivity, respiration, and ethylene.

*Cultivar Sensitivity.* Standard red and dark red flowering cultivars tend to be the most resistant to leaf yellowing, while white, pink, and lavender are the most

sensitive cultivars. Also, darker green leaf cultivars will display less leaf yellowing than lighter green leaf cultivars. Most geranium series will have one or two indicator plants, which are cultivars that are the most likely to display leaf yellowing.



**Fig 1.** Example of geranium leaf yellowing symptoms appearing during the first week in propagation.

*Respiration.* Respiration is the second factor that causes leaf yellowing. It is the process in plants where carbohydrates (sugars and starches) are consumed. The energy is used to maintain plant tissues. The amount of respiration that occurs is a function of temperature, which means that respiration increases as temperature increases. Thus, warm temperatures from the time the cutting is removed from the stock plant until it is stuck in the propagation bed will contribute to leaf yellowing. The ideal shipping and storage temperature for geraniums is 35 to 41 °F (2 to 5 °C).

*Ethylene.* The third factor is ethylene. Ethylene is a hormone that induces ripening and senescence of plant parts, such as leaves, flowers and fruits. Cuttings are wounded during harvesting, which results in ethylene production. The amount of ethylene generated by cuttings is also a function of temperature. Thus, the warmer the temperatures from harvest to sticking, the more leaf yellowing that will occur. Interestingly, cuttings that have higher carbohydrate levels are much more resistant to ethylene; therefore, if the postharvest temperatures have been relatively good, the cuttings have higher carbohydrate concentrations and are more resistant to ethylene.

Leaf yellowing symptoms typically are displayed on Days 2-5 in propagation. The reason for this is that the larger leaves on the cuttings are exporting their sugars to the base of the stem where they are needed for rooting. As these sugars are mobilized, the older leaves will turn yellow.

Geraniums that exhibit leaf yellowing after the first week in propagation have a different problem. It is usually related to inadequate nutrition, most often a nitrogen deficiency. Fertilization programs in

propagation should start before root initiation, so that nutrients are available when the first roots emerge from the basal stem.

## Solutions

### 1. Time Management

First, geranium leaf yellowing increases as the postharvest time increases; therefore, they should be stuck immediately after arrival. This is true even if the storage temperatures are perfect.

### 2. Temperature Management

Secondly, the warmer the cuttings are while they are waiting to be stuck, the more leaf yellowing that will occur. On arrival, the boxes must be cooled down as rapidly as possible. It is best to remove the bags of cuttings from the boxes and place them on shipping racks that can be rolled into a cooler maintained at 35-41 °F (2.5 to 5 °C). This is a better approach than placing the cuttings on propagation bench until there is time and labor available for sticking.

3.

Time and temperature management are key to preventing leaf yellowing because these are the factors that most directly affect the respiration rate (depletion of carbohydrates) and ethylene production.

### 4. Hormone Treatments

The plant growth regulator Fascination contains two active ingredients (benzyladenine and gibberellic acid) that reduce leaf yellowing (Fig. 2). These plant hormones are effective because

they reduce the translocation of carbohydrates from the mature leaves to the base of the stem. Benzyladenine applied alone is not as effective as Fascination. Fascination applications can negatively affect rooting, so it is critical that the base of the stem does not come in contact with the spray as this can totally prevent rooting. *Do not spray to runoff!*

Exercise caution with this treatment and be certain to practice several times on a very small scale until you are comfortable with the application technique. Some growers will make a foliar application of a water-soluble rooting hormone, such as K-IBA, to compensate for any potentially negative impact that Fascination may have on rooting. Note that Fascination applications will cause some petiole elongation and leaf expansion; therefore, some propagators will apply additional Cycocel to the cuttings to regulate plant growth.

## Plan of Action

1. *Geranium leaf yellowing cannot be completely prevented if the shipping stress is great, but the symptoms can be minimized with several proactive steps. Proper handling of cuttings upon arrival.* Minimize the time from arrival of the cuttings to the time they are stuck. Minimize the temperature stress by placing cuttings at 35-41 °F as quickly as possible upon arrival.

2. *Identify cultivars that are most susceptible to leaf yellowing.* Stick these cultivars first.

3. *Spray cuttings with Fascination.* Spray applications are made on Day 1 or 2 in propagation (Fig. 2). Add CapSil to increase uptake. A rate that has worked for many growers is 2.5 ppm, but you will need to experiment multiple times before making applications to a whole crop.



**Fig. 2.** *Top.* Untreated geranium cuttings. *Bottom:* Geranium cuttings treated with a Fascination spray on the second day after sticking the cuttings.

## Industry Impact

Proper implementation of these experimental results will result in less leaf yellowing of geraniums in propagation which will reduce labor costs and plant losses.

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