The LOUISIANA Home Orchard

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FREEZE PROTECTION FOR CITRUS TREES

Introduction

Freeze injury remains the **primary limiting factor** for successful citrus production in Louisiana home landscapes. While many citrus types can tolerate brief periods of cool weather, **extended exposure to freezing temperatures can severely damage or kill trees**, particularly when trees are not actively protected.

Unlike deciduous fruit trees, citrus does not reliably enter a true winter dormancy. Growth may slow during cooler weather, but trees often remain physiologically active throughout the winter, especially during warm periods. As a result, citrus remains vulnerable to freeze injury across much of the season, even when cold events occur outside of traditionally expected freeze windows.

Because of this vulnerability, successful citrus production in Louisiana depends heavily on **timely, effective freeze protection**, especially during sudden temperature drops or prolonged freeze events. Understanding how citrus responds to cold and how protection strategies function is essential for improving tree survival and long-term productivity.

Freeze Risk for Citrus in Louisiana

Citrus injury during freezes depends on **temperature, duration, cultivar cold tolerance, tree age and condition.** Damage is rarely caused by temperature alone; the length of exposure and whether the tree is actively growing play major roles.

- Temperatures **below 28 F** can injure fruit, leaves, and tender shoots.
- Extended exposure to temperatures in the **low 20s F** can cause significant wood damage.
- Sustained temperatures in the **mid- to low teens** for several hours can kill unprotected citrus trees.

Freeze damage is often more severe when cold temperatures are accompanied by **wind**, which increases heat loss from plant tissues. Trees that are actively growing or flushing new growth are especially susceptible to injury, even at temperatures that might not damage fully hardened tissue.

Because freeze events in Louisiana can be unpredictable and vary greatly from one winter to the next, **active freeze protection is essential** for long-term success with home citrus, particularly for young trees and cold-sensitive varieties.

Cold Hardiness of Different Citrus

Cold hardiness varies widely among citrus types and selections and is often misunderstood in home plantings. While some citrus selections are more cold tolerant than others, **cold hardiness is not a fixed or guaranteed trait** and should not be interpreted as immunity from freeze injury.

Cold hardiness ratings are typically based on the performance of **established, field-grown trees** under specific conditions. These ratings do not account for differences in tree age, establishment, rootstock, production environment or prior exposure to cold. As a result, young trees or trees recently planted from greenhouse production systems are often far more vulnerable than cold-hardiness descriptions suggest.

Cold Hardiness Is Influenced by Tree Condition

A citrus tree's ability to tolerate freezing temperatures depends on multiple interacting factors, including:

- Tree age and degree of establishment
- Rootstock selection
- Whether the tree has experienced previous winters

- Growth status at the time of the freeze
- Production history, including greenhouse or protected nursery culture

Trees planted from greenhouses or protected environments often remain actively growing later into the season and have **little inherent cold tolerance**, even when they are considered cold-hardy selections. These trees respond very differently to freeze events than mature, field-established trees of the same cultivar.

Cold Hardiness of Different Citrus Selections

Citrus types differ substantially in their relative tolerance to freezing temperatures. In general, **kumquats and satsumas are among the most cold-tolerant citrus**, followed by certain mandarins and sweet oranges. Grapefruit and tangelos are less tolerant, while lemons and limes are among the **least cold-hardy citrus types.**

Within each citrus type, individual selections may vary in cold response, but these differences are **incremental rather than absolute.** Selections marketed as cold hardy are not exempt from freeze injury, particularly when trees are young, poorly established or actively growing.

Cold-hardy selections may improve long-term survival potential when combined with:

- Appropriate rootstocks
- Gradual establishment over multiple seasons
- Consistent freeze protection during early years

They should not be used as a substitute for freeze protection, especially during prolonged or **severe freeze events.**

Figure 1. Relative cold hardiness of common citrus types.

Figure 2. Freeze injury varies among citrus types exposed to the same temperatures. These images show a thornless key lime, left, and a Bumper satsuma, right, following exposure to the same freeze event. Despite identical environmental conditions, the key lime exhibits severe leaf injury, while the satsuma shows minimal visible damage. This contrast illustrates the relative nature of cold hardiness among citrus types. Cold-tolerant selections are more likely to survive and recover from freeze events, but no citrus type is immune to freeze injury, particularly when trees are young, actively growing or unprotected. Photos by Anna Timmerman

Role of Rootstock in Cold Tolerance

Rootstock selection influences how citrus trees respond to freezing temperatures, but it should not be interpreted as a guarantee of freeze survival. Differences in cold response among rootstocks are **relative,** not absolute.

Trees grown on **trifoliate orange *(Poncirus trifoliata)* and trifoliate-hybrid rootstocks** generally exhibit improved cold tolerance compared to trees on nontrifoliate rootstocks. This improvement is primarily related to growth behavior. Trifoliate-based rootstocks tend to slow vegetative growth earlier in the fall, which reduces the amount of tender tissue exposed during freeze events.

Common rootstocks used in home citrus plantings differ in their contribution to cold response:

- **Trifoliate orange:** Provides the greatest improvement in cold tolerance among commonly used rootstocks. Trees tend to slow growth earlier in fall and may recover more reliably after moderate freezes.
- **Flying Dragon trifoliate:** A dwarfing form of trifoliate orange. Cold tolerance is similar to standard trifoliate, with the added benefit of reduced tree size, which can make freeze protection easier in home landscapes.
- **Trifoliate hybrids** (such as citranges and citrumelos): Offer moderate improvement in cold tolerance compared to nontrifoliate rootstocks, though typically less than pure trifoliate.
- **Nontrifoliate rootstocks:** Generally exhibit lower cold tolerance and later fall growth, increasing susceptibility to freeze injury under Louisiana conditions.

Rootstock effects are most apparent in **established trees** and during **moderate freeze events.** They do not eliminate the risk of injury during prolonged or severe freezes, particularly when trees are young, actively growing or poorly protected.

Rootstock selection should be viewed as a **supporting factor**, not a replacement for proper establishment and freeze protection.

Establishment and Protection Remain Critical

A major distinction exists between a newly planted tree that has never experienced winter conditions and a tree that has been protected, hardened and allowed to establish over several seasons. Trees that survive repeated winters — often with protection — may exhibit improved cold tolerance over time. This process is gradual and cannot be assumed at planting.

Regardless of citrus type or selection, **freeze protection remains essential during the early years after planting** and during severe freeze events.

Citrus Dormancy: What It Is and What It Is Not

Unlike deciduous fruit trees, **citrus does not enter a true winter dormancy.** Growth slows in response to cooler temperatures and shorter day length, but many citrus trees remain physiologically active throughout the winter. During warm periods, even in midwinter, citrus may continue limited growth or resume growth quickly in the event of warm weather.

This lack of true dormancy is a major reason citrus is vulnerable to freeze injury in Louisiana. When freezing temperatures occur, living tissues throughout the canopy — including leaves, shoots and young wood — may still be active and susceptible to damage.

Cold response varies among citrus trees and is strongly influenced by **rootstock selection.** Trees grown on **trifoliate orange or trifoliate-hybrid rootstocks** tend to slow growth earlier in the fall and generally exhibit improved cold tolerance compared to trees on nontrifoliate rootstocks. Even so, these trees still do not achieve full dormancy.

Because citrus cannot be reliably hardened off in the same way as peaches, apples or other deciduous fruit, management practices aimed at inducing dormancy have **limited effectiveness.** Withholding water, heavy pruning or stressing trees will not reliably improve freeze tolerance and may instead weaken trees and increase damage.

Practices that **do** help reduce freeze risk include:

- Avoiding excessive late-season nitrogen fertilization
- Avoiding fall pruning that stimulates new growth
- Allowing growth to slow naturally as temperatures decline

Citrus trees that are actively flushing at the time of a freeze are **far more likely to suffer injury,** particularly during early winter or late spring freeze events.

Tree Health and Cold Tolerance

Tree health plays a significant role in how citrus responds to freezing temperatures. **Healthy, well-managed trees tolerate cold stress better** than trees weakened by nutrient deficiencies, pests, diseases or poor growing conditions.

Factors that increase susceptibility to freeze injury include:

- Nutrient imbalances or deficiencies
- Root or trunk diseases
- Chronic insect pressure
- Poor drainage or prolonged water stress

Maintaining tree vigor during the growing season improves a tree's ability to withstand cold stress later in the year. Balanced fertilization, timely pest management and proper irrigation all contribute to stronger, more resilient trees.

At the same time, excessive late-season vigor can increase freeze damage risk. Nitrogen management influences cold response primarily through its effect on vegetative growth. Practices that promote **vigorous late-season flush** increase susceptibility to freeze injury and should be avoided.

Also, maintaining baseline tree health is important for freeze tolerance, particularly in trees under chronic stress from disease or root injury. Fertility programs that provide **low, steady nutrient availability without stimulating new shoot growth** may help support tree condition going into winter.

Pruning after late summer should be avoided, as it may stimulate tender growth that is easily damaged by freezing temperatures.

A tree that enters winter healthy but not actively growing is better equipped to survive freeze events than a stressed tree or one producing new flush.

Properly Covering Citrus Trees During Freeze Events

Properly covering citrus trees is the **most effective freeze protection method** available to homeowners when trees are small enough to be fully enclosed. When done correctly, covers reduce heat loss from the tree and trap warmth released from the ground. When done incorrectly, covers may provide little benefit or increase freeze injury.

The goal of covering is not to insulate individual leaves or branches, but to **create a protected air space around the entire tree** that slows heat loss during freezing conditions.

How Tree Covers Provide Freeze Protection

Tree covers function by:

- **Capturing radiant heat released from the soil beneath the tree.** Bare or lightly vegetated soil radiates significantly more stored heat at night than soil covered by thick mulch, grass or weeds, making ground contact and soil exposure an important part of effective freeze protection.
- **Reducing heat loss to the night sky**, which slows the rate at which the tree and the enclosed air space cool during clear, cold nights.
- **Limiting the effects of cold, dry wind** that strips heat from plant tissues and displaces warm air trapped beneath the cover.

Covers must **extend completely to the ground** and remain as sealed as possible to retain this heat. Covers that are open at the bottom or do not enclose the tree trap little heat and provide minimal protection.

Materials Suitable for Covering Citrus Trees

Recommended materials include:

- Commercial frost cloth or freeze fabric
- Blankets, quilts or heavy sheets used temporarily
- Layered fabric systems with plastic used only as an outer layer

Plastic should never be the only covering material and should not contact leaves or branches directly.

Whenever possible, covers should be supported by stakes or a simple frame so they drape over the tree without resting directly on foliage, especially when combined with a heat source.

Proper Tent-Style Covering

The most effective way to cover a citrus tree is using a **tent-style approach**, rather than wrapping tightly around the canopy or trunk.

With tent-style covering:

- The cover drapes outward from the canopy.
- The base contacts the ground **well beyond the trunk.**
- A wide soil surface is enclosed beneath the cover.
- A large, protected air volume is created around the tree.

For proper installation:

- Use stakes or a simple frame if needed to prevent direct contact with foliage.
- Drape the cover so it encloses the entire tree.
- Extend the cover outward and secure it to the ground on all sides.
- Seal edges with soil, boards, bricks or landscape staples. Freeze events in Louisiana are often accompanied by strong winds, and even small openings at the base of a cover allow wind to enter, rapidly displacing trapped warm air and greatly reducing protection.
- Remove or vent the cover the following day once temperatures rise above freezing.

When installed correctly, tent-style covers can raise temperatures several degrees within the protected space and significantly reduce freeze injury.

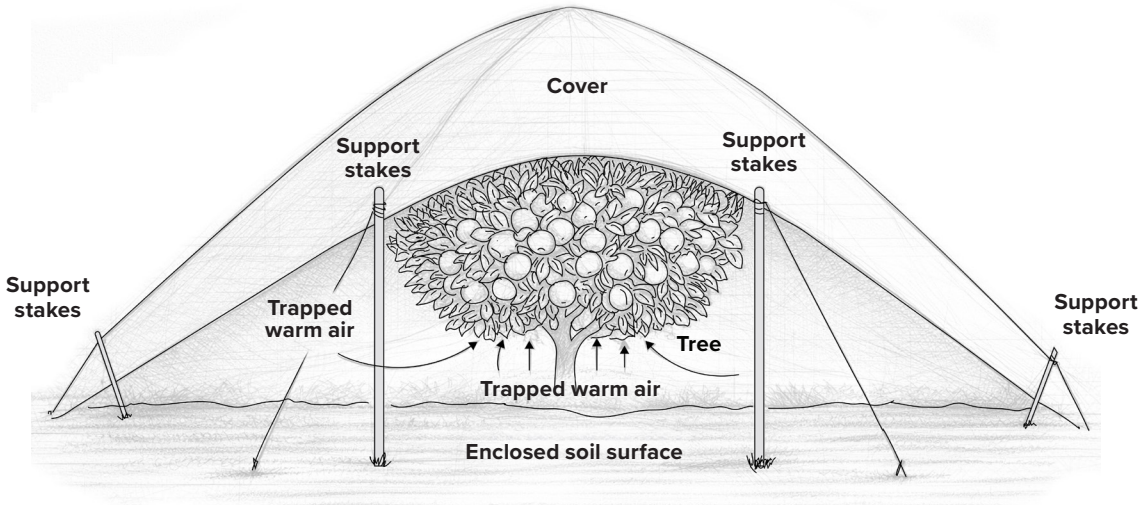

Figure 3. Proper tent-style covering of a citrus tree for freeze protection

Supplemental Heat Inside Covered Enclosures

Supplemental heat can provide **limited additional protection** during freeze events when used correctly and in combination with proper covering. Heat sources are most effective when they are used to raise temperatures slightly **within a fully enclosed space,** rather than attempting to warm an exposed tree.

Small increases in temperature — often just a few degrees — can significantly reduce freeze injury when air temperatures are near critical thresholds.

Incandescent light bulbs placed beneath a properly installed tree cover can supply modest but useful heat. Bulbs should be positioned near the trunk and kept away from direct contact with fabric or plant material. Only **non-LED incandescent bulbs** produce meaningful heat. LED bulbs are ineffective for freeze protection.

Heat sources should never be used without a cover. Without an enclosure to trap warmth, heat dissipates rapidly and provides little benefit.

Electric space heaters are generally not recommended for home citrus freeze protection. They present fire and electrical hazards, require substantial power and are difficult to use safely in outdoor conditions.

All electrical components used outdoors should be rated for exterior use and protected from moisture. Extension cords should be heavy-duty and kept off the ground where water may accumulate.

Supplemental heat should always be viewed as a **supporting measure,** not a primary protection strategy. Proper tent-style covering remains the most important factor in reducing freeze injury.

Soil Moisture and Radiant Heat (Supplemental Consideration)

Irrigation prior to a freeze may provide limited benefit under specific conditions, as moist soil can store and release more heat than dry soil during a freeze event. However, the temperature increase is typically small and should be viewed only as a supplemental practice, not a substitute for proper tree covering. Irrigation should be avoided prior to a freeze on poorly drained soils or sites where water may accumulate around the trunk, as excess soil moisture can increase tree stress and disease risk.

Common Covering Mistakes

Canopy-Only Covering (Lollipop Covering)

One of the most common and least effective freeze protection methods is **canopy-only covering or lollipop covering.**

In this approach, the cover is wrapped tightly around the foliage or upper canopy and often tied or cinched near the trunk. The cover **does not extend to the ground** and encloses little to no soil surface beneath the tree.

This method fails because it **does not capture radiant heat from the soil,** which is the primary source of warmth during a freeze event. Any heat trapped within the cover is quickly lost to the surrounding air, especially during windy conditions. Although the tree may appear covered, temperatures inside the canopy often fall nearly as low as outside air temperatures.

Canopy-only covering also **leaves the graft union and lower trunk fully exposed,** increasing the risk of serious injury or death of the scion. When freeze damage occurs below the graft, trees may resprout from the rootstock rather than the desired citrus variety, resulting in loss of the original tree.

Because canopy-only covering provides little thermal protection and often creates a false sense of security, it frequently results in widespread canopy damage or complete tree failure during extended freezes.

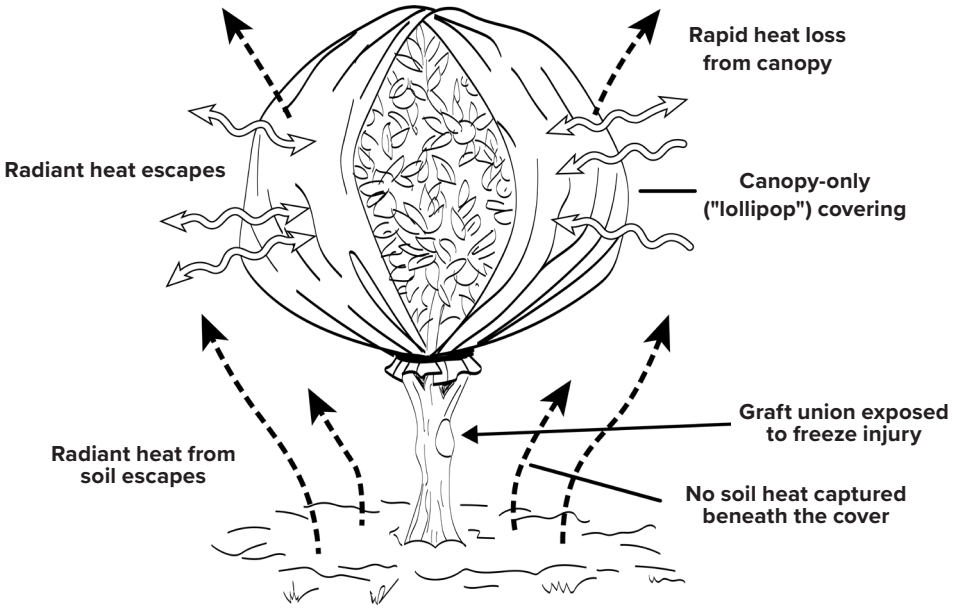

Figure 4. Canopy-only or lollipop covering of a citrus tree during a freeze event.

Narrow-Base or Funnel-Style Covering

A second, more subtle failure occurs with **narrow-base or funnel-style covering.**

In this approach, the cover does reach the ground, but it is pulled tightly around the trunk or lower canopy, creating a **very small footprint at the soil surface.** Although the tree technically appears to be covered to the ground, only a narrow area of soil is enclosed beneath the cover.

This method captures **too little soil heat** to provide meaningful freeze protection. The limited soil surface releases only a small amount of warmth, and the narrow air space beneath the cover cools rapidly during prolonged or windy freeze events. Warm air escapes easily, and temperature protection is minimal.

Funnel-style covering may provide **partial protection to the trunk or graft union,** but it often fails to protect the canopy. As a result, leaves, shoots and scaffold branches may be killed even though the base of the tree survives. This type of damage can lead to severe dieback, weak regrowth, delayed fruiting and poorly structured canopies in subsequent seasons.

Because funnel-style covers give the appearance of proper installation while still failing to enclose enough soil, they are a common cause of homeowner frustration following freeze events.

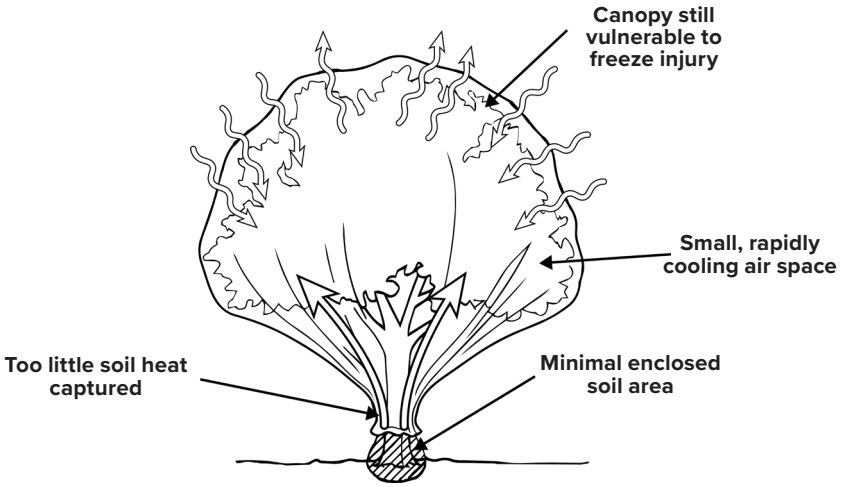

Figure 5. Narrow-base or funnel-style covering of a citrus tree during a freeze event.

Additional Installation and Material-Related Failures

Even when a citrus tree is covered using an appropriate tent-style design, **installation details and material choices can still lead to failure.** The following issues commonly reduce or eliminate the effectiveness of freeze protection.

Open Bottoms

Covers that do not reach the ground or are left open at the bottom allow warm air to escape and cold air to enter. Even small gaps at the base of the cover can significantly reduce protection, particularly during windy freeze events. Covers with open bottoms offer minimal benefit and often fail completely during extended freezes.

Plastic in Contact with Foliage

Plastic conducts cold efficiently and can transmit freezing temperatures directly to plant tissue. When plastic touches leaves, shoots or branches, freeze injury is often **more severe at the points of contact.** Plastic should never be used as the sole covering material and should be used only as an outer layer when separated from the tree by insulating fabric or frost cloth.

Loose or Wind-Blown Covers

Covers that are not properly secured can shift or lift during freeze events, exposing portions of the tree or collapsing onto foliage. High winds commonly accompany Louisiana freeze events and can quickly defeat otherwise well-designed covers. Anchoring the cover securely along the ground on all sides is essential to maintain protection throughout the event.

Tree Size Management and Covering Feasibility

Tree size plays a critical role in freeze protection success. Citrus trees that are kept **intentionally small** are far easier to cover completely and protect effectively.

Citrus naturally grows as a large tree if left unpruned. Once trees exceed a manageable height or width, full-tree covering becomes impractical, and protection options are severely limited. Citrus are fairly tolerant of pruning strategies that reduce the canopy height and overall size, including topping, hedging, shearing and removal of uppermost branches. Pruning in the spring, after the threat of frost has passed, is best and gives the cut ends time to heal over and seal before the coming winter. Prune through branch collars when cutting major limbs and branches. Removal of more than 30% of the canopy per year is not recommended.

The use of dwarfing rootstock, such as trifoliate orange Flying Dragon, works to naturally suppress canopy size and keep trees within a more compact growth habit.

Selective pruning to maintain a compact canopy improves:

- Ease of covering
- Freeze protection effectiveness
- Recovery after freeze events
- Long-term productivity in residential settings

Trees managed with freeze protection in mind are more likely to maintain canopy integrity and resume normal growth after winter.

Special Considerations for Container-Grown Citrus

Citrus trees grown in containers are **more vulnerable to freeze injury** than in-ground trees because their roots are exposed to air temperatures. Covering the canopy alone offers limited protection when root systems are above ground.

During freeze events, container-grown citrus should be moved to a **sheltered location**, such as:

- A garage
- A porch or breezeway
- A greenhouse or enclosed structure

Sheltered areas should remain above freezing and protected from cold wind. Once freeze danger has passed, trees can be returned to outdoor locations. Grow lights are not necessary when storing container-grown citrus in a protected area for less than a week. If container-grown citrus are stored in a protected area for more than a week, a grow light or exposure to a bright window can help to prevent leaf drop and pushing trees into a more dormant state. Trees stored indoors without adequate light for a prolonged period of time may completely defoliate, delaying blossoming and reducing yield in the following year.

Harvesting Citrus Ahead of Freezing Temperatures

Harvest timing plays an important role in reducing freeze-related fruit loss. Citrus fruit can tolerate cool temperatures, but **extended exposure to freezing conditions can cause internal damage,** even when external injury is not immediately visible.

Citrus fruit left on the tree often improves in color and flavor as temperatures cool in the fall. However, there are limits to this benefit. Some citrus, such as Moro blood orange and Rio Red grapefruits will not develop deep red internal coloration without some cold exposure.

Temperature Thresholds for Fruit Injury

Citrus fruit generally tolerates light freezes, but damage becomes more likely as temperatures drop and exposure time increases.

- Temperatures in the **mid- to low-20s F** sustained for **five to 10 hours** can freeze citrus fruit.
- Fruit damage may not be immediately visible but can appear later as:
  - Internal breakdown
  - Drying of juice vesicles
  - Off flavors, including fermentation
  - Increased fruit drop

Trees may survive these conditions, but fruit quality is often compromised.

When to Harvest Before a Freeze

When extended freezing temperatures are forecast, **harvesting mature fruit ahead of the freeze is often the best option,** particularly when:

- Fruit has reached acceptable eating quality
- Overnight temperatures are expected to remain below the mid-20s F for several hours
- Trees are not protected with covers or supplemental heat

Satsumas and kumquats may be harvested **before full orange color develops**. Fruit that has begun turning yellow is often fully edible and will continue to sweeten after harvest.

Oranges, grapefruit and other citrus generally require full color development before harvest, but should be picked ahead of a hard freeze once maturity is reached.

Late-Season Harvest Considerations

Citrus fruit can remain on the tree for extended periods under mild winter conditions. However, fruit left on trees **too late into winter** may reduce bloom and fruit set the following season.

As a general guideline:

- Citrus fruit should be harvested **by late January or early February.**
- Fruit left on the tree beyond this period may negatively affect the next year's crop.

Relationship Between Harvest and Freeze Protection

Harvest decisions should be coordinated with freeze protection efforts.

- If trees can be **fully covered and protected,** fruit may be left on the tree during light to moderate freezes.
- If trees **cannot be adequately protected,** harvesting mature fruit ahead of a freeze reduces the risk of total crop loss.

Removing fruit does not improve tree cold hardiness, but it does **preserve fruit quality and reduce disappointment after freeze events.**

Freeze Protection for Citrus Trees Too Large to Cover

Protecting the entire tree with a properly installed cover provides the **best freeze protection** for home citrus trees. However, citrus trees that have been allowed to grow tall or wide may become **impractical or impossible to cover** during freeze events.

In these cases, freeze protection shifts from **preserving the canopy to preserving the trunk and bud union,** which determines whether the tree survives.

Why Tree Size Matters for Freeze Protection

Citrus does not reliably enter full dormancy, and **freeze injury can occur throughout the canopy,** not just at the trunk. Trees that are small enough to cover can often be protected with minimal damage, while large, uncovered trees are more likely to suffer:

- Leaf and twig death
- Scaffold branch damage
- Complete canopy loss

Once trees exceed a manageable size, full-tree covering is no longer realistic, and protection efforts should focus on survival rather than production.

Trunk and Bud Union Protection (Survival Strategy)

For trees too large to cover, protecting the trunk and bud union may prevent total tree loss.

Protection options include:

- Commercial tree wraps
- Foam insulation or pipe wrap
- Multiple layers of cloth secured loosely

Best practices:

- Wrap from the soil line up to the first scaffold branches.
- Avoid tight or moisture-trapping wraps.
- Treat trunks with a **copper fungicide before wrapping** to reduce foot rot risk.
- **Remove wraps in spring** once freeze danger has passed.

If the trunk and bud union survive, the tree may resprout, even if the canopy is killed. It may take weeks or even several months for the extent of damage to become apparent. Many trees resprout above the graft or from the center of the canopy, even after shedding all leaves following a significant frost event.

Important Limitations of Trunk-Only Protection

Homeowners should understand the trade-offs:

- Does **not** protect leaves or branches
- Does **not** prevent canopy loss
- Often results in **slow recovery and delayed fruiting**
- Regrowth may be more vigorous but poorly structured, including weak, whip-like growth, water sprouts and witches' broom branching. Weak branches typically fail to set, support and produce harvestable fruit.

For this reason, trunk protection should be viewed as a **last-line survival measure**, not a substitute for full-tree covering.

Management Implication for Home Citrus

Citrus trees that are intentionally kept small are far easier to protect and more likely to remain productive after freezes.

Homeowners who wish to grow citrus long-term in freeze-prone areas should strongly consider **size management through selective pruning** to keep trees within a height and spread that can be covered during winter freezes.

Practices to Avoid During Freeze Events

Certain practices are commonly attempted during freezes but provide little benefit or may increase the risk of injury.

Plastic should not be placed directly in contact with leaves, branches or trunks. When plastic touches plant tissue, it conducts cold efficiently and can result in severe freeze injury at the points of contact. Plastic may be used only as an outer layer when separated from the tree by fabric or frost cloth.

Citrus trees should not receive **late-season fertility practices that stimulate new vegetative growth**, such as high-rate or quick-release nitrogen applications. Late pruning should also be avoided, as it commonly triggers tender growth that is highly susceptible to freeze injury.

Do not leave tree covers in place during warm, sunny conditions after a freeze. Enclosed trees can overheat rapidly, resulting in leaf scorch and stress. Covers should be removed or vented once air temperatures rise above freezing.

Do not rely on mulch, irrigation alone or trunk wraps as primary freeze protection for trees that are small enough to be covered entirely. These practices may improve survival in extreme situations but do not provide full canopy protection.

Attempting to stress trees to harden them off by withholding water or nutrients late in the season is unreliable and may weaken trees rather than improve cold tolerance.

Effective freeze protection depends on understanding citrus physiology and applying protection measures **before and during freeze events**, not after damage has occurred.

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