Incompatibilities In Top-Worked Hardy Intermediate Stocks

By M. T. Hilborn
Maine Agricultural Experiment Station,
Orono, Maine

The production of orchard trees on hardy intermediate stocks involves top-working the stock with the desired scion variety. This practice complicates the evaluation of potential hardy stocks since the grafting introduces the complex problem of stock-scion relationships. The two more commonly used hardy stocks, Virginia (Virginia Crab) and Hibernal, have been investigated for quite a number of years, and certain stock-scion combinations have been found by a trial and error method to be undesirable.

Hibernal appears to be congenial with a wide range of scion varieties, although not particularly recommended by some for Golden Delicious, Gravenstein, or Yellow Transparent.

Virginia as a Hardy Stock

Virginia, however, has exhibited varying degrees of incompatibility with a number of scion varieties grafted upon it. Research, primarily in the Midwest, has shown that Virginia partially dwarfs Rhode Island Greening, half dwarfs Turley, Winesap, and Willow-twig, fully dwarfs Mammouth Black Twig, and has a complete lack of affinity for such varieties as Blaxtayman, Pewaukee, and some strains of McIntosh. For general orchard use, Virginia also is not recommended by most investigators as a stock for Cortland, Northern Spy, or Stark. Delicious, Grimes, and Starking have been reported as being quite variable on Virginia and probably these combinations should not be recommended.

A recognition of the stock-scion incompatibilities of Virginia was one of the reasons why a research program was initiated at Maine to study potential hardy trunk-forming stocks with the hope of eventually replacing Virginia, and perhaps Hibernal, with something better. The final evaluation of these stocks will require long-time orchard testing, but already various incompatibilities between stock and scion have eliminated some from consideration.

Different Types of Incompatibility

Rather early in the research program, Baldwin was completely winter-killed on some Hibernal trees while surviving nicely on Virginia. This indicated one type of incompatibility and discouraged further testing of Baldwin on Hibernal. The location of this comparison is unfavorable, with respect to soil and climate, for fruiting of Baldwins even on Virginia. Gravenstein on Virginia produced an overgrowth at the graft union, a trait which while not indicating incompatibility did indicate that this combination might not be the best.

Lately there has been considerable

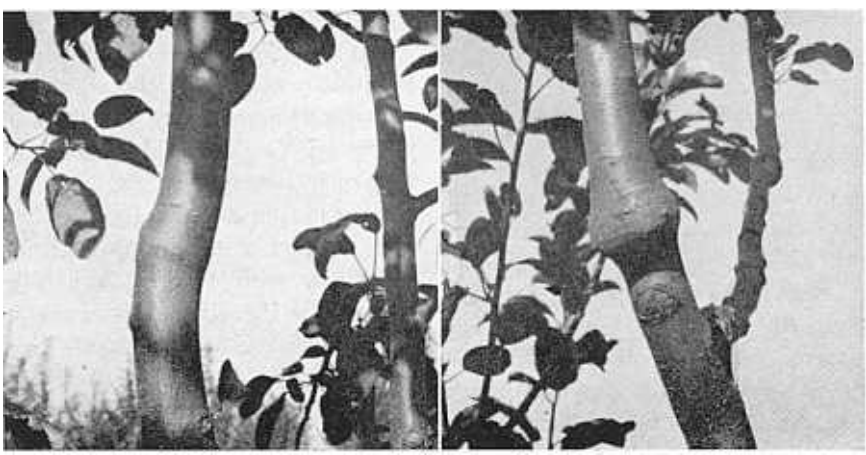
breakage of branches in Spy trees top-worked on Virginia. Some the trees of Rogers McIntosh on Virginia, after several years of cropping, do not appear as vigorous as desired. Perhaps these latter two incompatibilities should have been foreseen since each of these stock-scion combinations has been condemned by some observers.

The earlier plantings of newer sorts of trunk-forming stocks have now become old enough to exhibit some of the symptoms of incompatibility. In general, horticulturists consider incompatibility to have a range of symptoms extending from a complete form in which no union of stock and scion occurs, through the various forms of dwarfing and frequent breakage during high winds, to a stage where the symptoms are at first suppressed and a gradual decline occurs that finally results in death.

Delayed Incompatibility on Tayezhnoie

Tayezhnoie, a crab apple from Germany, looked very well in the earlier trials, but has lately begun to show symptoms of this delayed incompatibility. It propagated nicely in the nursery when budded on domestic seedlings, and produced an excellent nursery tree. When top-worked to Rogers McIntosh the trees appeared thrifty and although there was a swelling at the bud union this was more or less disregarded, since a swelling does not necessarily indicate incompatibility.

Investigators who have studied the subject of incompatibility in graft unions have generally agreed that in most of the unmistakably uncongenial com-



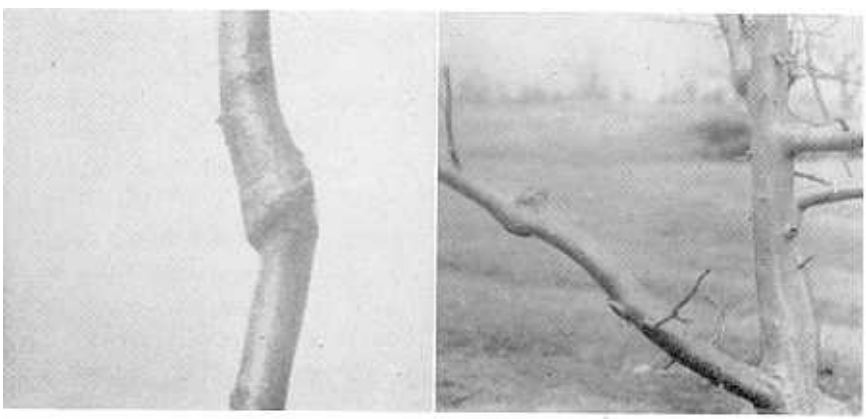
Left: Cortland/Tayezhnoie, showing good bud union.
Right: Northern Spy/Tayezhnoie, showing poor bud union.

binations a swelling at the union was entirely absent, and that some of the stock-scion combinations that did show swelling were apparently thoroughly compatible.

In the sixth orchard year the only trees bearing fruit in a test planting of nine different trunk-forming stocks were the Rogers McIntosh-Tayezhnoie combinations. The oldest scion wood in this planting was four years, and this early fruiting in itself was an indication of some sort of incompatibility. However, the trees appeared normal and it was not until the seventh orchard year that unmistakable symptoms appeared. Then the foliage of the scion variety began to turn yellow early in the season, the terminal growth became stunted, and the fruit did not size properly. It also dropped early. A closer examination of graft unions showed that union between the parts was incomplete, and breakage could early occur. Little pressure was required in most cases to break a branch off at the union. This delayed incompatibility has eliminated Tayezhnoie as a stock for Rogers McIntosh and made questionable its value under other varieties. At the present time Northern Spy also shows a pronounced swelling at the graft union, but with Cortland the union is perfectly smooth. This perhaps means that Northern Spy will go the way of Rogers McIntosh and the future of Cortland on this stock may be more hopeful.

Other Examples of Incombatibility

An even more striking case of incompatibility occurred when Baldwin was top-worked on Florence. One-year-old budling growth was easily broken at the union, sometimes just by the weight of a light snow or a moderate whipping by wind. Such early recogni-



Left: Rogers McIntosh/Tayezhnoie, showing poor bud union.
Right: Gravenstein/Virginia Crab, showing poor graft union.

tion of incompatibility is to be welcomed; it is delayed appearance of symtoms that more often cause disastrous results.

In 1946 a planting of Baldwin and McIntosh top-worked on Virginia and Hibernal began to bear the first fruits. The trees had been planted in 1940 and most of the top-working had been completed by 1943. No striking differences appeared in the 1946 fruiting, but in 1947 the Baldwin trees worked on Virginia fruited heavily, some trees producing over four bushels. Such heavy bearing casts a doubt on this particular stock-scion combination, since heavy bearing early in the life of a tree is usually an indication of incompatibility. If incompatibility occurs in this case, it will probably become more pronounced in subsequent years. The trees may be dwarfed, unthrifty, and ultimately poor orchard trees.

Hardy apple stocks will prevent severe winter injury such as occurred on this McIntosh tree in Maine.

Baldwins were top-worked on eleven new kinds of hardy stocks planted in 1941, with results not decided yet but prospects looking good on some. Other scion varieties were used in this test, and about forty other kinds of hardy stocks were planted in 1942, 1943, and 1944, and top-worked to a number of commercial varieties.

Long-time Program Necessary

All in all, the evaluation of trunk-forming stocks is a long-time study, since the orchard performance of the tree is the final criterion. The question of incompatibility is important. Although some stock-scion combinations may be eliminated from further investigation early in their testing, there remains the problem of delayed incompatibility that may show an originally promising stock-scion combination to be ultimately undesirable. Research on hardy trunk-forming stocks should proceed slowly and with caution toward the ultimate goal of producing hardy, thriving orchard trees.