New Tapping Guidelines

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A previous publication described the history of tapping guidelines in relation to tree diameter (Chabot 2004). There are several guidelines that exist (Koelling and Heiligmann 1996, Guay 1999). All recommend not tapping trees below a certain size and all permit more taps in larger trees. Here I explain why maple producers should know the growth rate of trees in addition to diameter to determine the number of tapholes per tree.

Existing guidelines suggest limiting the number of tapholes per tree to protect tree health. A better reason for limiting number of tapholes is to allow the tree to put new wood over the old taphole and thus avoiding tapping into old tapping compartments. Reducing the number of tapholes per tree to allow enough time to produce new wood is less well understood.

IMPORTANT FACTORS TO CONSIDER

Each taphole permanently damages tree tissue in an area around the taphole. Thus, to determine the productive number of tapholes a producer should use, the important information required is: usable circumference, the growth rate of the tree, and taphole depth. Some of these factors were introduced by McIntyre (1932) and Buzzell (1987), but have been forgotten in current publications. Guay (1999) recognized the importance of these variables in developing modified guidelines based on tree diameter. Gaston Allard (2004 pers. communication) includes these and other variables when he predicts the long-term impact on sap yield of different tapping approaches.

Although diameter and circumference relate to each other, producers need to know the tapping space on the surface of the tree. Circumference measures tapping space more directly than diameter. This is especially the case if one side of the tree is used preferentially, if there are damaged areas that need to be avoided, or if more than one tap is used on a tree.

Producers should avoid previously tapped wood, wood that has been "compartmentalized" through the wound healing process. When the tree compartmentalizes the area around a taphole wound, it takes this area out of sap production. The natural chemicals in the wound area can produce off-colors and off-flavors in the sap. The only sure way to avoid previously tapped wood is to place tap holes in a regular sequence around the tree circumference or above or below previous taps and not re-tap in a previously tapped area until enough new wood has been produced to accommodate the usual taphole depth.

TREE GROWTH RATE AND CIRCUMFERENCE

The radial growth of the tree determines how much time is needed to be able to re-tap the same location. A tree growing 1 inch in radius (2 inches diameter) in 10 years will

require 20 years to accommodate a 2-inch deep taphole at a previously tapped location. Slower growing trees will require more time to grow 2 inches of new wood.

Producers can determine the number of tapholes with a simple calculation. For example, let's use 1 inch as the strip of circumference damaged by each tap hole. This is the strip width used by McIntyre, based on a 0.5 inch hole width with 0.25 inch of colored wood on each side. Smaller tap holes produce less colored wood, but one inch apart is closer than most producers space tapholes. Smith and Walters (1972) determined that it is possible to tap within 1 inch of a previous taphole and not affect sap yield. A 10-inch diameter tree has a circumference of 31.5 inches. A 10-inch tree, without additional growth, could be tapped for 31.5 years at 1-inch hole spacing before the original tapping point is reached. Although I don't recommend tapping side-by-side, it is easiest to think about these relationships if each new hole is placed one inch from the hole of the preceding season. Placing holes in sequence around the tree would insure that the first hole drilled would have a full 31.5 years to become covered by new wood.

Considering the tree's circumference, rather than diameter, is even more important when the entire circumference is not used. This might happen if one side of the tree is preferred, such as the south face, or if a portion of the trunk is unusable or

inaccessible. Using only part of the circumference for tapping increases the demand on the tree to produce new wood over previously tapped areas. For example, tapping only on the south-facing quarter of the tree circumference will allow for 8 holes 1 inch apart and 8 years of radial growth. No maple tree is growing fast enough in 8 years to produce enough new wood to accommodate a 2-inch deep taphole in a restricted tapping space.

Increasing the distance between taps reduces the time it takes to get around the tree and reduces the amount of new wood over the previously tapped area. Two-inch taphole spacing on a 10-inch diameter tree will return to the starting point in 15-16 years. Few if any maples above 10-inch diameter are growing fast enough in 15-16 years to produce enough new wood to accommodate the usual taphole depth.

Expanding the tapping face vertically so that two or three bands of the circumference are tapped will allow more time for wood growth over the old tap holes in each band. But this means that the producer must design a tapping plan and length of drops to use two or more bands around the tree rather than a single band. Those using buckets have more flexibility in moving the tapping area vertically on the trunk.

GROWTH RATE AND MINIMUM TREE SIZES

Producers need to know the growth rate of trees to determine

when a tree has reached a tapable size. For example, a 10-inch diameter tree with 0.04 inch of annual radial growth, the average growth rate of tapped maples at Arnot Forest, will add 1.3 inches of radius in 31.5 years. This amount is much less than the usual tapping depth, which may be between 2 to 3 inches. A 10-inch diameter tree with 0.04 inch radial growth is too small to tap using normal tapping depths. It would be enough if the taphole depth is 1-1.5 inches. A tree with 0.04 inches of annual growth would need to be about 15 inches diameter (47 inches circumference) to produce 2 inches of radial growth during the 47 years of tapping before the starting point is reached. Doubling the growth rate to 0.08 inches per year would produce 2.5 inches in 32 years. So only with the higher growth rate would a 10-inch tree be large enough to support 32 years of tapping at a 1-inch spacing before the starting point is reached, at which point there would be 2.5 inches of new wood to continue tapping within this band. The point is that the growth rate and tap hole depth together determine what size the tree needs to be to support even one hole per year of annual tapping.

Faster growth rates shorten the time required for enough new wood to adequately cover old tap holes. Buzzel (1987) proposed tapping trees with a minimum annual radial growth of 0.125 inches. The 0.125 minimum is well above the growth rate of most trees in most years at the two Cornell sugarbushes and at other sugarbushes in NY that we

have sampled. Five sugarbushes in Quebec had average annual radial growth rates of 0.03 to 0.05 inches (Guay 1999). So we wouldn't be tapping many trees if Buzzel's guideline was followed.

As seen from these calculations, the growth rate is important in determining how much time it takes to put new wood over the old tapping area. Annual radial growth of a young tree with its canopy fully exposed to light might be 0.2 inch (= 4 inches of diameter growth per decade). Radial growth decreases with increasing tree size, poor sites, and environmental stress. The most generally important environmental stress is reduced light intensity from competition with other trees. Trees in subdominant canopy positions grow significantly more slowly than dominant trees in the same woods and crowded trees grow more slowly than trees without overlapping canopies.

TAPHOLE DEPTH AND NUMBER

As described above, tapping depth also is important in determining the appropriate tree size and taphole number. An annual growth rate of 0.04 inch produces 1 inches of new wood in 25 years and 2 inches in 50 years. A 7.9-inch dbh tree has 25 inches of circumference or 25 years of 1-inch deep tapping at 1-inch spacing. However, at this growth rate a starting size of 15.9 inch dbh would be required for one 2-inch-deep taphole each year.

Guay (1999) recommends varying the tapping depth with tree size. His recommendations are for a 1.6-inch taphole depth with tree growth rate of 0.03-inch radial growth per year increasing to a 2.4-inch depth for growth of 0.06 inches per year. Annual growth usually decreases as trees get larger so this does not mean that tapholes can be deeper in larger trees.

As demonstrated above, at 0.04-inches of annual radial growth a 10-inch dbh tree is too small to tap unless taphole depth is approximately 1 inch. Similarly, a 15-inch tree with this growth rate is also too small for two tap holes. A 15-inch dbh tree has 47 inches of circumference or 23.5 inches per taphole. Taphole depth would have to be less than 1-inch for 2 holes in a tree this size. A 16-inch tree would be needed for two 1-inch deep tapholes; a 20-inch tree would allow for two tapholes each 1.25-inches deep. It would take a 33-inch dbh tree to support two 2-inch-deep tapholes.

NEW GUIDELINES

Using information about tree growth results in more complex guidelines for tapping. Once growth rates are known within a particular sugarbush, it is possible to calculate taphole depth and spacing, minimum tree sizes for tapping and the number of taphole a tree can accommodate. The purpose of this article is to help the producer to understand the interactions between growth rate, taphole depth, and tree size. However, the simplest guidelines are:

1. No tree should have more than one tap unless it has a high growth rate or is very large. For those with vacuum, this should not be a problem since Tim Wilmot is finding that one taphole is sufficient to remove

much of the available sap in the tree. Those with buckets will collect less sap. However, if the producer is willing to move the tapping area vertically on the tree surface to have more than one tapping band, something closer to the traditional guidelines could be used.

2. Taphole depth should be closer to 1 inch and not more than 2 inches, especially in smaller, slower growing trees. Again, knowing the growth rate of your trees will help you determine the appropriate hole depth for your sugarbush.

3. Expand the taping area vertically by 12-15 inches above or below old tap holes. This increases the likelihood of finding new wood and allows more time for wood growth over old holes.

4. Use a tapping pattern that allows you to know what parts of the tree were tapped for as much as 20 years previously.

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