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The COMMERCIAL POTATO PEELING INDUSTRY

A SURVEY



Marketing Research Report No. 105

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service

October 1955
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CONTENTS

	<u>Page</u>
Summary.....	1
Origin and development.....	2
Method of survey.....	3
Location of the plants.....	3
Size of the industry.....	3
Quantities of potatoes used.....	3
Quantities and kinds of product.....	4
Types of outlets for peeled potatoes.....	5
Raw material, grades, and sizes.....	5
Testing and conditioning.....	6
Sizes of plants.....	6
Methods of peeling.....	6
Sizes and types of packages.....	10
Peeling losses.....	12
Disposition of peeling waste.....	12
Distribution practices.....	12
Pricing, costs, and margins.....	13

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THE COMMERCIAL POTATO PEELING INDUSTRY

(A Survey)

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SUMMARY

The commercial potato peeling industry began as a service to restaurants. In 1931 a plant located in the metropolitan area of Boston, Mass., peeled potatoes and delivered them to restaurants for 4 cents a pound. The potatoes were delivered in milk cans containing water or a special solution to keep them from turning dark. It was not until 1936 that the industry was able to deliver its product in dry-pack form. By the time the survey was carried out (August-September 1954), more than 100 plants were operating in the United States.

Approximately 3.2 million bushels of potatoes were utilized by these plants during 1953, producing nearly 145 million pounds of finished product. Nearly 85 percent of the production consisted of french-fry sticks ranging from 1/4 to 3/4 of an inch in size and of crinkle-cut slices. Other styles consisted of whole potatoes for boiling or mashing, slices for hash browning, and small quantities of diced potatoes for salads and canning. Peeled potatoes were being sold not only to restaurants, but also to hotels, hospitals, amusement park concessions, other institutional eating places, and in small quantities to retail stores.

Peeling plants were located, in most instances, in or near the areas of large populations. There were four geographic areas where they were concentrated: (1) The New England States, (2) near New York City and Philadelphia, (3) the middle western States of Ohio, Michigan, Indiana, and Illinois, and (4) on the Pacific Coast, particularly around Los Angeles.

Peeling plant operators preferred potatoes that are large, uniformly shaped, relatively free from bruises, blemishes, and decay, and have shallow eyes.

Three methods of peeling potatoes were used by plants participating in the survey: (1) Abrasive, (2) caustic (lye), and (3) steam. The plants using the abrasive method were the most numerous and peeled the most potatoes, although the plants using the caustic method peeled about twice as many potatoes per plant as the abrasive peeling plants. Only a few plants used a combination of these methods.

Packages of a great many different capacities were used for the peeled product. They ranged from 12 ounces for retail stores to 60 pounds for institutions. The 30-pound institutional size was the most popular, accounting for 56 percent of the output in 1953 of the plants surveyed.

The types of containers used were varied but all except a very small percentage were polyethylene bags, or were paper bags that had been treated to improve their wet strength or that enclosed some kind of impervious liner.

Peeling losses varied widely, according to skill and experience of the operator, type of equipment, type of potato, style of finished product, and quality of raw material. Losses from peeling with caustic solutions ranged from 5 to 28 percent; from abrasive peelers, 10 to 48 percent.

Distribution practices varied widely, with all but 5 of the plants providing delivery services. Ninety-five plants delivered daily except Sunday, but only 29 provided some kind of temperature protection during delivery.

The cost of the raw potatoes usually represents the major cost item in the price of peeled potatoes. Charges for peeling ranged from 3 to 6 cents a pound.

ORIGIN AND DEVELOPMENT

Many innovations in marketing in the form of added services to consumers have come about during the postwar period. For example, commodities such as fresh spinach and kale in washed and ready-to-cook form can be obtained in almost any grocery store. Ready-for-the-pan poultry is a notable example of an added service. Ease of preparation is a strong selling point for frozen foods. More recently the peeling and slicing of potatoes has become an important service offered to restaurants and institutions.

Potatoes occupy an important place in the American diet, although the per capita consumption fell from 195 pounds in 1910 to 104 in 1954. Drive-ins and other roadside eating places that serve quick meals to motorists make a practice of serving potatoes in some form, chiefly french fried, with their meals. Potatoes can be relied upon to receive relatively wide acceptance among those who eat in restaurants.

It has been estimated unofficially that institutions and restaurants used approximately 64 million bushels of potatoes from the 1954 crop 1/, a million more than in 1953. At the same time the production of peeled potatoes increased one million bushels. In other words, the increase in consumption of potatoes by restaurants and institutions paralleled that of the commercial peelers. In 1953, commercial peelers using potatoes at the rate of about 2.5 million bushels annually 2/ supplied a little more than 5 percent of this market.

With present-day wage rates, hand peeling of potatoes becomes a relatively costly and time-consuming job. It has been estimated that potato paring losses and spoilage in some restaurants have amounted to as much as 40 to 50 percent. For these reasons, peeling potatoes by mass production methods seemed a natural

1/ Mercker, A. E. Utilization of the 1954 Potato Crop. Amer. Potato Jour., vol. 32, No. 2, Feb. 1955, p. 71.

2/ Mercker, A. E. Utilization of Some Recent Potato Crops. Abstract of papers, Fifth Nat. Potato Util. Conf., Nov. 18-20, 1953, p. 20.

way of effecting economies that could not be achieved by many restaurants and institutions with their smaller scale of operation.

The first plant set up to peel potatoes on a commercial scale began operations in Boston, Mass., in 1931. Peeled potatoes were offered to institutions for 4 cents a pound. They were delivered immersed in water or a special solution in metal containers to prevent the potatoes from turning dark. It was not until 1936 that the product was delivered in dry-pack form. Potatoes still have to be dipped in a preservative to prevent their darkening.

While growth was slow prior to and during World War II, with the return to a peacetime economy the commercial potato peeling industry expanded rapidly. At first there were the starts and failures that often characterize a new industry. At present, peeling plants are located in almost every metropolitan area of the country. Of the 120 plants included in this study, 3 began operations prior to 1946, 34 during 1946 to 1951, and 81 since 1950. The date of origin of the other 2 plants is not known. Of the 31 plants that began operating in 1952, 30 were still in operation when the survey was made. During 1953 and 1954 the growth of the industry, though not so rapid as in 1952, has been steady, and there are indications that some stability has been achieved.

METHOD OF SURVEY

During August and September of 1954, the operators of each of the potato peeling plants that were known to be in business were personally interviewed. The purpose was to obtain information on the quantities of potatoes used, the types of potatoes purchased or desired, their size, grade, and variety, as well as other information that might give some indication of the size and characteristics of the market for potatoes. Although 2 plant operators did not furnish information, it is estimated that in 1953 over 90 percent of the total output of peeled potatoes was produced by the plants that cooperated in the survey.

LOCATION OF THE PLANTS

The commercial potato peeling plants from which data were obtained were located in 32 States and the District of Columbia. These plants, some of which were operated in conjunction with other businesses such as general produce, potato chip, and the partial-fried potato industries, were located near large metropolitan areas (fig. 1). Geographically there were 4 areas where peeling plants were concentrated: (1) The New England States; (2) near New York City and Philadelphia; (3) the middle western States of Ohio, Michigan, Indiana, and Illinois; and (4) on the West Coast, particularly around Los Angeles. Many of the plant operators expressed the opinion that to be successful a plant must be located in the vicinity of a population center of 100,000 or more persons.

SIZE OF THE INDUSTRY

Quantities of Potatoes Used

According to information obtained in the survey, 191,853,000 pounds of raw unpeeled potatoes were used by the potato peeling industry during 1953. This approximated 3.2 million bushels which, when compared with the unofficial

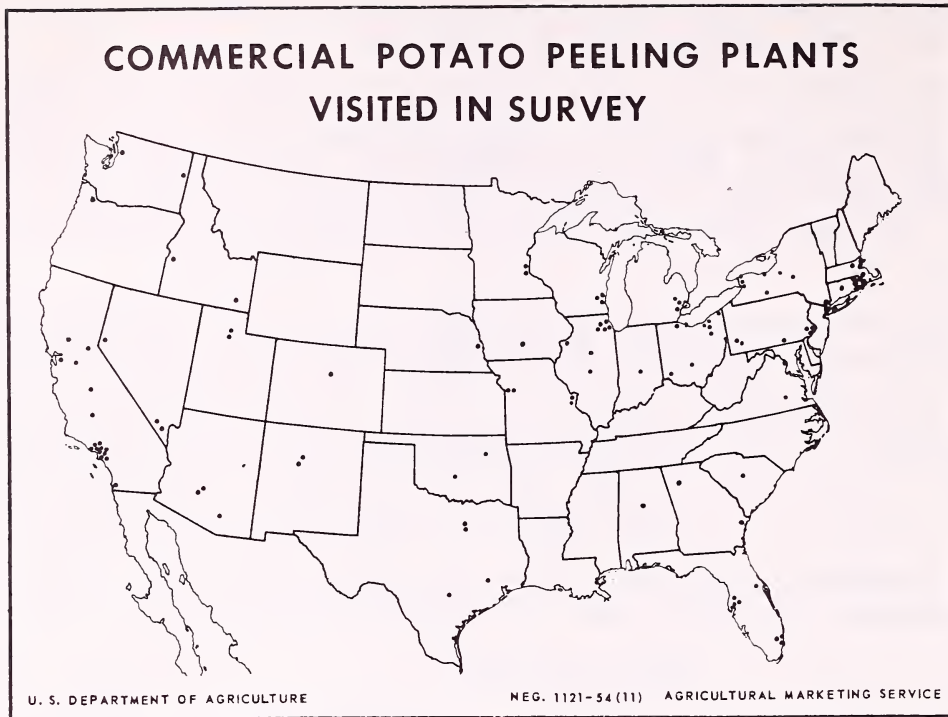


Figure 1

estimate ^{3/} of 245 million bushels of potatoes that entered the civilian food market in 1953 in fresh form or even the 29 million bushels that went into potato chips, makes the peeled potato industry appear relatively unimportant. But when the quantity of potatoes used by this industry is compared with the 1.6 million bushels used by the canners, or the 5.6 million bushels exported in 1953, the industry assumes more importance. It is particularly significant when one realizes that the volume of potatoes used in 1953 by the potato peeling plants participating in the survey is comparable to that used by the potato chip industry in 1940.

Quantities and Kinds of Product

The 3.2 million bushels of potatoes peeled in 1953 yielded approximately 145 million pounds of finished product. Preparation loss including waste and shrinkage amounted to 25 percent and ranged in individual plants from a low of 5 percent to a high of 48 percent.

Peeled potatoes were prepared in several different styles. French-fry sticks and crinkle-cut slices for french frying were by far the most popular styles produced; they accounted for about 85 percent of the total volume of potatoes peeled. All of the plants included in the survey produced at least one cut of potatoes for french frying. A number of plants produced cuts of

^{3/} See footnote 2.

several different sizes. French-fry cuts varied in size from one-fourth of an inch or smaller ("shoestring") to three-fourths of an inch. The 3/8-inch size for french frying appeared to be the most popular of these cuts.

In some plants, in addition to the french-fry cuts, potatoes were peeled and left whole for boiling or mashing, sliced for hash browning, and sometimes cubed or diced for salads or soups.

TYPES OF OUTLETS FOR PEELED POTATOES

Commercial potato peeling began as a service to hotels and restaurants and at the time of the study these outlets still accounted for the major portion of the output. Other institutional users such as hospitals, and also drive-ins and concessions in amusement parks, have become important outlets for this product.

Sixteen operators have tried marketing peeled potatoes through retail stores but at the time of the survey only 5 were still doing so. This outlet represents only a minor portion (far less than 1 percent) of the total sales of peeled potatoes.

The chief obstacles to marketing peeled potatoes through retail outlets are (1) the limited storage life of the product, and (2) the necessity of keeping the potatoes refrigerated. The longest period of time peeled potatoes can be safely stored is about 7 days, and in order to keep this long, they must be refrigerated at all times. Under refrigeration, the preferable temperatures are between 32° and 40° F. The retail store still appears to be the best potential outlet for expansion if some of these problems can be overcome.

RAW MATERIAL, GRADES, AND SIZES

When plant operators were asked what grades, sizes, and varieties of potatoes they preferred for peeling, they reported definite likes and dislikes. They had a preference for potatoes that are large, uniformly shaped, shallow eyed, and relatively free from bruises, blemishes, and decay. With the caustic method of peeling, there was less concern about odd-shaped potatoes than with the abrasive process. While plant operators were practically unanimous in their preference for large, uniformly shaped potatoes, they were not so particular about grade or variety. Often they could obtain the desired size of potato by purchasing a utility grade. Some operators even purchased field run and commercial potatoes at a reduced price. Many operators assured themselves a continuous supply of high grade potatoes from the late crop by purchasing large quantities in April and May and storing them for use during the summer months.

Where presized potatoes were not purchased, 52 plants did their own sizing. When potatoes were sized by the peeling plants, those not suitable for peeling were reported as either sold in bulk or packed in consumer-size packages and sold to retailers. Some peelers sorted and sized potatoes so they could supply their customers with baking potatoes of high quality and uniform size. Others carried this a step farther by washing the potatoes they considered suitable for baking and wrapping them in aluminum foil so that their customers need only put them into the oven. In a few instances, the peelers separated out

small potatoes to be peeled for boilers or creamers, but the cost per pound of peeling these was greater than for the larger potatoes. The reason for this was the added labor required for trimming the smaller potatoes.

Generally, potato peelers were interested in the best buy when purchasing raw material, but this does not necessarily mean they purchased the cheapest potatoes available. The three most important characteristics of acceptable potatoes were good quality, large size, and reasonable price. Ideas of what could justifiably be paid for raw material differed greatly between operators in different areas. In the interest of maintaining a uniform product for their customers, some operators insisted on potatoes from certain areas regardless of distance and transportation costs. Others did not go beyond certain distances because of high transportation charges.

Many operators stated varietal differences were important only to the extent that deep eyes and size were a factor, although a few said that some potatoes were not suitable for french frying or boiling because they had a tendency to lose their form and crumble when cooked.

TESTING AND CONDITIONING

About two-thirds of the peelers relied on a cooking test to insure the quality of the product they produced. This test consisted in selecting a sample of the potatoes they were interested in purchasing, peeling them, cutting them, and cooking them. They then judged the sample by its appearance and taste. Some peelers did not test the potatoes before buying, but most of them did.

About half of the peelers interviewed conditioned their potatoes before peeling. Some did not feel it was important; others did not know how to condition them or why they should be conditioned. Conditioning consisted in holding the potatoes at room temperature or at various temperatures ranging from 50° to 70° F. for from 1 day to 3 weeks.

SIZES OF PLANTS

There was a considerable range in the size of commercial potato peeling plants (table 1). Nine plants used more than 4.25 million pounds of potatoes each during 1953, and 13 used less than 250,000 pounds each.

METHODS OF PEELING

Several different methods of peeling potatoes have been used commercially (fig. 2). The plants participating in the survey used the abrasive, caustic, and steam methods. Flame and brine peelers have been used commercially but were not encountered during this survey. Some smaller plants did the peeling completely by hand.

Of the different methods of peeling used by the plants participating in the survey, the abrasive was first from the standpoint of both number of plants using it and the quantity of product peeled (table 2). Abrasive peelers require smaller investments in machinery and equipment and are somewhat simpler to

Table 1.--Commercial potato peeling plants by size of operation, 1953

Potatoes used per plant	Plants	Potatoes peeled					Net
		Total		Loss in peeling	Percent- age lost	Percent- age lost	
		Quantity	Percent- age dis- tribution				
Pounds	Number	Pounds	Percent	Pounds	Percent	Pounds	
0-250,000.....	13	1,878,000	1.0	521,048	27.7	1,356,952	
250,001-1,250,000....	40	30,720,600	16.0	7,884,645	25.7	22,835,955	
1,250,001-2,250,000..	25	42,984,500	22.4	10,365,754	24.1	32,618,746	
2,250,001-3,250,000..	9	23,145,500	12.1	5,199,967	22.5	17,945,533	
3,250,001-4,250,000..	4	15,000,000	7.8	3,632,000	24.2	11,368,000	
Over 4,250,000.....	9	78,124,300	40.7	19,397,300	24.8	58,727,000	
Total or average...	100	191,852,900	100.0	47,000,714	24.8	144,852,186	

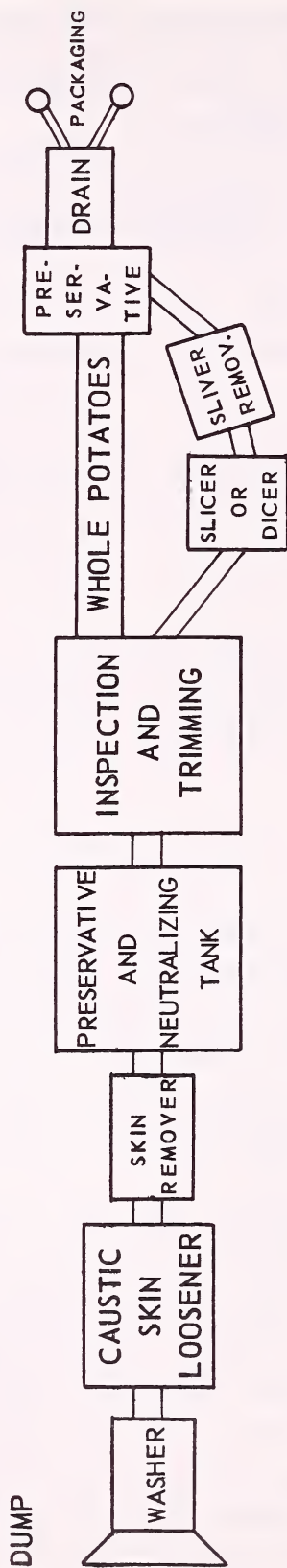
operate. On the other hand, the abrasive method requires more labor for trimming than the chemical.

The chemical or caustic method of peeling ranked next, both in number of plants using it and quantity of potatoes peeled. Based on quantities of potatoes peeled per plant, however, caustic peeling plants averaged about twice as large as the abrasive. Caustic peeling lends itself more readily to an assembly line type of operation. The caustic peeling plants also showed a lower average of peeling loss than the abrasive. The plants using a combination of these methods were too few to yield conclusive information. Steam peeling of potatoes on a commercial scale, while not widely used, has been relatively successful.

Where potatoes are peeled by abrasion, they are either dumped into a batch or a continuous-type abrasion peeler. Where the batch peeler is used, the peelings are removed by the rotation of the bottom of the drum. The bottom and sides of this drum have a rough silicon carbide finish. The bottom of the drum is rotated at high speed, rolling and tumbling the potatoes against these silicon carbide surfaces. This action rapidly removes the skin and some of the material close to the skin. Water is sprayed continuously over the potatoes to wash away the skin particles as they are removed. Most batch-type peelers will handle around a bushel of potatoes at a time, and the skins are fairly well removed after about a minute of operation. The continuous abrasion peeler consists of several compartments through which the potatoes pass. Each compartment contains a series of silicon carbide coated rollers that rotate at high speed, effectively removing the skins from the potatoes.

TWO METHODS OF POTATO PEELING USED BY COMMERCIAL PEELERS

CAUSTIC METHOD OF PEELING



BATCH ABRASIVE METHOD OF PEELING

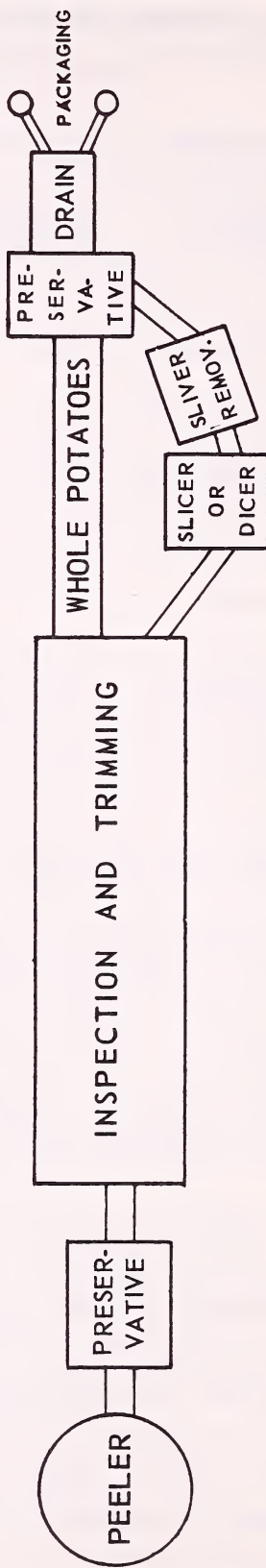


Figure 2

Table 2.--Potato peeling plants: Number, average production of plants, and quantities of potatoes peeled, by method, 1953

Method	Potatoes peeled										
	Average size of plant by production	Total	Loss in peeling	Net	Quantity : age distribution	Percent : age	Quantity : age distribution	Percent : age	Quantity : age distribution	Percent : age	
	Number	Pounds	Pounds	Pounds	Percent	Pounds	Percent	Pounds	Percent	Pounds	Percent
Abrasive.....	68	1,295,184	88,072,500	22,793,023	45.9	25.9	65,279,477	45.1			
Caustic.....	24	2,540,629	60,975,100	12,816,309	31.8	21.0	48,158,791	33.2			
Caustic and abrasive..	4	2,743,325	10,973,300	2,204,382	5.7	20.1	8,768,918	6.1			
Steam, caustic, and abrasive.....	4	7,958,000	31,832,000	9,187,000	16.6	28.9	22,645,000	15.6			
Total or average....	100	1,918,529	191,852,900	47,000,744	100.0	24.5	144,852,186	100.0			

Neither type of abrasion peeler will effectively remove the skin from the eyes or sunken portions of potatoes without wearing away much of the potato. With this type of peeler the skin in these areas is best removed by hand.

Many of the larger operators used the caustic method of peeling because it could handle a greater volume of potatoes and required less hand labor at the trimming table. It rather effectively removes the skin particles in the area around the eyes or in any depressed portions of the tuber. The common caustic peeler uses chemical attack on the tissues of the tuber below the skin as well as thermal shock to loosen the skin. After a caustic bath which loosens the skin, the potatoes pass through a rotating drum where sprays of water at high pressure wash off the skin and partially wash away the caustic solution. The potatoes are then dipped into a solution which neutralizes any remaining caustic and preserves the color of the potatoes during trimming and inspection.

Caustic solutions in common use vary in concentration from 15 to 25 percent lye and in temperature from 135° to 155° F. The length of time the potatoes were held in the caustic solution also varied according to the variety of potato, and the concentration and temperature of the solution. Higher concentrations and higher temperatures of caustic baths required less time than those of lower concentration or lower temperature. Potatoes remain in the caustic bath from 3 to 8 minutes.

The strength of solution, time of the potatoes in the bath, and temperature of the solution had to be adjusted to the individual lots of potatoes peeled. Most of the operators followed the practice of running a few potatoes through the solution, observing the results, and adjusting the soaking time accordingly.

A few of the peelers used high-pressure steam to remove the skins from the potatoes. This method relies on thermal shock and cooking of the surface to loosen the skins. The loosened skins are washed away with water or by gentle brushing or rubbing. This method of peeling, like the caustic method, has the disadvantage of cooking the outer surface of the potato if not closely controlled, but it has the advantage of effectively removing skin particles from the eyes and irregular surfaces.

SIZES AND TYPES OF PACKAGES

When the potato peeling industry accomplished delivery of its product in dry-pack form, it probably achieved its most significant advance since its origin. It could then furnish almost any size and type of package requested.

The plants surveyed used 12 different sizes of containers during 1953. The sizes ranged from the 12-ounce retail package to the 60-pound institutional pack (table 3). The 30-pound package was the most popular, accounting for more than 56 percent of the total output of peeled potatoes produced by these plants during 1953. The next most popular package was the 35-pound bag; the 25-pound bag was third.

There were 9 basic types of containers in use during 1953. Of these, 8 were dry-pack type containers. One plant was still delivering its potatoes in

Table 3.--Quantity of peeled potatoes packaged at the plants surveyed, by type and size of container, 1953

Type of container:	Size of container in pounds											Total	Percent
	1,000	10	15	20	25	30	35	40	50	60	1,000		
1/ or less:	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	age of total
1.....	26	92	---	2,935	3,462	56,199	2,847	192	96	4,096	69,945	48.3	
2.....	10	95	49	2,542	643	6,194	---	128	1,813	---	11,474	7.9	
3.....	---	166	---	6,653	6,223	7,661	2,408	2,400	---	---	25,511	17.6	
4.....	39	---	---	---	---	---	---	---	---	---	39	.1	
5.....	---	7	---	175	2,288	5,793	19,389	1,353	52	---	29,057	20.1	
6.....	---	---	---	---	---	---	200	---	---	---	200	.1	
7.....	---	---	---	---	1,579	210	---	---	---	---	1,789	1.2	
8.....	---	---	---	---	---	3,780	---	---	---	---	3,780	2.6	
9.....	---	---	---	---	120	---	---	---	---	---	120	.1	
U.....	---	22	---	1,103	---	1,820	---	---	---	---	2,945	2.0	
Total..	75	382	49	13,408	14,315	81,657	24,844	4,073	1,961	4,096	144,860	100.0	
Percent- age of total....	---	0.2	---	9.3	9.9	56.4	17.2	2.8	1.4	2.8	100.0		

- 1/ 1--Kraft paper outer bag with polyethylene inner liner.
 2--Polyethylene bag.
 3--Kraft paper bag with Kraft paper wet strength liner.
 4--Cardboard tray with cellophane overwrap.
 5--Double wet strength Kraft with wax liner.
 6--Wet proof box lined with wet proof paper.
 7--Corrugated wax lined carton-ventilated.
 8--Wooden box with parchment liner.
 9--Metal milk can.
 U--Unknown.

metal containers filled with water because State regulations did not permit the use of sulfites as a preservative in food products. Six of the containers were the dry-pack, bag type; another was a ventilated, corrugated, wax-lined carton; and another a wooden box with a parchment liner. Containers other than the bag type accounted for less than 6 percent of the production surveyed during 1953.

The type of container used most by the plants surveyed consisted of a two-ply, Kraft paper bag with an impervious inner liner of polyethylene. This type was used for 48 percent of the potatoes peeled in the plants during 1953. The Kraft paper, double-wet-strength bag with a wax liner was second, being used to package 20 percent. A container consisting of an outer Kraft paper bag with a wet-strength Kraft inner liner was third, being used for 16 percent. Some peelers used a variety of different sizes and types of containers. The question of which is the most suitable container for peeled potatoes apparently has not been settled.

PEELING LOSSES

There was wide variation in the amount of peeling loss reported by many of the operators. Obviously such factors as skill and experience of the operator, type of peeling equipment, type of potato, and the style of finished product had a bearing on losses. Generally the caustic peeler was able to remove the potato skins with less loss than the abrasive type. Operators using this type of peeler reported losses ranging from as low as 5 percent to as high as 28 percent, while abrasive peelers reported losses ranging from 10 to 48 percent.

While some plant operators reported differences in peeling losses according to size and variety of potatoes and season of the year in which they were peeled, it is extremely difficult to generalize. By far the most important factor affecting the amount of loss was the quality and condition of the potatoes. Most operators agreed that the proportion of loss was smaller when potatoes of fairly uniform shape, large size, and good quality were used.

There seemed to be some relationship between the size of plant and the amount of peeling loss. Those plants which used between 2.25 and 3.25 million pounds of potatoes during 1953 had less loss than the plants of any other size group. However, the differences cannot be attributed to size alone.

DISPOSITION OF PEELING WASTE

None of the plant operators interviewed found the disposal of peeling wastes a particular problem. Some gave this waste to hog or chicken farmers, others used garbage collecting facilities, and still others used a garbage disposal.

DISTRIBUTION PRACTICES

All except 5 of the plants surveyed provided delivery service. The frequency of delivery varied from as often as needed to twice weekly; however, 93 of the 118 plants provided service daily except Sunday. Generally the shorter the distance between plant and customer, the more frequent the delivery

service. Those plants which did not provide delivery service sold their peeled potatoes to hotel supply houses, institutional purveyors, and in some cases to frozen food distributors who in turn sold and delivered the product.

Of the plants providing delivery service, 29 used either refrigeration or insulation to protect the product during delivery. The reason given by the other plants for not doing so was that the hauls were short and service rapid enough to make it unnecessary.

PRICING, COSTS, AND MARGINS

Peelers used several different methods to price their product. Generally they calculated the cost of peeling, packaging, and delivering their product and added this amount to the price they had to pay for potatoes after adjusting for waste. For example: An operator pays \$4 for a hundredweight of potatoes. Assume his yield averages 80 percent. He would divide 0.80 into \$4 and arrive at a cost of \$5 per hundredweight for the unpeeled potatoes, including waste. To this cost he would add his cost of peeling and his profit.

Another method which was popular with peelers was to estimate the price at which they could supply their customers on a year-round basis and offer them a constant price for the peeled product.

A rather interesting method of pricing which was used by a number of operators consisted of simply charging for the peeling operation after adjusting the price of the potatoes for the peeling loss. For example: Several peelers were offering their customers peeled potatoes for 2 cents a pound above the market price for unpeeled potatoes. Then if their peeling loss averaged 25 percent, they guaranteed the buyer 75 pounds of peeled potatoes for each 100 pounds of unpeeled potatoes entering the peeling equipment. This would mean that with \$4 potatoes a customer would receive 75 pounds of peeled potatoes for \$6, or pay 8 cents a pound for the peeled product. Many of the plant operators said that they gave price discounts to quantity buyers.

The cost of potatoes for raw material usually represents the major cost item in the price of peeled potatoes. The charges for peeling ranged from a low of 3 cents to a high of 6 cents per pound.



