Reducing Trunk Splitting of Fraser Fir

Jeffrey H. Owen,
Area Christmas Tree Extension Specialist,
NC State University

Eric Hinesley, Professor,
Christmas Tree Research,
NC State University

Several growers, re-wholesalers, and retail lot operators complained of greater than normal problems with split trunks in their Fraser fir Christmas trees during the 1998 season. In most years, the incidence of trunk splitting is minimal industry-wide. However, in other years, it is a significant problem for trees cut from certain fields, for a few growers, or some retail lots. The problem is aggravated by interactions of climate, tree condition, and inadequate care after cutting. By gaining understanding of some basic wood physiology and current research on split trunks, strategies to prevent trunk splitting and other freshness problems can be identified. Maintaining the freshness of Christmas trees is the responsibility of all those in the industry who handle the trees: from the growers who cut them, the wholesalers who store and transport them, to the retail lot operators who store and display the trees.

Maintaining the freshness of Christmas trees is the responsibility of all those in the industry who handle the trees:

Understanding the mechanism of split trunks:

When trunks split, a single crack develops from the base of the cut trunk extending as much as 3 feet up one side of the tree. Splitting can occur in the field shortly after cutting if the trees are left in the sun for even a few hours during warm weather. It can also occur when trees are stored or displayed on retail lots without being watered. Exposure to warm weather will dry trees out rapidly and contribute to splitting. Trunk splitting is also affected by the extent of tree dormancy and the chilling that trees undergo in late autumn.

Research conducted at NC State University indicated that the cracks in Fraser fir Christmas trees are a result of stress caused by capillary tension (Hart and Hinesley, 1993). Capillary tension is the force that makes liquids rise in small diameter tubes. As foliage loses moisture, increased capillary tension draws more water from the trunk to the foliage. Capillary tension not only pulls up on a column of liquid, such as sap, but it also pulls inward on the walls of the column, in this case, cell walls. Capillary tension contributes to wood shrinkage by removing water and contracting the size of individual columns of cells. Studies of drying wood (Harlow, 1979) indicate that the greatest shrinkage occurs tangentially (around the rings of wood) rather than longitudinally (along the grain) or radially (from outside to inside). This matches the development of split trunks in Fraser fir.

While the outer rings of wood in cut Fraser firs initially contain more water, they lose water more quickly than the inner core of the trunk. As the wood dries, the outer shell physically contracts around the denser wood in the core. The tangential force applied by the drying outer wood, measured at 341 to 515 pounds per square inch(psi) in the NC State study, can exceed the average tensile strength of Fraser fir wood which is approximately 180 psi. When this level of stress occurs, individual cells in the wood collapse. A crack then spreads from the initial fault in the wood. The contracting outer wood pulls apart until the tension is released.

Cracks generally start from the base of the tree because hairline cracks created during cutting can serve as starting points for larger cracks. The cut trunk also dries most rapidly as water is pulled away from it by capillary tension toward the transpiring foliage.

Trunk-splitting occurs most often after a period of rapid drying. In fact, splitting seems to occur more frequently in trees that had a high moisture content when cut than in trees that were already under moisture stress. The gradients of stress in the wood during drying are apparently greater when more moisture is in the tree that is then lost more quickly. Any factors that increase evaporation and transpiration from foliage will increase water loss from the entire tree. Excessive exposure to sunlight, wind, and warm temperatures will aggravate trunk splitting.

The influence of dormancy on split trunks:

In extremely warm falls, the rate at which trees dry is affected by the level of dormancy which is achieved by the time of harvest. Dormancy of Fraser firs and other Christmas trees only occurs with the accumulation of cold

temperatures uninterrupted by extended warm spells. During a mild autumn, many woody plants fail to become fully dormant. Once a Christmas tree is cut and baled, the process of dormancy (which needs light and photosynthesis) is most likely halted.

Without full winter dormancy, trees transpire at almost the same rate as they did during the growing season. With transpiration increasing the rate of moisture loss from cut trees, the incidence of trunk splitting can be expected to increase in unusually warm seasons. Increased drying related to inadequate dormancy is compounded by the direct effects of higher temperatures that occur in such seasons during harvest. Trees that are cut later during the harvest season may be exposed to more cold temperatures which satisfy their chilling requirements for dormancy and thereby reduce transpiration and moisture loss.

While the cracks and splits are unsightly, their impact may not always affect the overall quality of Christmas trees. Certainly, some of the more severe splits would cull a tree, but most trees with cracks are still marketable.

Other factors involved in split trunks:

Many growers have had concerns about the influence of fertilizer treatments, particularly nitrogen and potash applications, on the incidence of split trunks in their fields, but several other factors may be involved.

The concern about nitrogen has risen largely from observations that trees with larger trunks tend to crack more than comparably sized trees with smaller diameter trunks. High nitrogen levels may be one factor contributing to the production of more wood in a Fraser fir trunk, but it is not the only factor. Heavily sheared trees have an additional year or two of wood production contributing to increased trunk size before they are cut. Wind can also increase the size of trunks. Fraser fir seedlings subjected to high winds developed trunks twice the size of seedlings that were not subjected to high winds in a study conducted at Wake Forest University (Telewski and Jaffe 1986). Field location could influence trunk size and subsequent trunk splitting. Trunk size may be an important factor in trunk splitting, but the causes of large trunks are complex and cannot simply be attributed to high nitrogen levels.

Many Christmas tree growers have used potash to increase the winter hardiness of ornamental crops and have wondered if increased potash levels could increase Fraser fir winter hardiness with a reduction in trunk splitting. While correction of deficient potassium levels has reduced winter injury in some perennial plants, it is not directly involved in the process of dormancy that influences trunk splitting in Fraser fir.

Increasing potassium levels above current recommendations is unlikely to impact trunk splitting and could have negative side effects in nutrient balance and/or root function.

Quality impacts of split trunks:

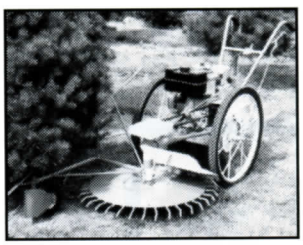
While the cracks and splits are unsightly, their impact may not always affect the overall quality of Christmas trees. Certainly, some of the more severe splits would cull a tree, but most trees with cracks are still marketable.

In the trunk splitting study at NC State, cracks developed after a period of rapid drying although water was still readily available in the wood . The trees would still have been considered fresh when the cracks started. All of the cracks or splits developed well before the trees dried to the point where they would not take up water. Many of the minor cracks and splits closed after the trees were placed in stands containing water. General observations by growers and customers have indicated that trees with cracks or splits generally re-

continued on page 8

"We've Got the Edge!"

Perfected with the Christmas Tree Grower in Mind!



(Shown with #87-970 Christmas Tree Head.) The 30" head cuts mowing time, has heavy-duty adjustable caster wheel for easy maneuverability, and a limb-lifter to protect branches and give a close trim.

- Three 8-HP Engines Available
- Self-Propelled w/Positive Traction
- Blade Clutch/Brake and Shields

We offer Quality, Safety, Versatility and Service with over 50 years of leadership in the high-wheel weed and brush cutter industry.

(Standard unit comes with a 26" cutting head.)

(Shown with 665AC Saw Blade Kit.) The Saw Blade Kit easily converts the weed head over to a harvesting unit; or can be used to cut stumps in a choose and cut operation to cut at ground level.

- Heavy Spokes w/Commercial Tires
- Revolving Guard (patented)
- Handles Anything from Grass to 6 ft. Weeds or 1" Saplings

PIONEER MANUFACTURERS OF QUALITY AG PRODUCTS — COMMERCIAL, AGRICULTURAL, INDUSTRIAL

BACHTOLD BROS., INC.

509 W. First St. • P.O. Box 485 • Gibson City, Illinois 60936-0485
Phone 217-784-5161

continued from page 7

Trunk Splitting continued...

hydrate and maintain their freshness no differently from trees that do not develop cracks. If a tree will not take up water, the degree of drying has surpassed that which initially caused the trunk to split.

If minor cracks and splits do not affect the ability for a tree to be placed in a stand, there really is no impact on quality. Tree stands that attach by rope to lower branches on the trunk would be least affected by trunk splitting. Stands with pins that require drilled trunks would be most affected by splits and cracks, but are often still usable. In traditional stands that screw into the trunk, the tree can usually be arranged to miss the crack.

Some growers and retail lot operators have tried to fix split trunks. Some have had moderate success in closing the cracks using automotive hose clamps or wood screws, but the problem of split trunks should be prevented rather than repaired. By reducing temperature and light and increasing moisture during post-harvest handling, trunk splitting will be minimized. These efforts will also reduce incidence of needleshed and stringburn.

Strategies for preventing split trunks and other freshness problems:

For prevention efforts to be effective, it cannot just be the grower's responsibility, but must involve all handlers including all wholesalers and retail lot operators. Maintaining the freshness of Fraser fir Christmas trees depends on a concerted effort of training and management throughout the post harvest handling period. The following strategies have minimized problems with freshness as long as all handlers have shared in the responsibility.


SoilMoist™

POLYMER FINES

MOISTURE PROTECTION FOR BAREROOT & SEEDLINGS

- *Increases Survivability Rate*
- *Reduces Shock*
- *Retains Moisture on Root System*
- *For Shipping & Planting*
- *Used by Nurseries, Government Agencies & Contractors*

JRM Chemical Inc.
15663 NEO Parkway, Cleveland, OH 44128
800-962-4010 ◆ 216-475-8488 ◆ web: www.soilmoist.com

** During warm falls, growers should delay harvest as late as possible to allow trees to achieve maximum dormancy.

** Cutting should be limited to mornings during on very hot days to take advantage of moisture stored in trees during the night and to minimize moisture loss.

** Trees should be transported from the field to a storage area as quickly as possible (preferably the same day as cutting) to avoid excessive exposure to sun, heat, an wind. This is very important when trees are cut in sunny, warm weather.

** Trees should be stored with their cut trunks in contact with the ground in a cool, dark, and moist location. Use a natural pine stand or a shade cloth structure with wet mulch on the ground. If the ground is wet, the cut trunks can take up water.

** Storage areas can be irrigated with fine mists to increase relative humidity and reduce temperatures through evaporation, particularly on warm sunny days (a fine mist will evaporate and cool more rapidly than heavy irrigation).

** Refrigerated trucks or night transportation should be used, particularly to Southern destinations. Trees in unrefrigerated or tarped trailers can be scalded by high temperatures.

** Trees on retail lots should be stored in cool, dark, humid areas that provide some means of watering the trees. Some lot operators construct shallow pools of plastic sheets or tarps laid over landscape timber frames and filled with water.

** In warm climates, retail lot display systems should include some method of watering trees such as a wet mulch, watered soil, or use of tree stands with water reservoirs. Just as in storage, shaded display areas will preserve freshness in a hot climate. Wetting displayed trees at night can also be an effective way to reduce or delay drying.

Literature Cited:

Hart, C. A. and L. E. Hinesley. 1993. Growth stress versus capillary tension in relation to trunk splitting in Fraser fir Christmas tree. For.Prod. J. 43(5): 53-56.

Harlow, W. M. 1979. *Inside Wood: Masterpiece of Nature.* The American Forestry Association, Washington, DC, 120pp.

Telewski, F. W. and M. J. Jaffe. 1986. Thigmomorphogenesis: field and laboratory studies of Abies fraseri in response to wind or mechanical perturbation. Physiol. Plantarum 66: 211-218.