



Roberto G. Lopez  
rglopez@msu.edu

Volume 10 Number 19 April 2021

# Don't Let Unpredictable Weather Nip your Crops in the Garden Center

*The pandemic, coupled with the cold winter has consumers demanding annuals, herb, and vegetable transplants weeks before the last average frost date. As growers, you obviously want to cash in and take advantage of these impulse purchases. But we all know this is risky! What can you do to prevent losses during those unpredictable cold snaps that occur in April and even into May? In this alert, we will provide some tips on how to protect your crops and provide you with a list of cold hardy plants you should be selling.*

The above normal and record breaking temperatures this past March has consumers visiting garden centers in search of anything to plant in their garden. These means that un-acclimated plants could be sitting on outdoor garden center benches, on a flat bed trailer or wagon in front of your greenhouse.

When should you be concerned about these crops and what can you do to protect them from injury or death as cold temperatures will inevitably return? What does it mean when the weather forecast say there is a “frost” and “freeze” warning or watch?



Figure 1. Chilling injury on celosia after one night in the garden center when the temperatures dropped down to 35 °F (1.7 °C) for a few hours. Photo credit: Roberto Lopez

## 2021 Sponsors



Funding Generations of Progress  
Through Research and Scholarships



P.L. LIGHT SYSTEMS  
THE LIGHTING KNOWLEDGE COMPANY

Reprint with permission from the author(s) of this e-GRO Alert.

[www.e-gro.org](http://www.e-gro.org)



Frost advisories are only issued under atmospheric conditions that will likely lead to a frost. These include a combination of a thermal inversion where temperatures near the ground surface drop, while warmer air develops above, winds are calm, and the sky is clear. During a frost advisory, temperatures are  $\leq 36$  °F ( $\leq 2.2$  °C). On the other hand, freeze and hard freeze warnings are only issued when air temperatures are expected to be between 29 to 32 °F (-1.6 to 0 °C) or  $\leq 28$  °F (-2.2 °C), respectively. Freezes occur when winds are above 5 mph and a cold air mass moves into an area bringing temperatures below 32°F. A freeze/ hard freeze watch may be issued a few days ahead of time if the potential exists for temperatures to fall.

#### What is Freezing injury?

Freezing injury is damage that occurs to plant tissues when temperatures are below 32 °F. Pure water freezes at 32 °F, however, water in plant tissue has dissolved salts (ex. plant sap), which freezes at temperatures a few degrees below 32 °F. If water freezes in a plant cell, the sharp ice crystals can cut cell membranes, resulting in fluids leaking from the cell, leading to cell and plant death. Freezing injury symptoms include tissue browning, dark green foliage that then appears water soaked, blackening, wilting or curling of leaves and stems. Young plant tissue is more vulnerable to freezing than mature tissue. The cold tolerance of hardy and frost tolerant crops to freezing temperatures increases as the plants are gradually acclimated to cooler temperatures over time. In other words, a cold hardy plant grown in a warm (heated) greenhouse is more susceptible to freezing injury in the garden center than one that has been in a cold frame, high tunnel, unheated structure, or outdoors.



Figure 2. Chilling injury (desiccated areas on leaves that appear like water spots) on an unprotected impatiens crop (cold sensitive crop) in a garden center a day after a frost advisory. Photo credit: Roberto Lopez



Figure 3. Chilling injury on wax begonia appearing as necrotic speckled lesions on leaves and flowers. Plants were in the parking lot of a big box store. Photo credit: Roberto Lopez



Figure 4. Symptoms of chilling injury on cold tolerant cilantro that was not acclimated and placed in a garden center. Photo credit: Roberto Lopez





Figure 5. Freezing injury on cold sensitive coleus after exposure to near freezing temperatures. Photo credit: Roberto Lopez



Figure 6. Exposure to temperatures around 35 °F in early May caused severe chilling injury on tomato leaves that appear as brown speckling. Photo credit: Roberto Lopez

### What is Chilling Injury?

Chilling injury is a form of cold damage (with similar symptoms to freezing injury) that occurs to certain plants when exposed to non-freezing temperatures (Figures 1 to 6). Depending on the plant, chilling injury can occur at temperatures from 32 to 55 °F (0 to 10 °C). Plants from tropical origins are often chilling-sensitive, while most temperate zone species are not if they have been properly acclimated to cold temperatures (Figure 4).

### How can you Protect Crops on those Cold Nights?

You can reduce convective heat loss from the surface of crops and trap radiant heat during the day by carefully placing frost blankets, floating row covers (ie. Reemay cloth), straw, tar paper, or plastic above crop (Figures 7 and 8). Make sure plastics do not directly touch the crops as this can lead to conductive heat loss.

An irrigation system or overhead sprinkler can be used to apply a very low rate of water to form a continuous film of water on crop foliage to prevent freeze damage (Figure 9). The principle behind this practice is that as water cools, it gives off heat until the temperature of the water is 32 °F (0 °C). This ultimately results in preventing the temperature of the plant from falling below 31.5 °F (-0.3 °C). During this process, a layer of ice forms on the leaves (Figure 9). This method used by orchards can protect plants from temperatures as low as 21 °F (-6 °C). The application of water should begin as soon as temperatures are right near freezing and a film of water needs to be maintained until temperatures have risen above freezing. If you prematurely discontinue sprinkling or equipment fails, evaporative cooling will draw heat from leaves as the ice melts and damage can occur. Additionally, if the freezing temperatures last for a long period of time, a thick layer of ice may form on leaves and branches (Figure 9). Upon melting plants should not be injured (Figure 10).

If you are not a risk taker, plants can be brought into a heated barn, hoop house or other structure until temperatures are above freezing.

## Know the Cold Tolerance of the Crops you Grow

Make your customers successful gardeners by only producing and selling crops that can tolerate the “average” conditions of where they will be sold and take the average frost-free date into consideration. Table 1 contains the general cold hardiness of several popular annuals, herbs, and vegetables that have been acclimated.

Table 1. Cold Tolerance of Acclimated Vegetables and Ornamentals

Hardy/ Cold-tolerant	Frost Tolerant	Tender	Cold-sensitive
Alyssum	Ageratum	Aster	Alternanthera
Asparagus	Broccoli	Geranium	Angelonia
Bidens	Brussels sprout	Nicotinia	Basil
Calibrachoa	Bells of Ireland	Scabiosa	Begonia
Cilantro	Cabbage	Statice	Celosia
Collard greens	Cauliflower	Snap bean	Cleome
Diascia	Calandula (pot marigold)	Sweet corn	Coleus
Forget me not	Coreopsis	Verbena	Cosmos
Kale	Chard		Cucumber
Lettuce	Chinese cabbage		Eggplant
Nasturtium	Cyclamen		Impatiens
Nemesia	Dianthus		Ipomoea (sweet potato vine)
Ornamental cabbage & kale	Dusty Miller		Lantana
Parsley	Dutch bulbs		Marigold
Pansy	Lobelia		New Guinea impatiens
Pea	Osteospermum		Peppers
Potato	Petunia		Portulaca
Primrose	Pocketbook plant		Salvia
Ranunculus	Rudbeckia		Sunflower
Rhubarb	Snapdragon		Watermelon
Spinach	Sweet pea		Vinca
	Sugar snap pea		Zinnia
	Stock		

Hardy/ cold tolerant crops can withstand short periods of freezing temperatures and hard frosts without injury. They may be planted 4 to 6 weeks before the average frost free date.

Frost tolerant crops can withstand light frosts and can be planted 2 to 3 weeks before the average frost free date.

Tender crops are injured or killed by frost and should be planted on or after the average frost-free date.

Cold-sensitive crops cannot tolerate prolonged exposure to temperatures below 50 °F. They should be planted 1 to 2 weeks after the average frost-free date.



Even though cole /brassica crops (ie. cabbage, broccoli, and cauliflower) are considered frost tolerant, young plants exposed to cold temperatures will respond by bolting (producing a flowering stalk). Therefore, these crops should not be exposed to several days of temperatures below 45 °F (7 °C) when the stem is smaller than the width of a pencil. Bolted plants should be discarded.



Figure 8. A big box store attempting to protect the plants in their garden center with clear plastic prior to freezing temperature. Photo credit: Roberto Lopez



Figure 7. This garden center is covering their crop with a frost cover as the temperatures are forecast to reach 32 °F. Photo credit: Roberto Lopez



Figure 9. This grower started sprinkling when the lowest observed leaf or flower temperature was 32 °F. Photo credit: Royal Heins



Figure 10 (left). Once the ice melted, the calibrachoa crop survived and was uninjured after exposure to temperatures in the low 20's for several hours. Photo credit: Royal Heins

**e-GRO Alert**

[www.e-gro.org](http://www.e-gro.org)

**CONTRIBUTORS**

Dr. Nora Catlin  
Floriculture Specialist  
Cornell Cooperative Extension  
Suffolk County  
[nora.catlin@cornell.edu](mailto:nora.catlin@cornell.edu)

Dr. Chris Currey  
Assistant Professor of Floriculture  
Iowa State University  
[ccurrey@iastate.edu](mailto:ccurrey@iastate.edu)

Dr. Ryan Dickson  
Greenhouse Horticulture and  
Controlled-Environment Agriculture  
University of Arkansas  
[ryand@uark.edu](mailto:ryand@uark.edu)

Thomas Ford  
Commercial Horticulture Educator  
Penn State Extension  
[tfz@psu.edu](mailto:tfz@psu.edu)

Dan Gilrein  
Entomology Specialist  
Cornell Cooperative Extension  
Suffolk County  
[dog1@cornell.edu](mailto:dog1@cornell.edu)

Dr. Joyce Latimer  
Floriculture Extension & Research  
Virginia Tech  
[jlatime@vt.edu](mailto:jlatime@vt.edu)

Heidi Lindberg  
Floriculture Extension Educator  
Michigan State University  
[wolleage@anr.msu.edu](mailto:wolleage@anr.msu.edu)

Dr. Roberto Lopez  
Floriculture Extension & Research  
Michigan State University  
[rglopez@msu.edu](mailto:rglopez@msu.edu)

Dr. Neil Mattson  
Greenhouse Research & Extension  
Cornell University  
[neil.mattson@cornell.edu](mailto:neil.mattson@cornell.edu)

Dr. W. Garrett Owen  
Greenhouse Extension & Research  
University of Kentucky  
[wgowen@uky.edu](mailto:wgowen@uky.edu)

Dr. Rosa E. Raudales  
Greenhouse Extension Specialist  
University of Connecticut  
[rosa.raudales@uconn.edu](mailto:rosa.raudales@uconn.edu)

Dr. Beth Scheckelhoff  
Extension Educator - Greenhouse Systems  
The Ohio State University  
[scheckelhoff.11@osu.edu](mailto:scheckelhoff.11@osu.edu)

Dr. Ariana Torres-Bravo  
Horticulture / Ag. Economics  
Purdue University  
[torres2@purdue.edu](mailto:torres2@purdue.edu)

Dr. Brian Whipker  
Floriculture Extension & Research  
NC State University  
[bwhipker@ncsu.edu](mailto:bwhipker@ncsu.edu)

Dr. Jean Williams-Woodward  
Ornamental Extension Plant Pathologist  
University of Georgia  
[jwoodwar@uga.edu](mailto:jwoodwar@uga.edu)

Copyright ©2021

*Where trade names, proprietary products, or specific equipment are listed, no discrimination is intended and no endorsement, guarantee or warranty is implied by the authors, universities or associations.*

**Cooperating Universities**

**Cornell CALS**  
College of Agriculture and Life Sciences

**Cornell Cooperative Extension  
Suffolk County**

**IOWA STATE UNIVERSITY**

**University of  
Kentucky**



**PennState Extension**

**VIRGINIA  
TECH**

**UCONN**

**MICHIGAN STATE  
UNIVERSITY**



**College of Agricultural &  
Environmental Sciences  
UNIVERSITY OF GEORGIA**

**PURDUE  
UNIVERSITY**

**NC STATE  
UNIVERSITY**



**THE OHIO STATE  
UNIVERSITY**

**UofA DIVISION OF AGRICULTURE  
RESEARCH & EXTENSION**  
*University of Arkansas System*

**In cooperation with our local and state greenhouse organizations**

**MAUMEE VALLEY GROWERS**  
*Choose the Very Best.*



**Metro Detroit Flower Growers Association**



**Indiana  
FLOWER  
GROWERS  
Association**

