



# Nursery Cooperative Freeze Injury Alert for Landowners

## Monitor Your Seedlings for Freeze Injury

When newly planted seedlings are subjected to extreme cold temperatures and high winds, there is always **the potential for freeze injury**. Injury **may not show up for up to two weeks or more** after the actual cold event. Even if your seedlings do not experience mortality, freezing temperatures can negatively affect the survival of newly planted pine seedlings through **injury to interior tissues**. **Mortality can occur in the future** due to the loss of vigor and slow growth rate as your damaged seedlings may be more susceptible to other biotic agents such as insects. This guide will show you how to check for damage and **what to look for**.

### General Guidelines: How to check for freeze injury.

Cold weather damage to conifers poses two problems:

1. Assessing the level of (immediate) damage to the seedlings
2. Predicting the future performance of damaged stock

For this reason you must carefully monitor your seedlings for several months after the cold event. Here are the general guidelines.

**When to check?** Check now and then wait 1-2 weeks or until temperatures have warmed up some. Repeat in several more weeks to confirm.

**What to check?** Check all seedlings but especially your most freeze-sensitive seedlings such as slash or longleaf or coastal loblolly. Longleaf is more susceptible than loblolly. Roots are more susceptible than the stem. Seedlings that were de-acclimated to cold due to warmer weather before the freeze with rapid and significant drops in temperature are more susceptible than those that were acclimated to cold for days before the freeze.

**How to check?** With your fingernail or knife, remove just the bark from the stem from about 2" above the root collar and continue into the root region. If you see foliar injury, you may want to remove the bark above the root collar. You are looking for brown tissue just below the bark. Be sure to remove all the bark since it is very common for the brown streak indicating freeze injury to be located on just one side of the stem. These seedlings may survive if environmental conditions are favorable, however their first-year growth will be impacted.



## Examples of Cold Injury Symptoms on Conifer Seedlings

Record breaking temperatures have occurred in the past couple of weeks in early 2014. Fortunately, we have learned some important facts from previous freeze events. The January 2004 freeze was one in which seedlings had been de-acclimated to the cold by several nights of warm temperatures prior to a hard freeze, making seedlings more susceptible to injury. The potential for damage is also increased when the freeze is accompanied by high winds. Some seedlings may not show immediate damage but need to be checked periodically until spring for root damage.

With an event such as the recent unprecedented freeze, cold injury is eminent. Some seedlings may be injured and recover but will still show symptoms. These photos will help you to identify cold injury symptoms as the season progresses.



Symptoms of winter-burn on needles of loblolly pine seedlings



- If not severely damaged, seedlings can recover from winter-burn.
- The middle and left photos were taken January 9, 2004 of seedlings planted in early December. The fully developed secondary needles on these seedlings were desiccated by strong, continuous, dry winds associated with a cold event that occurred on December 20-21, 2004. Average wind speeds recorded at the Savannah International Airport for December 17-20 ranged from 9-12 mph with gusts ranging from 23 to 32. Seedlings in a protected area along one edge of the plantation lacked symptoms of cold injury and appeared to be healthy during an inspection on February 27.
- A few scattered seedlings were already dead when inspected in late February, most of which had been planted in pockets of debris. However, the terminals of most seedlings with brown needles were still alive and some new root growth had already been initiated.
- The photo on the right was taken June 1, 2004 from the same plantation. Note the older needles that were desiccated in December/January have fallen off and the trees have put on a healthy flush of new growth.
- The seedlings in this plantation apparently were not seriously affected by the early January cold event that caused heavy mortality in other plantations in the area. This plantation is located on a wet site with a soil that has a high moisture retention capacity at the surface. Thus, the high soil moisture probably moderated temperatures at the surface during the early January cold event and also reduced the effects of a 6-week drought in late February and March.





- These three photos are of a unique seedling planted in December, which was dying in May after it had begun to flush.
- The far left photo shows a constriction in the stem just above the ground line. The area below ground is clearly seen with very dark to black bark.
- The center photo is a closer view of the constriction that resulted from frost damage. This tree continued to live into May, probably in a moist micro site, but since the carbohydrates produced in the seedling top could not move down the stem, they accumulated and caused a swelling above the damaged, “constricted” region. With the warm weather in May, the seedling began to die since the root system, starved for energy, could not keep up with the water demand of the seedling top.
- In the right photo, sectioning the stem revealed a dark brown pith in the freeze-damaged region of the stem.

## Cold Injury on Pine Seedlings: Conclusions

- Cold damage can occur at anytime during the planting season. More freeze events may still occur during the 2014 planting season.
- Warm weather conditions immediately before the cold event could begin to de-acclimate or break the dormancy of pine seedlings, especially Coastal Piedmont seed sources.
- Seedling survival should be assessed in early spring in order to help determine the cause of early seedling mortality.
- With your fingernail or a knife, remove just the bark from the stem from about 2” above the root collar and continue into the root region. You are looking for brown tissue just below the bark. Be sure to remove all the bark since it is very common for the brown streak indicating freeze injury to be located on just one side of the stem.
- Section seedlings to also reveal the pith. Green indicates healthy tissue. Dark brown pith indicates cold damage and will always be found in conjunction with brown stem/root tissue.
- Cold damage to the stem is usually located just above the ground line. Be sure to check the root zone also, since roots are the most sensitive plant tissue.
- Freeze damage alone can kill seedlings, but additional mortality results when other stress factors are involved, such as drought or anaerobic conditions and significant woody and herbaceous competition.
- Seedlings can recover from minor freeze injury if stress factors are minimal following outplanting.

**If you have questions about your seedlings and freeze damage, please call a forestry expert in your area.**