Variation of Wood Tissues from Two Cultivars of Apples

Roy K. Simons[1]

Observations in commercial orchards have shown that 'Golden Delicious' has brittle wood as compared with that of 'Jonared'. This has been found to be true after a severe winter freeze that caused serious injury to main limbs and scaffold branches. In one particular instance, such severe injury persisted that, 2-3 years later, limb breakage occurred on trees with a heavy crop load. This caused great economic loss to the grower over a long period of time, and continued until all of the damaged wood was removed by pruning or breakage.

Koehler (2) has defined brashness in wood as an abnormal condition that causes wood in bending to break suddenly and completely across the grain when deflected only a small amount. He also states that wood may be brash as a result of adverse conditions during growth. It may be relatively weak in various mechanical properties without showing abrupt fractures when broken in bending. When abrupt fractures do occur in wood, they show that its shock resistance, at least, is below normal, although it may be more nearly normal in other mechanical properties.

Aaron and Clarke (1) found variations in limb breakage occurring between 3 varieties ('York Imperial', 'Stayman Winesap', and 'Baldwin'). In the wood of each variety, some abnormal xylem was found. This abnormal xylem consisted of masses of cells in a parenchymatous condition where wood fibers, or in some cases vessels and tracheids, would ordinarily have been.

Figs. 1 and 2 were obtained on a Cambridge Series II scanning electron microscope. Longitudinal sections were obtained from the trunks of a living one-year-old 'Jonared' tree (Fig. 1) and 'Golden Delicious' (Fig. 2). The samples were mounted on standard stubs and then were placed in a vacuum where they were coated with gold/palladium.

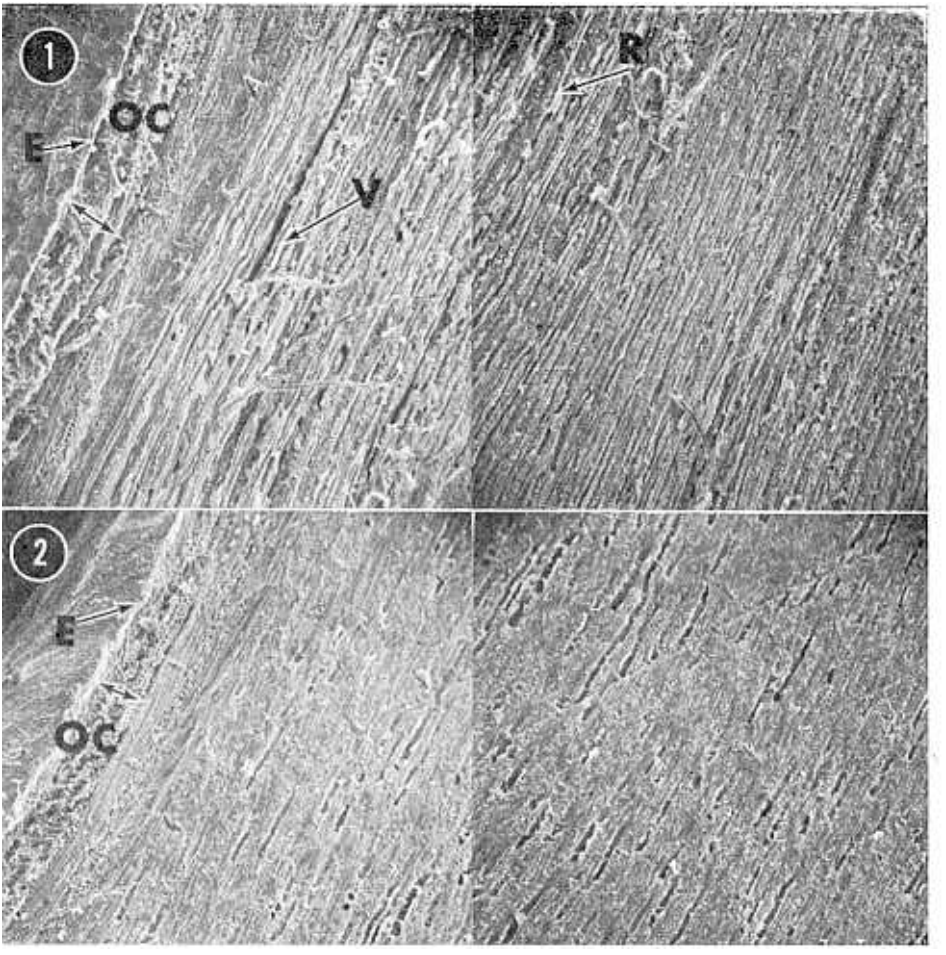
The 2 cultivars were selected because of known differences existing in relation to wood brashness and susceptibility to fire blight caused by the bacterium *Erwinia amylovora*. The main differences occurring between cultivars of the same species are that 'Jonared' had a wide, loosely arranged outer and inner cortex (OC) (left, Fig. 1, arrows). This may be contrasted to that of the more dense, narrow region of that in 'Golden Delicious' (left, Fig. 2, arrows).

Tissue denseness of the 2 cultivars was variable in the development of rays (R) and vessels (V). 'Jonared' had rays that contained more adjacent parenchyma and fiberous tissue continuing on to the center of the trunk (right, Fig. 1) than 'Golden Delicious' (Fig. 2). The wood tissue of 'Golden Delicious' had vessels with less fiberous parenchyma than 'Jonared'. The increased number of fibers in 'Jonared' may give it more flexibility when exposed to stress, and it also might provide a better medium for translocation of bacteria due to the loosely arranged structure from the outer cortex into the xylem tissues.

Literature Cited

1. Aaron, Isador and William S. Clarke, Jr. 1949. Breakage of apple trees. *Proc. Amer. Soc. Hort. Sci.* 54:57-60.
2. Koehler, Arthur. 1933. Causes of brashness in wood. *Tech. Bul.* 342. USDA, Washington, D. C.

[1]Professor of Horticulture, University of Illinois, Urbana, Illinois 61801.



Figs. 1 and 2. Median longitudinal section through the trunk of a 1-year-old 'Jonared' apple tree showing tissue organization from the epidermis into the xylem (wood) tissues (Fig. 1) as compared with that of a similar section through a 'Golden Delicious' trunk (Fig. 2). Note tissue differences in the outer cortex and in the xylem (wood) areas. E, epidermis; OC, outer cortex; V, vessels; R, rays. Both × 34.