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CONTROLLING TAPHOLE DEPTH IN MAPLE SAP PRODUCTION RESEARCH

Abstract. Because bark thickness of sugar maple trees varies considerably, the depth of tapholes for collecting maple sap should be varied accordingly to get the taphole depth that will produce the best sap flow. A system of removable collars on the drill bit is recommended as a means of regulating taphole depth in research studies.

When tapholes for collecting sap from sugar maple trees are bored to a uniform depth from the surface of the tree bole, which is the usual practice, how deep the hole goes into the wood depends on how thick the bark is. Since sap flows only from the wood or xylem tissues, these differences in penetration of the wood may be a source of variation in sap yields and thus could have serious implications in research work on sap and sugar production.

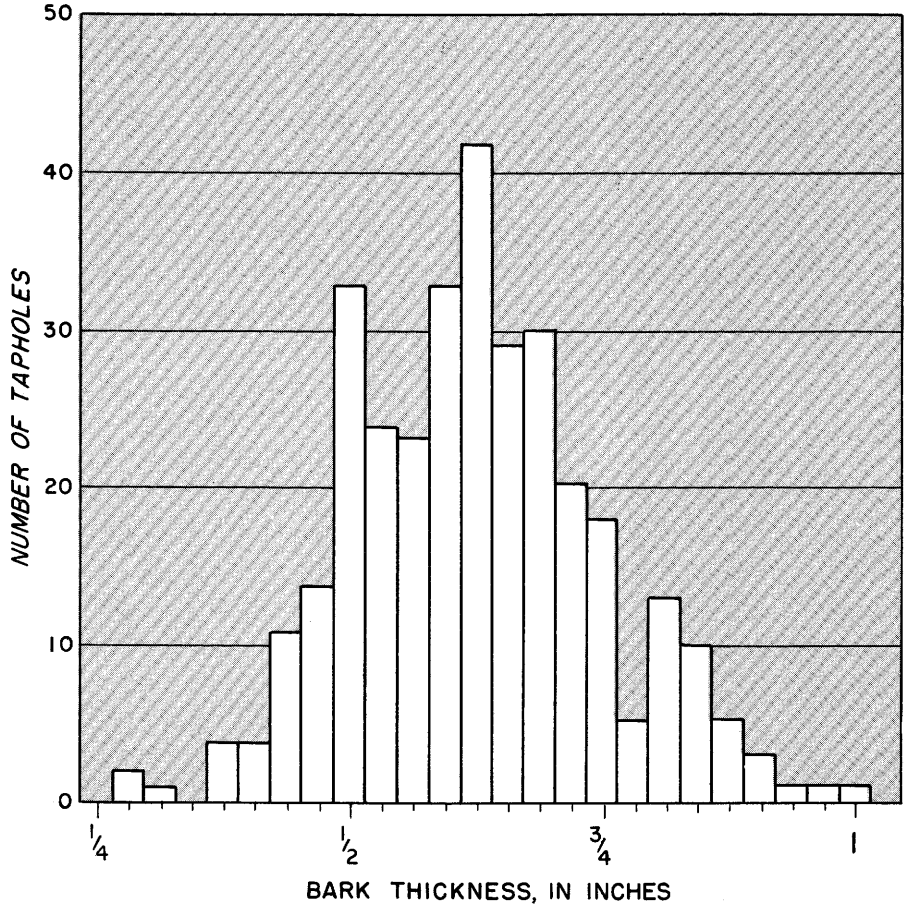
Several investigators have recognized the influence of taphole depth on total maple sap yield. Cope[1] observed that up to one-third of the total sap flow from a 4-inch taphole may be obtained from the innermost 2 inches. Morrow[2] reported a signficant increase in sap yields from 3½-inch tapholes as compared to 2-inch tapholes (depth was exclusive of bark thickness). Robbins[3] found that sap yields from 4-inch deep tapholes (including bark) were significantly greater than from those at 2- or 6-inch depths.

[1]Cope, J. A. DEPTH OF TAPPING IN RELATION TO YIELD OF MAPLE SAP. J. Forestry 47: 478-480, 1949.

[2]Morrow, Robert R. INFLUENCE OF NUMBER AND DEPTH OF TAPHOLES ON MAPLE SAP FLOW. Cornell Univ. Agr. Exp. Sta., N.Y. State Coll. Agr. Bull. 982. 3 pp. 1963.

[3]Robbins, Putnam, W. INFLUENCE OF TAPPING TECHNIQUES ON MAPLE SAP YIELDS. Mich. State Univ. Agr. Exp. Sta. Res. Rep. 28. 11 pp. 1965.

Figure 1.—Distribution of bark thickness by units of 1/32 inch among 327 tapholes in three Vermont sugarbushes.



To minimize error in any experiment, all known sources of variation should be held as nearly constant as possible. Obviously, in maple research, variation arising from taphole depth could be greatly reduced by standardizing the depth of the tapholes into the wood.

If taphole depth is gauged from the outside at the bark surface, effective depth in the wood will vary inversely with bark thickness. Bark thickness was determined for 327 tapholes during the course of recent research investigations in three sugarbushes in northern Vermont. These tapholes were drilled with a commercial bit equipped with a fixed stop 2½-inches back of the tip.

Bark thickness in these tapholes was found to vary from ¼-inch to 1-inch (fig. 1). The mean depth of wood penetration was found to be

1⅞-inches. This is considerably less than the optimum depth of 3½- to 4-inches. Such variations in depth almost certainly would affect sap yields among treatments and thereby would increase the experimental error in the data.

To reduce error from variation in taphole depth, attachments for a standard tapping bit were designed to facilitate drilling tapholes to a uniform depth *into the wood.* The attachments enabled us to compensate for variations in bark thickness. Although not designed for use on a commercial scale, a bit thus equipped has been used successfully in research studies where taphole depth must be accurately controlled.

The attachments consisted of a ½- by 1-inch metal collar to slip over a standard 7/16- by 6-inch bit, and 24 hard-fiber washers, each 1/16-inch thick. The collar was fitted with a 3/16-inch Allen screw and clamped securely to the shank of the bit exactly 4 inches back of the cutting tip. The washers were then placed over the bit, resting on the collar (fig. 2). This left 2½-inches of the bit exposed.

When tapping a tree, the bit is first used with all the washers in place. The resulting hole is 2½-inches deep, including bark. The thickness of the bark is then measured in 1/16-inch units (fig. 3). If, for example, the bark thickness is 5/16-inch, five washers are removed, and the bit is then re-inserted in the hole and sunk the additional 5/16-inch into the wood. Thus, the depth of the resulting taphole in actual sap-producing tissue is 2½-inches. Before drilling a new hole, all washers are replaced; then the procedure is repeated. If tapholes of other than 2½-inches effectve depth

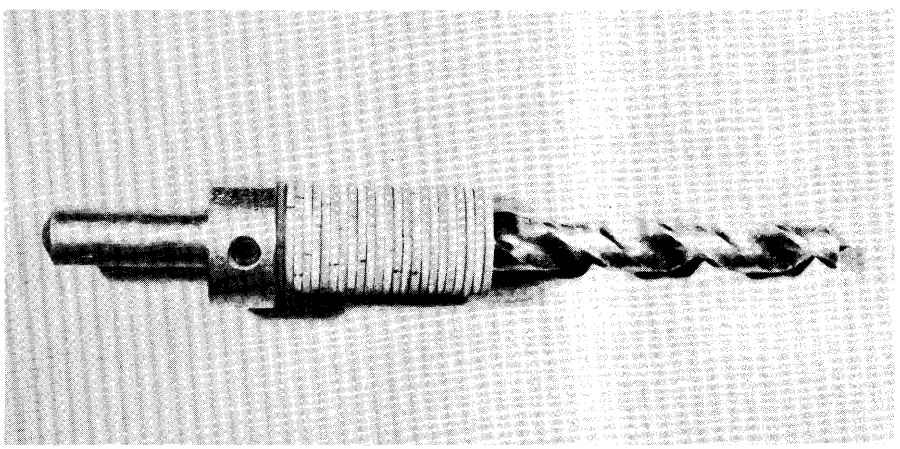


Figure 2.—Standard tapping bit equipped with a metal collar and washers to regulate drilling depth.

Figure 3.—Measuring bark thickness in 1/16-inch units.

are desired, appropriate compensations can be made in the number of washers removed.

Although these attachments for a tapping bit are suitable only for use in research investigations where the time required to make holes to exact specifications can be justified, the importance of taphole depth as affected by bark thickness should not be overlooked in commercial operations. To achieve closer control of effective depth in commercial tapping, it is suggested that an average bark-thickness value be determined for each sugarbush or, if a bush were not reasonably uniform, for each distinctly different section of it. Then appropriate allowances for bark thickness could be made when drilling the tapholes.

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