Texas variety almond tree nearly destroyed by canker. Mallet wounds resulted in severe cankers which eventually girdled and killed the large scaffold limbs. Severe pruning back to new wood helped to reclaim this tree.

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Mallet wound

Canker of A

Limb cankers that expand rapidly and often girdle and kill major limbs within three or four years are reported to be of increasing incidence in California almond orchards. One or several limbs may be attacked in a single season. Where the condition continues, the trees must be severely pruned or removed. The cankers are typified by a depression of the infected tissues and the production of an orange, frothy gum. The disease is frequently found in the Winters, Chico, and Rumsey areas and occasionally as far south as Stanislaus County. The Texas (Mission) variety is most susceptible to the cankers, as measured by the girdling and killing of branches, but Nonpareil, Peerless, and Ne Plus Ultra are often severely damaged. The Drake variety is less susceptible, and cankers on these trees apparently expand more slowly than the cankers on trees of the other varieties.

Although this disease is associated primarily with injuries sustained at harvest time where mallets or clubs are used to knock the almonds to the ground, cankers often develop around other wounds or bruised bark on the trunk and lower limbs. The common method of harvesting, by knocking the almonds to the ground with mallets, causes a certain amount of bark and wood injury including a crushing and splitting of the bark tissues. In cases of Texas, Nonpareil, and other susceptible varieties, bark injuries provide entry points and a favorable nutrient medium for two fungi—*Ceratocystis fimbriata* and *Cytospora rubescens*—not previously recognized as pathogens on almond trees. The fungus *Ceratocystis fimbriata* is the more frequent cause of the cankers. These fungi are commonly present in almond orchards, but apparently, they become parasitic and cause cankers only when in contact with injured bark tissues. Following penetration into the wounded tissue, the fungi develop fairly rapidly causing cankers many of which enlarge continually. Even after a limb has been girdled and killed, Ceratocystis can continue, year after year, to invade healthy tissues and eventually girdle and kill other branches. As the cankers develop, there is a noticeable collapse of the cortical or bark tissues. The injured areas take on a water-soaked or darkened appearance around the margins. Copious amounts of gum are produced in and around the canker and the outer layers of bark tend to peel back. Although rolls of callus tissue occasionally develop around the cankers, the fungi frequently penetrate or circumvent these barriers.

The over-all appearance of these fungus cankers is almost identical to bacterial gummosis caused by the bacterial canker organism—*Pseudomonas syringae*—a serious disease of stone fruit trees. However, cankers caused by Ceratocystis are active all months of the year and continue to grow and enlarge year after year. In contrast, bacterial cankers are active only when the trees are dormant and in the early spring months. After a bacterial canker has run its course during these few months, it usually becomes permanently inactive. Another

Failure to prune out all the original canker in this Texas almond tree resulted in the infection of new wood. Note cutaway of young lateral branch showing the extent of the canker.

lmond Trees

major difference is that bacterial cankers are most frequently found in young trees, whereas the fungus cankers are found in trees of all ages, especially older trees.

In field experiments, harvesting with mallets was compared with harvesting by mechanical tree shakers to determine which method caused the least injury and resultant number of cankers. Mallets were used on 52 limbs of ten 16-year-old Texas variety trees, and a mechanical shaker was used on 55 limbs of similar trees. The mallets caused much more bruising and cracking of the bark than the shakers. Furthermore, preliminary observations indicated a considerably higher count of cankers in the trees where mallets were used. However, lack of skill on the part of the operator can result in greater injury from mechanical shakers than that resulting from the use of mallets.

From counts of naturally occurring cankers on almond trees in different orchards, it is conservatively estimated that one out of 10 mallet strikes will result in a fungus canker. At present, the only effective control of this disease is to prune out diseased wood and avoid bruising-type injuries to the trees. No chemical treatments are known which will effectively control the deep-seated infections caused by the canker fungi. Frequently, diseased limbs are pruned lightly and a part of the canker is left to invade new wood. In general, however, pruning wounds are less susceptible to invasion by the fungi which cause canker than are other types of tree injuries often caused by orchard equipment in use.

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Proper use of shakers causes little or no injury to the limbs. This photograph shows a representative limb shaken by a mechanical shaker. The site of contact with the shaker head is set off by paint marks.

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Typical canker, 18 months old, resulting from a mallet wound on a Ne Plus Ultra tree. Notice the gumming and darkened area on the bark showing the extent of the canker.

Large canker—indicated by arrow—originating at bruise on trunk and scaffold branch inflicted by orchard cultural equipment striking the tree.