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# *A Mechanical Huller and Separator for Harvesting Pecans*

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THE PECAN IS A VALUABLE NUT CROP. THE PRINcipal pecan-producing states are Texas, Georgia, Oklahoma, Alabama, Louisiana, Mississippi, Florida, Arkansas and the Carolinas. Over 200 million pounds of pecans were harvested in these states in 1953, and the yearly average from 1944 through 1953 was 141 million pounds. The largest crop in Texas in recent years was 57 million pounds; the yearly average is about 30 million pounds.

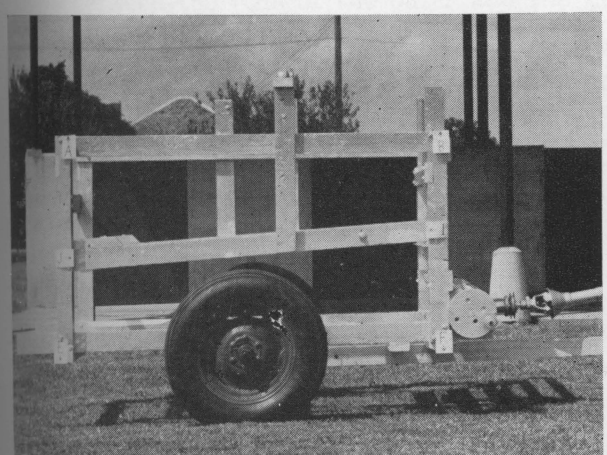
Harvesting pecans presents unusual problems. Pecan trees attain great size. The harvest season begins in mid-October and continues into winter. Labor skilled in gathering pecans frequently is scarce. Daylight is short during this season and rain, cold and wind often interfere with the harvest. The demand for fancy pecans is best before the Thanksgiving and Christmas holidays, and better prices prevail at those seasons than later. A delay in gathering pecans may result in losses from crows, squirrels, floods, theft and deterioration in market quality.

The time-honored method of gathering pecans has been to thresh the nuts from the trees with poles, and to pick them from the ground by hand. This is slow, tedious, hard work. Widespread use is now made of mechanical pecan shakers operated with tractor power in shaking pecans from trees. Some growers use sheets spread under trees to catch the pecans. Under favorable conditions, these sheets enable the grower to harvest pecans in less time and at less cost than with hand picking. The best time to use sheets is early in the gathering season before many pecans have fallen to the ground. Sheets can be used whether the pecans are threshed by hand, or shaken down with a mechanical shaker. In either case leaves, dead twigs, husks and pecans fall on the sheets. When a tree is threshed or shaken, particularly early in the season, some pecans with partially-opened husks usually are mixed with those that have already separated from the husks and special effort is required to remove the hulls. The percentage of such unhulled pecans depends on the variety and the stage of maturity. The final harvesting operation consists of removing these partially opened husks from the pecans and separating all nuts from the trash, twigs, husks and leaves.

Members of the Department of Horticulture of the Texas Agricultural Experiment Station have developed a machine known as a pecan huller and separator which effectively removes any adhering husks, and separates pecans from other materials. The essential features of the machine were described in Progress Report 1196, "Equipment Developed for the Mechanical Harvesting of Pecans." Additional adjustments and refinements have resulted in improved performance.

## THE PECAN SEPARATOR AND HULLER

The separating mechanism consists of two screens, one located above the other, with a similar screen between the two to convey unhulled pecans to the huller. When the machine is in operation, all three screens move back and forth



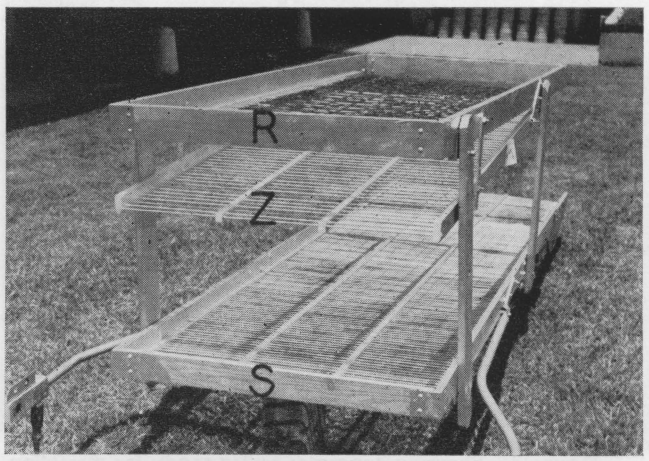



Figure 1. Left—Trailer frame to support screens. Right—Screens ready to be set in trainer frame. R = top screen; length, 84 inches; width, 36 inches. Z = middle screen; length, 60 inches; width, 36 inches. S = bottom screen; length, 115 inches; width, 36 inches. Measurements, inches, A to B, 72; E to F, 72; A to J, 20; J to E, 14; B to I, 16; I to F, 18.

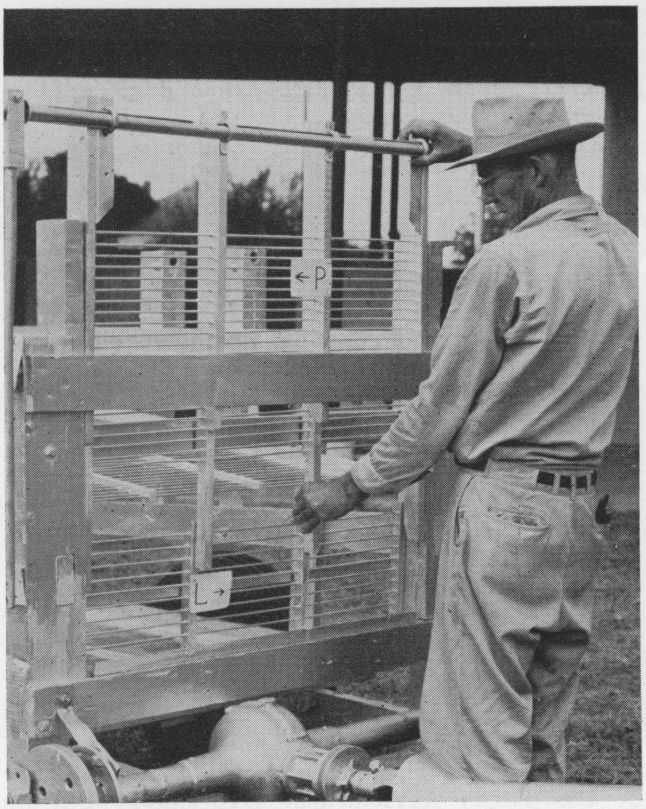



**Figure 2. Outer huller frame, P, raised to show inner huller frame, L. Width of outer and inner huller frames, 35 inches; height of outer huller frame, 36 inches; height of inner huller frame, 12 inches.**

horizontally at the rate of about 75 movements per minute. A 6-inch back and forth stroke is used. The three screens assembled on the pivot bars which support them are shown, before mounting in Figure 1, and after mounting in Figure 3.


**Figure 3. Showing separator-huller ready for operation. R, top screen; Z, middle screen; S, bottom screen; circumference of belt, E, 114 inches; length of pivot bar, X, 33 inches.**

### Top Screen

The materials which fall onto sheets in threshing or shaking—pecans, husks, leaves and twigs—are carried by a mechanical conveyor from a hopper slightly above ground level and dumped directly onto the front part of the top screen. It has 1½-inch openings which permit the husks, hulled and unhulled pecans to fall through. The leaves and twigs are retained temporarily on the top screen, but as it continues to move back and forth these are gradually discharged at the opposite end. This is facilitated by mounting the top screen so that the discharge end is slightly lower than the front end, and by providing an opening in the screen to allow the trash to drop through. A metal baffle sheet, not shown in the accompanying photographs, is mounted in a sloping position on the rear framework to let the trash slide off to one side.

### Middle Screen

A second screen is placed under the top screen to catch unhulled pecans that fall through and to convey them to the huller. The bottom of this middle screen is made of 3/16-inch steel rods spaced properly for the pecans being harvested.

The spacing of the rods should be sufficient to permit the hulled pecans to fall through, but to retain the unhulled ones. A spacing of 1¼ inches is suitable for average pecans of the Success, Stuart and Desirable varieties, and 1 inch is about right for the Schley, Moore, Ideal and Western Schley. Screens with openings of different sizes can be interchanged easily for pecans of different sizes. This screen, shown at Z in Figures 1 and 3, is mounted with the end next to the huller lower than the opposite end, so that unhulled pecans are dumped into the huller as the middle screen moves back and forth in the normal operation of the machine. A metal apron, not shown in the accompanying photographs, is mounted underneath the discharge end of the middle screen and inclined so that the pecans falling on it roll into the huller.

### Lower Screen

The bottom of the lower screen is made of 3/16-inch steel rods, spaced so that hulls will fall through, but hulled pecans which have fallen directly from the top screen and those that have gone through the huller, will be retained. As the screen moves back and forth, the pecans move toward the lower end of the tray, where the wide spacing of rods permits them to fall into a trap, from which they are discharged. The trap, labeled Y, is shown in Figures 3 and 5, and the final harvesting operation is shown in Figure 7. The widest spacing that will retain the pecans is most desirable since it allows the husks and other trash to fall through more readily than a closer spacing. A spacing of 5/8-inch is about right for such varieties as the Moore, San Saba Improved, Ideal, Nuggett and Western Schley; 1 inch is satisfactory for larger varieties. This

lower screen, like the middle one, is removed easily to install a screen of the right spacing for the variety of pecans being harvested.

### Huller

The hulling unit consists of 3/16-inch steel rods placed in a vertical framework consisting of an outer and an inner frame. The inner one, labeled L in Figure 2, is stationary but removable to permit substitution of frames with suitable rod spacings for different varieties of pecans. The rods in this frame are spaced to permit the hulled pecans to pass readily between them. For pecans the size of Moore, Schley, Western Schley and Ideal, a 1-inch spacing is about right. For larger varieties, like Success and Stuart, a 1¼-inch spacing is recommended. The outer huller frame, labeled P, is shown in Figure 2, and only one such frame is normally constructed for each machine. It has rod spacings of 5/8 inch, and is used for pecans of all sizes. In operation, this outer frame moves up and down and rubs the pecans against the stationary inner frame. Best performance will be obtained if the distance between the rods of the two huller frames is the same as the interval between the rods of the inner frame. Since the rods of the outer frame are spaced ½ inch from the edge, the variation in distance to accommodate pecans of different sizes must be provided in setting the rods in the inner frame. For example, if a spacing of 1 inch is desired between the rods of the two huller frames the rods in each would be spaced ½ inch from the edges of the frames; if a spacing of 1¼ inches is desired, the rods in the inner frame would be spaced ¾ inch from the edges of the frames; and those in the outer frame would be placed ½ inch from the edges, except for those near the top.

To facilitate the entrance of the unhulled pecans into the space between the huller frames, the rods near the top of the outer frame are spaced a greater distance from those of the inner frame than the normal spacing. The regular distance between the rods of the outer and the inner huller frames would be 1 or 1¼ inches, but the outward flaring of the rods in the upper part of the outer frame provides a distance of about 2 inches between the rods of the two frames. This wider spacing enables pecans from the middle screen to fall readily between the huller frames, and they are pushed downward into the narrower area between the rods of the two frames by the up-and-down movement of the outer frame. As soon as the husks are rubbed off, the pecans are pushed out between the rods of the inner frame or fall out the bottom onto the lower screen of the separator.

### Hopper and Elevator

The leaves, twigs, husks and pecans which fall on sheets in shaking or threshing are bulky and heavy. The belt elevator, shown in Figures 3, 4 and 7, conveys all of this to the top screen where

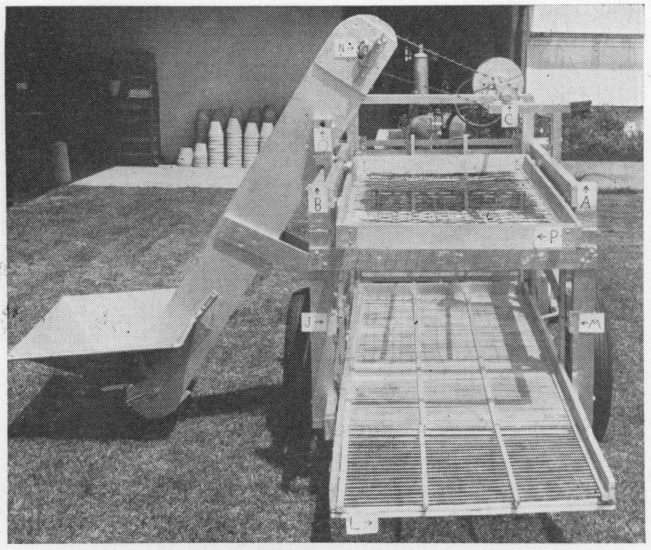



**Figure 4. Rear view of screens, showing extra long lower screen and feeder elevator. B to A, 46 inches; length of elevator, 84 inches; O is axle for tilting elevator when moving from one location to another in the grove.**

the separation begins. The hopper of the elevator is placed as near the ground as possible so that the pecans and other materials can be dumped easily into it. The conveyor is made of a 6-inch flat belt with 10 brackets spaced 16 inches apart to carry the pecans. The elevator belt is driven by a V-belt and chain drive, as shown in Figure 3.

### Drive and Operation Mechanism

The trailer-mounted pecan huller-cleaner may be driven from the power-take-off of a tractor or by a small gasoline engine of 1 to 2 hp. As most pecan growers have a tractor, the power-take-off drive is described. A propeller shaft transmits the power from the power-take-off to the differential gear of an automobile. The brake hubs are removed and crank-wheels installed on the ends of the axles, Figure 3. Large wrist pins are inserted off-center near the rims of each wheel. Long pitman rods, M in Figure 3, extend from these wrist pins to a central point on each side of the separator frame, to oscillate the separating

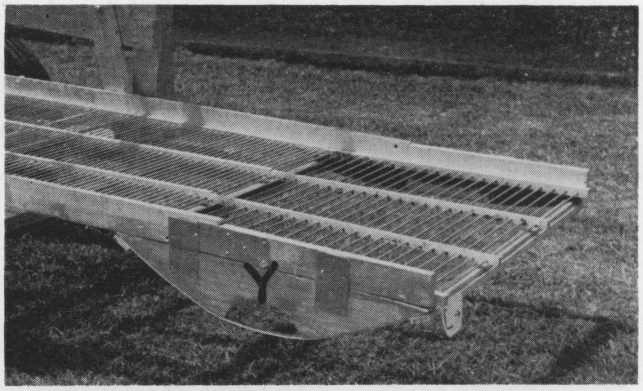


**Figure 5. Wide spacing of rods at end of lower screen permits pecans to fall into trap below, from which they are discharged through side opening.**

Figure 6. Left—Picking up large trash. Right—Rolling pecans, hulls and light trash into pile on sheet.

screens, Figures 1 and 3. Another set of pitman rods extends from the same wrist pin, or from other wrist pins mounted on the horizontal pitman rods, to each end of a shaft attached to the top of the outer huller rack, as shown in P, Figure 3. As the pitman wheel revolves, the horizontal pitman rods move the three separating screens, set in a frame, back and forth; the vertical pitman rods move the outer huller rack up and down.

## USING THE PECAN SEPARATOR AND HULLER

The combination pecan separator and huller can be operated satisfactorily by two men. After the pecans are threshed or shaken onto sheets, the larger limbs and trash are gathered and thrown out, Figure 6. Pecans and other materials are brought together in one pile. The separator-huller machine is pulled into place so that the pecans can be dumped easily into the hopper. These steps are shown in Figures 6 and 7. One man usually feeds the hopper while the other removes any trash and defective pecans, and pours the clean pecans into bags. The capacity of the machine is determined by the size and shape of the pecans. It is best adapted to large round and oblong cylindrical pecans. Difficulty is encountered with oblong pecans that are tapered with one end measurably larger than the other. The small end of such pecans tends to become wedged between the steel rods of the screens and they hang vertically instead of rolling along toward the discharge end.

The best sheets for catching the pecans are made of a good grade of domestic cloth. Sheets twice as long as they are wide spread easier and fit better under trees; convenient sizes are 20 x 40 and 25 x 50 feet. Such sheets will be ruined in a few days if left in a pile or stored while damp. If they are kept spread out while damp, and stored only when dry, they will remain serviceable for many years. The writer kept one set of such sheets for 15 years, and used them for harvesting nine crops of pecans. The sheets frequently are damaged by smokers who accidentally drop burning embers. Camouflage nets which

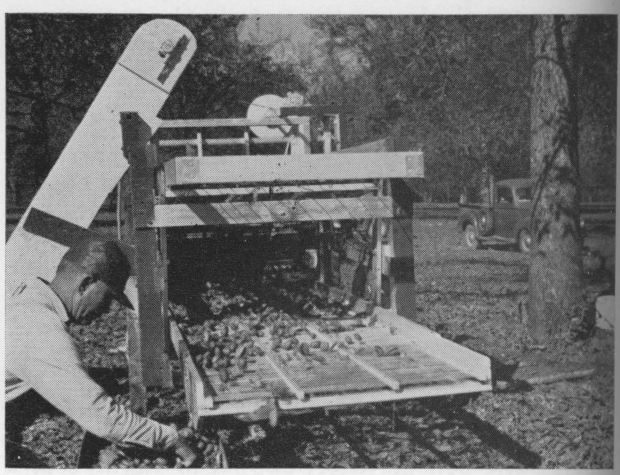


Figure 7. Left—Feeding pecans mixed with trash into hopper of elevator. Right—Clean pecans ready to be sacked.

were available as surplus war materials are troublesome to use because small dead limbs become entangled easily in the meshes. Duck cloth is expensive, heavy and difficult to handle.

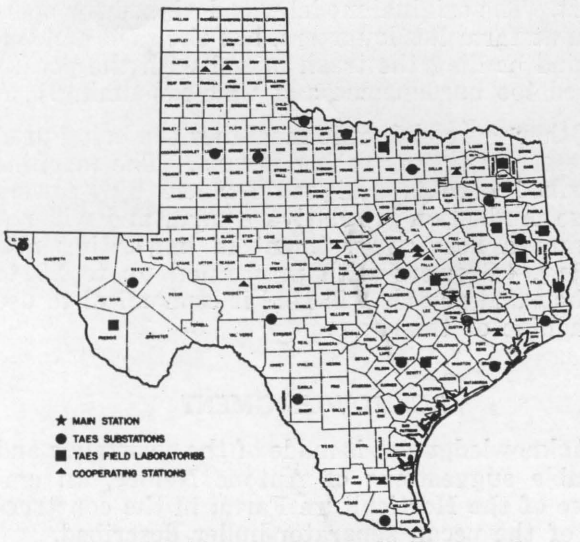
Tests with the machine in 1954 in harvesting Success pecans showed that two men could easily clean 500 pounds of pecans per hour. The conditions for these tests were favorable: the trees were 20 years old and yielded about 140 pounds per tree, the nuts were large and at the proper stage of maturity, they hulled out readily and little hand culling was required.

The machine is of simple design and easy construction. It is mounted on wheels so that it can be pulled by tractor from tree to tree. This makes it possible to take the machine directly to the place where the pecans are collected under the trees; the pecans and other materials can be dumped into the hopper with the least necessary effort. The original model was designed for operation at farm headquarters, but the task of loading and hauling the trash mixed with the pecans proved too burdensome and time-consuming.

Other more elaborate machines are being used successfully in harvesting pecans. The machine described here is designed for use by growers whose production is relatively small and will not warrant a heavy investment in harvesting machinery. Growers with production up to 20 to 30 thousand pounds will find it economical to use a machine of this type.


## ACKNOWLEDGMENT

Acknowledgment is made of the assistance and valuable suggestions of Antone Nemec, an employee of the Horticulture Farm, in the construction of the pecan separator-huller described.




Location of field research units in Texas maintained by the Texas Agricultural Experiment Station and cooperating agencies

# State-wide Research

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**The Texas Agricultural Experiment Station is the public agricultural research agency of the State of Texas, and is one of nine parts of the Texas A&M College System**

IN THE MAIN STATION, with headquarters at College Station, are 16 subject-matter departments, 2 service departments, 3 regulatory services and the administrative staff. Located out in the major agricultural areas of Texas are 21 substations and 9 field laboratories. In addition, there are 14 cooperating stations owned by other agencies, including the Texas Forest Service, the Game and Fish Commission of Texas, the U. S. Department of Agriculture, University of Texas, Texas Technological College and the King Ranch. Some experiments are conducted on farms and ranches and in rural homes.

RESEARCH BY THE TEXAS STATION is organized by programs and projects. A program of research represents a coordinated effort to solve the many problems relating to a common objective or situation. A research project represents the procedures for attacking a specific problem within a program.

THE TEXAS STATION is conducting about 350 active research projects, grouped in 25 programs which include all phases of agriculture in Texas. Among these are: conservation and improvement of soils; conservation and use of water in agriculture; grasses and legumes for pastures, ranges, hay, conservation and improvement of soils; grain crops; cotton and other fiber crops; vegetable crops; citrus and other subtropical fruits; fruits and nuts; oil seed crops—other than cotton; ornamental plants—including turf; brush and weeds; insects; plant diseases; beef cattle; dairy cattle; sheep and goats; swine; chickens and turkeys; animal diseases and parasites; fish and game on farms and ranches; farm and ranch engineering; farm and ranch business; marketing agricultural products; rural home economics; and rural agricultural economics. Two additional programs are maintenance and upkeep, and central services.

RESEARCH RESULTS are carried to Texas farm and ranch owners and homemakers by specialists and county agents of the Texas Agricultural Extension Service.