# Three systems for gathering slash pine cones tested

*by*

**R. G. Hallman**

*Forester.*

*Missoula Equipment Development Center*

*USDA Forest Service Missoula, Mont.*

The short lime span in which tree seed can be collected, the increasing necessity to collect larger amounts in specific locations, and labor shortages are sonic of the reasons why mechanical methods are needed to harvest tree seed. Since 1964, the Missoula Equipment Development Center has been investigating equipment for collecting cones and seeds and has found that mechanical shakers used in fruit and nut orchards remove cones from some tree species. However, a mechanical system for gathering cones shaken from the tree is needed. The Center evaluated three mechanical fruit-gathering systems for gathering cones of the slash pine (pious *elliotti)* al the Georgia State Forestry Commission's seed orchard near Cochran, Ga. The orchard is located on relatively flat terrain, with a tree spacing of 16x 16 feet.

Concurrent with the mechanical systems evaluation, the Forestry Commission manually collected cones using a 19-member crew. The cost of manually collecting cones served as a standard to compare with the other collection methods.

## Systems Tested

The three basic descriptions of cone collection systems which the Missoula Equipment Development Center tested follow:

Catching frames.-Two catching frames designed by the Center and built commercially were used in conjunction with a tree shaker. Both frames were constructed of 2-inch welded steel tubing and covered with polypropylene cloth. The frame measured 26 x 26 feet, and was built in two sections, each with an indentation to fit around tree trunks. One frame was designed to lay flat on the ground and to he driven over (fig. 1). It weighed 350 pounds. The other frame sloped so that cones would slide to one end (fig. 2). The sloped frame had a tractor opening 8½ x 12 feet that elevated to 6 feet by use of two supporting legs made of steel tubing. The sloped frame weighed about 550 pounds. A four-man crew placed the frames under the trees to catch cones as they were shaken off.

**Mechanized canvas.-The** second collection system combined a me-

Figure 1.—Drive-over frame shown with shaker.

Figure 2.-Drive-into frame shown with shaker.

ehanized catching canvas with a Shipley Blue Braeero harvester (fig. 3). The canvas was split in the middle and was large enough to encircle the tree. The canvas was pulled front the machine and placed around the tree. After the cones were shaken from the tree onto the canvas, the machine retracted it. As the cones on the retracting canvas reached the machine, they spilled onto a belt that moved perpendicular to the retracting canvas. The belt carried the cones past a blower that removed needles and twigs, then finally deposited thenm in a container at the end of the machine. This Shipley machine measured 41 feet long, 48 inches wide, and 44 inches high, and weighed about 3,600 pounds. The conveyor belt was approximately 36 feet long and 30 inches wide and was 23 inches above the ground. The retractable canvas measured 30 by 30 feet, A tractor with power takeoff operated the machine and provided hydraulic power for its moving parts. Steerable wheels made it very maneuverable in close quarters.

Rotary pickup collector.-A rotary pickup collector, the self-propelled Ramacher Harvester, was also tested (fig. 4). The machine measured 18 feet long, 9 feet 8 inches wide, 5 feet 8 inches high, and weighed 6,620 pounds, It had a pickup swath of 6 feet 10 inches, To increase production, a power sweeper was used with this machine. The sweeper, with a 6-foot sweeping swath, concentrated the cones into a windrow away from the trees. Teeth on the harvester lifted cones, needles, and twigs onto a conveyor. Fans and tumblers separated needles and twigs from the cones, and coot: were then conveyed to a trailer towed behind the harvester.

## Test Results

The following tabulation shows production rates and costs for the cone collection methods evaluated:

| | Average bushels per hour | Cost per bushel |
|---|---|---|
| 19-member crew | 62 | .50 |
| 4-man crew, flat frame | 19 | .53 |
| 5-man crew, sloped frame | 28 | .15 |
| Ilriver. 2-man crew, Shipley harvester | 108 | .22 |
| Operator, Ramacher collector, power sweeper | 103 | .31 |

The 19-member crew picked about 62 bushels of cones an hour. At an average of $1.65 per hour per crewman, it cost approximately $.50 per bushel. The cones were hand loaded onto a truck, completely clean of needles, grass and branches, and ready for the extractor.

A four-man crew was needed to lift the flat catching frame,, or to tilt each side of it, after the tree had been shaken, so cones would slide off. The crew averaged 26 trees or about 19 bushels per hour. Figuring each crewman at about $2.50 per hour, the cost of getting the cones concentrated beneath the tree was about $.53 per bushel. The task of picking up the cones remained and, because they were covered with needles and branches all windrowed together, they had to be picked up manually.

A five-man crew was needed for the sloped frame. The extra man raked the cones down the sloped frame because the needles and sharp spines on the slash pine cones held them back. The crew averaged about 37 trees or 28 bushels per hour. Using $2.50 per hour per man, a bushel cost $.45 per hour with the

sloped frame. Again, the cones were mixed with needles and branches, and had to be picked up manually.

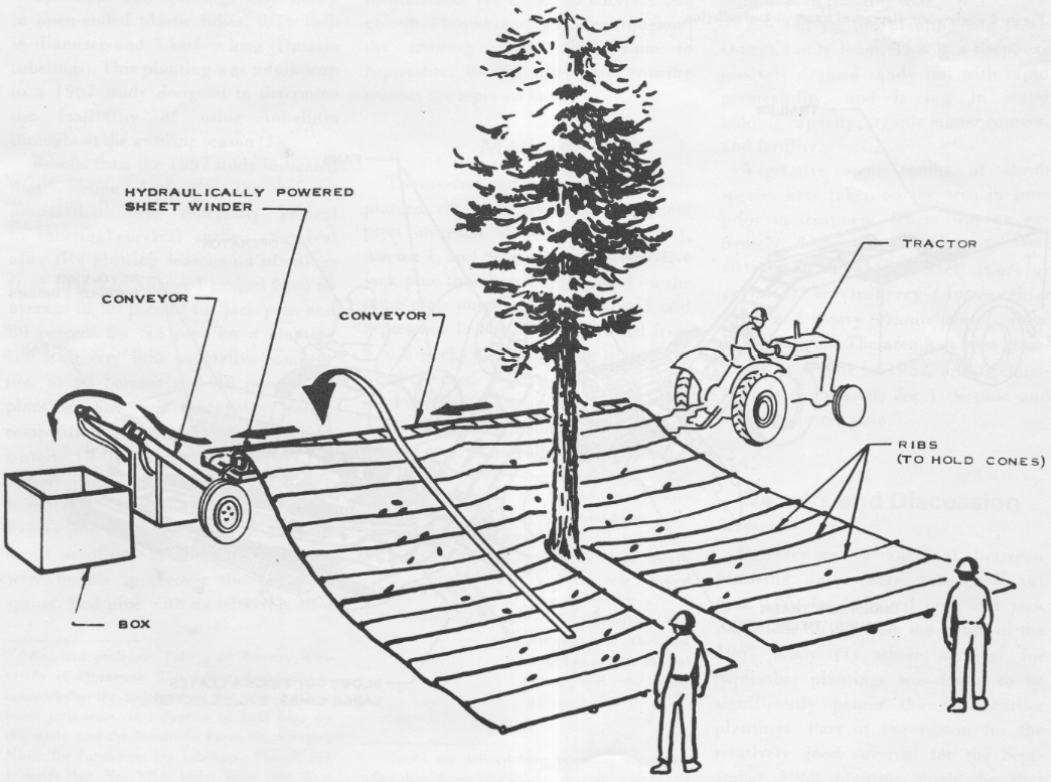
A tractor driver and two laborers were needed for the mechanized catching frame combined with the Shipley Blue Bracero Harvester. Approximately 108 bushels were collected per hour. At a combined estimated rental rate of $15 per hour for the tractor and the Shipley machine, $3.50 per hour for the driver, and $2.50 for the two laborers, cost per bushel was $.22. The blower on the Shipley machine was not powerful enough to remove all needles and branches. With blower modification, trash-free cones could be delivered to a container that was loaded onto a truck in a separate operation.

The Ramacher collector and power sweeper collected 103 bushels per hour. With estimated rental rates of $15 an hour for the collector, $10 for the power sweeper, and $3.50 for each operator, cost per bushel was $.31. The machine passed over about 10 percent of the cones, and those that were picked were not completely cleaned because the blower was not powerful enough. The machine could be modified to pick up most of the cones and deliver them, trash free, to the trailer.

## Discussion

Manual collection of cones is costly and labor to do this work is becoming scarce. Neither of the hand-carried frames tested offered an advantage for collecting cones in a seed orchard. The frames were heavy, cumbersome, aril though well-constructed, were easily damaged.

Figure 3.—Diagram of mechanized canvas and tractor harvester.



The retractable canvas was very efficient for collecting cones in a seed orchard, with only the slight disadvantage of having to he combined with a shaker. However, experienced collecting crews might overcome this by keeping up with the normal speed of the shaker. One other shortcoming was that the largest practical size box to use with this machine was just 4 by 4 by 4 feet. Although cones must he retrieved from the assortment of needles, branches, and cones shaken from the tree, ground clutter is not also mixed with the cones.

One man can handle the entire cone collecting job at a large orchard with the rotary pickup machine. It is not necessary to operate it simultaneously with the shaker. The disadvantage o1 this system is that cones must be sorted from under windrows of dead needles and branches that have accumulated on the ground as well as those that have shaken from the tree. If the ground clutter is damp, it can add to the load on the blower. Improved blowers, or precleaning the orchard floor, would correct this problem.

## Conclusions

Manual collection of shaken cones is too slow and too expensive, and collecting cones with hand-carried frames in a seed orchard is even slower and more costly than manual collection. However, both the retractable canvas sheet collector and the rotary pickup collector show promise and, with modification, could reduce cone collection costs in a seed orchard.

Figure 4.—Schematic diagram of rotary pickup collector.