## MECHANICAL HARVESTING OF SMALL FRUITS

The research program on fruit crops at the University of Arkansas interrelates the areas of harvest mechanization, pre- and postharvest physiology and processing. This program is designed to serve a highly competitive, growing processing industry. Through cooperative research undertaken by the Departments of Horticultural Food Science and Agricultural Engineering, mechanical harvesters were developed for blackberries (refer HortScience 13:228-235) and strawberries (refer HortScience 13: 000-000). Utilizing the principle of fruit abscission, blackberry fruit can be selectively mechanically harvested on a commercial basis at the rate of 1 acre per hour, while product quality is superior to hand-harvested fruit.

As a result of the ever constricting squeeze of labor shortage and cost, mechanization of the strawberry industry has become necessary to maintain the supply of affordable, mass-market processed products to the consumer. However, the development of a harvester and perfection of a production and utilization system for strawberries has been more of a challenge, and industry has been justifiably skeptical. Historically, strawberries have been considered to be among the least adaptable crops to mechanical harvest. Two physiological traits of the strawberry present obstacles to mechanical harvest: 1) the lack uniform-ripening of firm-fruited, cultivars and 2) the fact that as fruit matures and increases in size on high yielding cultivars there is a tendency for the fruit supporting truss to sag to the ground. In cooperation with the Department of Horticulture, parallel programs are in progress in the area of plant breeding to further adapt strawberries to mechanization. (refer HortScience 12:522.)

In the process of developing a mechanical harvester for strawberries, several harvesting principles were evaluated. One approach included cutting or clipping the fruit from the plant, but a majority of the large fruit was not harvested since it was on the ground. Therefore, it was considered necessary to use a mechanism which would lift the large fruit from the ground to facilitate harvest. The University of Arkansas harvester, shown on the cover, operating in research plots, utilizes a pneumaticstripping system. The strawberries are harvested once-over when a majority of the crop has developed acceptable color.

During the development of the harvesting system, it was soon realized that



The 1978 commercial model of the University of Arkansas strawberry harvester is a 2-row unit which requires a driver and a minimum of 2 lug-tenders. This model also has a brush system designed immediately behind the mower to remove the majority of the cut foliage prior to the picking mechanism.

unless equipment could be developed that would clean and grade the fruit, the advantages offered by mechanically harvesting would be lost. Therefore, efforts were directed toward developing in-plant equipment for handling and pre-processing cleanup of mechanically harvested strawberries. This in-plant equipment was developed with the capability of separating the strawberries into distinct maturity classes.

The percentage of immature fruit present on an optimum once-over harvest date of suitable cultivars does not detract from the product quality of puree or the processed products manufactured from this puree. Research is being continued to determine the maximum percentage of green fruit that can be tolerated in processed products and to determine the consequences of immature fruit on the storage stability of these products. Additional research is also needed to develop a practical way to remove the calyx and calyx particles from the strawberries if the whole and sliced berry industry is to be completely mechanized.

The success of this research program has been due largely to the research team's efforts to develop new, totally intergrated systems for production, harvesting, raw product handling and utilization. Emphasis has been placed on quality maintenance for both the raw and the final processed product. It required 10 years of research to develop the blackberry and strawberry harvesting systems. The commercial success of these systems has been the result of

cooperation from the machine manufacturer, who made constant improvements and refinements in the harvester. The processing industry has modified and improved the in-plant cleaning and processing line that was developed to handle machine harvested fruit, and strawberry producers have adapted their production methods to the suggested new cultural systems. Commercial strawberry producers in Michigan and Oregon who are using the new 2-row harvesters have found with their cultivars that it is economically feasible to make one hand picking of the early, largest fruit. The remainder of the crop is allowed to ripen and this results in better uniformity of ripeness of the once-over harvested fruit. Ideally, a once-over harvest will be necessary.

We believe that hand harvesting is no longer feasible or available for most of our processing fruit crops. In small fruit crops such as blackberries and strawberries, hand harvesting costs account for 1/2 to 3/4 of the total cost. In addition to the cost factor there is a trend for the virtual elimination of harvest labor from outside the states and increasing problems with domestic labor. In the future, unless these crops requiring hand harvest are mechanically harvested, their processed products could be relegated to the luxury foods outside the reach of the majority of consumers.

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