In 1956, the only attractant available for use in the many thousands of survey traps was angelica seed oil, which is obtained from a biennial plant grown in Belgium. Annual world production of this oil is only 600 pounds. Keeping about 50,000 survey traps supplied with attractant soon exhausted the stocks of angelica seed oil. The price rose from an original $56 per pound to $250 per pound.

Substitute concoctions were made up by the perfumery trade, which smelled to the human nose like angelica seed oil. But they did not fool the medfly—not attracting him in the least.

In the meantime, the chemists at Beltsville discovered a synthetic attractant and continually modified its structure to get more effective lures. There were about half a dozen of these synthetics, all more or less attractive to the medfly, and all of them of different odor to the human nose.

But the male medflies responded to something that must depend upon the similar structures of these compounds—and not to the smell that is perceptible to humans.

This brings us back to our starting point—what you and I smell is not what insects smell.

Tree Shaker Saves Our Cherry Pies

NORMAN E. ROBERTS

One summer day in 1959, a strange-looking machine was wheeled into place under a cherry-laden tree in a Michigan orchard. A clamp at the end of a mechanical arm was secured to a branch of the tree. The machine's motor was started, and the tree shook violently, the cherries falling to a net spread beneath.

This was the first mechanical harvester for red tart cherries. Its introduction may have meant as much to 20th-century cherrygrowers as the gin and the reaper did to 19th-century cotton and grain farmers.

It may even have saved cherry pie, one of America's most popular desserts, from becoming a rare treat.

Picking cherries by hand is hard, slow work. An experienced picker would do well to gather 300 pounds in a day. The harvest season is short—a scant 3 weeks—and many thousands of workers (45,000 in Michigan alone) have been needed to harvest a crop that usually runs around 190,000 tons.

In the past 10 or 15 years, the job of recruiting these armies of pickers has become well-nigh impossible. The last hope of maintaining the cherry industry with handpickers fled when the supply of foreign migrant workers was cut off at the end of 1964. How could an orchardist pay pickers fair wages by domestic standards to harvest only 300 pounds a day and still sell his fruit in today's competitive food market? And even if he could, where would the workers come from?

Some years before the clouds of economic disaster began gathering over the cherry orchards of Michigan, New York, Wisconsin, and Pennsylvania, Jordan H. Levin had an idea.

"Wouldn't it be great," he told his group of Agricultural Research Service engineers at Michigan State University, "if we had a machine that would just shake the cherries off the trees?"

Mechanical harvesters had already been tried for walnuts and some other crops. But most people thought Levin's idea was crazy—like a small boy's dream of getting his chores done effortlessly. How would you prevent bruising and maintain high quality if you allowed delicate cherries to fall on top of each other from heights as great as 20 feet? And wouldn't the tree be killed, or at least the bark ruined, by a mechanical monster which grabs the branches firmly enough to shake with such vigor?

Undaunted by this skepticism, Levin and his engineers began studying designs for mechanical harvesters, with the idea of developing an entirely new machine that would meet the special demands of red tart cherries.

In the meantime, Chemist R. T. Whittenberger was working with another group of ARS scientists at the eastern utilization laboratory in Philadelphia. They, too, were taking a critical look at traditional methods of harvesting and processing cherries. Yet, these scientists were not concerned with economics or labor, but solely with the quality of the processed product. They had established bruising as the number one cause of downgrading cherry quality. And they had proved that the human pickers themselves cause most of the bruising as they take the cherries off the tree and drop them into the pail.

Whittenberger's group began to experiment with other means of picking cherries that might cause less damage to the fruit. One such method was to suspend a minnow net beneath the tree and have the pickers loosen the cherries from the branches with their fingertips and allow the fruit to fall into the net. With the impact of their fall broken by the net, the cherries suffered much less bruising. "But what if a machine could be devised to do this shaking?" the experimenters mused.

It was not long before the two ARS groups were collaborating. The result of their collective labors was the crude machine that shook the cherries from about 300 trees in that Michigan orchard in 1959. There was no question that this first model did more damage to the cherries than careful handpicking. But with experience, Levin and Whittenberger were able to use it to gather cherries of reasonably good quality. They began to see possibilities for modifying the machine to make it a practical harvester.

Over the next few years, working with David Friday, an energetic and imaginative machinemaker, Levin and Whittenberger steadily improved and refined the harvester. Inertia shakers that shake only the tree—not the tractor they are mounted on or the operator—were developed to separate the cherries from the trees more easily. Self-propelling units were built that could be used on hillsides. Experiments were made with various cushioning materials to minimize bruising as the cherries fall onto the collecting frames. Special clamps were devised that virtually eliminated bark damage. Small models were built that could be operated by one or two men.

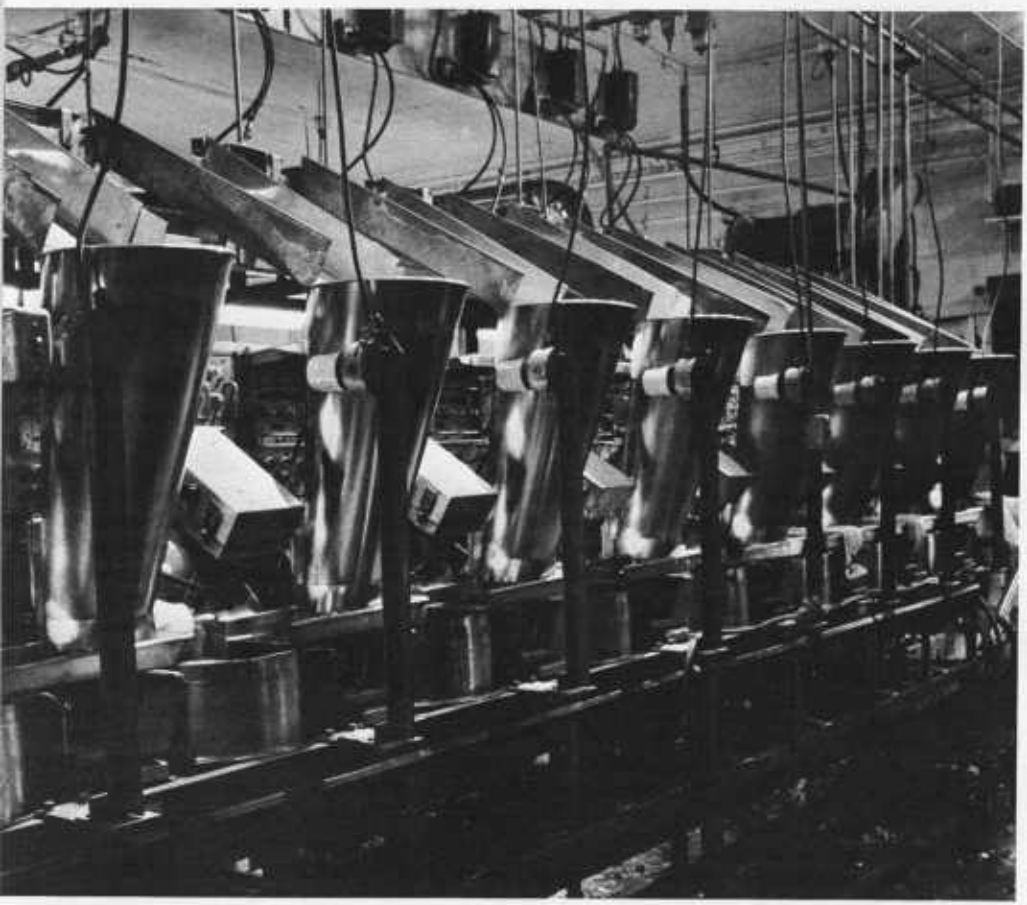
Growers became enthusiastic about the new machine with which they could harvest as many cherries in a day with a five-man crew as could be gathered by 100 handpickers.

But processors were skeptical. Despite their improved quality, machine-harvested cherries required a different kind of treatment than those picked by hand. Processors scorned them, except for making juice. In 1964, only about 3 percent of the cherry pack was machine harvested and the following year, only 8 percent.

Each season, Levin and Whittenberger worked together as a team, Levin with machine manufacturers to

NORMAN E. ROBERTS *is Public Information Officer, Eastern Utilization Research and Development Division, Agricultural Research Service, Philadelphia.*

Cherry harvester, *top*, is positioned beneath tree. It has two hydraulic shakers and a catching frame. Elevator takes fallen cherries to cold water tank. In processing plant, *below*, each of these eight electric sorters can handle up to 2,800 pounds of cherries an hour.



perfect the harvesting equipment and Whittenberger with processors and processing equipment manufacturers to help the canneries meet this new challenge.

Concurrent with the development of mechanical harvesters in the field, electric sorting machinery came into use in cherry-processing plants. First used commercially in 1963, the electric sorter does the work of three or four manual inspectors. It picks up each cherry individually, scans it photoelectrically, and accepts or rejects it on the basis of its reflectance.

The electric sorters can handle as much as 2,800 pounds an hour—that's over 5,000 cherries a minute. New sorters that work twice as fast are now in experimental operation. These scan the cherries as they fall freely past photoelectric cells, pneumatically removing rejects.

Electric sorters became a valuable complement to mechanical harvesters. Both have vastly improved the efficiency with which red tart cherries are being packed.

The destemmer is even more important than the electric sorter in enabling processors to handle machine-harvested cherries. When cherries are picked by hand, very few of the stems remain on them, and these are easily removed by inspectors at the plant. Shaking, however, allows many stems to remain on the cherries.

Until as late as 1966, processors were seriously slowed down in the handling of machine-harvested cherries by the tedious stem-removing operation. Whittenberger and Levin worked with equipment manufacturers to develop a device which would automatically remove the stems without damaging the cherries.

Several destemmers were under experimentation in 1965, when Russell and Vernon Smeltzer, two brothers who operate orchards near Frankfort, Mich., came up with the idea of installing a rotary blade above an oscillating tabletop. The cherries, in a single layer, are continuously kept in motion on the tabletop. As the stems turn up, they are knocked off by the dull edge of the blade rotating about one-eighth of an inch above the cherries.

Successful experiments with these destemmers were first made in 1965, and over 50 of them were in commercial use by 1967.

So a revolution has saved the cherry pie. Mechanization in the orchard has reduced the total cost of cherry harvesting to around one and a quarter cents per pound. Mechanization in the processing plant has speeded up operations to such an extent that even bumper crops can be processed within the brief harvesting period.

Mechanical harvesting is still a long way from completely replacing handpicking. In 1967, it was estimated that about 50 percent of the crop was harvested by machine; the year before that, only about 22 percent was.

It is significant that these 2 years, the first in which mechanical harvesting was done to any appreciable extent, both yielded unusually small crops. Experiences with mechanical harvesting in these seasons have proved its value in times when it might seem to be least needed. In poor crop years, many trees bear so few cherries that it is not worth the time and effort of handpickers to climb them. But a tree with few cherries can be shaken just as quickly and easily as one heavily laden, and the effort is economically rewarding, especially when shortages inflate the price.

It's estimated that the 1967 harvest of red tart cherries, 45 percent of normal, would have been only 40 percent of normal had orchardists been solely dependent upon handpicking. That's a difference of $2 million worth of cherries at 1967 prices.

It appears, then, that whether future crops of red tart cherries are large or small, mechanical harvesting and streamlined processing have saved our cherry pie from the near-oblivion to which it once seemed headed.