

Progress in

SELECTIVE HARVESTING:

Lettuce

R. E. GRIFFIN • R. GARRETT
M. ZAHARA

Head lettuce is a major crop in California with over 100,000 acres harvested annually—accounting for about 60% of the nation's total supply. With labor problems a certainty when the Mexican bracero program is discontinued, harvest mechanization efforts have taken on new importance. The University-designed experimental machine described in this report is capable of selectively harvesting mature heads of lettuce without injury, and allows many handling possibilities after cutting.

ONE OF THE problems in harvesting head lettuce is that it does not mature evenly, and selective harvests of two, three or more times over a field are necessary. Hand laborers determine which heads are ready for market by feel, and only those which are firm to the feel are harvested. To harvest present-day varieties mechanically, machine requirements include a means of determining and selecting the firm heads without disturbing those needing more growth and development. The mechanical harvester being developed by the Department of Agricultural Engineering at the Davis campus is designed with the same selection principle used by man—pressing down on the top of the lettuce head to determine firmness.

Field trials of U.C. experimental lettuce harvester, showing rotary, wheel-type elevator for lifting cut heads from field to conveyor for loading (see cover photo also).

The machine consists primarily of a selector which presses down on the top of each lettuce head to determine if it is firm and ready for harvest, a memory device which stores the information received from the selector, a cutter and a rotary, wheel-type elevator to lift the lettuce out of the row for final preparation and shipment to market.

The selector, shown in close-up photo, is the essential part of the harvester. The rubber belt is ground-driven from the wheel shown and rides up onto the lettuce head without disturbing it. As soon as the belt is positioned on the head, a switch located just behind the first roller locks the belt in position by closing the solenoid, which can be seen in the center of the picture, and the belt is no longer free to float up and down. The back roller is

slightly lower than the front one, and to pass on over the lettuce head, one of two things must happen: (1) If the head is firm, it tends to push up on the belt which is now locked and also held by spring tension. This upward push closes a second switch which sends a signal to the memory unit. (2) If the head is not firm, the back roller just rides on over, leaving the head undisturbed. The firmness can be selected by changing the tension on the spring. The memory unit stores the signal sent by the selector until the selector passes the mature lettuce head at which time it sends a signal to the cutter. The cutter, actuated by a fast-acting clutch, cuts the head without disturbing the others.

After the lettuce head is cut, it can be handled in one of several ways, depend-



The number of fruits and vegetables harvested by machine has increased rapidly along with changing conditions in farm economics and labor procurement. Tomatoes and prunes are among the most recent of these crops to pass from the experimental to the commercial harvesting stage. Each crop presents special problems in removal of fruit from the plant and in subsequent handling. One problem common to many such crops is the need for selective—and often several—harvests of fruit as it matures, without damaging remaining plants. The University-designed harvesters for lettuce and cantaloupes, described here, show two different approaches to selective harvesting.

ing upon how growers want to handle their lettuce. It can be lifted into a basket or bin for further trimming and packing in a shed, or the harvester can be more elaborately designed for maintaining the position of the head for mechanical trimming and packing. This process has not been worked out yet, but packing in the field seems to be preferred.

Another consideration in designing a selective harvester is the possibility of injuring the harvested heads or those left in the field. Tests with this machine show that the four or five pounds of pressure applied by the selector is not harmful to a lettuce head. Most lettuce heads can withstand static pressures up to 14 lbs without damage.

Questions about the rate at which the machine can harvest and the economics

involved, including purchase price, must be left to individual manufacturers. The University's role in such projects is to engineer ideas for use by the industry that will then be developed by private manufacturers. Indications are that this machine will harvest lettuce satisfactorily. The single row unit used in the tests could harvest one acre of lettuce in about seven hours, but a manufactured machine would no doubt be a multi-row machine with greater capacity.

Richard E. Griffin is Extension Engineering Technologist; Roger Garrett is Lecturer and Assistant Professor of Agricultural Engineering; and Mike Zahara is Assistant Specialist, Department of Vegetable Crops, University of California, Davis.

Cantaloupes

MICHAEL O'BRIEN

The experimental harvester for cantaloupes described in this report has a conveyor belt allowing vines to be lifted as many as six or seven times with tension-removal of ripe fruit without damage to melons remaining, or plants.

MECCHANICAL HARVESTING for cantaloupes requires some means of automatic selection, because the ripening time of melons from one vine may vary from one to two weeks. The harvesting problem was approached with a plan for selective harvesting of mature melons several times during the ripening season. Exploratory research was done during the 1962 season to determine the reaction of melon vines to training and to successive handling. The forces needed to remove the mature cantaloupes while leaving the immature melons were also investigated. Tests showed that the vines could be trained successfully to one side of the row during the growing period before the first-set melons reached 1½-inch diameter. The vines with melons could be lifted by a conveyor belt while still attached to the ground and laid back down for as many as six or seven subsequent handlings without excessive damage.

Elements of a mechanical harvesting system were designed for testing during the 1963 season. The harvest system includes planting near the edge of the bed

Close-up of selector mechanism of U.C. lettuce harvester. The rubber belt "feels" the firmness of the head as it runs over the row and records the position to activate the cutter as it passes.

