Tree Planter's Notes, Volume 41, No. 1 (1990)

New Techniques for Tree Shaking in Older Seed Orchards

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Several new techniques were developed to shake large trees in older seed orchards without damaging their bark. The techniques worked equally as well as conventional shaking but were slower and could be expensive. Tree Planters' Notes 41(1):26-28; 1990.

Many acres of seed orchards in the Southeastern United States were planted in the late 1950's and early 1960's. The trees remaining after thinning and rogueing are 20+ years old and as large as 16 to 20 inches D13H. Although new, second-generation seed orchards are now coming to maturity, the older orchards are still producing the bulk of the seed used in the Southeast.

The process of collecting cones and seeds in older seed orchards is difficult because of the large size, both in height and DBH, of the trees. In addition, grafted seed orchard trees tend to have thinner bark than seedling-grown trees. The seed orchards have been thinned and rogued until there are only a select few trees remaining per acre. Trees have been heavily fertilized to enhance flowering. Such older, larger orchard trees generally produce large quantities of cones and seeds and their health and well-being must be protected.

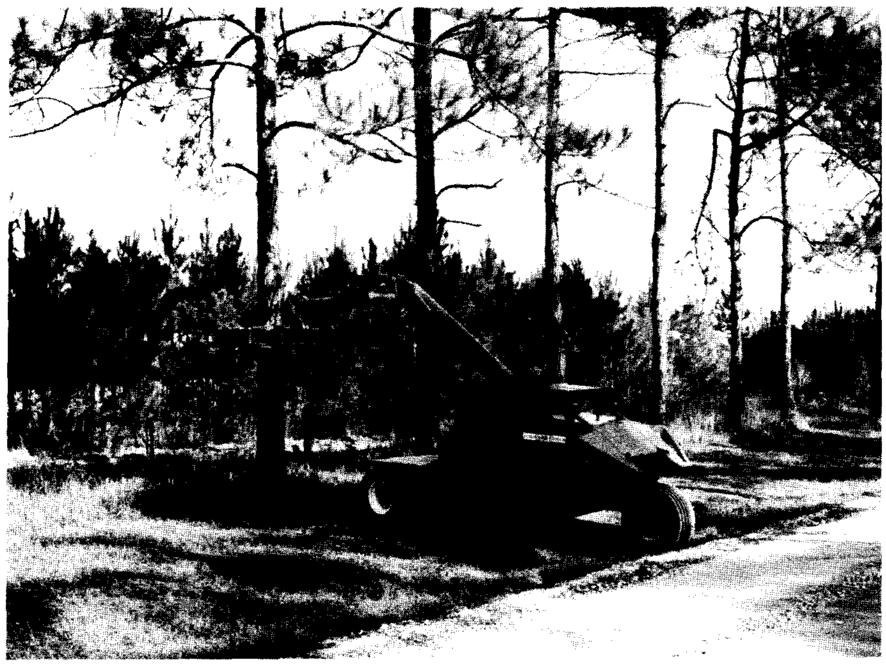

Figure 1—*Conventional tree shaking operation.*

Traditionally, commercial pecan shakers have been used to shake trees in seed orchards (fig. 1). Mechanical tree shakers do a satisfactory job of getting both cones and seed from the tree crown to the ground for most species and for younger, smaller-diameter trees.

However, for larger trees, the tree shakers apply more pressure to the trunks of the trees, which, in many cases, results in unacceptable damage to the bark. If the shaker operator does not position the gripping pads correctly, the shaking action will rub the bark and cause a wound on one or both sides of the tree trunk. These wounds will bleed resin and thus attract bark beetles and can also serve as an entry point for the spores of pitch canker and other diseases.

In an attempt to alleviate problems relating to bark damage from shaking seed orchard trees, the USDA Forest Service, region *8,* in cooperation with the Missoula Technology and Development Center, Missoula, MT, has evaluated several new techniques and pieces of equipment at the Forest Service

Francis Marion Seed Orchard near Charleston, SC. The orchard produces loblolly (*Pinus taeda* L.), longleaf (*P. palustris* Mill.) and shortleaf (*P. echinata* Mill.) seed for the national forests in North Carolina, South Carolina, and Georgia. Sixty-eight of the orchard's 138 acres are planted in loblolly pine. To date, 75% of the seed crops harvested has been loblolly pine. Seeds are mainly collected in nets laid under the trees.

Tree Shaker-Bolt System

Several types of bolts have been installed in the tree itself to eliminate the direct contact between the tree shaker pads and the bark of the tree. The bolts are of two basic types: threaded rod and lag screw.

The threaded rod type bolt was first used in tests to evaluate the initial idea. Although the concept was established as potentially useful, it was immediately obvious that there were several problems to overcome. A threaded rod placed in a hole that has been drilled completely through the heart of a tree does create certain mechanical and physical problems for the tree. Testing established that the conventional pecan-type tree shaker could transfer enough energy to the tree to dislodge both cones and seeds, and the tree did not appear to be damaged. However, this type of bolt has several other problems:

Hole through the tree. The diameter of the hole must be as small as possible to minimize the structural weakening of the trunk. On the other hand, the rod diameter needs to be as large as possible to prevent bending. After many size comparisons, it was found that a 1'/2 inch-diameter threaded shaft was the best compromise.

Thrust plates. If the compression nut, which holds the thrust plates tight to the sides of the tree, is not released each year after shaking, the tree tends to overgrow the thrust plate. It does not take long until the shake points can no longer be located and used.

Acorn nuts. The rod ends extending out on each side of the tree must be able to meet the shaker head in order to transmit the energy from the shaker to the tree. A conventional hex head nut (domed on the outboard end) was found to provide a good interface between the threaded shaft and shaker head.

Bolt length (threaded entire length). The portion of the bolt extending beyond the tree on either side bends from the shaking action. The greater the extension, the larger the moment arm, and the more chance there is of bending the rod. In an attempt to correct this problem, the bolts were cut to length for each tree. This did not allow for future growth and the threaded section must be replaced periodically.

Shaker-head adapter plates. The tree shaker as supplied for conventional tree shaking has resilient pads designed to grip the tree trunk. The pads do not interface well with the bolt heads, therefore a dimpled metal plate was substituted for the pads. The domed bolt heads fit into one of the dimples, which serve as receptors (fig. 2).

The offset rows of dimples help insure alignment when the shaker head is closed and make it possible to accommodate some misalignment or tilt. To date the plates have worked well in transferring the shaker's energy to the tree.

Clamping of the shaker head. Visual alignment of the bolts and shaker head prior to clamping is extremely critical and at the same time difficult to

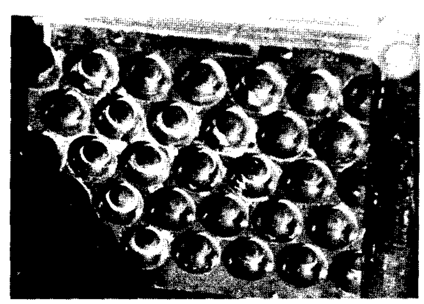

Figure 2—*Receptor plate (attached to shaker head).*

accomplish. All the problems associated with rapid clamping have not been solved. At present attachment is quite slow, too long for a production operation, and cannot be done by the operator without a second person.

Lag Screws

Using the lag screws, which is presently under evaluation, appears to eliminate many of the problems associated with the threaded rods. A basic lag screw with a domed hex nut welded to the top is used (fig. 3).

A shallow hole of matching diameter to the lag screw is drilled into each side of the tree and the lag screw inserted (fig. 4). Each year after shaking the lag screw is backed out enough to permit room for growth. The following concerns have been eliminated:

1. Structural damage to the tree created by drilling holes completely through the tree.
2. Bending of rod extensions.
3. Thrust plate overgrowth.
4. The jam nut used to hold the outboard nut working loose.

Overall, the system is working quite well and shows promise of being a workable system. Technology development by the Forest Service is on hold until a definite need is determined.

Note added in proof: Hurricane Hugo struck the Francis Marion Seed Orchard September 21, 1989. Many orchard trees were broken by its winds. The evidence is inconclusive that the bolts caused trees to break: some trees containing bolts broke, others did not. Some with bolts broke above the bolt.

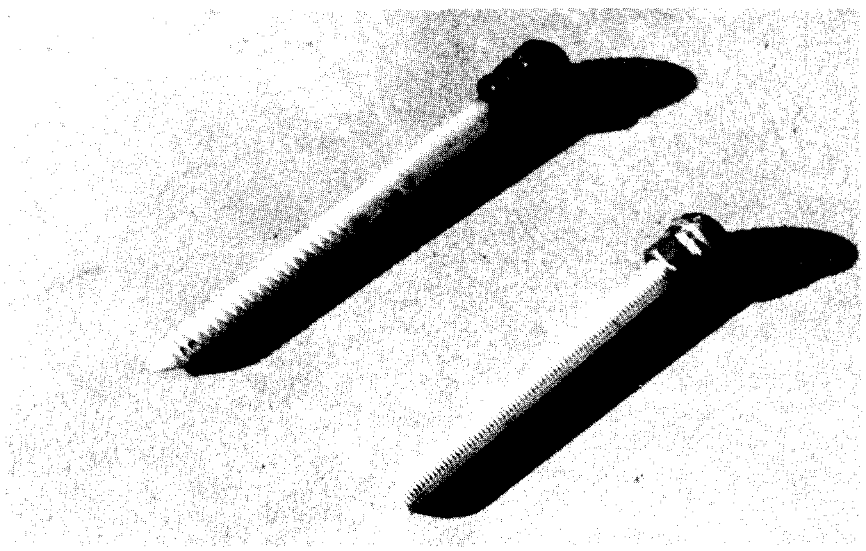

Figure 3—*Lag screw with domed hex nut head.*

Figure 4—*Lag screw installed in tree.*