Electric Sorting Machines for TART CHERRIES

(1963 Studies)

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The Electric Sorting Machine Division of Mandrel Industries, Inc.,[4/] has been building, installing, and maintaining photoelectric color sorting machines for many years. Machines of this type are used in sorting peas, beans, nuts, coffee, olives, lemons, and potato cubes. More than 3,500 sorting machines are used throughout the world. When the Electric Sorting Machine Company produced a machine in 1963, which they said would sort red tart cherries (fig. 1), the processors of cherries quickly ordered many units. Of the 40-odd machines made available to the cherry industry in 1963, 35 were installed in Michigan processing plants.

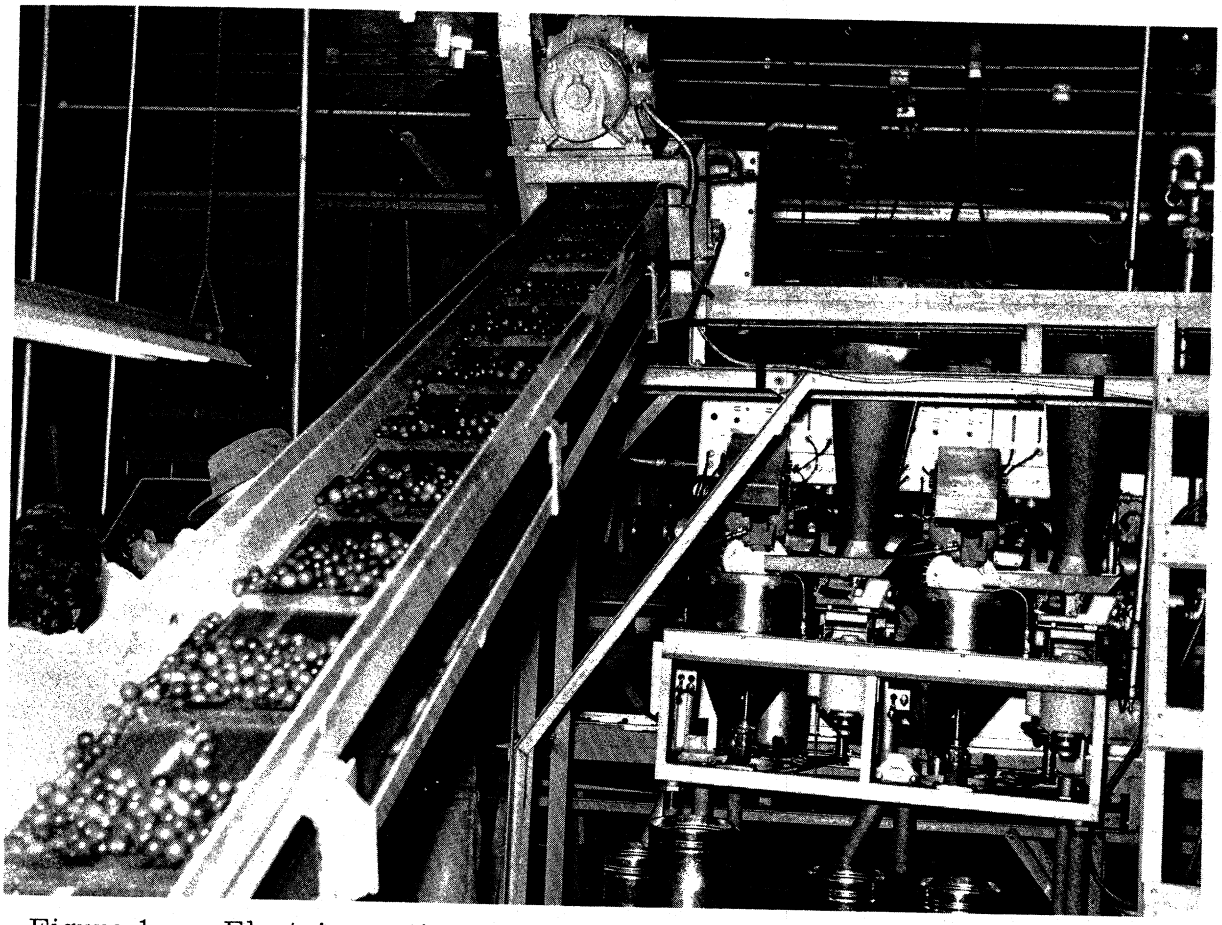

Figure 1. -- Electric sorting machines in operation. The elevator is delivering cherries to two sorting machines on the right.

Observations on the performance of the new sorting machines were made in 1963 by the USDA-Michigan State University Research Group that has been studying cherry harvesting, handling, and processing problems. This group wanted answers to the following questions:

1. Do electric sorting machines throw out enough defective cherries to materially raise raw product grades?

[4/] Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U. S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

ELECTRIC SORTING MACHINES FOR TART CHERRIES

Performance Studies in 1963

THE PROBLEM

Even under favorable growing conditions, most commercial lots of red tart cherries delivered to processing plants contain some blemished fruit that must be sorted out before the packed cherries will meet grade A standards. Fortunately, the necessary routine sorting can usually be done quickly and at a moderate cost.

When growing, harvesting, and handling conditions are unfavorable, the percentages of windwhipped, scalded, and otherwise blemished cherries may be so high that the sorting expense needed to bring the fruit up to grade A standard is prohibitive. In the highly competitive business of processing cherries, sorting costs may mean the difference between profit and loss.

Because of these facts, the industry has given a great deal of thought to ways and means of reducing sorting costs. The width and color of sorting belts, on-the-belt distribution of fruit, type of illumination, rate of sorting, closeness of supervision, and many other factors have been investigated. As a result, some improvements in sorting have been made.

Two recent developments have made the sorting problem more acute than ever. First, the wages paid human sorters have risen more rapidly than has the price of processed cherries. Secondly, machine harvesting, which is increasing rapidly, tends to put additional stress on sorting facilities at the processing plants. Unlike human pickers, the mechanical harvesters are not selective, but bring down all the fruit on a tree, blemished as well as unblemished. The arrival of large quantities of orchard-run fruit at the processing plant thus causes processors to increase their efforts to solve the sorting problem.

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TABLE 2. -- Comparison of machine and hand sorting of low- and high-quality cherries

Plant	Factor	Sorted by - 1 machine	Sorted by - 1 woman
A---	Original cherries, U.S. No. 1 --------percent	68.3	68.3
	After sorting, U.S. No. 1 --------percent	87.7	79.6
	Good cherries lost ----percent	2.6	0.4
	Rate of sorting --------lb./hr.	1,655	446
	Cost of sorting -------dol./ton	8.2	10.2
B---	Original cherries, U.S. No. 1 --------percent	94.6	94.6
	After sorting, U.S. No. 1 --------percent	95.6	95.8
	Good cherries lost -----percent	0.3	0.2
	Rate of sorting --------lb./hr.	1,600	893
	Cost of sorting -------dol./ton	8.4	5.0

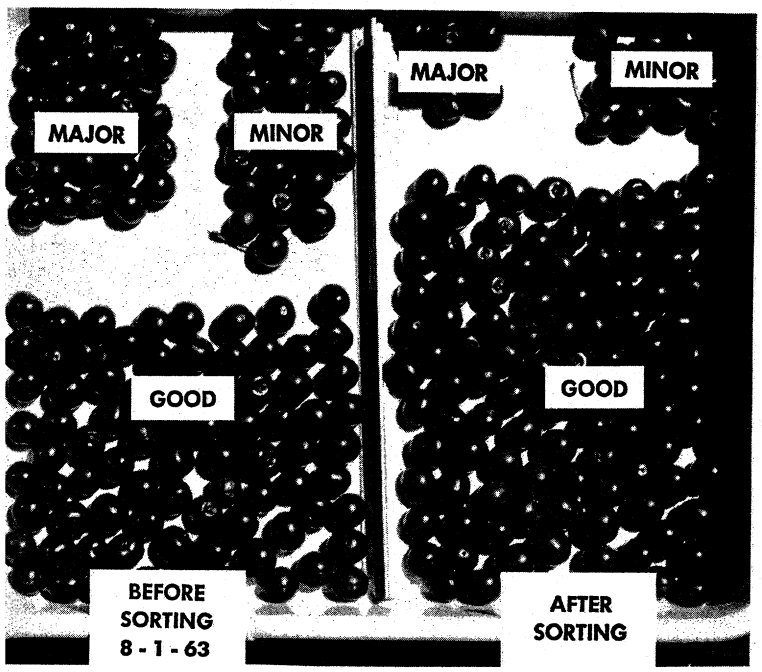

Figure 2.

Results of machine sorting. Grade of unsorted fruit (left) was 68 percent U.S. No. 1. After sorting (right), the grade was 88 percent U.S.No.1. Major and minor defects are shown.

2. What is the capacity of the machines?

3. Do the machines throw out significant percentages of good cherries?

EXPERIMENTAL PROCEDURE

The performance of 11 of the 35 sorting machines in Michigan was studied in detail. Four typical processing plants were included in the trials. Two of these were located in southwest Michigan and the other two in the Traverse City area. In most cases two or more machines had been installed in the processing plant in such a way that they supplemented the work done by women sorters. This arrangement made it possible to compare the sorting of the machines with that of the women. In addition to checking the performance of the machines during commercial operation, the effectiveness of the machines was also tested. Small samples containing 0, 25, 50, and 100 percent of cherries having windwhip scars were prepared and passed through the machines. The results provided an accurate measure of the effectiveness of the machines in sorting cherries with a particular type of defect.

During studies, the machines were checked and adjusted frequently by plant personnel. Members of the research group confined their activities to tabulating the results achieved, and did not under any circumstances make adjustments or change settings.

RESULTS

The effectiveness with which the machines handled various types of defects was based on 38 small-scale tests in three processing plants (table 1). The machines did not throw out any considerable percentage of scalded or cracked cherries or cherries with stems attached. The machines did, however, prove quite effective in eliminating cherries that had been windwhipped and limb rubbed and that were decayed. These defects were reduced from an average of 41.7 percent to 13.7 percent. In view of the fact that these defects are the most common, the improvement was significant.

TABLE 1. -- Effectiveness of electric cherry sorting machines in eliminating cherries with stated types of defects

Type of defect	Before Sorting	After Sorting
	Percent	Percent
Attached stems	15.3	15.0
Scald	34.1	32.8
Serious cracks	3.8	3.6
Windwhip, decay, etc.	41.7	13.7

A comparison of machine and hand sorting of low- and high-grade cherries was based on five tests in two processing plants (table 2). With low-quality fruit, the

TABLE 4. -- Summary of results obtained by four Michigan processors who used electric cherry sorting machines in 1963

Factor	Average	Range
Raw product grade before sorting, U.S. No. 1 ----------percent	88.7	63.0 to 98.1
Raw product grade after sorting, U.S. No. 1 ----------percent	92.4	85.0 to 99.5
Total cherries rejected ----------percent	5.4	0.3 to 21.7
Good cherries rejected ----------percent	1.6	0.1 to 6.0
Loss in yield from sorter bruising ----percent	1.3	0.6 to 1.7
Rate of sorting ---------- lb./hr./sorter	1,514.0	645.0 to 2,220.0
Estimated cost of sorting ---------- dol./ton	8.9 [1/]	6.08 to 20.96
Processed grade ---------- score	90.4	85.0 to 95.6
Processed grade ------ percent U.S. Grade A	73.0	25.0 to 100.0

[1/] Costs were calculated on the basis of a lease rate of $2,700 per machine. It was assumed that the machines would be used 20 hours per day for a 20-day season, and that the average machine would sort 1,500 pounds per hour. The estimate did not include a charge for the technical help that will probably be required to keep the machines properly adjusted and supplied with cherries. The average labor cost of hand sorting was $7.65 per ton.

Some bruising of cherries occurred during the machine sorting operation, particularly as cherries were discharged onto hard surfaces. Since the bruising was responsible for an average loss of 1.3 percent in pitted weight, processors should give some attention to antibruise measures during installation of the machines.

All of the machines studied rejected some unblemished fruit. The loss of good cherries ranged from 0.1 percent to 6.0 percent of the original weight, and the average loss was 1.6 percent. The comparable loss for human sorters was 0.4 percent.

SUMMARY AND CONCLUSIONS

Considerable differences were found in the performance of the 11 electric cherry sorting machines studied. Although none of the electric sorters was entirely satisfactory, the most effective machines performed as follows:

1. Raised raw product grade materially.

2. Sorted cherries for a little less cost than did human sorters.

3. Threw out only about twice as many good cherries as did human sorters.

The fundamental value of the machines was established. There is reason to believe that adjustments can be made that will raise the performance of all machines to, or at least close to, that of the most effective machines studied. It is hoped that improvements, refinements, and adjustments can be made that will increase the efficiency of even the best of the machine sorters. If this can be done, electric sorting machines may provide:

1. The long sought for method of lowering cherry sorting costs.

2. A practical method of sorting machine-picked cherries.

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A REPORT OF WORK DONE BY

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