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Cherry Brining Costs as Affected by Container Types

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FOREWORD AND ACKNOWLEDGMENTS

This report presents an analysis of costs and efficiencies of handling, storing, and transporting brined cherries in different types of containers. Five methods of operation using alternative containers or combinations of containers are evaluated. These are (1) storing in barrels and marketing in barrels; (2) storing in bins and marketing in bins; (3) storing in tanks and marketing in tank rail cars; (4) storing in tanks and marketing in barrels; and (5) storing in tanks and marketing in bins.

This study has been made under a regional project concerned with bulk containers and their effects on costs and efficiency and on the structure and organization of markets for selected agricultural commodities. The Experiment Stations of Oregon, California, and Idaho are participating in this research. The authors are indebted to many members of the industry for their cooperation and assistance in obtaining the data required for this work.

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CHERRY BRINING COSTS AS
AFFECTED BY CONTAINER TYPES

By H. L. Bontrager and H. M. Hutchings

SUMMARY AND CONCLUSIONS

Except for year-to-year fluctuations, there has been little change in the production of sweet cherries in the United States since World War II. There have been significant shifts, however, in the utilization and consumption of sweet cherries. Fresh market sales have trended downward as a percentage of total sales, while the percentage of total sales for brining has increased substantially. Today, brining is the largest single-market outlet for sweet cherries. Oregon is the leading state in the production of cherries for brining, and during the 1958-61 period Oregon accounted for 33% of all cherries brined in the United States.

The domestic cherry brining industry has been protected from foreign import competition since 1921. In spite of this protection, imports from Italy, France, and Spain have increased in recent years. Annual imports of brined and finished cherries today are equal to approximately 20% of the annual domestic production of brined cherries, and the domestic cherry brining industry has become very conscious of the need to improve its competitive position.

The purpose of this study is to provide an evaluation of various methods and containers used in handling, storing, and transporting brined cherries and to assist the industry in achieving greater efficiencies and improving its competitive position through reduction of costs.

Container handling costs account for a substantial portion of the cost of brining, storing, and transporting cherries for maraschino and glacé cherry products. For years, the container used by the brining industry has been the wooden barrel. After World War II, some plants began using large wooden tanks for storing and curing orchard-run fruit. More recently, cherry brining plants have shown active interest in the possibilities of using palletized bulk bins with polyethylene liners.

The high cost of the container and the high labor costs associated with handling barrels have been responsible for the interest in

development of these new containers. The price of barrels has increased 60% in the past 15 years. Wage rates have increased by 67%. Another factor has been the relative scarcity of barrels in recent years. Only one firm in the Northwest is currently engaged in manufacturing barrels.

This study evaluates five methods of operation made possible by the use of alternative containers or combinations of containers. These are (1) storing in barrels and marketing in barrels; (2) storing in bins and marketing in bins; (3) storing in tanks and marketing in tank rail cars or trucks; (4) storing in tanks and marketing in barrels; and (5) storing in tanks and marketing in bins.

Costs of five "models" based on the five methods of operation (Models 1-5) have been estimated by use of the economic-engineering approach for plants of selected rates of output. Synthetic plants have been constructed which use least-cost techniques of handling each of the various containers. Crew and equipment requirements for handling each of the containers were determined primarily by studying time and production of actual brining operations. Costs were estimated by applying current costs and wage rates to the estimated input requirements.

With the assumptions made in the study, it was found that Model 3 (storing in tanks and marketing in tank rail cars) had the lowest total cost for all plant sizes. Model 5 (storing in tanks and marketing in bins) had the next lowest costs, followed in order by Model 2 (storing in bins and marketing in bins); Model 1 (storing in barrels and marketing in barrels); and Model 4 (storing in tanks and marketing in barrels). Costs shown by the various models for any given plant size varied substantially. For example, for the 200-barrel-per-day plant, costs per hundredweight of graded cherries were: Model 3--\$4.43, Model 5--\$5.61, Model 2--\$5.69, Model 1--\$8.68, and Model 4--\$8.72. The assumed season's output was 4,850 tons.

A price differential was being paid in 1963 for brined cherries marketed in different containers. Cherries marketed in barrels had a price premium of three cents a pound, and those marketed in bins one cent a pound, over those marketed in tank rail cars or trucks. Part of this may be explained by the relative usefulness of the container to the finisher. Another partial explanation may be that briners are willing to pass along to finishers a part of their cost savings realized by lower-cost containers and reduced handling costs.

Comparison was made of cost differences between models, after using these price differentials as an offset against total costs. Adjusted costs were obtained by subtracting \$3.00 and \$1.00 per hundredweight, respectively, from the costs of those models marketing cherries in

barrels and bins. Cost differences were reduced after being adjusted in this manner. Model 5 (storing in tanks and marketing in bins) had the lowest adjusted cost for plants with output less than 175 barrels per day. Model 3 (storing in tanks and marketing in tank cars) had the lowest cost for plants with outputs larger than 175 barrels. Model 4 (storing in tanks and marketing in barrels) still had the highest cost for all plant sizes.

Considerations other than those of container cost and cost of handling are important when evaluating the feasibility of each container. The cost of shipment from the briner to the finisher must be considered. After adjustment for the weight of the container, transportation rates per hundred weight net of graded cherries from Salem, Oregon, to San Francisco, California, are \$1.17 for cherries shipped in barrels, \$1.13 in bins, and \$1.05 in tank cars.

Preference and container acceptance by finishers is another important factor. Many finishers are small firms and prefer to purchase cherries in barrels for several reasons. Small firms often utilize the barrels in their finishing operation. Many prefer to purchase mixed lots of grades, varieties, and sizes of cherries and are somewhat restricted in this respect when purchasing in tank cars. Many of the firms are housed in buildings which are not designed for receiving cherries in tank cars or bins.

Because of the great difference in handling costs, there may be some economic inducement for finishers to take necessary steps which will permit them to purchase brined cherries in bins or tank cars at a lower price. This would give them a lower cost of raw product and also permit them to improve their own efficiency in handling. The degree of competition in the finishing industry may determine whether or not this transition will take place. Further research is needed to evaluate this aspect of the problem.

INTRODUCTION

During the recent period of 1958-61 Oregon, Washington, and California accounted for 68.5% of the total United States production of sweet cherries. Eastern states of Michigan, New York, Pennsylvania, and Ohio accounted for 23.8%; and other western states consisting of Idaho, Montana, Utah, and Colorado, for about 7.7%. During these years, Oregon has been either the principal or next most important state in the production of sweet cherries. In 1961, Oregon produced slightly more than 26% of the United States crop.

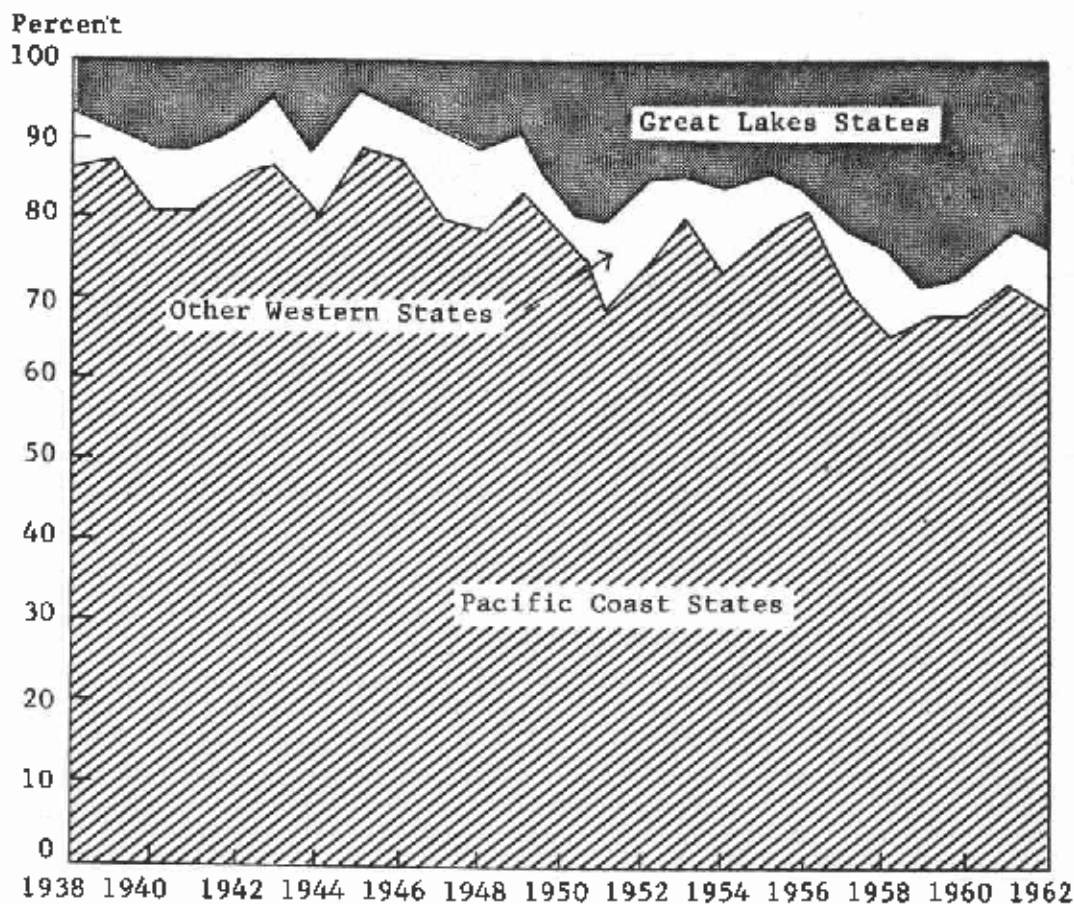
Total production of sweet cherries in the United States has shown no marked trend either upward or downward since World War II, although there have been significant year-to-year changes in production due to weather conditions. During this period there has been a slight decrease in production in the three Pacific coast states, while production in the Great Lakes states has increased. Figure 1 shows the proportion of sweet cherries produced by major areas in the United States for the period 1938-62.

While total production of sweet cherries has remained fairly constant except for year-to-year variations in yield, there have been some shifts in the utilization and consumption of sweet cherries. The trend of fresh market sales as a percentage of total sales has been downward since 1938. Fresh sales averaged about 28,500 tons and comprised about 35% of total sales during the 1958-61 period. Two decades earlier, about half of total sales went to fresh outlets.

The volume of sweet cherries processed has been increasing since 1938. During 1958-61 an average of 55,000 tons, or 65% of total sales, has been processed. Brining and canning are the principal means of processing cherries. A relatively small amount of cherries is frozen and only a fractional percent goes into juice, wine, or preserves. Figure 2 gives the disposition of sweet cherries in the United States for the years 1938-62.

The volume of canned cherries has not varied greatly since 1945, although fluctuations in production are reflected in quantities canned. During 1958-61, the amount of sweet cherries canned averaged about 14,000 tons and comprised about 17% of total sales.

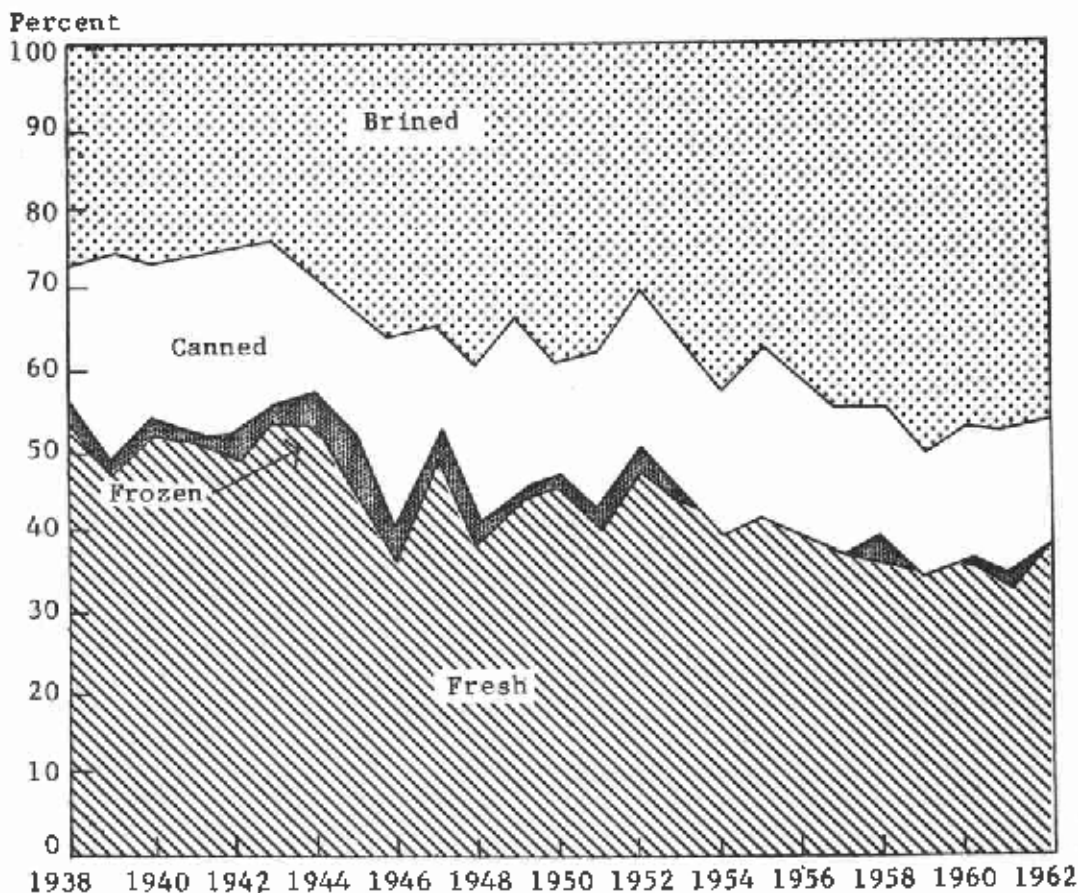
The percentage of total sales for brining, on the other hand, has increased substantially during the past two decades. Today brining is the largest single market outlet for United States sweet cherries.



Source: Data were obtained from Fruits (Noncitrus)--Production, Use and Value. U.S. Dept. of Agriculture.

Figure 1. Production of sweet cherries in the United States by major producing areas, 1938 - 1962.

Disposition of sweet cherries into fresh and the various processed uses differs by state and region. For example, almost 61% of the sweet cherries sold in Washington during 1958-61 was sold for the fresh market, while in Oregon only slightly less than 16% was disposed of through fresh market outlets. During the same period, the amount of cherries brined in Oregon and the Great Lakes states expressed as percentages of total sales amounted to 61 and 69%, respectively; 41% of salable sweet cherries was brined in California, and only 15% was brined in Washington. During this period, Oregon has been the leading state in the production of cherries for brining and has accounted for 33% of all cherries brined in the United States. Figure 3 shows the disposition of cherries by major states and areas both in absolute quantities and as a percentage of total production.



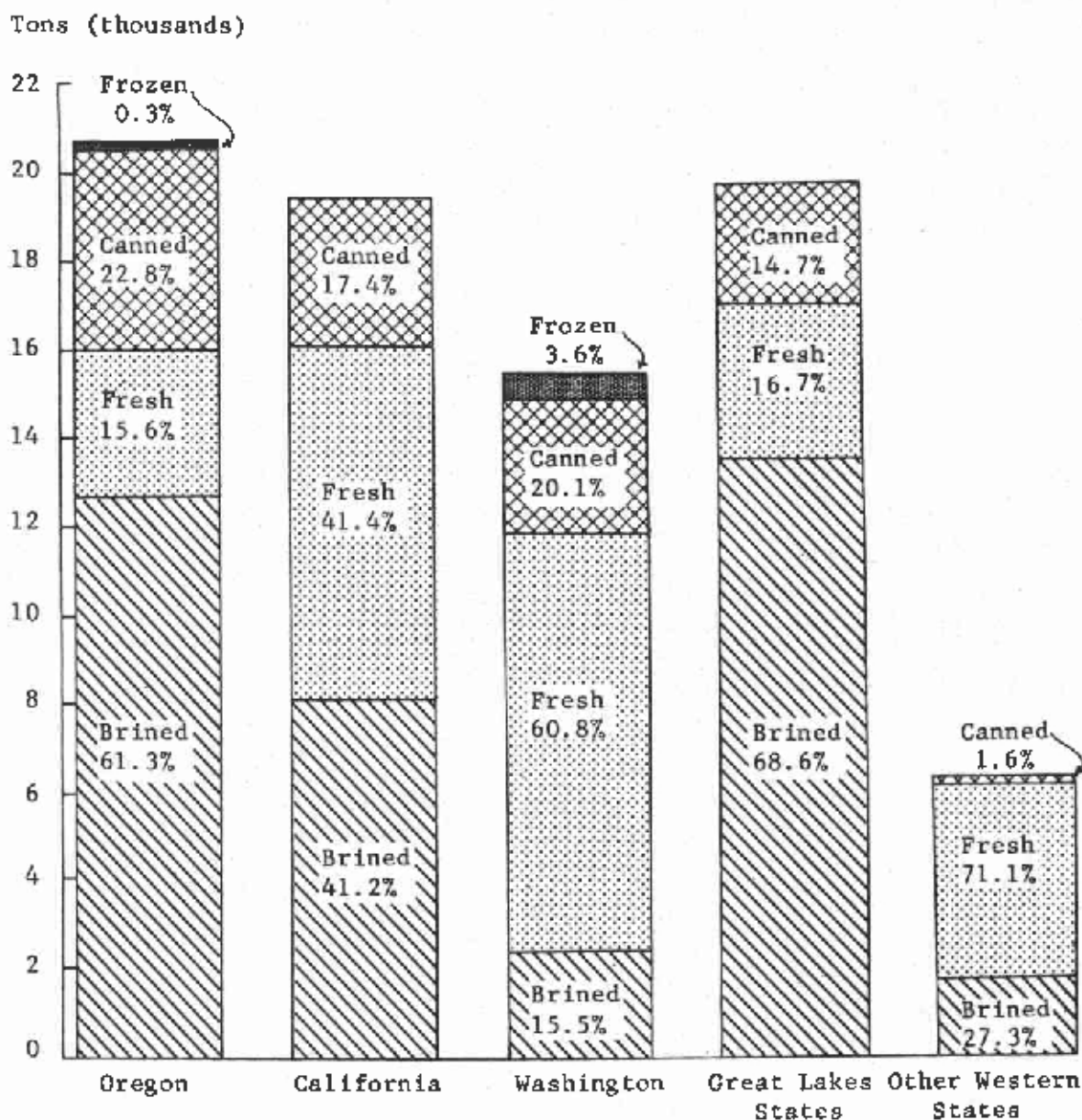
Source: Data were obtained from Fruits (Noncitrus)--Production, Use and Value. U. S. Dept. of Agriculture.

Figure 2. Utilization of salable production of United States sweet cherries, 1938 - 1962.

The Evolution of the Brined Cherry Industry

Brined cherries are cherries which have been bleached and preserved in a solution of sulphur dioxide with hydrated lime added as a hardening agent. Brined cherries are used as raw product for remanufacture into maraschino, candied, crystallized, and glacé cherries. Maraschino cherries are used as cocktail cherries and also as an ingredient in such products as ice cream, candy, and fruit cocktail. Glacé, candied, and crystallized cherries are used mostly in fruit cakes and other bakery products.

Brining preserves cherries indefinitely. This characteristic permits the holding over of brined cherries from one season to the next, thereby achieving a more orderly marketing of an otherwise highly



Source: Data were obtained from Fruits (Noncitrus)--Production, Use and Value. U. S. Dept. of Agriculture.

Figure 3. Disposition of sweet cherries by major producing states and areas, 1958-61 average.

perishable commodity. The development of the brining process has provided a market for very large quantities of cherries which could not easily be absorbed by the market in fresh or canned form.

Brining in the United States is a relatively recent development. The brining process now used was developed by Oregon State University researchers in 1925, under the leadership of Ernest H. Wiegand, now Professor Emeritus of Food Science and Technology. Prior to 1925, most brined cherries used in the United States were imported from Italy. The process used in Italy was quite complicated and did not produce cherries of consistent quality. The Italians packed their cherries in a salt brine for shipment, thus the term "brined cherries." The process developed in the United States uses no brine, so today the term "brined cherries" is really a misnomer. The process developed at Oregon State University is now used throughout the world.

During the period 1925-29, annual domestic production of brined cherries averaged only about 18,000 barrels or four and a half million pounds, as compared to more than 400,000 barrels or 100 million pounds in 1962. This was less than 3% of the average annual United States total production of sweet cherries. All of the domestic brining during these early years was done on the Pacific coast, and the output was used largely in meeting the needs of the maraschino and glacé manufacturers of that area. Eastern manufacturers relied upon imports, chiefly from Italy, for their supplies of brined cherries. There was practically no movement of Pacific coast brined cherries to the East prior to 1930.

Import duties on sulphured or brined cherries were established in 1921, and duties on maraschino and glacé cherries were made effective in 1930. These duties encouraged Pacific coast growers and packers to expand their output of brined cherries. Commercial cherry production in the United States increased rapidly during the late twenties and early thirties as substantial plantings in the years after World War I came into bearing. The fresh markets and canning outlets proved wholly inadequate to absorb the added production. The cherry industry experienced large surpluses and low prices and even greater crops were in prospect. It was under these circumstances that the industry turned to the brined market.

A small volume of Pacific coast brined cherries moved East in 1930, and thereafter shipments increased rapidly as Pacific coast and Midwest production of brined cherries was expanded. Today much of the brined cherry pack of the Pacific Northwest is sold and shipped to eastern manufacturers. Some of the northwest pack and much of the California pack is used in California for maraschino manufacture, chiefly for canned fruit cocktail and fruit salad packs.

A tariff of 5½ cents per pound on unpitted sulphured or brined cherries has been in effect since 1930. Duties imposed on maraschino, candied, crystallized, or glacé cherry imports in 1930 were initially at the rate of 40% ad valorem plus 9½ cents per pound, but since 1947 they have been 10% ad valorem plus 7 cents per pound.

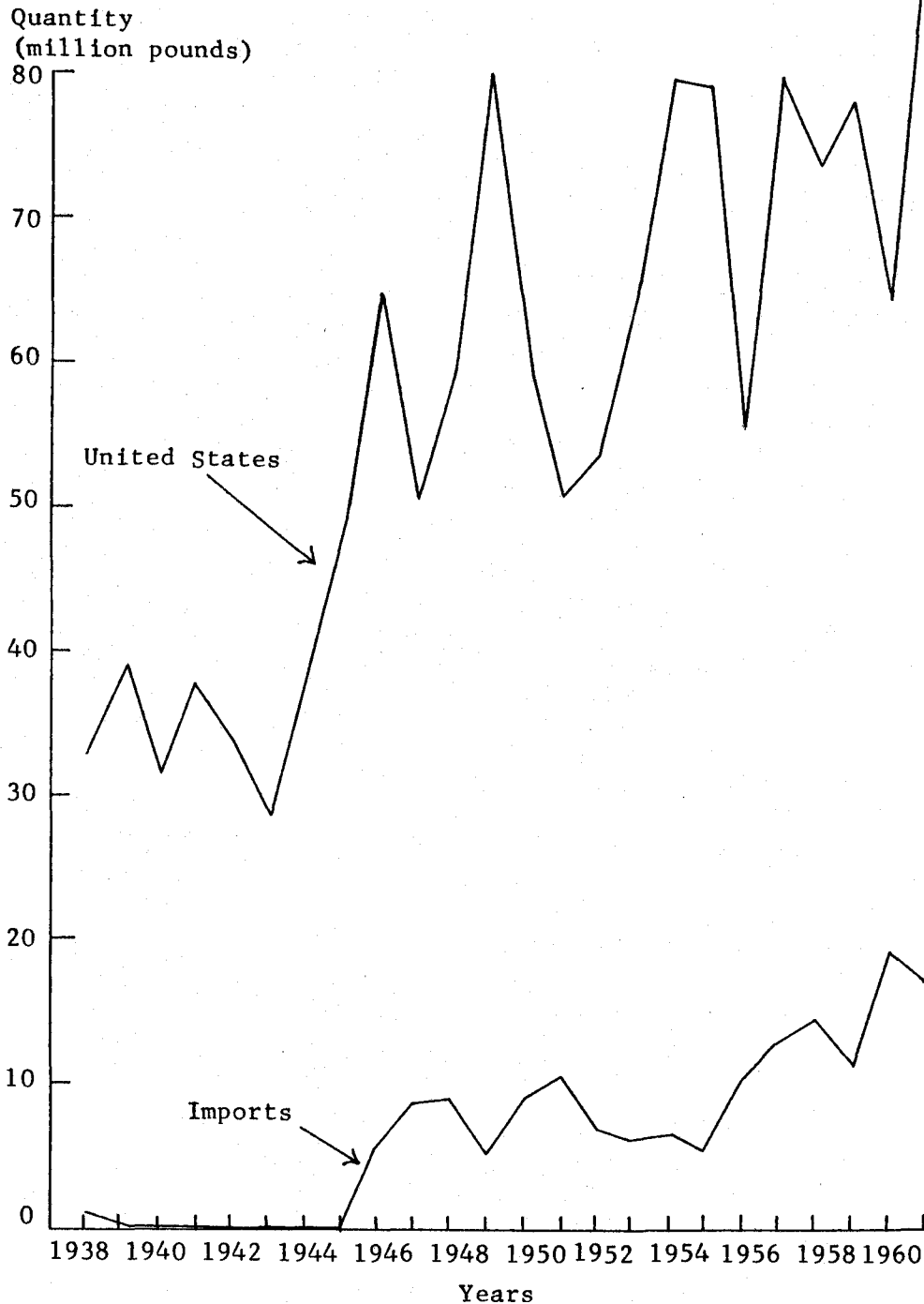
Despite this tariff protection, there has been a steady and significant increase over the years in imports of both glacé and brined cherries, and these, of course, have been in direct competition with domestic brined cherries. Figure 4 shows the relationship of imported brined and glacé cherries to the production of U. S. brined cherries, both converted to a common unpitted basis.

The United States produces a minor portion of the world's supply of cherries. During the period 1958-61, U. S. production amounted to approximately 20% of world production. This includes both sweet and sour cherries, as data are not available for sweet cherries alone.

Italy, France, and Spain, the principal exporters of brined cherries and cherry products to the United States, have all increased their production in recent years. Italy, with an average production of 139,000 tons during the 1951-55 period, increased her production to 223,000 tons in 1961 and 230,000 tons in 1962. France and Spain have increased their production by 14 and 30%, respectively, during this same period.

Purpose of the Study

Because of the increased production of cherries in foreign countries and the increased importations into the United States, the domestic cherry brining industry has become very conscious of the need to improve its competitive position. This study evaluates the costs and efficiencies of various methods and containers used in handling, transporting, and storing brined cherries, as an aid to the industry in its efforts to achieve greater efficiencies and reduce costs.



Source: Summary of Foreign Commerce of the United States, 1938-61.

Figure 4. Comparison of annual imports of brined and glacé cherries with United States brined cherry pack, unpitted brined basis, 1938-1961. (One pound glacé = .95 pound pitted brined; .7 pound pitted brined = 1 pound unpitted brined. U. S. brined pack based on quantity of fresh cherries brined.)

CHARACTERISTICS AND PRACTICES OF THE OREGON CHERRY BRINING INDUSTRY

Eleven firms in Oregon are currently engaged in cherry brining. These firms, located principally in the Willamette Valley and in Wasco County, vary considerably in size. Some of the firms process a number of fruits and vegetables, with cherry brining a minor portion of their overall operation. Others deal exclusively in sweet cherries, but pack and ship for the fresh market in addition to their brining operations. Still others confine their activities to cherry brining only.

A number of the firms brining sweet cherries in Oregon are organized as cooperative associations and brine the crop of their grower members. Some of the noncooperatives are local firms and some are plants controlled by national organizations.

In addition to differences in plant size and firm organization, wide variation exists with respect to techniques and containers used in plant operations. Some of the plants are using techniques which are efficient for the particular circumstances under which they are operating. Others are operating with considerably less efficiency than could be achieved. One reason for this is that changes and innovations have taken place since some of the plants began operations. Changes in technology are slow to be adopted in existing plants, especially if obsolete equipment and plant design, even though inefficient, are still usable. This is in part due to the large investment frequently associated with the adoption of new technologies. These capital investments, when amortized over several years of useful life, could result in lower total-unit costs than would be the case using the old equipment and the less efficient methods. Difficulty in procuring sufficient capital to purchase equipment, however, sometimes acts as a deterrent to the adoption of new technologies.

Brining Procedures

The general practice followed by Oregon cherry brining plants is to have the cherries picked with stems several days before they are fully ripe. Delivered to the plants in lug boxes, the cherries are dumped into tanks, barrels, or bins to which is added a bleaching and preservation solution consisting of liquid sulphur dioxide plus a hardening agent. Cherries must remain in this solution for a minimum of 30 days in order to cure properly. During the curing period, the solution absorbs the fruit sugar from the cherries, bleaches them to a uniform light yellow color, and hardens them.

After curing and as plant-operating and market conditions permit, the cherries are removed from the container in which they were brined and stored and are passed through a processing line. In the processing line they are mechanically sized and pitted, manually graded, and inspected. Stems may or may not be removed, depending upon the type of product desired.

After sizing, pitting, and grading, the cherries are put back into the containers, again in a sulphur dioxide solution, and are either shipped immediately to maraschino or glacé manufacturers or put back into storage for shipment at a later date.

Substantial loss of weight occurs during the processing. Not only is there loss of sugar during curing, but the weight is further reduced by removal of the pit and stem and by elimination of defective fruit by visual inspection. Cherry briners estimate a weight shrinkage of from 25 to 30%, depending upon variety and condition of the fruit. Weight of the brined cherries when ready for marketing is approximately 70 to 75% of the weight of the fresh fruit.

Varieties of Cherries Brined in Oregon

Several varieties of sweet cherries are brined in Oregon. The Royal Ann, a light-colored variety, has long been the principal brining variety because of its large size, firm texture, and ability to bleach uniformly. Over two-thirds of all cherries brined in Oregon in 1961 were of this variety. Large quantities of dark sweet cherries, formerly considered best suited for fresh shipment, are now being brined. Most important varieties of dark cherries brined in Oregon are Bing, Lambert, and Black Republican. Because of characteristic differences in size among varieties brined, some of the dark varieties are preferred for some uses.

Sizes and Grades of Brined Cherries

Brined cherries are processed under federal and state regulations and are marketed according to federal grades adopted by the U. S. Department of Agriculture, effective May 14, 1956. The federal grades were adopted by the Oregon State Department of Agriculture, effective January 1, 1963. These grades are Oregon No. 1, Oregon No. 2, Oregon No. 3, and Oregon combination grade. Cherries also are occasionally sold in small lots as an "orchard-run" grade.

The five size classifications used in marketing brined cherries are applicable to all grades and are as follows: (1) extra small--14 mm. to 16mm.; (2) small--16 mm. to 18 mm.; (3) medium--18 mm. to 20 mm.; (4) large--20 mm. to 22 mm.; and (5) extra large--22 mm. and over.

In addition to the grades and sizes mentioned above, cherries are classified as having stems attached (cocktail cherries) or having been stemmed. Occasionally, brined cherries are sold with pits, although the normal procedure is to sell them pitted.

Containers and Container Handling Methods Used in Oregon

For years, the container used by the industry has been the wooden barrel which holds 250 pounds net of stemmed cherries. During harvest season, the cherries are dumped directly into barrels for curing and storage. After curing is completed, they are removed from the barrel, run through the processing line, and put back into barrels again for immediate shipment to buyers or for storage until sold.

Shortly after World War II, some cherry brining plants began using large wooden tanks of 25-to-50-ton capacity for the initial brining and curing of orchard-run fruit. Cherries are dumped from lug boxes directly into the tank. After curing, they are taken out of the tanks and run through the processing line, then put into barrels for storage and marketing.

More recently there has been active interest in the possibility of using palletized bulk bins with polyethylene liners for handling, storing, and transporting brined cherries. Several firms have used a limited number of bins of different types in experimental operations. A number of bulk bins and liners of different design, construction, and size were obtained and tested for use in handling, storing, and transporting brined cherries. Progress during 1961 and 1962 had advanced to the stage where at least one firm had commercially adopted the bulk bin. The bin most commonly used is constructed of 1 inch by 4 inch fir boards, has inside dimensions of 47½ by 47½ by 24 inches and is covered by a thin plywood lid. The box is built on a pallet so that it may be handled by forklift. The liner most commonly used is constructed of polyethylene sheets 8 mil (.008 inch) thick and 10 feet square. A fibreboard liner also is used in bins to protect the polyethylene liner from punctures. The bulk bin is designed to hold 900 pounds of orchard-run cherries or 1,000 pounds of graded, stemmed cherries.

In addition to the containers mentioned above, there has been some shipment of cherries to market in recent years in tank rail cars and tank trucks.

New Containers and Handling Methods Evaluated

Interest in development and use of these new containers has been brought about for several reasons. Prices of barrels have increased 60% over the past 15 years. Currently, a new fir barrel which will hold 250 pounds of brined cherries costs \$10.00. Wooden barrels require a substantial amount of labor for handling because they are bulky and difficult to maneuver. Wage rates for labor in cherry brining plants in Oregon have increased by 67% over the past 15 years. Another reason for considering other containers is weight of barrel per pound of cherries shipped. This becomes a costly item, especially for cherries shipped long distances.

Because of possible economies in using containers other than barrels, there is considerable interest on the part of the industry in an economic study of container costs. Changes in operations brought about by the adoption of new containers should also be considered in such an evaluation.

The purpose of this study is to make such a comparison. Five different methods using specific containers or combinations of containers are considered in this study. These are (1) storing in barrels and marketing in barrels; (2) storing in bins and marketing in bins; (3) storing in tanks and marketing in tank cars or trucks; (4) storing in tanks and marketing in barrels; and (5) storing in tanks and marketing in bins. These methods may be described briefly as follows:

Method 1 - Storing in barrels and marketing in barrels

Cherries received at the brining plant in lug boxes are unloaded by either hand truck or forklift, weighed, and then moved to temporary storage. From temporary storage, the cherries are taken to the dumping station by hand truck or forklift. Techniques of dumping cherries into barrels vary by plants. Most commonly, the boxes are removed from the pallet or stack and the cherries dumped by hand into a hopper with an elevating conveyor which carries them to a chute leading directly to a barrel sitting on a scale. When the barrel is filled to 250 pounds, it is moved off the scale and replaced with an empty barrel. From the scale, the barrel is moved by roller track conveyor to a heading station where it is headed and hoopered. The barrel is pushed from the machine hooper to a crew which sets it on a pallet, fills it with brine, and bungs it. The palletized barrels are moved to storage by forklift.

After the curing period, the barrels of brined cherries are transported from storage by forklift. Cherries are removed from the barrel and are placed into the processing line by one of several techniques. In some plants, brine is drained from the barrel, the head removed, and the cherries dumped from the barrel into a sump tank. From the sump tank the cherries are pumped into the processing line. In other plants, barrels are dumped by utilizing a hydraulic or mechanical barrel dumper. As the barrel is dumped, cherries fall directly onto a shaker screen and from there go into the processing line.

Stemming, sizing, pitting, and sorting operations in the processing line are quite similar regardless of the container used. From the inspection belt, cherries go directly into barrels. As a barrel is filled from the inspection belt, it is removed from the line and is transported by hand truck to a scale where it is weighed and the weight adjusted to 250 pounds for stemmed cherries or 235 pounds for cocktail cherries. The barrel is then pushed off the scale onto a roller track where it is tagged, headed, and machine hoopered. Barrels are then palletized, filled with brine, bunged, and transported to graded storage by forklift.

Graded cherries remain in storage until they have been sold. At that time, barrels are removed from storage to a preparation area where the brine level is checked and the barrel is stenciled and made ready for delivery. From the preparation area, barrels are moved to the carloading dock, loaded into the truck or rail car, rolled into position, and braced to protect against damage in transit.

Method 2 - Storing in bins and marketing in bins

This method of operation uses the same receiving and dumping techniques as those in Method 1. Cherries are dumped into a hopper with an elevating conveyor which carries them to a chute directly above a bin sitting on a scale. After the bin is filled, it is pushed off the scale onto a roller track where the bin is lidded, filled with brine, bunged, and tagged. The bin is then taken to storage by forklift.

When the cherries are taken from storage to be processed after curing, bins are transported by forklift to a sump tank. Lids are removed and the cherries are dumped into a sump tank. A forklift with a rotating head is used for dumping the bins.

The cherries are delivered to the processing line from the sump tank by a pump and continue through the line until they come off the inspection tables and drop into bins. When the bin is filled, it is moved to a scale by forklift and the weight of the cherries is adjusted to 1,000 pounds for stemmed cherries or 940 pounds for cocktail cherries. The bin is then moved on a roller track conveyor to an area where it is lidded, filled with brine, bunged, and tagged. The cherries go to graded storage by forklift.

When cherries are sold, the bins are taken out of storage and made ready for delivery by checking the brine level in each bin and stenciling a description of the content and the destination of the cherries on the lid. The bins are loaded into the truck or rail car by forklift. As was the case with the barrels, the bins are braced and shored in place to protect against damage in transit.

Method 3 - Storing in tanks and marketing in tank rail cars or tank trucks

This method is not currently being practiced in any plant in Oregon, although most phases of the operation are being used to some extent in one or more of the plants studied. In no case is it current practice to store all orchard-run cherries in large wooden tanks, putting graded cherries back into tanks by grade and size, and shipping only in tank rail cars or tank trucks. The method, however, is one being given serious study by some firms of the industry as a possible means of achieving considerable cost savings through a reduction in labor and container requirements. The practicality of the method has been discussed with plant personnel and management, equipment manufacturers and their engineers, and it appears that the method is operationally sound and physically feasible. Because of the apparent interest and the possible cost advantages to be offered by this method, it has been included in this study. It should be pointed out that since no such handling method is being used in Oregon brining plants, the costs shown for this method are partly hypothetical. As such, they are subject to greater error than costs for other methods, which are estimates based on time studies of work being performed and the cost of equipment actually in use.

The receiving of cherries for Method 3 is similar to that of Methods 1 and 2. After receiving and temporarily storing in lugs, however, the method differs somewhat in that the distance for transporting cherries to the dumping station is increased because of the plant layout and space requirements for tanks.

The dumping operation for Method 3 is the same as for Method 2 except that instead of the cherries dropping off a short conveyor into a bin, they are carried to the tank field by a much longer conveying system and by the use of adjustable shunts are deposited into selected tanks. The conveying system and dumping station are portable and can be moved from row to row of tanks.

The cherries remain in the tanks during the curing period and until processing operations begin. At this time the cherries are pumped out of the tanks and delivered to the plant either by gravity through aluminum pipe or by mechanical conveyor belt. The cherries proceed into the processing line and go through the same operations as for other methods.

When the graded cherries come off the final inspection table, they are dropped into a hopper by size and grade; an elevating belt conveys them onto one of a number of transverse conveying belts. From the transverse belts, the cherries are carried back to the tank field by conveyor. Cherries are then put back into tanks, with each tank containing cherries of a single grade, variety, and size. Prior to

putting the graded cherries into the tank, the brine is removed, the tanks are washed out, and fresh brine is added. Graded cherries remain in the tank until ready for shipment.

In Method 3, cherries are shipped in bulk by either tank rail cars or tank trucks. Cherries are pumped out of the storage tanks into a weighing mechanism.¹ From the weighing mechanism, the cherries are dumped into a small holding tank and then pumped to a chute which carries them into the rail car or truck. Prior to the cherries being put into the tank car or truck, a fixed amount of brine is put in to serve as a cushion. After the desired amount of cherries by weight has been added, the tank car or truck is filled with brine and closed.

Method 4 - Storing in tanks and marketing in barrels

This method of handling cherries is a combination of Method 1 and Method 3. Orchard-run cherries are stored for curing in large wooden tanks, as in Method 3. After being processed, the cherries are placed in barrels for storage and subsequent marketing, as in Method 1.

Method 5 - Storing in tanks and marketing in bins

As was the case in Method 4, this method of handling brined cherries is a combination of two methods, Methods 2 and 3. Orchard-run cherries are stored in tanks, as in Methods 3 and 4, and processed cherries are handled in bins, as in Method 2.

Many techniques other than those discussed are used by brining plants for the various operations involved in brining cherries. Some of the techniques are unique and are adapted to a particular plant size or design. Only the most common techniques have been considered.

The five methods described will be referred to in the remainder of this study as: (1) Model 1--barrel to barrel; (2) Model 2--bin to bin; (3) Model 3--tank to tank; (4) Model 4--tank to barrel; and (5) Model 5--tank to bin.

¹ Although no such weighing mechanism exists for brined cherries, such devices are being used for other commodities. Food processing equipment manufacturers indicate it would be feasible to adapt such a mechanism to cherries.

PROCEDURES AND COST ESTIMATES

Selection of Factors Affecting Costs

This analysis has been developed around the variables which have the greatest effect on costs of brining cherries. These are capacity, as indicated by rate of output of brined cherries; container type; and method of operation.

Ten different rates of outputs have been assumed. These are expressed in output of barrels per day of graded cherries. The plant sizes begin at 75 barrels per day and are graduated by 25-barrel increments until the size of 300 barrels per day is reached. This range of plant sizes is consistent with the plant capacities of all Oregon cherry brining plants.

Containers and container handling costs account for a substantial portion of the total costs of brining, storing, and transporting cherries. Not only do container costs vary, but some containers have operational advantages which allow for less handling and a reduction in costs.

Several methods or techniques are available at many stages of operation for the same container. These techniques vary in the amount of labor and equipment required, thereby causing variations in costs. Where more than one method exists for a given operation, each has been evaluated and the most efficient and least costly method has been determined. This least costly method is then used when comparing one model with another.

Method of Determining Costs

Costs presented in this analysis are based on data collected from economic engineering studies conducted in selected cherry brining plants in Oregon. Selections were based on plant size, container used, and technologies used at specific stages. In these plants, time and production studies were made of actual jobs and machine operations. Interviews with management and supervisory personnel provided further information as to physical requirements and input costs. Building contractors, equipment manufacturers, and other related concerns also have been sources of information. Based upon data obtained from these sources, standards of performance for labor and equipment have been developed. These standards have been used to estimate and compare crew and equipment requirements and costs for the various methods and containers used in handling brined cherries. Model plants were synthesized and costs estimated for operations of various sizes and combinations of variables, whether or not similar plants actually existed.

Plant Organization and Cost Components

The brining of cherries involves a series of steps or operations beginning with unloading from trucks and ending when graded cherries have been loaded to rail cars or trucks for delivery to finishers. Figure 5 illustrates the movement of cherries through the brining plant.

These activities can, for convenience of analysis, be grouped into several stages, each consisting of one or a group of closely related activities. These stages have been selected to allow independent cost analysis for each segment of the overall operation. The operating stages, together with several categories of indirect costs not associated with any particular stage, form the following plant cost components: (1) receiving; (2) filling and storing; (3) processing; (4) carloading; (5) container; (6) buildings including water and electrical facilities; and (7) miscellaneous.

Only those costs of operation which are directly or indirectly associated with different containers used are included in the analysis. The study does not include costs for raw product, administration, operation of the office, management, procurement of raw product, and sales. Excluded also is the cost of operating capital except that for containers.

Stage 1 - Receiving

The receiving stage involves taking the lugs from the farm truck and transporting them to temporary storage, transporting from temporary storage to dumping station, moving empty lugs to temporary storage, and transporting empty lugs onto farm trucks.

Cherries are received at all Oregon cherry brining plants in lug boxes.² The dimensions of these lug boxes are not standardized among plants, and they may hold from 30 to 40 pounds of cherries. The 30-pound lug box was most commonly used.

While several techniques of handling lug boxes are used by brining plants, only hand truck and forklift techniques are considered in this analysis. Other methods observed proved to be not economically feasible or were adapted to unique situations which cannot be applied to all plants.

²Recently some plants have shown interest in the possibility of taking bins partly filled with brine to the orchard, and delivering cherries to the plant in these bins. This operation has been conducted on an experimental basis only.

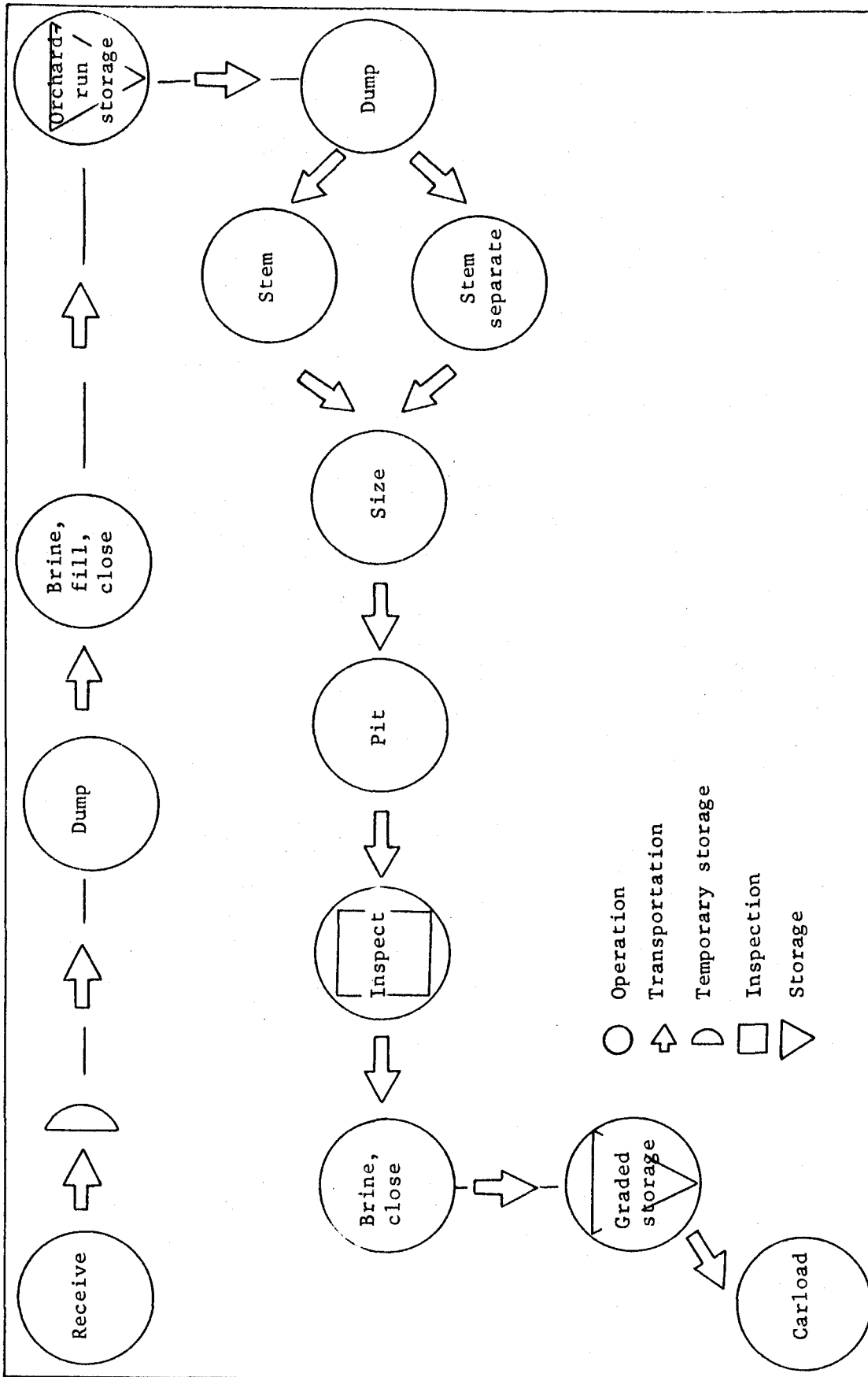


Figure 5. Material flow process chart for cherry brining plants.

Receiving costs are affected by the container used for storage and by plant size. Both of these factors influence plant design and layout and thereby affect distances traveled to temporary lug storage areas and to dumping stations. Figure 6 depicts a typical plant layout for a 200-barrel-capacity cherry brining plant operating under conditions of Model 1. Plant layouts for Models 2, 3, 4, and 5 for a plant of the same capacity are shown in Appendix Figures 1 through 4.

The following assumptions were made in estimating receiving costs:

1. Cherries are received at the plant for 22 days.
2. Receiving is divided into two periods, a 10-day peak period and a 12-day period of low receipts (6 days before and 6 days after the peak).
3. Plants receive 70% of the cherries during the peak period and 30% during the period of low receipts.
4. Plants receive for 10 hours a day during the peak period and for 8 hours a day during the period of low receipts.
5. Cherries are received at the brining plant in lug boxes containing 30 pounds.
6. All cherries are delivered on flat bed trucks.
7. Lugs are stacked seven high on the farm truck for receiving by hand truck and 48 to a pallet for receiving by forklift.
8. All incoming loads are weighed on a truck scale.

Total receiving costs per hundredweight of graded cherries as related to plant model, size of plant, and method are shown in Figure 7.³ Receiving costs are the same for Models 1 and 2 for a given plant size. Both models have the same general plant design and layout, thus there is no difference

³ Cherry briners estimate a loss of from 25 to 30% in weight of cherries from the time they are received at the plant until they are shipped to finishers. The assumption is made in this study that there is an average loss of 28%. This loss does not occur evenly throughout the stages of operation, nor is it exclusively associated with any one stage. To facilitate presenting a total cost estimate on the basis of graded cherries, each stage cost has been adjusted to reflect costs per hundredweight of graded cherries.

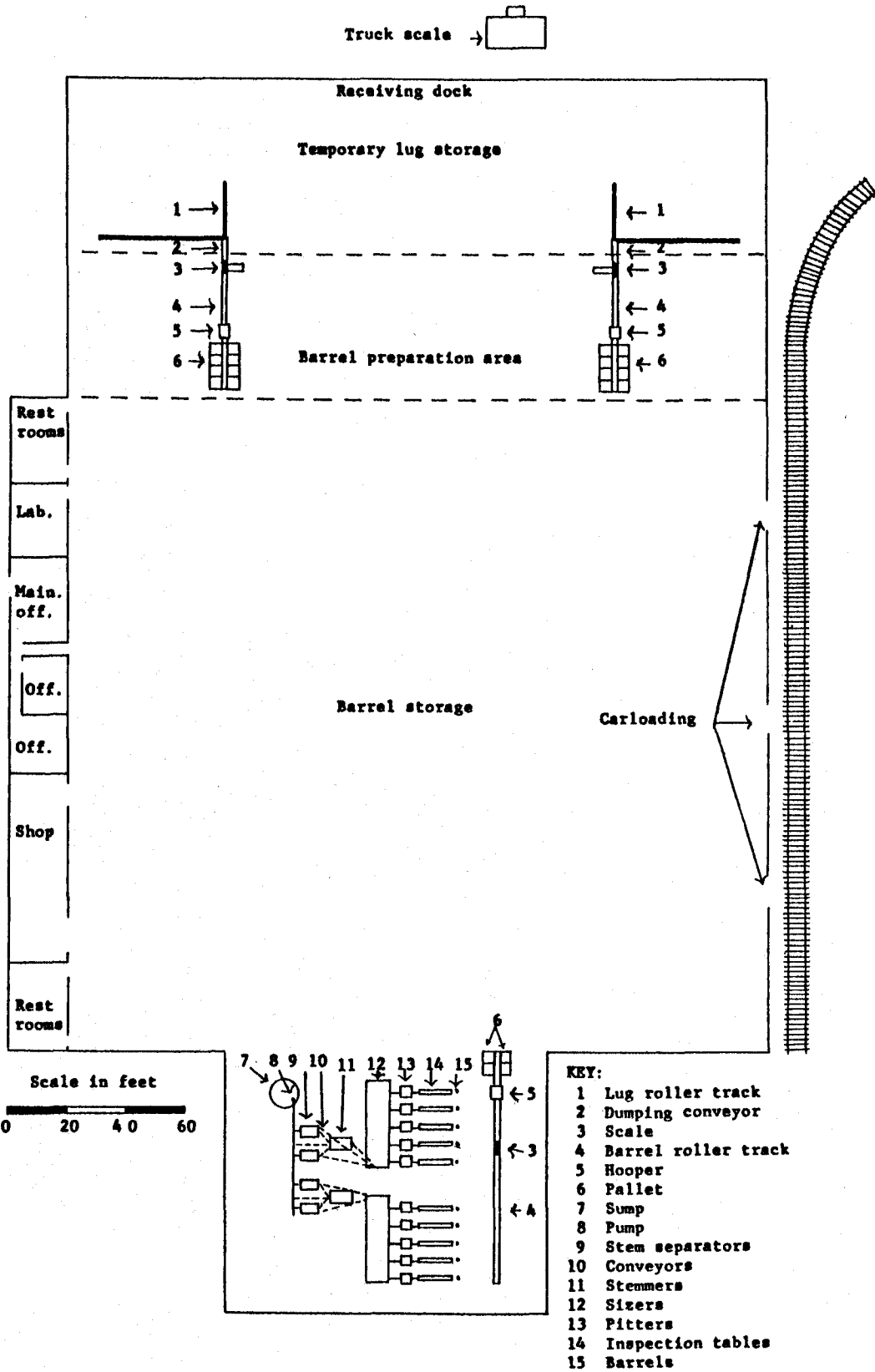


Figure 6. Cherry brining plant layout, Model 1, 200-barrel-per-day capacity.

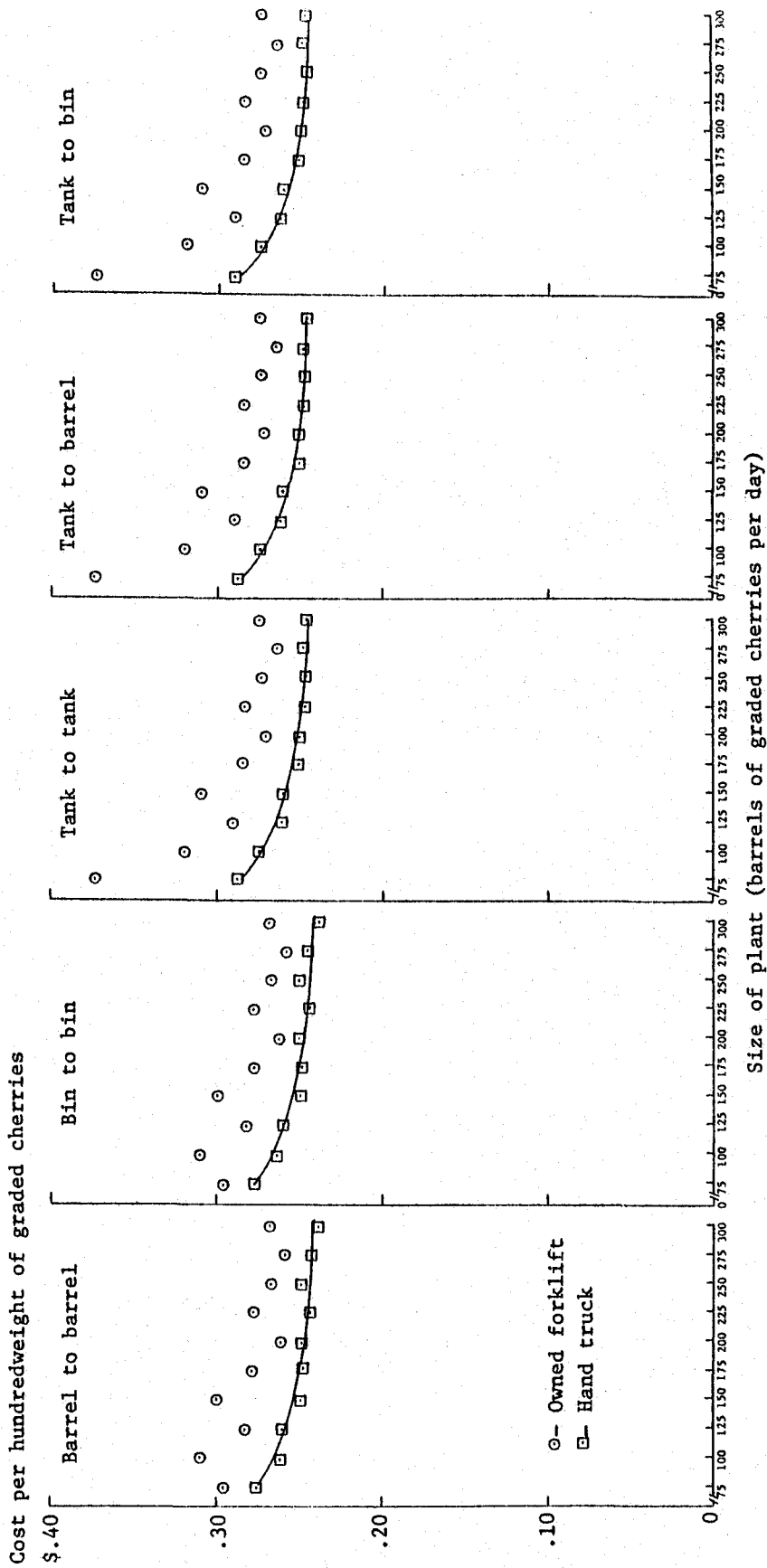


Figure 7. Comparative costs of receiving cherries by hand truck and forklift as related to size of operation and plant model, 1963.

in cost factors. Plant models that store cherries in tanks have a slightly higher receiving cost than do the barrel-to-barrel and bin-to-bin models. This results from the greater distance traveled because of plant layout and space requirements for tank field. Work standards, crew sizes, wage rates, and equipment requirements for receiving, as well as for the other stages, are presented in an earlier publication.⁴

Stage 2 - Filling and storing

This stage includes all operations from the time the full lug of cherries is taken from temporary storage and set on the roller track leading to the dumping station until the full container of cherries is in storage.

Work elements for Models 1 and 2 for this stage include set lug on roller track, dump, dispose empty lug, stack empty lug, prepare container, supply container, fill, brine, close, and transport to storage. Work elements for Models 3, 4, and 5 include set lug on roller track, dump, dispose empty lug, stack empty lug, and prepare container.

The following assumptions were made in estimating costs for the filling and storing stage:

1. The dumping operation begins four hours after the beginning of the receiving operation.
2. Cherries are dumped on the basis of first received, first dumped.
3. The length of day for filling is 18 hours during the peak period and 10 hours during the period of low receipts.
4. Equipment and crew sizes for each plant are such as to meet hourly requirements to complete filling in the assumed length of day.
5. Barrels hold 250 pounds of orchard-run cherries, bins hold 900 pounds, and tanks hold 23.5 tons.

⁴ Bontrager, Harold L., "An Analysis of Costs and Efficiencies in Cherry Brining as Affected by Container Type," M.S. thesis, Oregon State University, Corvallis, 1963.

6. Pallets of barrels are stacked five high in storage, while bins are stacked four high.

Figure 8 shows average costs of filling and storing per hundredweight of graded cherries. Barrel and bin models experience a high labor cost per unit, while tank models have relatively low labor costs but high equipment costs per unit. This lower labor cost for plants which store orchard-run cherries in tanks results from lower labor requirements in preparing and closing containers, and from elimination of the cost of transporting to storage. Tank plants experience further economies at the dumping and filling station. At this point, tank plants require a smaller crew than do either barrel plants or bin plants.

Models 3, 4, and 5 employ the same dumping technique as do Models 1 and 2, but when the cherries come from the hopper they are deposited on a longer conveyor system which, by the use of shunts, deposits the cherries into the designated tank. This dumping and conveying system is portable so that it can be moved from row to row of tanks.

Stage 3 - Processing

The processing stage begins with taking cured orchard-run cherries out of storage and continues through grading operations and putting graded cherries in storage. Work elements differ by models, but the equipment used in the processing line is the same for all models for a given plant size.

Work elements for Models 1 and 2 include transport orchard-run cherries from storage by forklift, open container, dump cherries into sump, pump to line, stem or stem separate, size, pit, inspect, prepare container, brine, close, and transport container to graded storage. Cherries from barrels are dumped into the tank manually, while a rotating head on a forklift is used for dumping cherries from bins into the sump. When the cherries come off the inspection table, they fall into the container; then the container is closed, filled with brine, and transported to storage by forklift.

Work elements for Model 3 include pump from tank field to sump, pump to line, stem or stem separate, size, pit, inspect, and operate conveyors. Estimated costs for Model 3 are based on using conveyors to transport graded cherries back to the tank field. Cherries are then placed back into tanks with each tank containing cherries of a single grade, variety, and size.

For Models 4 and 5, work elements are the same as for Models 1 and 2 except that cherries are pumped from the tank field to the sump rather than dumped into it.

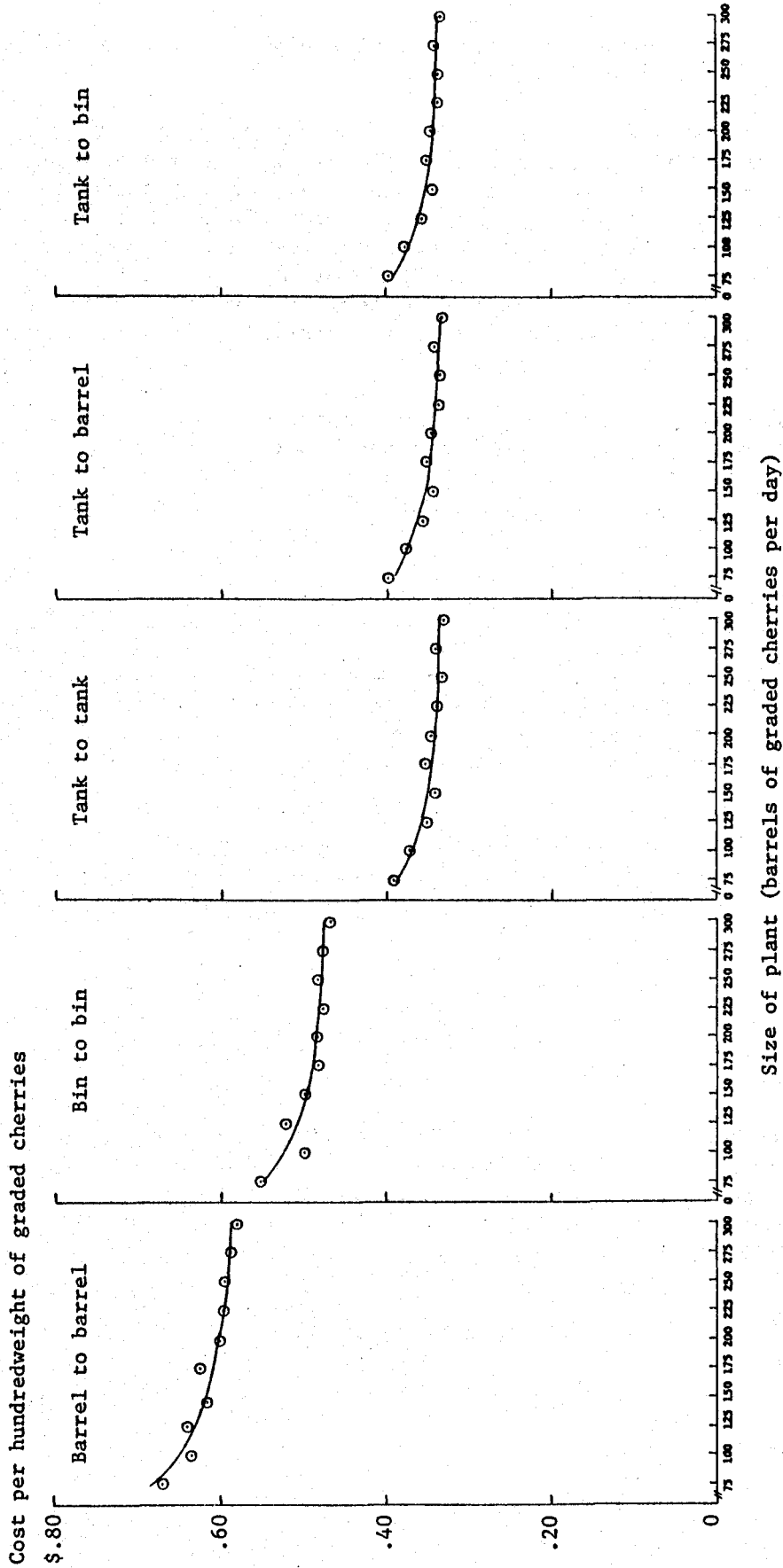


Figure 8. Comparative costs of filling containers and transporting to storage of orchard-run cherries as related to size of operation and plant model, 1963.

Estimated processing costs are based upon the following assumptions:

1. Plant operates 200 eight-hour days.
2. One-half of the output is cocktail cherries and the remainder stemmed cherries.
3. The plant processes either stemmed or cocktail cherries at any given time, but never both at once.

Assumption 1 involves the duplication of the line of processing equipment as the rate of output increases. An alternative to this assumption would be to increase the number of hours of operation per day. The plant could operate with a greatly reduced amount of equipment. An analysis of this problem has shown that a single line of processing equipment operating for two or three shifts was a more costly approach than to operate single shifts with duplicated equipment. The considerable savings in equipment costs were more than offset by the increase in indirect labor (such as supervisory personnel) and increased wage rates for night labor.

Costs for the processing stage are affected by the container used, rate of output, and procedure. Although more than one technique is available for performing many of the operations, only the least costly is presented in this analysis. Costs for the processing stage are shown in Figure 9 by plant size and model.

As a result of the cost of the conveyors used to transport graded cherries back to the tank field and into tanks, the tank-to-tank model has the highest equipment cost of the five models for this stage. This high equipment cost more than offsets the lower labor cost associated with this stage.

The barrel-to-barrel model has a lower total cost of processing than does the tank-to-barrel model, even though it has a higher labor cost. The higher labor cost results from higher labor requirements for transporting orchard-run cherries from storage and dumping into the sump.

Stage 4 - Carloading

The carloading stage begins with taking graded cherries out of storage and ends when the cherries are in the rail car and the car is closed.

Estimated costs for Models 1, 2, 4, and 5 are based on transporting containers from storage to a preparation area by forklift, preparing container for shipment, moving container to rail car by forklift, placing the container in the car and bracing it in position, and closing the car.

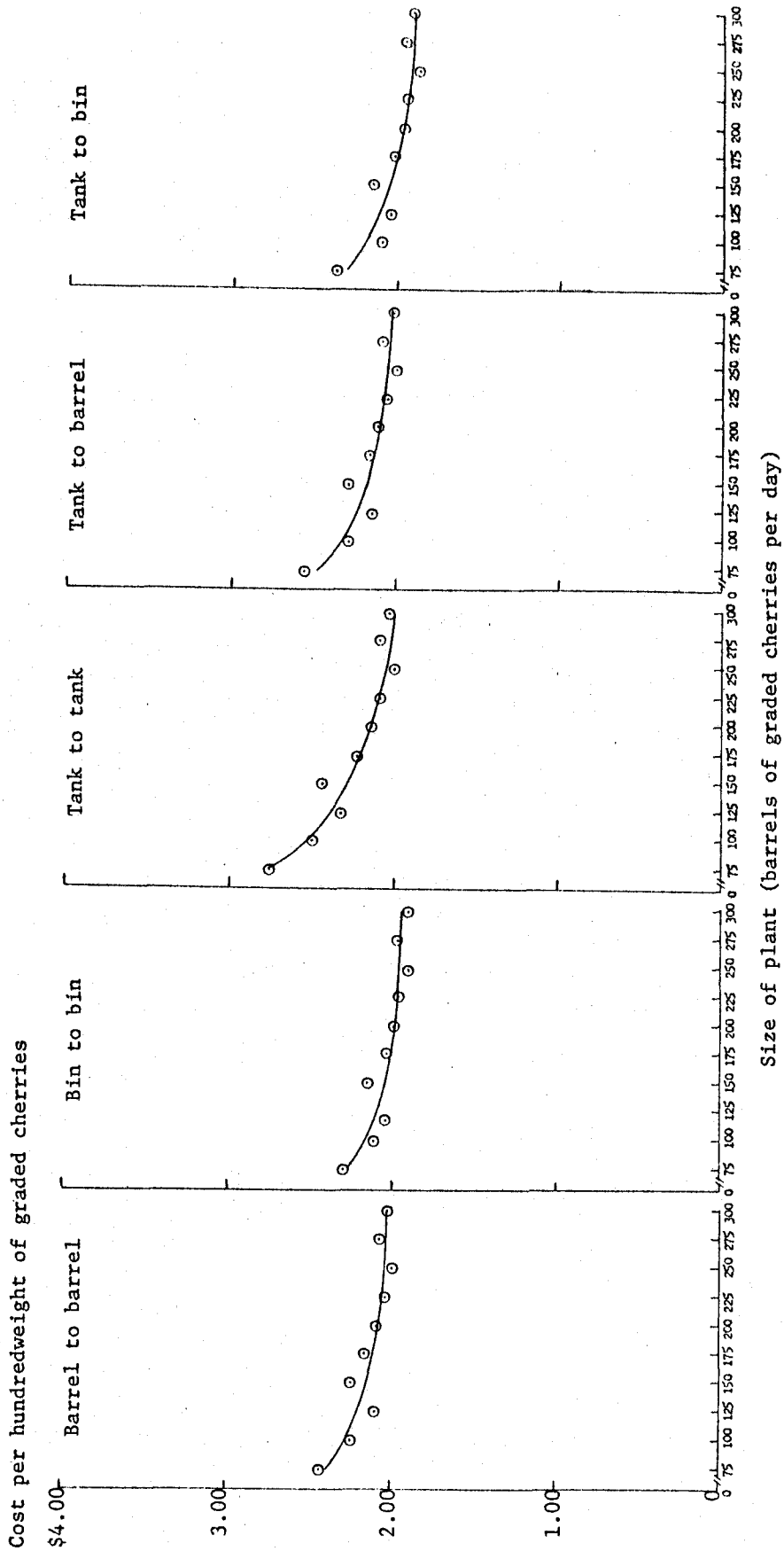


Figure 9. Comparative costs of processing brined cherries as related to size of operation and plant model, 1963.

For Model 3, the graded cherries are pumped out of the tank onto a conveyor, conveyed to a weighing mechanism, weighed, and pumped to a chute which carries them into the car; brine is then added to the car, and the car is closed.

Most of the cherries brined in Oregon are shipped by rail; for this reason, costs in this analysis are based on loading cherries into rail cars. The cost of carloading is shown in Figure 10. Cost components vary considerably between carloading either barrels or bins and carloading bulk cherries from tanks into rail cars. A high portion of the total cost of carloading barrels and bins is attributed to labor, while carloading bulk cherries involves a high equipment cost.

Stage 5 - Container

Basis for calculating container costs was somewhat different for each of the five models. It is assumed that barrels and bins are purchased new each year and are used only once. This is currently the prevailing practice in the industry. The alternative to this is for the briner to have his containers returned from the finisher so that he may re-use them the next year. This possibility is discussed later.

Assuming that barrels and bins are purchased new, the full cost of the container is chargeable to the yearly operation. Replacement cost of the new fir barrel is \$10.00. Replacement cost of the bin is \$9.00. To the cost of the bin must be added the cost of the plywood lid, fibreboard and polyethylene liners. Costs of these are \$1.00, \$0.95, and \$1.57, respectively, bringing the total replacement cost to \$15.04.⁵

In addition to the replacement cost of containers used only once, there are other costs associated with the container. An allowance of 5½% of replacement cost has been included to cover such items as insurance, taxes, repairs for containers, and interest on operating capital. This charge plus replacement cost brings the total container cost for barrels to \$10.55 and for bins to \$15.59.

Because of the 28% loss in weight of cherries between the time orchard-run fruit is delivered and the time graded cherries are ready for delivery, the number of barrels and bins needed to store orchard-run fruit is in excess of the number required for shipping. Containers

⁵ New lids and fibreboard and polyethylene liners are inserted before filling with orchard-run cherries and again before filling with graded cherries.

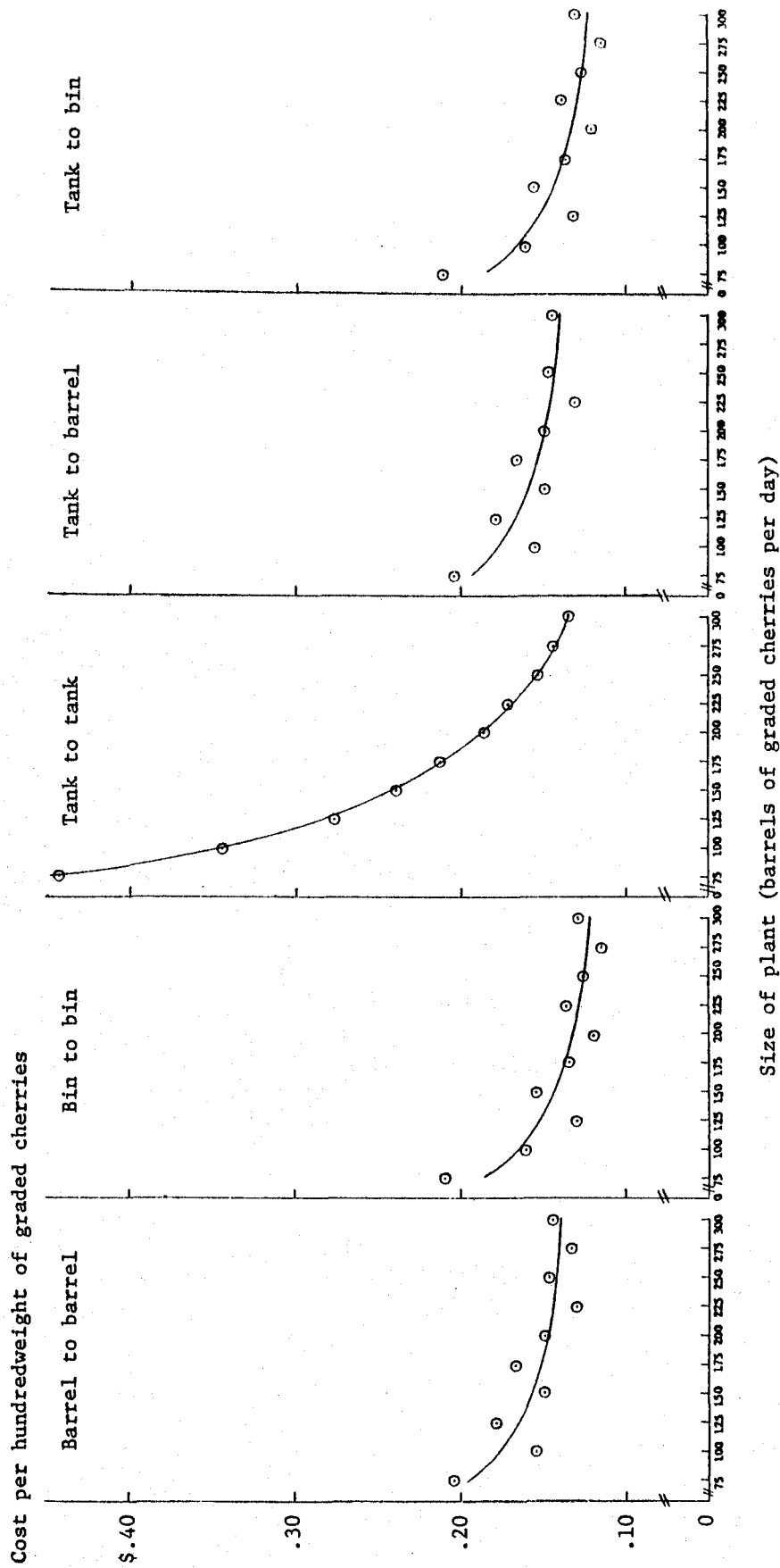


Figure 10. Comparative costs of carloading brined cherries as related to size of operation and plant model, 1963.

which are not shipped to finishers are carried over and used the following year. After the first year of operation, plants need only to buy enough containers for the graded output, as the containers carried over can again be used for orchard-run storage. It is assumed no barrel or bin is carried over by the plant for more than one year and will be shipped out with graded cherries in the second year.

In addition to the cost of the container for graded cherries for Models 1 and 2, there is a one-time cost for containers to store the larger quantity of orchard-run cherries. It is assumed that this added investment in container is amortized over a 10-year period. Annual costs for this additional container requirement are based on a percentage of replacement costs amounting to 15½%. This includes depreciation at 10%, and insurance, taxes, interest, and repairs, 5½%.

Tank costs have been calculated on a basis of 25 years of useful life. Replacement plus installation cost of a 25-ton tank is \$3,800. Annual fixed costs per tank were calculated to be \$313.50. This includes 4% of replacement cost for depreciation, as well as an additional 5½% to cover taxes, insurance, interest, and repairs and maintenance. The number of tanks required for a given plant size for Model 3 is based upon the storage space requirements for orchard-run cherries. To this requirement, additional tanks have been added for storing graded cherries until some tanks have been emptied of orchard-run cherries.

Model 4 container requirements are based on the number of tanks required for storage of orchard-run cherries and a sufficient number of barrels for shipping graded cherries. Model 5 container costs are calculated on the same basis as Model 4, except bins are used for shipping the graded cherries.

Comparative costs of containers for the five models are shown in Figure 11.

Stage 6 - Buildings

Building costs are based on estimates provided by building contractors in the Willamette Valley. These costs reflect estimated floor space required for efficiently organized plants of the given capacities, engineering estimates of quantities of building material and labor required for buildings of selected size and construction, and 1963 Willamette Valley prices for materials and wages.

Buildings are constructed differently for the five models. The barrel model has concrete floors throughout. The temporary lug storage area has aluminum siding and roof. The filling, storage, and processing areas have concrete sidewalls and asphalt roof. For the barrel model, the roof is 20 feet above floor level. Receiving and loading docks are of concrete construction four feet high.

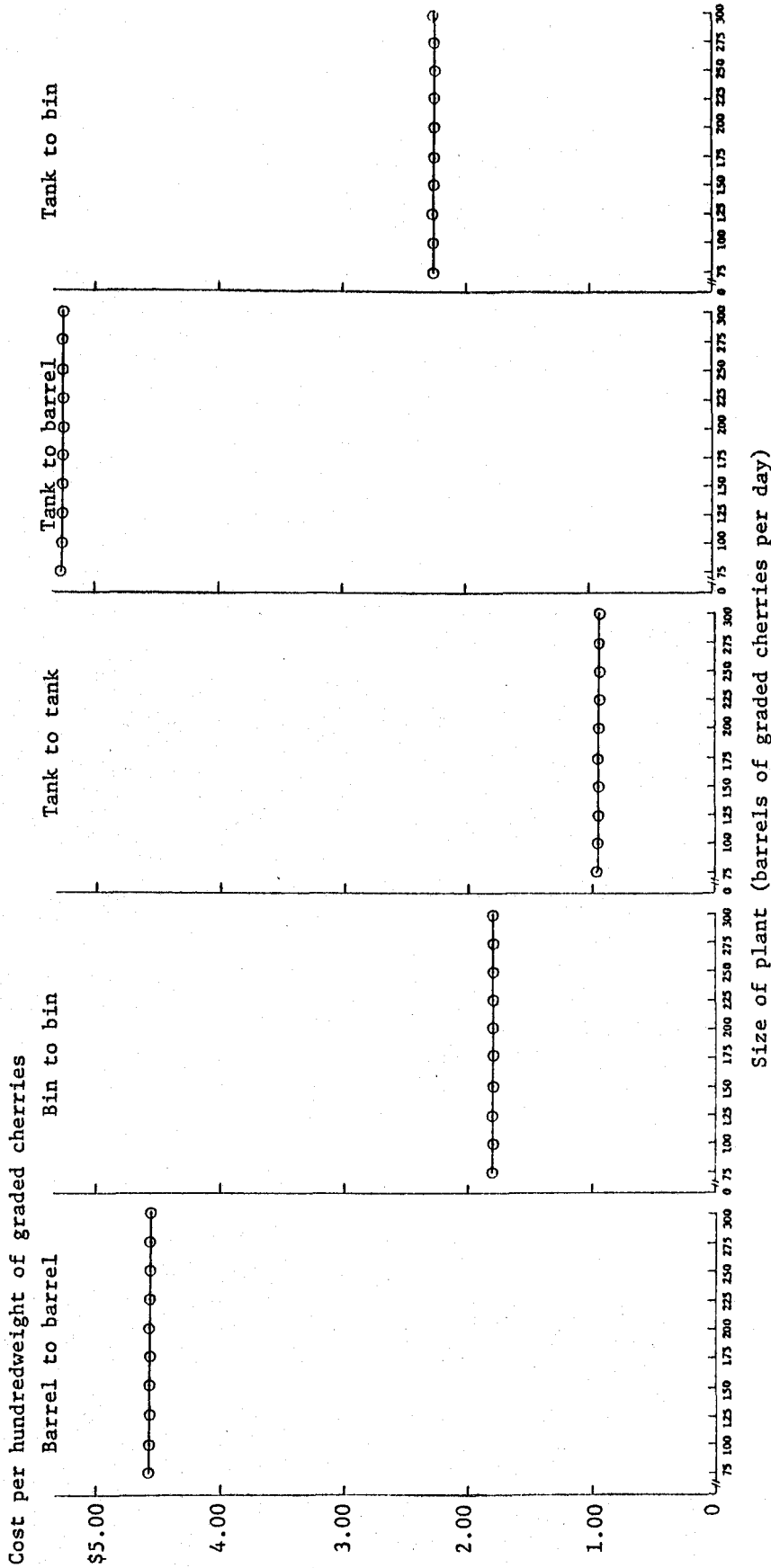


Figure 11. Comparative costs of containers used in brining cherries as related to size of operation and plant model, 1963.

The bin model has the same general construction as the barrel model except that the roof is only 16 feet above the floor level. Difference in height of roof is due to difference in the height of storage containers. In the analysis it is assumed pallets of barrels are stacked five high in storage while bins are stacked only four high. Floor space includes allowances for receiving dock, loading dock, temporary lug storage area, filling area, container storage area, processing area, office, laboratory, rest rooms, and shop. See Figure 6 and Appendix Figures 1 through 4 for plant layouts for each of the models for a given size plant.

The tank-to-tank model has a concrete floor for the temporary lug storage area. This area has an aluminum roof 16 feet above floor level, but no sidewalls. A plank floor is laid in the tank field with the tops of the tanks 40 inches above this plank floor. The building for processing is located apart from the tank field and is constructed with concrete floor, concrete sidewalls, and asphalt roofing. The roof is 24 feet above the floor level to allow for the transverse belts and flight conveyors used in transporting graded cherries back to the tanks. Receiving and loading docks at the tank field are four feet high and of concrete construction.

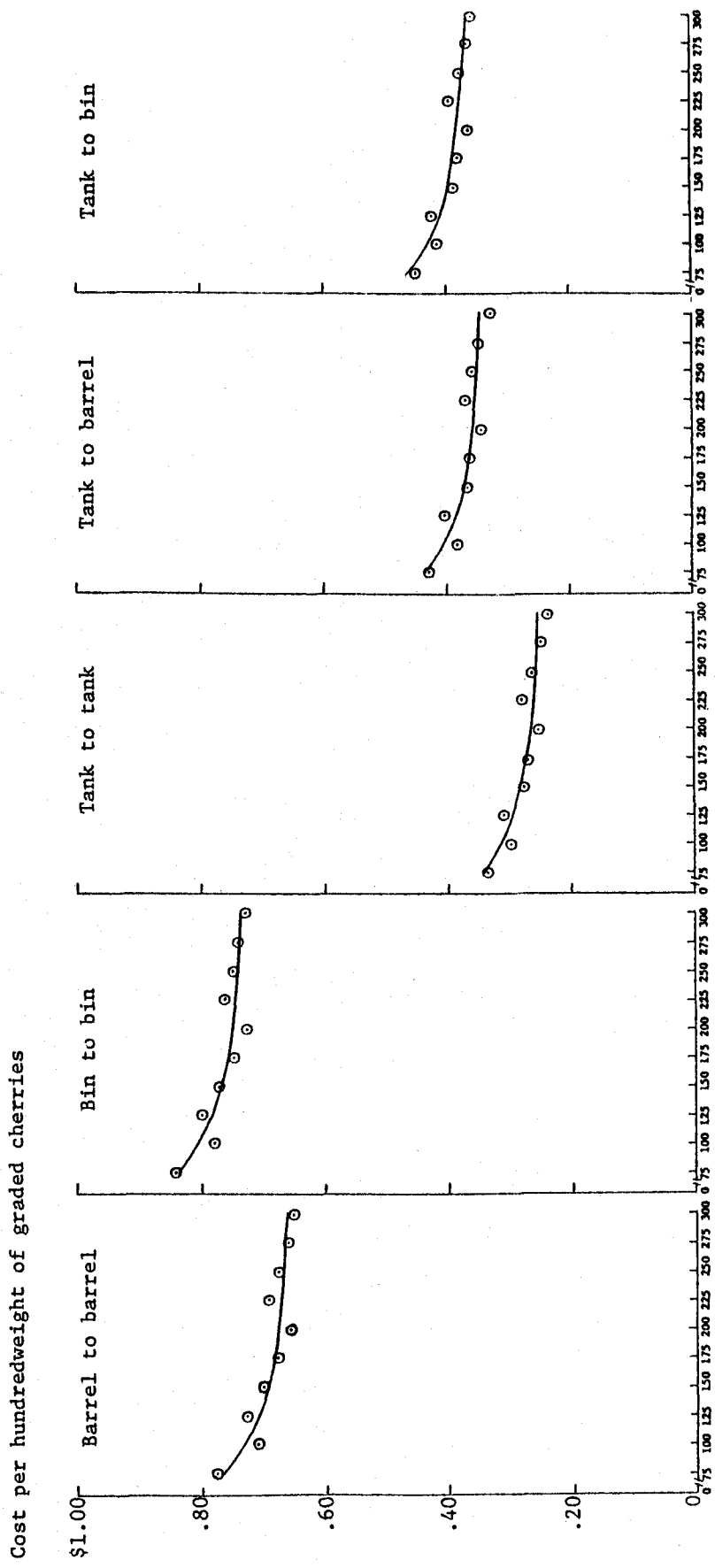
The tank fields in the tank-to-barrel and tank-to-bin models have the same construction as in the tank-to-tank model. Storage space is required for graded cherries in barrels or bins, however. This is built adjacent to the processing building and is of the same type of construction. Costs are based on the assumption that the storage area for these models is large enough to store one-third of the plant's total output of graded cherries.

Building costs include primary plumbing lines, primary water lines, and main electrical panels and lighting. The costs do not include water or electrical installations assignable to specific items of equipment, but improvements for offices, rest rooms, and the laboratory (i.e., plumbing, heating, lighting, etc.) are included.

Annual building costs per hundredweight of graded cherries are shown in Figure 12. Annual costs are computed as a percentage of building replacement cost as follows: depreciation - 2.5%; repairs - 1.8%; insurance - 0.8%; taxes - 1%; and interest - 3% (interest at 3% is equal to approximately 5.5% of the undepreciated balance).

Stage 7 - Miscellaneous

This stage includes cost elements which are not assignable to any specific stage but which are associated with plant operation. It includes labor costs of the plant foremen, mechanics, and brinemakers. Water and electricity charges and an allowance for costs of small items of equipment (such as shop tools) not assignable to any specific



Size of plant (barrels of graded cherries per day)

Figure 12. Comparative costs of buildings for brining cherries as related to size of operation and plant model, 1963.

equipment or stage are included. This allowance is based on 5% of the investment cost of equipment.

The miscellaneous stage also includes a land charge made up of 5% interest on an assumed land price of \$1,500 per acre, and estimated annual taxes.⁶

Figure 13 shows miscellaneous costs per hundredweight of graded cherries as related to size of operation and plant model.

RESULTS OF ANALYSIS AND IMPLICATIONS TO THE INDUSTRY

Since cost estimates for the seven cost components have been based on most efficient techniques of operation, the summation of costs for receiving, filling and storing, processing, carloading, container, building, and miscellaneous items for any given plant size and model gives an estimate of minimum total costs. A comparison of these costs for all models and plant sizes considered is shown in Figure 14.

A comparison of the five models indicates a substantial spread in cost of operation. The tank-to-tank model has the lowest cost per hundredweight of graded cherries. The cost advantage of this model over the other models results from lower costs for filling and storing, container, and building. The tank-to-bin model has a slight cost advantage over the bin-to-bin model, resulting from lower costs in the filling and storing stage and in building; however, the bin-to-bin model has a cost advantage for containers. The barrel-to-barrel and tank-to-barrel models have relatively high costs when compared to the other models.

"Total costs" here do not include all costs associated with the brining of cherries. Raw product costs, administrative and office costs, procurement costs, and interest on operating capital are not included in the analysis.

⁶Land charge used in this study is lower than actual land charges for most existing plants. Lower land prices used are based on the assumption that a new cherry brining plant would only be built on the outskirts of any town or city where land prices are much lower than those within the city limits.

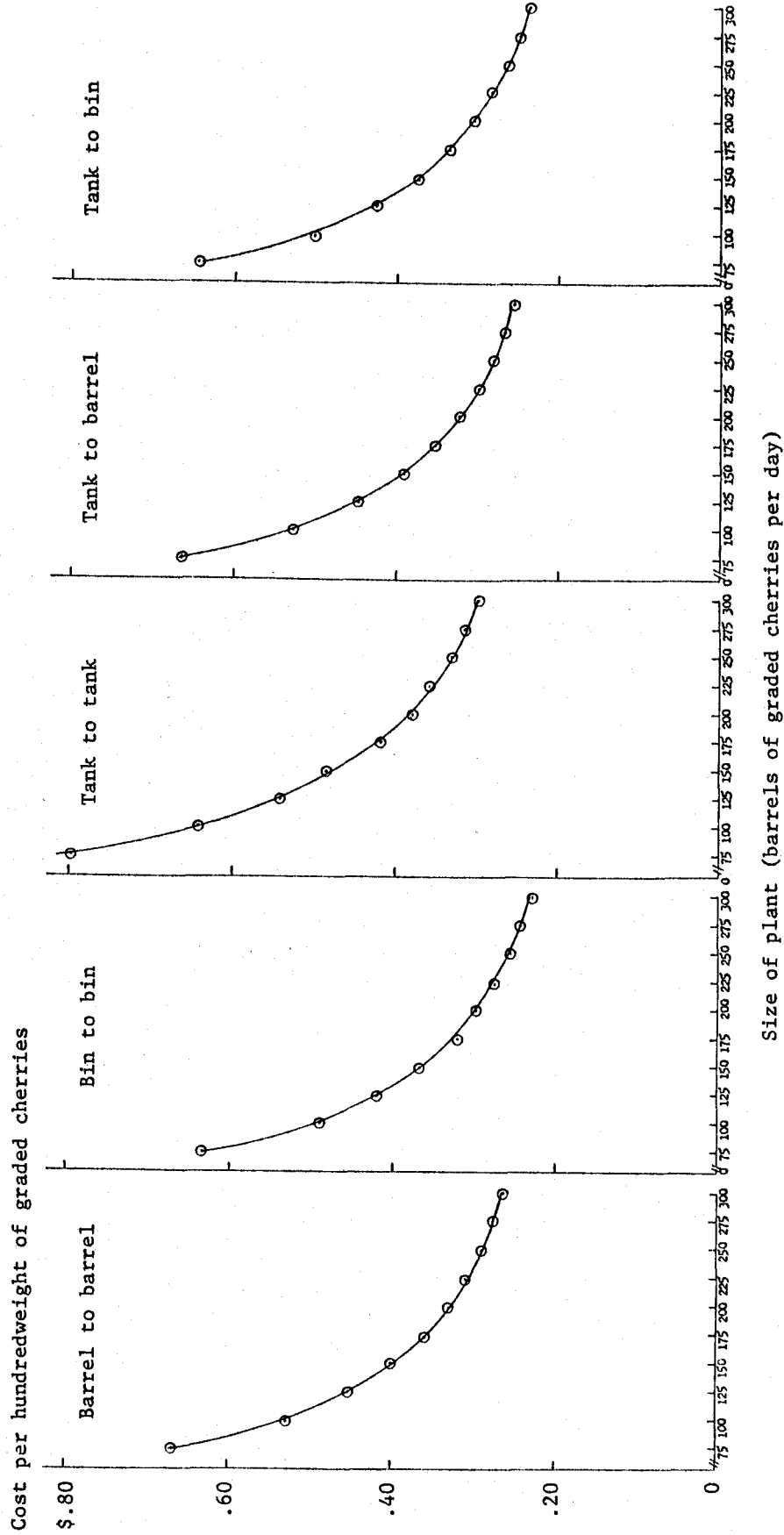


Figure 13. Comparative miscellaneous costs of brining cherries as related to size of operation and plant model, 1963.

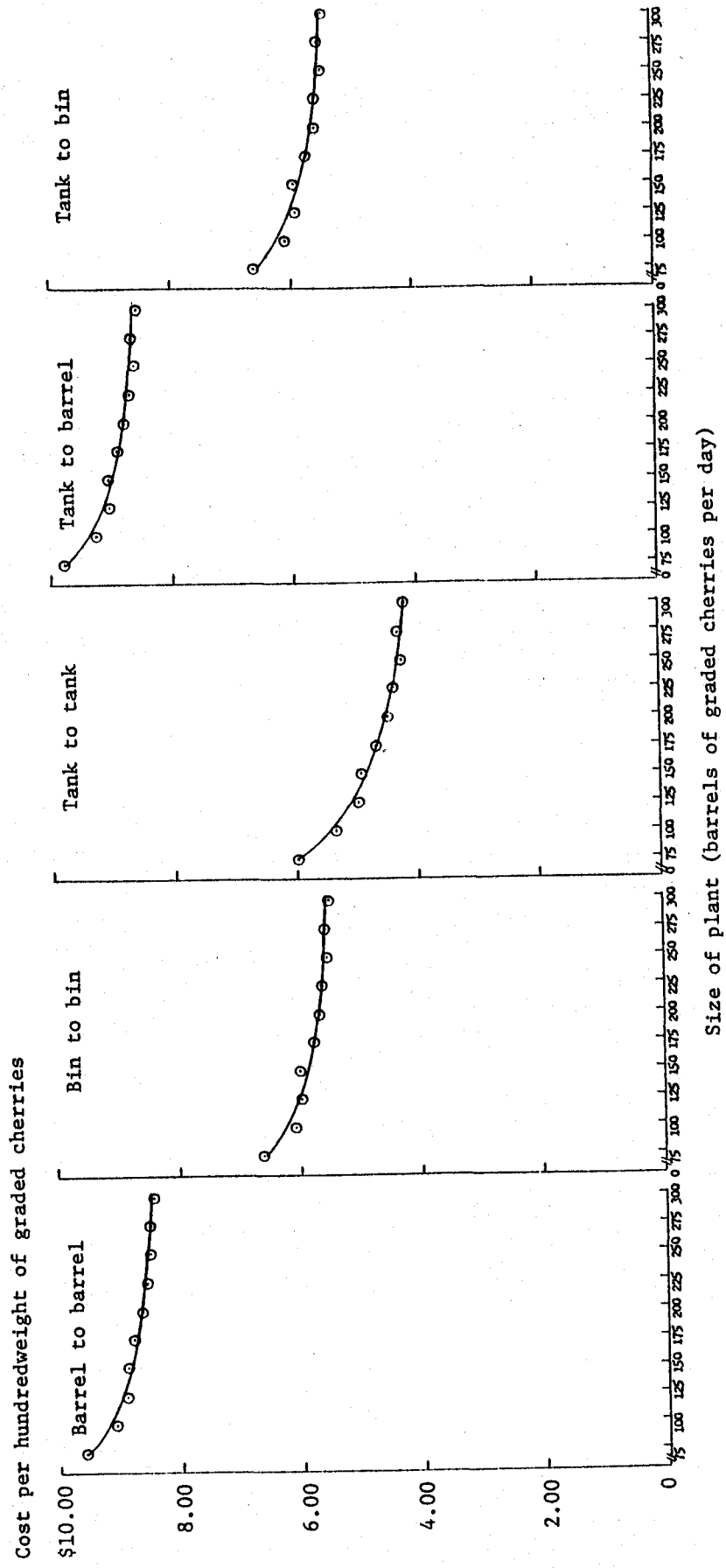


Figure 14. Comparative total costs of brining cherries as related to size of operation and plant model, 1963.

Comparative Costs Exclusive of Container

A substantial portion of the differences in total cost for the various models can be attributed to container costs. To emphasize the effects of container cost, Figure 15 shows costs per hundredweight of graded cherries exclusive of container costs. In deducting container costs from total costs for Models 3, 4, and 5, tanks have been considered to be containers; therefore, their entire cost has been deducted as container costs. It should be noted, however, that tanks not only replace barrels and bins as containers, but also eliminate the need for building space for storing barrels and bins.

The spread of the cost curves for the various models has been reduced considerably with the exclusion of container costs. The relative position of the various models is also changed. Model 5 is now the least-cost method for all plant sizes.

Comparative Costs Adjusted for Industry Price Differentials

Prices received f.o.b. cherry brining plants in Oregon for specific grades of brined cherries in 1963 differed by type of container in which cherries were supplied. Finishers were paying a premium of three cents per pound in barrels and one cent in bins above cherries sold in tank rail car or truck. This price differential may have been due in part to the relative usefulness of the containers to the finishers. Many finishers of maraschino cherries, particularly smaller firms, use the barrel in their finishing process. Others have a ready market for used barrels and are able effectively to reduce the price of brined cherries by selling the used containers.

Another partial explanation for the price differential may be that managers of cherry brining firms are willing to pass along to finishers a portion of their cost savings brought about by the use of lower-cost containers and reduced handling costs. In this sense, the price differential is used as an inducement to finishers to purchase cherries in the container having the lowest total cost to the briner.

While this price differential may not remain at 1963 levels, it is of interest to compare costs of brining for the five models after applying these differences in selling price as an offset to costs and adjusting accordingly.

Figure 16 shows total costs adjusted by the price premiums. Costs have been adjusted by subtracting \$3.00 per hundredweight from graded cherries marketed in barrels, and \$1.00 per hundredweight for those marketed in bins.

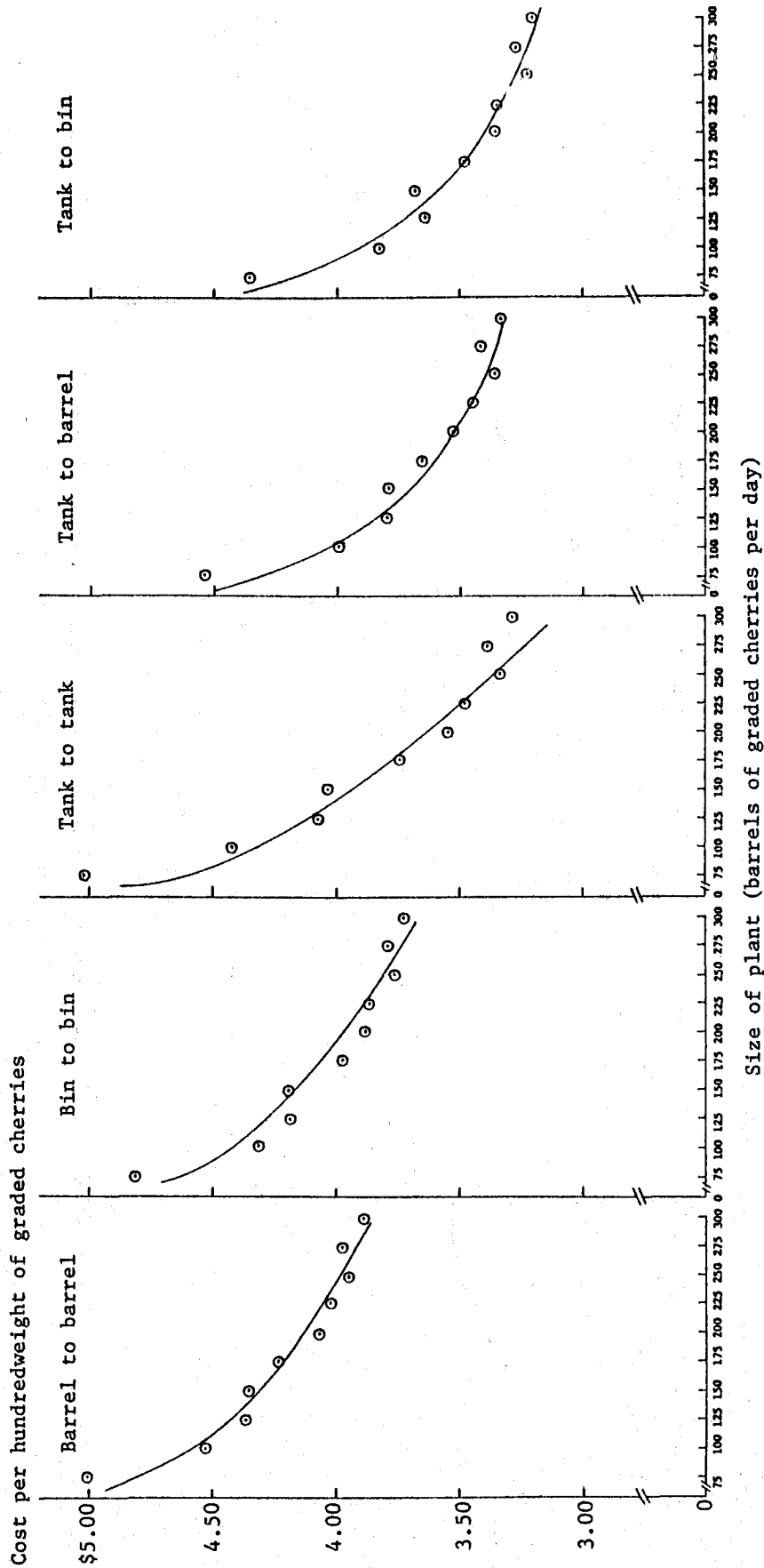


Figure 15. Comparative total cost of brining cherries, exclusive of container cost, as related to size of operation and plant model, 1963.

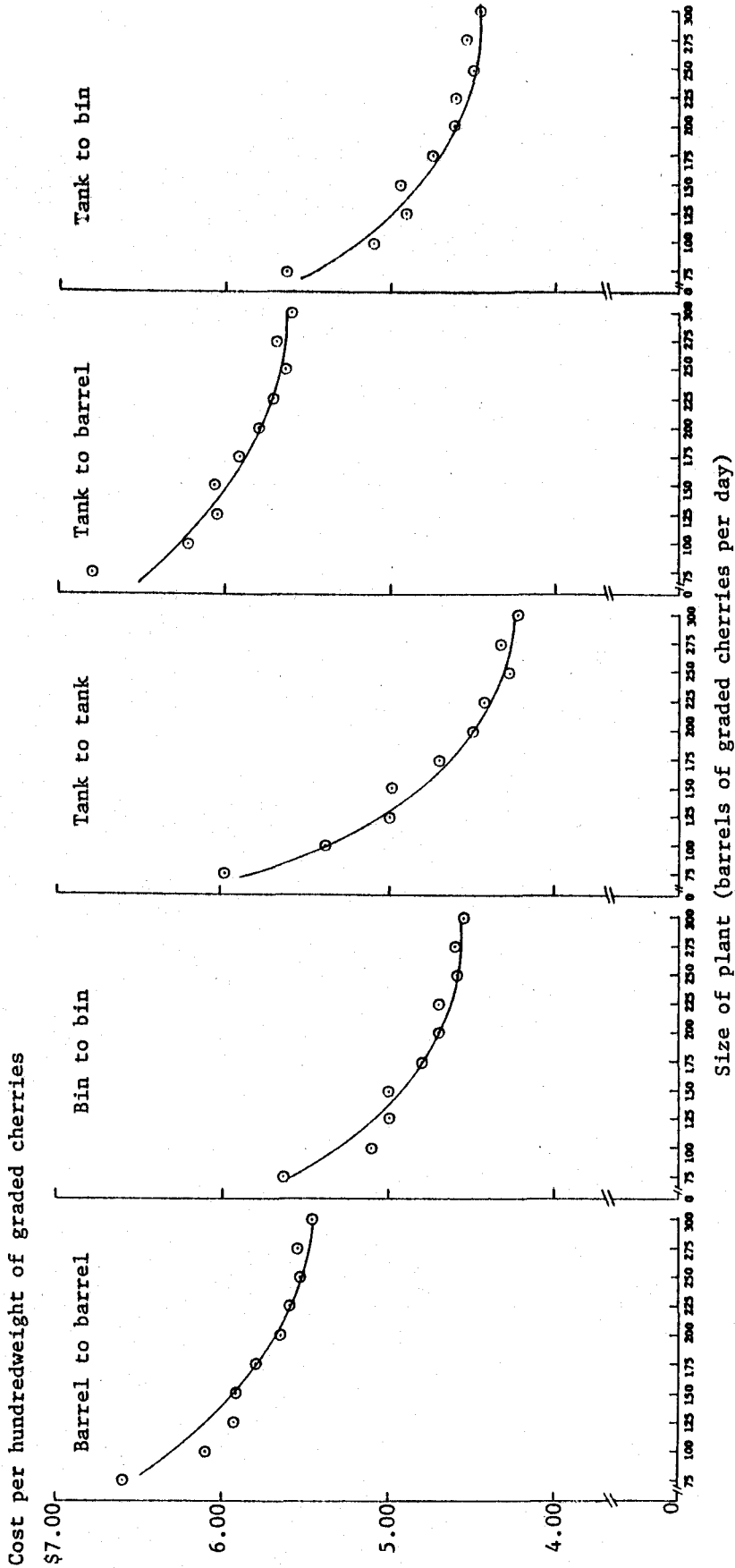


Figure 16. Comparative adjusted total costs of brining cherries as related to size of operation and plant model, 1963.

The adjustment of costs for industry price differentials has resulted in a shift in the relative position of the cost curves. Model 5 is the low cost model for plants with an output of 150 barrels or less. For plants larger than 150 barrels per day, Model 3 has the lowest cost.

Considerations other than container cost and cost of handling are important to the industry when evaluating the feasibility of each of the containers. Most important among these are: transportation problems and costs, possibilities for re-use of containers, and preferences and acceptance by finishing firms.

Transportation Costs

Although cherries are usually shipped f.o.b. the brining plant, transportation costs are still an important cost consideration. Finishers are concerned with total costs of getting brined cherries to the finishing plant.

Rail rates in 1962 for shipping cherries from Salem, Oregon, to San Francisco for given-size loads were the same regardless of type of container in which shipped. Rates to New York for shipment in tank cars were slightly higher than for shipment in barrels. Rates to New York in bins were not established because of limited movement in this container.

Rail rates are based on the gross weight of the load, including weight of cherries, brine, and the container. The ratio of brine to cherries is approximately the same regardless of the marketing container. Weight of a new fir barrel is approximately 50 pounds, or 20 pounds per net hundredweight of cherries. A palletized bulk bin including lid and liners weighs about 130 pounds, or 13 pounds per net hundredweight of cherries. In the case of the tank car, the container is the car itself, and there is no freight charge on the weight of the car.

Because of this difference in container weight, freight rates per net hundredweight of cherries differ even though the gross rates are the same. Rates from Salem to San Francisco, when converted to a net hundredweight of stemmed cherries basis, were \$1.05 when shipped in tank cars, \$1.13 in bins, and \$1.17 in barrels.

Protective heater service must be considered in transporting brined cherries, as they may be subjected to freezing temperatures in transit during the winter months. Freezing of cherries causes deterioration of the product. Rail cars have heaters installed in them to prevent the freezing of cherries in barrels or bins. Tank cars now in use do not have provisions for heating, but instead, are insulated to protect against freezing. The heaters installed in rail cars in which barrels or bins are shipped have been more successful at preventing freezing than have the insulated tank cars.

Possibilities for Re-use of Container

Although this study assumes plants will buy new barrels and bins each year to replace those shipped to finishers, the possibility does exist for returning empty containers to the briners for re-use. This would, in effect, result in a lower container cost for plants following this practice. For example, assume that a plant in The Dalles handles its cherries in barrels and sells them in San Francisco. Container cost for this plant if the barrels were used only once would be \$4.57 per hundredweight of graded cherries (Figure 11). If this plant were to have its barrels returned from San Francisco for re-use, estimated cost of the container would be \$2.58 per hundredweight of graded cherries. This includes the annual fixed cost of the barrel, as well as the transportation cost for returning the empty container.⁷ Re-use of barrels would result in a saving of \$1.99 per hundredweight of graded cherries. The possible economy is reduced as distance from plant increases, because of higher freight rates for returning empty barrels.

There is another consideration, however. If brining plants were to adopt the practice of having barrels returned from the finishers, the current premium being paid for cherries in barrels would possibly be reduced or completely eliminated. Then costs adjusted for the price differential (Figure 16) would be higher for the operation which returned its barrels than for the one buying new barrels each year.

Impact on Finishers

Selection of the type of container by briners cannot be made without considering the preferences of purchasers of brined cherries and their acceptance of the various containers. Time and resources did not permit a complete study of this problem. Based on discussions and interviews with a limited number of finishers and with management of cherry brining firms, it was found that the container in which finishers prefer to buy cherries seems to depend on three factors: (1) the finishing process used; (2) size of the finishing operation; and (3) location of the finishing plant. These factors are somewhat interrelated.

⁷ Annual fixed cost is based on a percentage of replacement cost as follows: 25% for depreciation (four-year useful life), 1% taxes, 1% insurance, 3% interest (approximately 5.5% of undepreciated balance), and 3% repairs. The allowance for repairs has been increased substantially over the one-half percent assumed when barrels were used only once. Return rate for the empty barrel from San Francisco to The Dalles is \$1.44 per hundredweight.

There are two processes used for converting brined cherries into maraschino and other types of finished cherries. One method is known as the "cold process" and utilizes barrels in the finishing operation. Finishers buy cherries in barrels, drain and wash off the brine, and add syrup, sugar, and coloring. The barrels are then manually rolled to mix the cherries and the additives. This process is repeated weekly for four weeks. Bins have not proven to be a satisfactory container for use in this process because of the required mixing.

The other process used in finishing cherries is called the "hot process." This involves the dyeing and sweetening of fruit in heated syrup in large stainless steel vats. Barrels are not used for this process. The hot process takes much less time and is reported to produce a more uniform product, but it involves a larger investment in plant and equipment than does the cold process.

Because of the increased investment required, the hot process is usually employed by firms with the larger and newer plants. Firms with the smaller plants have resisted the adoption of the hot process because of the larger equipment requirements.

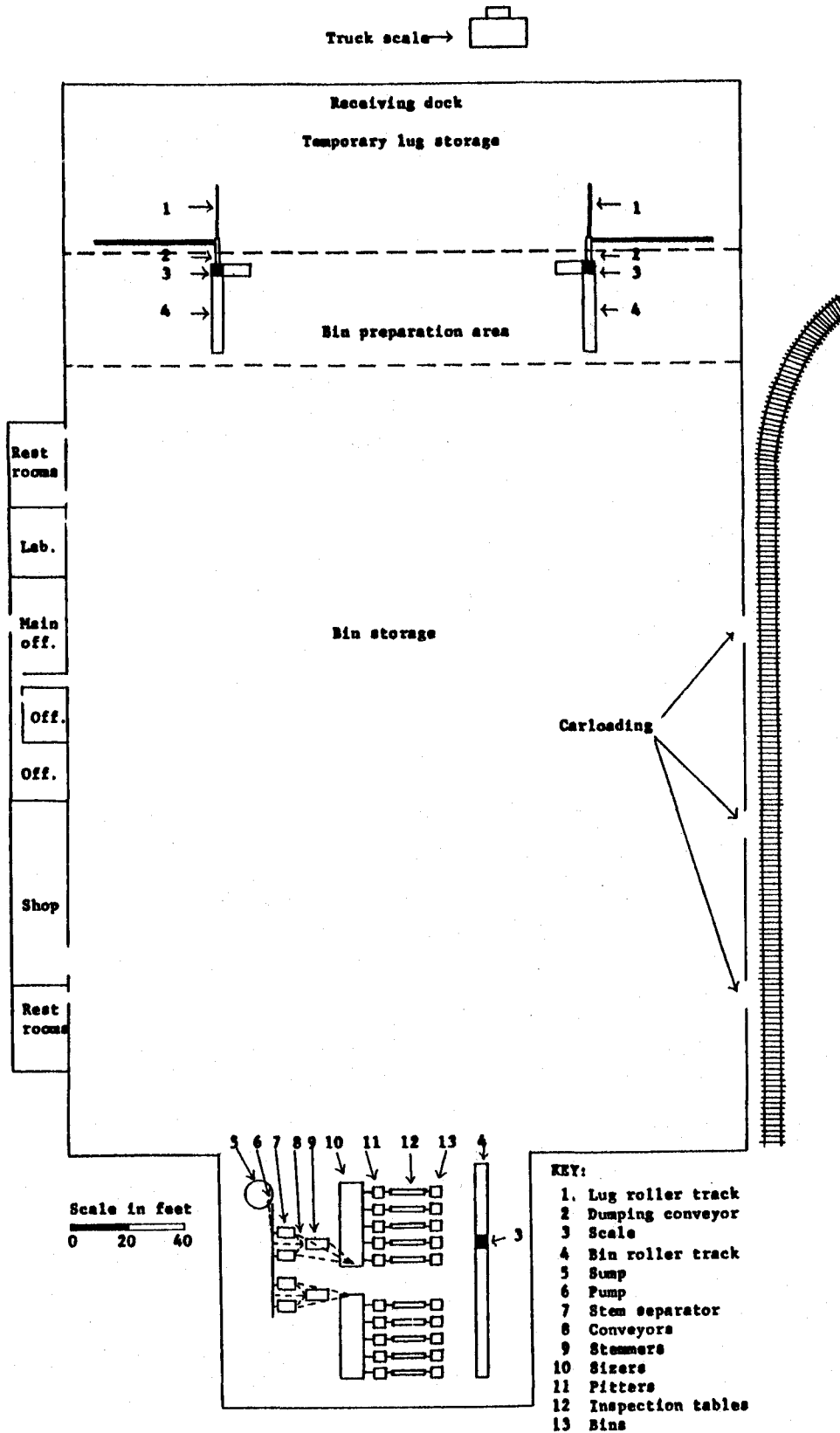
Briners report that the majority of firms in the finishing industry and particularly those located on the East coast are small firms. Many are housed in old buildings which are not designed for forklift operations required to handle bins. In addition, these small firms usually order split lots of graded cherries and are not equipped to handle large quantities of any one size, grade, and variety. Although some tank cars and trucks are divided into compartments, the buyer is still somewhat restricted with regard to how much of a size, grade, and variety, or how many sizes and grades, can be purchased in a single shipment.

If any degree of competition exists in the finishing industry, and the number of firms indicate that it is a relatively competitive industry, then costs of brined cherries as well as the cost of finishing are important. If brined cherries can be purchased in bulk at two or three cents less per pound than in barrels, then it would appear that plants that could purchase in bulk would have a competitive advantage over firms that could not. In addition, large plants designed to handle cherries in bins and tanks may realize efficiencies in handling which would result in additional cost reduction. It would appear that this competitive advantage would soon force the smaller firms to redesign their plants to take advantage of these possibilities for reducing costs.

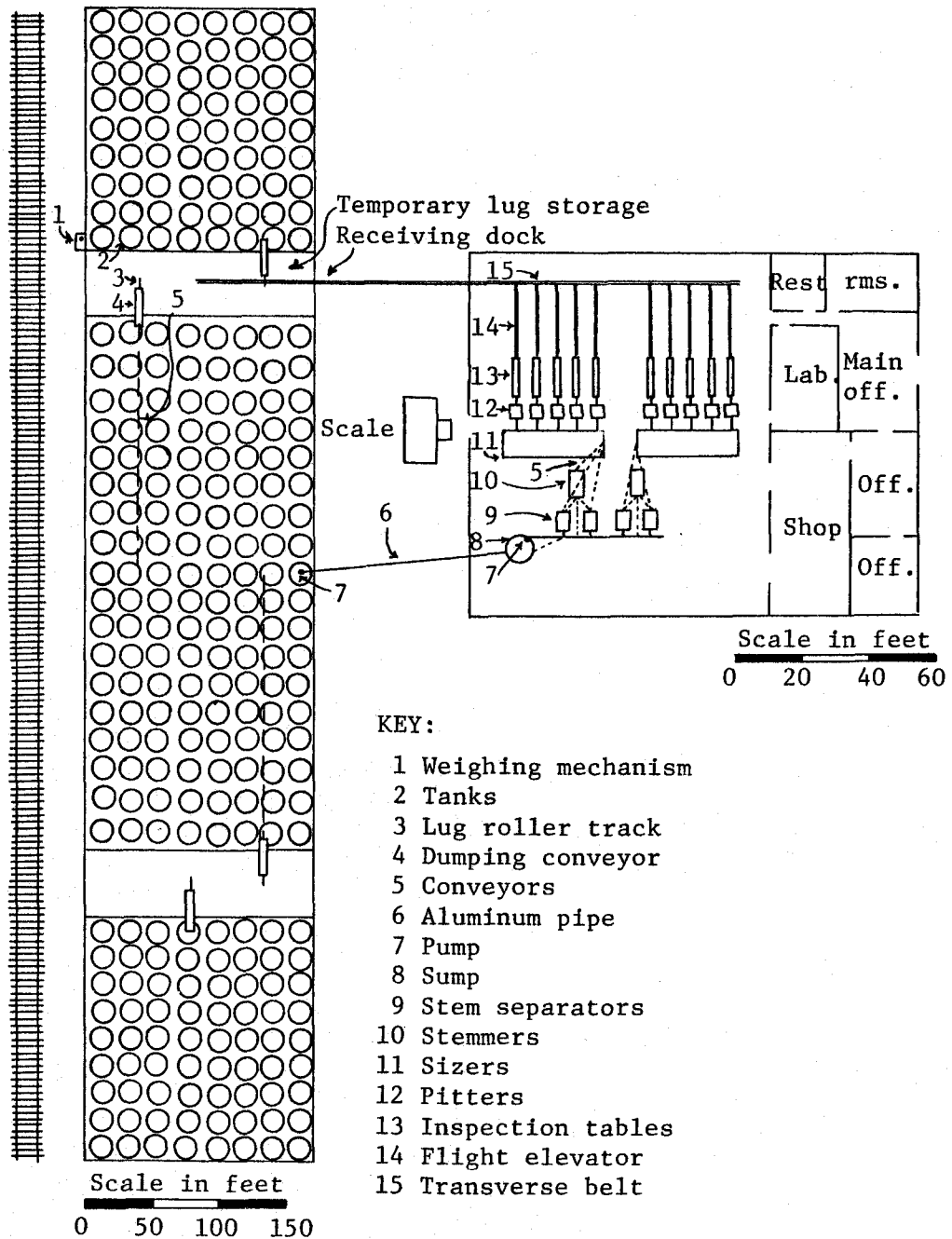
The price differential which exists in the industry today for brined cherries in different containers is an indication that the brining industry is passing along some of its cost savings to the finishing industry. This should, in effect, encourage firms in the finishing industry to undertake changes which would permit them to purchase cherries in containers other than barrels.

Further research which would study the comparative costs of finishing maraschino cherries by both hot and cold processes would be most useful in assessing the impact of the handling of cherries in various containers on the finishing industry.

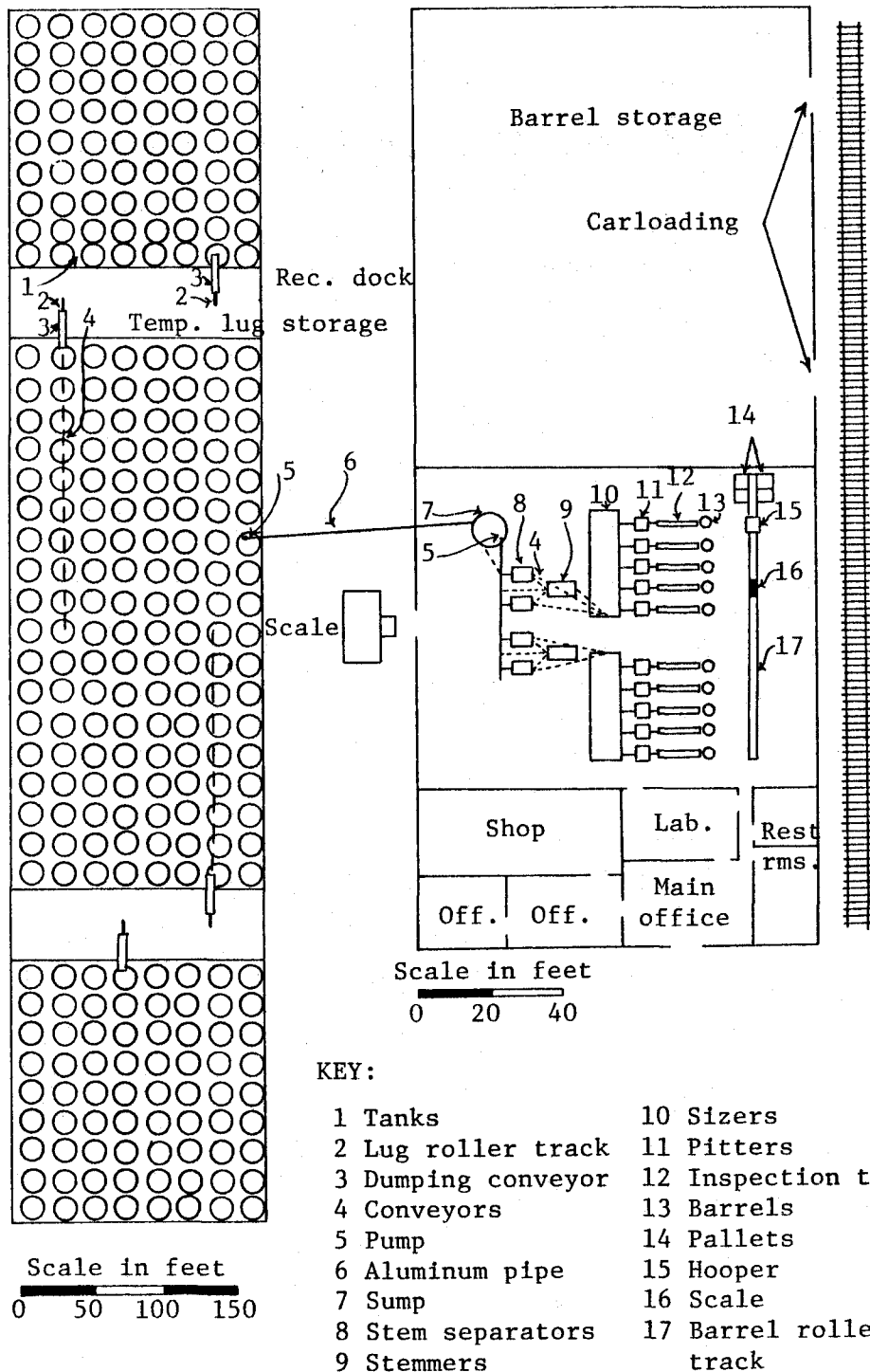
APPENDIX



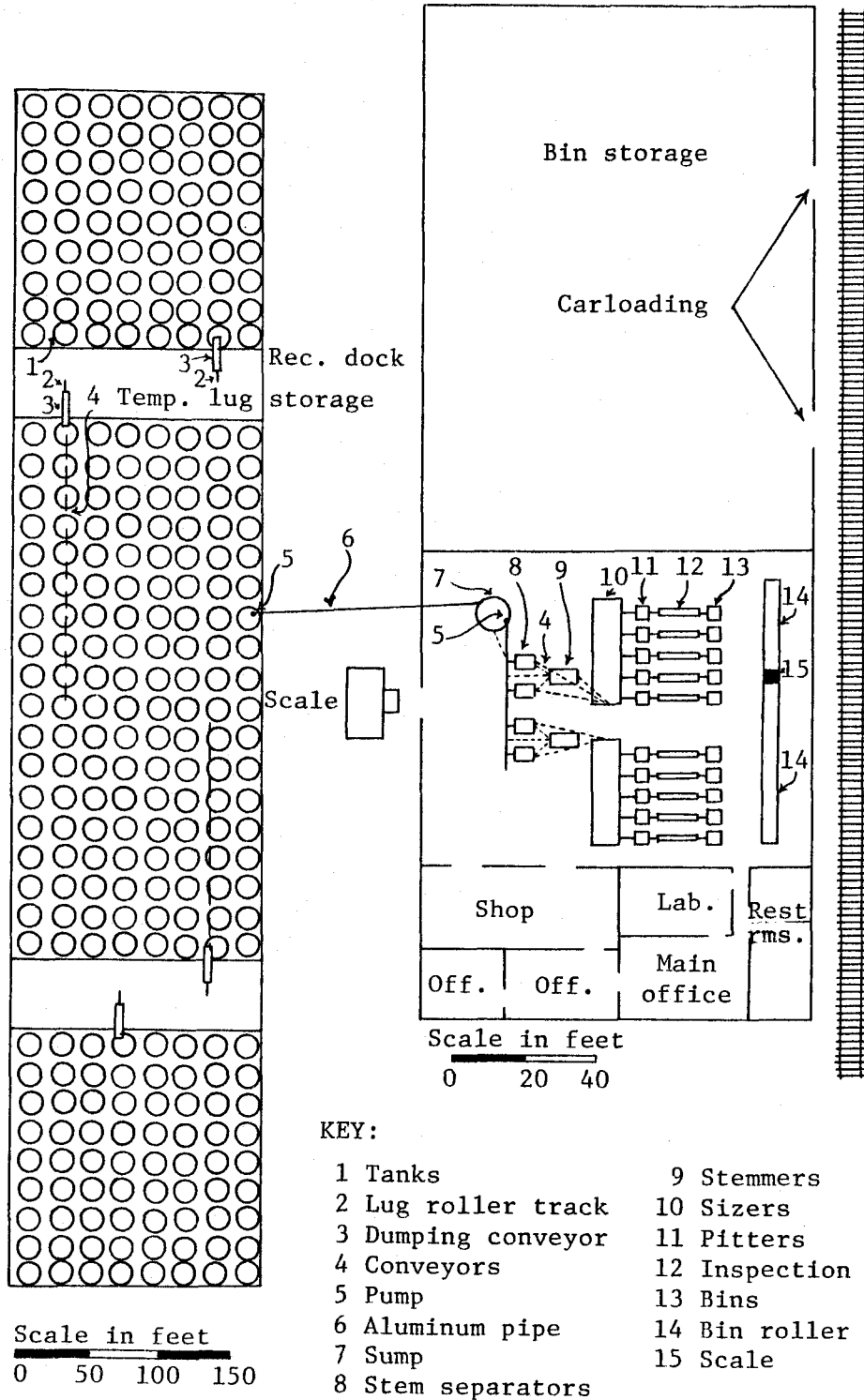
Appendix Figure 1. Cherry brining plant layout--200-barrel-per-day capacity, Model 2.



Appendix Figure 2. Cherry brining plant layout--200-barrel capacity, Model 3.



Appendix Figure 3. Cherry brining plant layout--200-barrel capacity, Model 4.



Appendix Figure 4. Cherry brining plant layout--200-barrel capacity, Model 5.